

NFPA 72

Chapter 24 Emergency Communications Systems (ECS)

24.1 Application.

24.1.1 The application, installation, and performance of emergency communications systems and their components shall comply with the requirements of this chapter.

24.1.2* The requirements of this chapter shall apply to emergency communications systems within buildings and outdoor areas.

24.1.3 The requirements of Chapters 10, 12, 17, 18, 21, 23, 26 and 27 shall also apply, unless they are in conflict with this chapter.

24.1.4 Inspection, testing, and maintenance shall be performed in accordance with testing frequencies and methods in Chapter 14. **[ROP-450]**

24.1.5 The requirements of Chapter 14 shall apply.

24.1.6 The requirements of this chapter shall not apply to Chapter 29 unless specifically indicated.

24.2 Purpose.

24.2.1 The systems covered under Chapter 24 are for the protection of life by indicating the existence of an emergency situation and communicating information necessary to facilitate an appropriate response and action.

24.2.2 This chapter establishes minimum required levels of performance, reliability, and quality of installation for emergency communications systems but does not establish the only methods by which these requirements are to be achieved.

24.2.3 An emergency communications system is intended to communicate information about emergencies including, but not limited to, fire, human-caused events (accidental and intentional), other dangerous situations, accidents, and natural disasters.

24.3 General.

24.3.1* Intelligent Voice Messages. Emergency communications systems shall be capable of the reproduction of prerecorded, synthesized, or live (e.g., microphone, telephone handset, and radio) messages with voice intelligibility in accordance with Chapter 18.

24.3.2 Microphone Use. **[ROP-351]**

24.3.2.1 All users of systems that have microphones for live voice announcements shall be provided with posted instructions for using the microphone. **[ROP-351]**

24.3.2.2* All systems listed after January 1, 2016, that have microphones for live voice announcements shall be provided with one or more of the following: **[ROP-351]**

(1) A method for automatically electronically controlling the amplitude of the speaker's voice

(2) Visual meters or indicators that provide indication of the level of audio being introduced into the microphone

24.3.3* Required Emergency Communications Systems. An emergency communications system shall be installed in occupancies where required by the authority having jurisdiction or by other applicable governing laws, codes, or standards.

24.3.4* Nonrequired (Voluntary) Emergency Communications Systems.

24.3.4.1 Nonrequired emergency communications systems and components shall meet the requirements of this chapter.

24.3.4.2 Nonrequired emergency communications systems and components shall be identified on the record drawings required in 10.20.2.3(2).

24.3.5 Ancillary Functions.

24.3.5.1 Ancillary functions shall not impair the required operation of the ECS. **[ROP-338a]**

24.3.5.2* Loudspeakers used for ECS functions also providing ancillary functions shall meet the conditions of either 24.3.5.2(1) or (2): **[ROP-338b, 338c]**

(1) The fire command center or the central control station as applicable shall be constantly attended by trained personnel, and selective paging is permitted by the authority having jurisdiction.

(2) All of the following conditions shall be met:

(a) The loudspeakers and associated audio equipment are installed or located with safeguards to resist tampering or misadjustment of those components essential for intended emergency notification.

(b) The monitoring integrity requirements of Section 10.19 continue to be met while the system is used for non-emergency purposes.

24.3.5.3 Ancillary functions shall be inspected and tested annually to verify they will not impair the operation of the fire alarm system or the mass notification system. **[ROP-339]**

24.3.6 Pathway Survivability.

24.3.6.1 Pathway survivability levels shall be as described in Section 12.4.

24.3.6.2 Other component survivability shall comply with the provisions of 24.4.2.8.4.6.

24.3.6.3* The pathway survivability requirements in 24.3.6.4 through 24.3.6.12 shall apply to notification and communications circuits and other circuits necessary to ensure the continued operation of the emergency communications system.

24.3.6.4 In-building fire emergency voice/alarm communications systems shall comply with 24.3.6.4.1 or 24.3.6.4.2.

24.3.6.4.1 For systems employing relocation or partial evacuation, a Level 2 or Level 3 pathway survivability shall be required.

24.3.6.4.2 For systems that do not employ relocation or partial evacuation, a Level 0, Level 1, Level 2, or Level 3 pathway survivability shall be required.

24.3.6.4.3 Refer to Annex G for previous nomenclature and cross reference.

24.3.6.5 Pathway survivability levels for in-building mass notification systems shall be determined by the risk analysis. **[ROP-344]**

24.3.6.6 Pathway survivability levels for wide area mass notification systems shall be determined by the risk analysis. **[ROP- 345]**

24.3.6.7 Two-way in-building wired emergency communications systems shall have a pathway survivability of Level 2 or Level 3.

24.3.6.8 Two-way radio communications enhancement systems shall comply with 24.3.6.8.1 and 24.3.6.8.2.

24.3.6.8.1 Where a two-way radio communications enhancement system, exclusive of the antennae, is used in lieu of a two-way in-building wired emergency communications system, it shall have a pathway survivability of Level 2 or Level 3.

24.3.6.8.2 Where a two-way radio communications enhancement system is used in lieu of a two-way in-building wired emergency communications system, the design of the system shall be approved by the authority having jurisdiction.

24.3.6.9.2 Circuits intended to transmit off-premises shall have a pathway survivability of Level 0, Level 1, Level 2, or Level 3.

24.3.6.11 Central command station emergency communications systems shall have pathway survivability as determined by the risk analysis.

24.3.6.12 All other emergency communications system circuits shall have pathway survivability as determined by the risk analysis.

24.3.7* System Classification. Emergency communications systems (ECS) shall consist of two classifications of systems, one-way and two-way.

24.3.8* Design. Design documents shall be prepared prior to installation of any new system. **[ROP-381]**

24.3.8.1 Systems that are altered shall have design documents prepared applicable to the portions of the system that are altered.

[ROP-381]

24.3.8.2 Documents shall be revised as necessary following installation to represent as-built conditions and include record drawings. [ROP-381]

24.3.9 Listing. Control units installed as part of a mass notification system shall be in compliance with this Code and applicable standards such as ANSI/UL 864, *Standard for Control Units and Accessories for Fire Alarm Systems*, or UL 2017, *Standard for General-Purpose Signaling Devices and Systems*, or ANSI/UL 2572, *Control and Communication Units for Mass Notification Systems*.

[ROP-370, ROP-371]

24.3.10* Risk Analysis for Mass Notification Systems. [ROP-377]

24.3.10.1* Each application of a mass notification system shall be specific to the nature and anticipated risks of each facility for which it is designed.

[ROP-377]

24.3.10.2 The designer shall consider both fire and non-fire emergencies when determining risk tolerances for survivability for the mass notification system. [ROP-377]

24.3.10.3 Performance-based design and the risk analysis shall be applied in accordance with Section 24.7. [ROP-377]

24.3.10.4 The risk analysis shall consider the number of persons, type of occupancy, and perceived peril to occupants.

[ROP-377]

24.3.10.5 Number of Persons. The analysis shall be based on the maximum occupant load calculation for every occupiable room, building, area, space, campus, or region is expected to contain. [ROP-359, ROP-377]

24.3.10.6 Occupancy Characteristics. [ROP-377]

24.3.10.6.1 The risk analysis shall consider characteristics of the buildings, areas, spaces, campuses or regions, equipment, and operations that are not inherent in the design specifications.

24.3.10.6.2 Those elements that are not inherent in the design specifications, but that affect occupant behavior or the rate of hazard development, shall be explicitly identified and included in the risk analysis.

24.3.10.7 Anticipated Threat. The risk analysis shall consider the following types of potential events. The list is not all inclusive but reflects the general categories that shall be considered in the risk analysis.

- (1) Natural Hazards - Geological Events
- (2) Natural Hazards - Meteorological Events
- (3) Natural Hazards - Biological Events
- (4) Human Caused - Accidental Events
- (5) Human Caused - Intentional Events
- (6) Technological - Caused Events

[ROP-377]

24.3.10.8 Extent of Notification. The risk analysis shall include a review of the extent to which occupants and personnel are notified, based on the anticipated event (potential hazard).

[ROP-377]

24.3.10.9 The risk analysis shall be used as the basis for development of the ECS provisions of the facility emergency response plan. [ROP-377]

24.3.11* Emergency Response Plan Elements. A well-defined emergency response plan shall be developed in accordance with *NFPA 1600, Standard on Disaster/Emergency Management and Business Continuity Programs*, and *NFPA 1620, Standard for Pre-Incident Planning*, as part of the design and implementation of a mass notification system. [ROP-377]

24.4 One-Way Emergency Communications Systems.

24.4.1 General. [ROP-353a]

24.4.1.1* Message Content. Messages shall be developed for each scenario developed in the emergency response plan. [ROP-353a]

24.4.1.2 A message template shall be developed for each message required in 24.4.1.1. [ROP-353a]

24.4.1.3 For an evacuation message, a tone in accordance with 18.4.2 shall be used with a minimum of two cycles preceding and following the voice message. [ROP-353a]

24.4.1.4 A test message that clearly states "this is a test" shall be provided. [ROP-353a]

24.4.2* In-Building Fire Emergency Voice/Alarm Communications Systems (EVACS). Subsection 24.4.2 shall be used in the design and application of in-building fire emergency voice/ alarm communications for fire alarm systems.

24.4.2.1 Automatic Response. The in-building fire emergency voice/alarm communications system shall be used to provide an automatic response to the receipt of a signal indicative of a fire alarm or other emergency.

24.4.2.1.1 When the monitoring location is constantly attended by trained operators, and operator acknowledgment of receipt of a fire alarm or other emergency signal is received within 30 seconds, automatic response shall not be required.

24.4.2.1.2 If acceptable to the authority having jurisdiction, the system shall permit the application of an automatic evacuation signal to one or more evacuation signaling zones and, at the same time, shall permit manual voice paging to the other evacuation signaling zones selectively or in any combination.

24.4.2.2 Voice Evacuation Messages.

24.4.2.2.1 Unless otherwise permitted by 24.4.2.8, evacuation messages shall be preceded and followed by a minimum of two cycles of the emergency evacuation signal specified in 18.4.2.

[ROP-356]

24.4.2.2.2 Voice messages shall comply with the requirements of 24.3.1.

24.4.2.2.2.1 The following requirements shall be met for layout and design:

- (1) The loudspeaker layout of the system shall be designed to ensure intelligibility and audibility. [ROP-338c]
- (2) Intelligibility shall first be determined by ensuring that all areas in the building have the required level of audibility. [ROP-358]

24.4.2.2.2.2* System design shall incorporate designation of acoustically distinguishable spaces (ADS) within the occupiable areas as required in Chapter 18. [ROP-359]

24.4.2.2.2.3 Audibility shall be required in all areas in accordance with Chapter 18. [ROP-360]

24.4.2.3 Positive Alarm Sequence. In-building fire emergency voice/alarm communications systems shall be permitted to use positive alarm sequence complying with 23.8.1.3.

24.4.2.4 Tones. The tone preceding any message shall comply with 24.4.1.4.1 through 24.4.1.4.4. [ROP-353]

24.4.2.4.1 The tone preceding any message shall be permitted to be a part of the voice message or to be transmitted automatically from a separate tone generator. [ROP-353]

24.4.2.4.2* Except as specified in 24.4.2.4.3, in occupancies where sleeping accommodations are provided and the voice message is intended to communicate information to those who could be asleep, a low-frequency tone that complies with 18.4.5 shall be used. **[ROP-353]**

24.4.2.4.3* In areas where sleeping accommodation are provided, but the voice communication system is used to communicate to occupants who are awake, the low frequency tone shall not be required. **[ROP-353]**

24.4.2.4.4 Audible signal tones for alert or evacuation shall meet the audibility requirements of either 18.4.3 (Public Mode Audible Requirements), 18.4.4 (Private Mode Audible Requirements), 18.4.5.1 and 18.4.5.2 (Sleeping Area Requirements), or 18.4.6 (Narrow Band Tone Signaling for Exceeding Masked Thresholds), as applicable. **[ROP-353]**

24.4.2.5 Controls.

24.4.2.5.1* Controls for the in-building fire emergency voice/ alarm communications system shall be at a location approved by the authority having jurisdiction.

24.4.2.5.2 Controls shall be located or secured to allow access only by trained and authorized personnel.

24.4.2.5.3 Operating controls shall be clearly identified.

24.4.2.5.4 If there are multiple in-building fire emergency voice/alarm communications control locations, only one shall be in control at any given time.

24.4.2.5.5 The location having control of the system shall be identified by a visible indication at that location.

24.4.2.5.6 Manual controls shall be arranged to provide visible indication of the on/off status for their associated evacuation signaling zone.

24.4.2.5.7 If live voice instructions are provided, they shall perform as follows:

(1) Override previously initiated signals to the selected notification zone(s).

(2) Have priority over any subsequent automatically initiated signals to the selected notification zone(s). **[ROP-362]**

(3) If a previously initiated recorded message is interrupted by live voice instructions, upon releasing of the microphone, the previously initiated recorded messages to the selected notification zones shall not resume playing automatically unless required by the emergency response plan.

ROP-362]

24.4.2.6 Loudspeakers. [ROP-338c]

24.4.2.6.1* Loudspeakers and their enclosures shall be installed in accordance with Chapter 18. **[ROP-338c]**

24.4.2.6.2 Loudspeakers used as alarm notification appliances on fire alarm systems shall also be permitted to be used for mass notification. **[ROP-338c]**

24.4.2.7 Priority.

24.4.2.7.1* Notification appliances required to provide special suppression pre-discharge notification shall not be overridden by other systems.

24.4.2.7.2 When the fire alarm system has been activated, and mass notification has been given priority over the fire alarm system, a distinctive audible and visible indication shall be provided at the building fire alarm control unit.

24.4.2.7.3 It shall not be required to transmit this condition to a supervising station.

24.4.2.7.4 The fire alarm system shall not automatically override emergency mass notification messages. **[ROP-363]**

24.4.2.7.5 Priority of mass notification messages over fire alarm evacuation shall be permitted when evaluated by the stakeholders through a risk analysis in accordance with 24.3.10. **[ROP-363]**

24.4.2.8* Relocation and Partial Evacuation. The requirements of 24.4.2.8 shall apply only to systems used for relocation or partial evacuation during a fire condition.

24.4.2.8.1 Systems shall be provided with manual voice transmission capabilities selectively to one or more zones or on an all-call basis.

24.4.2.8.2 Under a fire condition, where the system is used to transmit relocation instructions or other fire emergency non-evacuation messages, a 1-second to 3-second alert tone followed by a message (or messages where multi-channel capability is used) shall be provided.

24.4.2.8.2.1 The sequence [the alert tone followed by the message(s)] shall be repeated at least three times to inform and direct occupants in the evacuation signaling zone where the alarm initiation originated, as well as other evacuation signaling zones in accordance with the building fire safety plan.

24.4.2.8.2.2 Approved alternative fire alarm notification schemes shall be permitted so long as the occupants are effectively notified and are provided instructions in a timely and safe manner in accordance with the building fire safety plan.

24.4.2.8.3 Where provided, loudspeakers in each enclosed stairway, each exit passageway, and each group of elevator cars within a common shaft shall be connected to separate notification zones for manual paging only. **[ROP-338c, ROP-364]**

24.4.2.8.4 The requirements of 24.4.2.8.4 shall apply to both audible (tone and voice) and visible notification appliance circuits.

24.4.2.8.4.1* Fire alarm systems used for partial evacuation and relocation shall be designed and installed such that attack by fire within an evacuation signaling zone does not impair control and operation of the notification appliances outside the evacuation signaling zone.

24.4.2.8.4.2 Performance features provided to ensure operational reliability under adverse conditions shall be described and technical justification provided in the documentation submitted to the authority having jurisdiction with the analysis required in 23.4.3.1.

24.4.2.8.4.3* All circuits necessary for the operation of the notification appliances shall be protected until they enter the evacuation signaling zone that they serve by the protection provided by the pathway survivability level required in 24.3.6.4.1 or by performance alternatives approved by the authority having jurisdiction.

24.4.2.8.4.4 Where the separation of in-building fire emergency voice/alarm control equipment locations results in the portions of the system controlled by one location being dependent upon the control equipment in other locations, the circuits between the dependent controls shall be protected against attack by fire by the protection provided by the pathway survivability level required in 24.3.6.4.1 or by performance alternatives approved by the authority having jurisdiction.

24.4.2.8.4.5 Protection of circuits between redundant control equipment locations that are not mutually dependent shall not be required.

24.4.2.8.4.6 Where the separation of the in-building fire emergency voice/alarm control equipment occurs as in 24.4.2.8.4.4, and where the circuits are run through junction boxes, terminal cabinets or control equipment, such as system control units, power supplies and amplifiers, and where cable integrity is not maintained, these components shall, in addition to the pathway survivability required by 24.3.6.4.1, be protected by using one of the following methods:

(1) A 2-hour fire rated enclosure

(2) A 2-hour fire rated room

(3) Other equivalent means to provide a 2-hour fire resistance rating approved by the authority having jurisdiction

24.4.2.8.4.7 Paragraphs 24.4.2.8 through 24.4.2.8.4.6 shall not automatically apply when relocation or partial evacuation is of a non-fire emergency unless identified and required by a risk analysis.

24.4.2.9 Evacuation Signal Zoning.

24.4.2.9.1* Undivided fire or smoke areas shall not be divided into multiple evacuation signaling zones.

24.4.2.9.2 If multiple notification appliance circuits are provided within a single evacuation signaling zone, all of the notification appliances within the zone shall be arranged to activate or deactivate simultaneously, either automatically or by actuation of a common manual control.

24.4.2.9.3 Where there are different notification appliance circuits within an evacuation signaling zone that perform separate functions, such as presignal and general alarm signals, and pre-discharge and discharge signals, they shall not be required to activate or deactivate simultaneously.

24.4.3* In-Building Mass Notification Systems. The requirements of 24.4.3 shall apply to mass notification systems installed in buildings or structures for the purpose of notifying and instructing occupants in an emergency.

24.4.3.1* General Performance. The performance, selection, installation, operation, and use of a mass notification system shall comply with the requirements of 24.4.3.

24.4.3.1.1 Interconnection of protected premises emergency control functions with the mass notification systems shall comply with Chapter 21.

24.4.3.1.2 An in-building mass notification system shall include one or more of the following components:

- (1) Autonomous control unit (ACU)
- (2) Local operating console (LOC)
- (3) Fire alarm control interface
- (4) Notification appliance network
- (5) Initiating devices
- (6)*Interface to other systems and alerting sources

24.4.3.1.3 All mass notification system notification appliances that receive their power from a signaling line circuit of a mass notification system control unit shall be listed for use with the control unit. **[ROP-420]**

24.4.3.1.4 Mass notification system components shall be installed, tested, and maintained in accordance with the manufacturer's published instructions and this Code.

24.4.3.1.5 In-building emergency mass notification operation shall be permitted to be initiated by manual or automatic means.

24.4.3.1.6 Mass notification system activation shall initiate recorded messages or live voice and visible notification.

24.4.3.1.7 The priority level of recorded messages shall be determined by the emergency response plan.

24.4.3.1.8 Only recorded messages determined by the emergency response plan to be of higher priority than fire alarm activation shall be permitted to override the fire alarm notification and initiate the mass notification priority indicator.

24.4.3.1.9 Activation of any other recorded message shall not interfere with the operation of fire alarm notification.

24.4.3.1.10 Initiation of live voice announcements from microphones on the fire alarm system at an ACU, and at an LOC, shall not automatically place the fire alarm system in a mass notification priority mode.

24.4.3.1.11 Combination of mass notification with fire alarm systems shall be permitted and shall meet the requirements of 23.8.4.

24.4.3.2 System Operation.

24.4.3.2.1* Authorized personnel shall be permitted to control message initiation over the mass notification system.

24.4.3.2.2* Where required by the emergency response plan, the mass notification system shall provide the capability for authorized personnel to remotely activate live and prerecorded emergency messages. **[ROP-378]**

24.4.3.2.3* Operating controls shall be clearly identified.

24.4.3.2.4 If there are multiple control locations, only one shall be in control at any given time.

24.4.3.2.5 If there are multiple control locations, a visible indication shall be provided at all other control locations indicating that another control location is in use.

24.4.3.2.6 Manual controls shall be arranged to provide visible indication of the on/off status for their associated notification zone.

24.4.3.2.7 If live voice instructions are provided, they shall perform as follows:

- (1) Override previously initiated signals to the selected notification zone(s).
- (2) Have priority over any subsequent automatically initiated signals to the selected zone(s).

24.4.3.2.8 A manual means shall be provided at each mass notification system control location to permit the mass notification system to relinquish control of the fire alarm system.

24.4.3.2.9* During the period after the mass notification system has seized control of the audible and visual notification appliances, but before the mass notification system relinquishes control, the mass notification system shall activate the audible and visual notification appliances at least once every 30 seconds. **[ROP-378a]**

24.4.3.3 Coverage.

24.4.3.3.1* The mass notification system shall provide for live voice and prerecorded localized messaging within a protected individual building, areas surrounding the building, and other outdoor designated areas.

24.4.3.3.2 System design shall incorporate designation of acoustically distinguishable spaces (ADS) within the occupiable areas as required in Chapter 18. **[ROP-428]**

24.4.3.3.3 Notification zones shall be established on the basis of a risk analysis.

24.4.3.3.4* If the mass notification system serves more than one building, it shall be capable of providing separate messages to one individual building or to multiple buildings at any given time.

24.4.3.4 Loudspeaker Circuits. [ROP-338c]

24.4.3.4.1* Loudspeaker circuits used for mass notification that are not fire alarm circuits shall be exempt from the monitoring requirements of this Code, provided that alternate methods of achieving comparable reliability are accepted by the authority having jurisdiction. **[ROP-338c]**

24.4.3.4.2 Survivability for loudspeaker circuits used for mass notification shall be determined by the risk analysis for the building. **[ROP-338c]**

24.4.3.5 Documentation.

24.4.3.5.1* Security. Security for mass notification systems documentation shall be determined by the stakeholders. **[ROP-380]**

24.4.3.5.2 Record of Completion.

24.4.3.5.2.1* A record of completion form similar to that shown in Figure 10.20.2.1.1, shall be required for documentation of the mass notification system. **[ROP-382]**

24.4.3.5.2.2 All systems that are modified after the initial installation shall have the original, or latest overall system, record of completion revised or attached to show all changes from the original information and shall be identified with a revision date. **[ROP-383]**

24.4.3.5.2.3* Where the original, or the latest overall system, record of completion can not be obtained, a new overall system record of completion shall be provided that documents the system configuration as discovered during the current projects scope of work. **[ROP-383]**

24.4.3.5.3 Required Documentation. Every system shall include the following documentation, which shall be delivered to the owner or the owner's representative upon final acceptance of the system:

- (1) An owner's manual including a complete set of operations and maintenance manuals, manufacturer's published instructions, and product data sheets covering all system equipment
- (2) Record and as-built drawings
- (3) A written sequence of operation [ROP-385]
- (4) One current copy of the record of completion form, updated to reflect all system additions or modifications
- (5) For software-based systems, a record copy of the system specific software
- (6) A copy of the site-specific software shall be stored on-site in non-volatile, non-erasable, non-rewritable memory. [ROP-384]
- (7) Emergency response plan, with operational management procedures defined for management and activation of the system
- (8) The risk analysis, when provided [ROP-385]

24.4.3.5.4 Risk Analysis Documentation. [ROP-386]

24.4.3.5.4.1 When a risk analysis is required to be prepared, such as for a mass notification system, findings of the risk assessment shall be documented. [ROP-386]

24.4.3.5.4.2 When identified by the stakeholders, security and protection of the risk analysis shall be in accordance with 24.4.3.5.1. [ROP-386]

24.4.3.5.5 Document Accessibility.

24.4.3.5.5.1 An as-built plans cabinet shall be provided to house the documentation required in 24.4.3.5.3.

24.4.3.5.5.2 The cabinet shall be sized so that it can neatly contain all necessary documentation, including future inspection and service reports.

24.4.3.5.5.3 The contents of the cabinet shall be accessible by authorized personnel only.

24.4.3.5.5.4 Mass notification system and fire alarm system as-built plans and other related documentation shall be permitted to be maintained together, including the appearance of both systems on the same drawings.

24.4.3.5.5.5 The requirements of 10.20.3 and Section 14.6 shall be applicable for mass notification system records and record keeping.

24.4.3.6 Impairments. The requirements of Section 10.21 shall be applicable when a mass notification system is impaired.

24.4.3.7 Inspection, Testing, and Maintenance Requirements. Mass notification systems shall be inspected, tested, and maintained in accordance with the manufacturer's published instructions and the inspection, testing, and maintenance requirements of Chapter 14. [ROP-387]

24.4.3.8* System Response Priorities. Priority levels shall be established on the basis of the risk analysis. [ROP-387a]

24.4.3.9 Initiation Indication. The source of system activation shall be visibly and audibly indicated at the central control station and at the building control unit, unless otherwise required by the emergency response plan. [ROP-388]

24.4.3.10 Initiating Devices.

24.4.3.10.1 Devices connected to a mass notification system for the purpose of initiating an automatic response to an emergency shall be evaluated based on the emergency response plan. [ROP-390]

24.4.3.10.2* All mass notification initiating devices shall be listed for their intended purpose.

24.4.3.10.3 Where no listed device exists for the detection required by the emergency response plan, non listed devices shall be permitted to be used if their failure will not impair the operation of the mass notification system.

24.4.3.10.4 Non-fire emergency manual actuating stations (boxes) shall be listed to ANSI/UL 2017, *Standard for General Purpose Signaling Devices and Systems*. [ROP-391]

24.4.3.10.5 Non-fire emergency manual actuating boxes shall have tactile markings, be of a contrasting color to manual fire alarm boxes on the protected premises, and not be red.

24.4.3.10.6 Non-fire emergency manual actuating boxes shall be installed similarly to manual fire alarm boxes in accordance with the requirements of 17.14.3 through 17.14.8.2.

24.4.3.11* Secure Access of Fire Alarm/Mass Notification System

Interface. Access to, and physical protection of, the fire alarm/mass notification system interface shall be determined by the risk analysis and as defined in the emergency response plan.

24.4.3.12 Autonomous Control Unit (ACU).

24.4.3.12.1 Where provided, the building ACU shall monitor and control the notification appliance network.

24.4.3.12.2 Building occupants meeting the requirements of 24.4.3.2.1 shall be permitted to initiate communications from the ACU.

24.4.3.12.3 Unless otherwise identified in the emergency response plan, actions taken at the building ACU shall take precedence over actions taken at any remote location, including the local operating console, or inputs from a wide-area mass notification system. [ROP-394]

24.4.3.12.4 When there are multiple ACUs controlling the same notification appliance network, only one shall be in control at any given time.

24.4.3.12.5 When the ACU is integrated with the building fire alarm control unit to form one combined system that performs both functions, the system shall meet the standby power requirements of this chapter.

24.4.3.12.6 When a combined system is installed with an ACU and fire alarm control unit and placed in separate equipment enclosures, the ACU and fire alarm control unit shall be interfaced as required by this chapter.

24.4.3.12.7 When the ACU is part of a stand-alone mass notification system and no fire alarm system exists, the ACU shall meet the requirements of this chapter.

24.4.3.13 Local Operating Console (LOC).

24.4.3.13.1* Building occupants meeting the authorized personnel requirement of 24.4.3.2.1 shall be permitted to initiate communications from the LOC.

24.4.3.13.2 The use of lock wire seals or break-glass-type enclosures to house the operating consoles for the system, or equivalent protection against unauthorized use, shall be permitted.

24.4.3.13.3 Operating controls shall be clearly identified.

24.4.3.13.4 If there are multiple control locations, only one shall be in control at any given time.

24.4.3.13.5 The location having control of the system shall be identified by a visible indication at that location.

24.4.3.13.6 Upon initiation of an emergency message, a visible indication shall be provided to the user that the LOC is connected to the audio network. [ROP-396a]

24.4.3.13.7 If live voice instructions are provided, they shall override previously initiated signals to the selected notification zone(s) and shall have priority over any subsequent automatically initiated signals to the selected zone(s).

24.4.3.13.8 The emergency message shall be of an all-call basis. [ROP-397a]

24.4.3.14 Voice Message Priority.

24.4.3.14.1* The priority of mass notification messages shall be established using the emergency response plan. [ROP-398]

24.4.3.14.2 The local building mass notification system shall have the ability to override the fire alarm system with live voice or manual activation of a higher priority message, but only where that message and operation are approved under the emergency response plan. [ROP-400]

24.4.3.14.3 All other messages shall also be prioritized by using the emergency response plan. [ROP-401]

24.4.3.14.4 When identified by the emergency response plan, messages from the mass notification system shall be permitted to take priority over fire alarm messages and signals. [ROP-404]

24.4.3.14.5 If the fire alarm system is in the alarm mode and a recorded voice message is playing, or the audible signals are sounding, and then the mass notification system is actuated, it shall cause deactivation of all fire alarm-initiated audible and visible notification. [ROP-406]

24.4.3.14.6 After the mass notification system relinquishes control, the following shall occur:

(1) Without an active fire alarm signal, the fire alarm system shall automatically restore to normal operation.

(2)*With an active fire alarm signal, the fire alarm system shall operate based on the emergency response plan.

24.4.3.14.7 Deactivation of fire alarm audible and visible notification signals shall cause an individually identified supervisory signal to be initiated at each affected fire alarm control unit. [ROP-407]

24.4.3.14.8 The fire alarm signal deactivation function shall be permitted to occur only when both the fire alarm system is in an alarm condition and notification is being given by the mass notification system. [ROP-408]

24.4.3.14.9 When the fire alarm notification is overridden as permitted in 24.4.3.14.8, all other features of the fire alarm system shall remain unaffected. [ROP-353a]

24.4.3.15 Volume Control.

24.4.3.15.1 Local controls shall be permitted to adjust volume levels of ancillary functions. [ROP-409]

24.4.3.15.2 Upon activation of an emergency signal, the system shall override any local volume setting to deliver at a preset volume setting that has been established through testing and acceptance of sound level and speech intelligibility as required by this Code.

24.4.3.16 Visible Notification.

24.4.3.16.1 Where audible notification is provided, mass notification systems shall also provide visible notification information to serve the hearing impaired and for high-noise areas.

24.4.3.16.2 The visible notification required by 24.4.3.16.1 shall be accomplished using strobes.

24.4.3.16.3 In addition to the strobes required by 24.4.3.16.1, textual, graphic, or video displays shall be permitted.

24.4.3.16.4 Transmission of visible notification and messages shall be simultaneous to audible notification and messages.

24.4.3.17 Visible Appliances.

24.4.3.17.1 Visible appliances shall meet the requirements of 24.4.3.17.2 through 24.4.3.17.10. [ROP-411, 416]

24.4.3.17.2 Visible notification appliances shall be of a sufficient quantity and intensity and located so as to meet the intent of the design and be in compliance with Section 18.5. [ROP-416]

24.4.3.17.3 Strobes used in combination systems where the same strobe is used for both mass notification and fire notification shall comply with the following:

(1) Be clear or nominal white, meeting the listing requirements of ANSI/UL 1971, *Standard for Signaling Devices for the Hearing Impaired*

(2) Have no marking or be marked with the word "ALERT" stamped or imprinted on the appliance

(3) Be visible to the public

24.4.3.17.4 In situations where existing notification appliances previously used exclusively for fire alarm applications, and are marked with the word "FIRE," and are to be used for other emergency notification purposes, field modification to the marking shall be permitted, provided that it is accomplished by one of the following methods:

(1) Replacement of the manufacturer's approved escutcheon or trim plate

(2) Covering of, or removal of, the word "FIRE" using a manufacturer's approved method

(3) Installation of a permanent sign directly adjacent or below the notification appliance indicating that it is multipurpose and will operate for fire and other emergency conditions

[ROP-414, ROP-416]

24.4.3.17.5 Strobes with colored lenses shall be marked with the listed effective intensity using the lens color installed. [ROP-15, 416]

24.4.3.17.6 The spacing of colored strobes shall be in accordance with public mode spacing requirements of 18.5 using the effective intensity as the basis for spacing. [ROP-416]

24.4.3.17.7 Where strobes are used solely for mass notification, the word "ALERT" shall be stamped or imprinted on the appliance and be visible to the public. [ROP-416]

24.4.3.17.8 Where colored strobes are used solely for mass notification, they shall be listed to an applicable standard such as ANSI/UL 1638, *Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling*. [ROP-416]

24.4.3.17.9 Strobe appliances listed to ANSI/UL 1971, *Standard for Signaling Devices for the Hearing Impaired*, shall be considered as meeting the intent of this Code. [ROP-416]

Exception: Color lens strobes shall meet the requirements of 24.4.3.17.8. [ROP-416]

24.4.3.17.10 Strobes used for mass notification shall meet the synchronization requirements of Section 18.5.

24.4.3.18* Textual and Graphical Visible Appliances. [ROP-421]

24.4.3.18.1 Textual and graphical visible notification appliances shall be permitted to be used for primary or supplemental notification. [ROP-421]

24.4.3.18.2 Textual and graphical visible notification shall be considered to be primary notification where it is the only method used to convey emergency mass notification information to the general public or to specific individuals. [ROP-421]

24.4.3.18.3 Primary and supplemental textual and graphical visible appliances shall meet the requirements of Chapter 18. [ROP-421]

24.4.3.18.4 Textual and graphical visible appliances other than a main control unit shall be permitted to not have a dedicated primary circuit as required by Chapter 10, but shall meet all other requirements for the monitoring of primary power and all requirements for secondary power.

[ROP-421]

24.4.3.18.5 Textual and graphical visible appliances shall be permitted to be used for non-emergency purposes. [ROP-421]

24.4.3.18.6 Emergency textual and graphical messages shall override non-emergency textual and graphical messages. [ROP-421]

24.4.3.18.7 Supplemental textual and graphical visible appliances that are not monitored for integrity or loss of communication

by a control unit shall be provided with visual status indicators, including loss of communication or loss of power, that are clearly visible on the appliance.

[ROP-421]

24.4.3.19 Tactile Notification Appliances. Where tactile notification appliances are provided for emergency notification, they shall meet the requirements of Section 18.10.

24.4.3.20* Video Alerting. Video display systems that provide alerts and messages to video appliances shall be permitted to be used to supplement mass notification.

24.4.3.21 Supplemental Notification. Supplemental notification shall be permitted to provide additional information or more detailed instructions than those transmitted by the primary notification means.

24.4.3.22 Interfaces. Any abnormal condition that would prevent reliable emergency operation of any interfaced system shall be annunciated both audibly and visibly as a trouble signal at the affected control location. [ROP-421a]

24.4.3.22.1 Fire Alarm Control Interface (FACI).

24.4.3.22.1.1 Where a fire alarm system is installed covering all or part of the same building or other area as the mass notification system, an interface shall be provided between the systems for operational coordination purposes.

24.4.3.22.1.2 A listed barrier gateway in accordance with 10.3.1, integral with, or attached to, each control unit or group of control units, as appropriate, shall be provided to prevent the other systems from interfering with or controlling the fire alarm system.

24.4.3.22.1.3* The fire alarm control interface shall coordinate signals to and from each system to accomplish the following:

- (1) Indicate the failure at the system control unit that will be impaired
- (2) Provide a signal indicating 3MNS Active3 at the FACU [ROP-422]
- (3) Cause the fire alarm system to deactivate all audible and visible notification appliances whose operation could interfere with the intelligibility of the mass notification message or that will deliver conflicting information to occupants
- (4) Not permit the fire alarm system to turn off audible and visible notification appliances for special suppression predischARGE notification required by 24.4.2.7.1

(5) Where required by the emergency response plan or by other governing laws, codes or standards, or by other parts of this code, or by the authority having jurisdiction, provide for a supervisory signal to a supervising station in accordance with Chapter 26 that is indicative of the mass notification system overriding the fire alarm system notification appliances during simultaneous fire and mass notification events. [ROP-422]

24.4.3.22.1.4 If the fire alarm control interface is used to broadcast non-emergency messages, music, or other signals over the fire alarm notification appliance circuits, the operation shall meet the requirements of 24.4.3.15 and 23.8.4. [ROP-423]

24.4.3.22.2 Interfaces to Emergency Control Functions. The mass notification system shall be permitted to provide emergency control functions as described in Chapter 21 as required by the emergency response plan and as permitted by the authority having jurisdiction. [ROP-424]

24.4.3.22.2.1 When mass notifications systems are controlling building life safety systems the Mass Notifications systems equipment shall be listed for UL 864, *Control Units and Accessories for Fire Alarm Systems*. [ROP-426]

24.4.3.22.3 Interfaces with Wide-Area Mass Notification Systems.

24.4.3.22.3.1* Individual building mass notification systems shall be permitted to interface with wide-area mass notification systems.

24.4.3.22.3.2 The in-building mass notification system shall not be activated or controlled by a wide-area mass notification system, unless the wide-area mass notification system also meets the design and performance requirements of this chapter or has been deemed to be acceptable by the risk analysis and the authority having jurisdiction.

24.4.3.23 Combination Emergency Communications Systems.

24.4.3.23.1* When the mass notification system is integrated with the building fire alarm control unit to form one combined system that performs both functions, the system shall comply with this chapter.

24.4.3.23.2 All components that affect the operation of the fire alarm system shall be listed for fire alarm use and shall be in compliance with applicable standards such as ANSI/UL 864, *Standard for Control Units and Accessories for Fire Alarm Systems*.

24.4.3.24 Public Address (PA) Systems Used for Emergency Communications.

24.4.3.24.1 The voice communications or public address system that is to be used for mass notification shall be evaluated by the emergency communications system designer, as defined in Chapter 10, to determine applicability and compliance.

24.4.3.24.2 A document signed by the emergency communications system designer attesting to the fact that the public address system has been evaluated and meets the requirements determined by Chapter 24 and the emergency response plan, and is therefore deemed reliable and acceptable to provide emergency communications for the particular facility, shall be maintained with the fire alarm record drawings. [ROP-427]

24.4.3.25 Public Address (PA) System Interface with Facility Fire Alarm System.

24.4.3.25.1 When a public address system is used to deliver mass notification messages, the public address system shall provide (either internally as a design feature or with an approved or listed external controller) for a signal to control the facility's fire alarm system for the purpose of deactivating the fire alarm audible and visible notification appliances in accordance with 24.4.3.22.1.

24.4.3.25.2 All of the following features shall be provided in, or added to, the public address system:

- (1) Emergency messages must have priority over nonemergency messages.
- (2) All individual or zone speaker volume controls must default to the emergency sound level when used for an emergency mass notification message.
- (3) When monitoring of circuit integrity is provided by the public address system, monitoring must continue, even if local loudspeaker volume controls are placed in the "off" position. [ROP-338c]
- (4) The required visible notification appliance network (i.e., strobes and textual signs) must be provided where required.

24.4.4* Wide-Area Mass Notification Systems.

24.4.4.1 Voice Messages.

24.4.4.1.1 Voice messages shall comply with the requirements of 24.3.1.

24.4.4.1.2 Where required by the emergency response plan, multiple languages shall be permitted to be used. [ROP-431]

24.4.4.1.3 Where required by the emergency response plan, specific warning tones shall be provided.

24.4.4.2* Password Protection. Wide-area mass notification systems shall have multiple levels of password protection access control, including levels for system administrators, system operators, maintainers, supervisors, and executives, or other means to limit access to system controls shall be provided based on the emergency response plan. [ROP-432, ROP-434, ROP-435]

24.4.4.3* External Connections. Wide-area mass notification systems shall be permitted to connect to regional mass notification systems, public emergency alarm reporting systems, as defined in this Code, and public reporting systems as defined in NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*. [ROP-436]

24.4.4.4 Wide-Area Mass Notification System Components.

24.4.4.4.1 Central Control Station. Refer to Section 24.6 for requirements of a central control station.

24.4.4.4.2* High Power Speaker Array (HPSA). When required by the risk analysis, high power speaker arrays (HPSAs) shall be provided, installed, and maintained.

24.4.4.4.2.1 The HPSA shall be arranged in such a manner to provide intelligible voice and audible tone communications.

(A) When multiple HPSAs are used, they shall be arranged in physical or virtual notification zones so that each notification zone can be individually controlled by the central control station.

(B)* HPSAs shall be designed to maintain the intelligibility of voice signals within the notification zone in accordance with the requirements of Chapter 18.

24.4.4.4.2 Secondary power for HPSAs used for wide-area mass notification systems shall have sufficient capacity to operate the unit for a minimum of 7 days in standby, followed by 60 minutes of operation at full load.

24.4.4.4.3 An HPSA shall have the capability to provide voice communications and tones as determined by the emergency response plan.

[ROP-439]

24.4.4.4.4* An HPSA shall operate in the environment in which it is located, considering such factors as temperature, humidity, wind, dust, vibration, and other environmental factors.

24.4.4.4.3 High Power Speaker Array Enclosures.

24.4.4.4.3.1 Enclosures for HPSAs shall be of the NEMA 4 or 4X type.

24.4.4.4.3.2 HPSA enclosures shall have intrusion detection that signals the central control station.

(A) The signal shall be initiated whenever the door of the enclosure is in the open position.

(B) The transmitted signal shall be a latching supervisory signal.

24.4.4.4.4 High Power Speaker Array Mounting.

24.4.4.4.4.1 HPSAs shall be mounted at a minimum mounting height that is based on the rated output of the array.

24.4.4.4.4.2* HPSAs shall be installed at a height and orientation to prevent hearing damage to anyone in the immediate vicinity of the speakers.

24.4.4.4.4.3 All external conductors (conductors passing outside of the HPSA equipment cabinet) shall be provided with surge suppression to minimize potential equipment damage from lightning strikes.

24.4.4.4.5 High Power Speaker Array Noise Consideration.

HPSA notification zones shall not be used to provide mass notification inside any structures.

24.4.4.4.6* High Power Speaker Array Structural Loads, Wind, and Seismic Design. HPSAs and their supporting structures shall meet the structural, wind, and seismic loads as identified in the risk analysis.

24.4.4.4.7 Textual Visible Appliances. Textual visible appliances shall meet the requirements of Section 18.9 and 24.4.3.18.

24.4.4.4.7.1 After loss of primary power, textual visible appliances shall have sufficient secondary power to operate for a minimum of 2 hours of continuous display time during an emergency event.

24.4.4.4.7.2 Scrolling message boards shall be provided with means to control the scrolling rate.

24.4.4.4.8 In-Building Mass Notification Systems. The inbuilding mass notification system shall meet the requirements of 24.4.3.

24.4.4.4.9 Interfaces with Wide-Area Mass Notification Systems.

Interfaces between wide-area mass notification systems and in-building mass notification systems, other alert and notification systems, regional mass notification systems, and offsite interfaces shall have a standard interface method (such as an audio line-level output and multiple relay contacts) or supply the necessary communications protocols to provide interoperability and a secure communications link.

24.4.4.4.9.1 The interface shall be such that the primary function of both systems shall not be compromised.

24.4.4.4.9.2 The interface shall be monitored for integrity in accordance with Section 10.19, so that an abnormal condition that could prevent reliable system operation is audibly and visibly annunciated as a trouble signal at both systems' control units. **[ROP-442a]**

24.4.4.4.10 Control Hierarchy. There shall be a predefined control hierarchy between the wide-area mass notification system, the in-building mass notification system, and the regional mass notification system for information flow from the remote control center, as well as information from specific locations.

24.4.4.4.11 Communications Links.

24.4.4.4.11.1 The wide-area mass notification system, including communications links, shall minimize the potential for interference from jamming, spoofing, hacking, eavesdropping, or other malicious acts.

24.4.4.4.11.2 The wide-area mass notification system shall have a primary and redundant communications link with minimal functional and spatial interconnection with each other.

24.4.4.4.11.3 Wide-area and in-building mass notification systems equipment and interface methods connecting to, or utilizing, public emergency alarm reporting systems and associated communications infrastructure shall be electrically and operationally compatible so as not to interfere with the public emergency alarm reporting systems.

24.4.5* Distributed Recipient Mass Notification Systems (DRMNSs).

24.4.5.1* Overview. Distributed recipient mass notification system (DRMNS) alerting shall not be used in lieu of required audible and visible alerting mass notification systems but shall be integrated with mass notification systems whenever possible.

24.4.5.2* Targeted Recipients. The DRMNS shall be capable of sending alert messages to target recipients.

24.4.5.3* Network Security Compliance. DRMNSs shall be installed behind the appropriate internet system firewalls to protect the integrity of the network.

24.4.5.4 Network Architecture. The network shall be provided with net-centric architecture that fully supports local designated standards and security requirements.

24.4.5.5* Delivery Methods. The DRMNS shall be capable of sending alert messages to end-users (recipients) via multiple delivery methods.

24.4.5.6* Backup Distributed Recipient Mass Notification Systems.

DRMNS used to send emergency messages shall be provided with a backup configuration to facilitate distribution of messages. **[ROP-443c]**

24.5 Two-Way, In-Building Emergency Communications Systems.

24.5.1* Two-Way, In-Building Wired Emergency Services Communications Systems.

24.5.1.1 Two-way telephone communications equipment shall be listed for two-way telephone communications service and installed in accordance with 24.5.1.

24.5.1.2 Two-way telephone communications service, if provided, shall be for use by the fire service and collocated with the in-building fire emergency voice/alarm communications equipment.

24.5.1.3 Monitoring of the integrity of two-way telephone communications circuits shall be in accordance with 10.19.2.

24.5.1.4 Additional uses shall be permitted to include signaling and communications for a building fire warden organization and signaling and communications for reporting a fire and other emergencies (e.g., voice call box service, signaling, and communications for guard's tour service).

24.5.1.5 Variation of equipment and system operation provided to facilitate additional use of the two-way telephone communications service shall not adversely affect performance when used by the fire service.

24.5.1.6* Two-way telephone communications service shall be capable of permitting the simultaneous operation of any five telephone stations in a common talk mode.

24.5.1.7 A notification signal at the control equipment, distinctive from any other alarm, supervisory, or trouble signal, shall indicate the off-hook condition of a calling telephone circuit. If a selective talk telephone communications service is supplied, a distinctive visible indicator shall be furnished for each selectable circuit, so that all circuits with telephones offhook are continuously and visibly indicated.

24.5.1.8 A means for silencing the audible call-in signal sounding appliance shall be permitted, provided that it is key operated or located in a locked cabinet, or provided with protection to prevent use by unauthorized persons. The means shall operate a visible indicator and sound a trouble signal whenever the means is in the silence position and no telephone circuits are in an off-hook condition.

24.5.1.9 If a selective talk system is used, means as specified in 24.5.1.8 shall be permitted, provided that subsequent telephone circuits going off-hook operate the distinctive off-hook signal.

24.5.1.10 Two-way telephone systems with common talk mode (i.e., a conference or party line circuit) shall be permitted. [ROP-445]

24.5.1.11 In buildings provided with a two-way telephone communications system, at least one telephone station or jack shall be provided at the following locations:

- (1) Each floor level
- (2) Each notification zone
- (3) Each elevator cab
- (4) Elevator lobbies
- (5) Elevator machine room(s)
- (6) Emergency and standby power room(s)
- (7) Fire pump room(s)
- (8) Area(s) of refuge
- (9) Each floor level inside an enclosed exit stair(s)
- (10) Other room(s) or area(s) as required by the authority having jurisdiction

24.5.1.12 If the two-way telephone system is intended to be used by fire wardens in addition to the fire service, the minimum requirement shall be a selective talk system, where phones are selected from the control location.

24.5.1.13 Telephone circuits shall be selectable from the control location either individually or, if approved by the authority having jurisdiction, by floor or stairwell.

24.5.1.14 If the control equipment provided does not indicate the location of the caller (common talk systems), each telephone station or telephone jack shall be clearly and permanently labeled to allow the caller to identify his or her location to the control center by voice.

24.5.1.15 If telephone jacks are provided, two or more portable handsets, as determined by the authority having jurisdiction, shall be stored at each control center for use by emergency responders.

24.5.1.16 Wall-mounted telephone appliances or related jacks shall be not less than 36 in. (910 mm) and not more than 66 in. (1.68 m) above floor level with clear access to the appliance that is at least 30 in. (760 mm) wide. [ROP-266a]

24.5.1.17 If accessible to the general public, one telephone appliance per location shall be not more than 48 in. (1.22 m) above floor level.

[ROP-266a]

24.5.1.18* All circuits necessary for the operation of two-way telephone communications systems shall be installed in accordance with the pathway survivability requirements in 24.3.6.7.

24.5.2* Two-Way Radio Communications Enhancement Systems.

24.5.2.1 General.

24.5.2.1.1 Non-Interference. No amplification system capable of operating on frequencies or causing interference on frequencies assigned to the jurisdiction by the FCC shall be installed without prior coordination and approval of the authority having jurisdiction. The building manager/owner shall suspend and correct other equipment installations that degrade the performance of the public safety radio system or public safety radio enhancement system.

24.5.2.1.2 Approval and Permit. Plans shall be submitted for approval prior to installation. At the conclusion of successful acceptance testing, a renewable permit shall be issued for the public safety radio enhancement system where required by the authority having jurisdiction.

24.5.2.2 Radio Coverage. Radio coverage shall be provided throughout the building as a percentage of floor area as specified in 24.5.2.2.1 through 24.5.2.2.3.

24.5.2.2.1 Critical Areas. Critical areas, such as the fire command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the authority having jurisdiction, shall be provided with 99 percent floor area radio coverage. [ROP-445a]

24.5.2.2.2 General Building Areas. General building areas shall be provided with 90 percent floor area radio coverage.

24.5.2.2.3 Amplification Components. Buildings and structures that cannot support the required level of radio coverage shall be equipped with a radiating cable system or a distributed antenna system (DAS) with FCC-certified signal boosters, or both, or with a system that is otherwise approved, in order to achieve the required adequate radio coverage.

24.5.2.3 Signal Strength.

24.5.2.3.1 Inbound. A minimum inbound signal strength of ≥ 95 dBm, or other signal strength as required by the authority having jurisdiction, shall be provided throughout the coverage area.

24.5.2.3.2 Outbound. A minimum outbound signal strength of ≥ 95 dBm at the donor site, or other signal strength as required by the authority having jurisdiction, shall be provided from the coverage area.

24.5.2.3.3 Isolation. If a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas and shall be a minimum of 15 dB above the signal booster gain under all operating conditions.

24.5.2.4* System Radio Frequencies. The public safety radio enhancement system shall be capable of transmitting all public safety radio frequencies assigned to the jurisdiction and be capable of using any modulation technology.

24.5.2.4.1 List of Assigned Frequencies. The authority having jurisdiction shall maintain a list of all inbound/outbound frequency pairs for distribution to system designers.

24.5.2.4.2* Frequency Changes. Systems shall be capable of upgrade, to allow for instances where the jurisdiction changes or adds system frequencies, in order to maintain radio system coverage as originally designed.

24.5.2.5 System Components.

24.5.2.5.1 Component Approval. Components utilized in the installation of the public safety radio enhancement system, such as repeaters, transmitters, receivers, signal boosters, cabling, and fiber-distributed antenna systems, shall be approved and shall be compatible with the public safety radio system.

24.5.2.5.2 Component Enclosures. All repeater, transmitter, receiver, signal booster components, and battery system components

shall be contained in a NEMA 4- or 4X- type enclosure (s). [ROP-447]

24.5.2.5.3 External Filters. Permanent external filters and attachments shall not be permitted.

24.5.2.5.4 Signal Booster Components. If used, signal boosters shall meet the following requirements, as well as any other requirements determined by the authority having jurisdiction:

(1)*Signal boosters shall have FCC certification prior to installation.

(2) All signal boosters shall be compatible with both analog and digital communications simultaneously at the time of installation. The authority having jurisdiction shall provide the maximum acceptable propagation delay standard.

24.5.2.5.5 Power Supplies. At least two independent and reliable power supplies shall be provided for all repeater, transmitter, receiver, and signal booster components, one primary and one secondary. [ROP-448]

24.5.2.5.5.1 Primary Power Source. The primary power source shall be supplied from a dedicated branch circuit and comply with 10.5.5.1. [ROP-448]

24.5.2.5.5.2* Secondary Power Source. The secondary power source shall consist of one of the following:

(1) A storage battery dedicated to the system with at least 12 hours of 100 percent system operation capacity and arranged in accordance with 10.5.9.

(2) An automatic starting, engine-driven generator serving the dedicated branch circuit or the system with at least 12 hours of 100 percent system operation capacity and storage batteries dedicated to the system with at least 2 hours of 100 percent system operation capacity and arranged in accordance with 10.5.10.3.

[ROP-448]

24.5.2.5.5.3 Monitoring Integrity of Power Supplies. Monitoring the integrity of power supplies shall be in accordance with 10.17.3. [ROP-448]

24.5.2.6 System Monitoring.

24.5.2.6.1 Fire Alarm System. The public safety radio communications enhancement system shall include automatic supervisory and trouble signals for malfunctions of the signal booster (s) and power supply(ies) that are annunciated by the fire alarm system and comply with the following:

(1) The integrity of the circuit monitoring signal booster(s) and power supply(ies) shall comply with 12.6.1.

(2) System and signal booster supervisory signals shall include the following:

(a) Antenna malfunction

(b) Signal booster failure

(c) Low-battery capacity indication when 70 percent of the 12-hour operating capacity has been depleted. [ROP-449]

(3) Power supply signals shall include the following for each signal booster: [ROP-449]

(a) Loss of normal ac power

(b) Failure of battery charger

[ROP-449]

24.5.2.6.2* Dedicated Panel. A dedicated monitoring panel shall be provided within the fire command center to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster: [ROP-445a]

(1) Normal ac power

(2) Signal booster trouble

(3) Loss of normal ac power

(4) Failure of battery charger

(5) Low-battery capacity

24.5.2.7 Technical Criteria. The authority having jurisdiction shall maintain a document of technical information specific to its requirements. This document shall contain, as a minimum, the following:

(1) Frequencies required

(2) Location and effective radiated power (ERP) of radio sites used by the public safety radio enhancement system

(3) Maximum propagation delay (in microseconds)

(4) List of specifically approved system components

(5) Other supporting technical information necessary to direct system design

[ROP-450]

24.6* Information, Command, and Control. The requirements of Section 24.6 shall apply to the communications methods and equipment used to receive and transmit information between premises sources or premises systems and the central control station(s).

24.6.1* Central Control Station for Emergency Communications Systems.

24.6.1.1* The location of the central control station shall be defined in the emergency response plan and as approved by the authority having jurisdiction.

24.6.1.2 The level of security at the central control station shall be defined in the emergency response plan.

24.6.1.3* Staffing.

24.6.1.3.1 Central control station personnel requirements shall be defined in the documentation in the emergency response plan.

24.6.1.3.2* Individuals expected to operate an emergency communications system shall be properly trained in the purpose, functions, procedures, and anticipated actions of such systems.

24.6.1.4 The central control station shall be capable of receiving voice messages by telephone or radio and transmitting via equipment at the central control station.

24.6.1.5 The central control station operator shall have the ability to monitor inputs/sensors and control output devices automatically, manually, or automatically with operator override.

24.6.2 Emergency Communications Control Unit (ECCU).

24.6.2.1 An emergency communications control unit (ECCU), where identified by the risk analysis, and defined in the emergency response plan, shall be provided at each central control station.

24.6.2.2 The system operator shall be able to send live voice signals or activate prerecorded voice messages, tones, and other signals.

24.6.2.3 The signals shall be selectable to individual buildings; zones of buildings; individual outdoor speaker arrays; zones of outdoor speaker arrays; or a building, multiple buildings, outside areas, or a combination of these, in accordance with the emergency response plan established for the premises.

24.6.2.4 The central control emergency communications control unit shall automatically or manually assign priorities to all transmitted signals.

24.6.2.5 Multiple Emergency Communications Control Units.

24.6.2.5.1 In wide-area mass notification systems, the central control station shall have a primary emergency communications control unit.

24.6.2.5.2 Multiple emergency communications control units shall be permitted.

24.6.3* Signals. Where identified by the risk analysis and defined in the emergency response plan, the emergency communications control unit shall be permitted to automatically or manually send different messages or signals to different locations.

24.6.4 Power Supply.

24.6.4.1 All control units shall meet the requirements of Section 10.6. [ROP-454, ROP-455]

24.6.4.2 The power supply for the central control station shall include an uninterrupted power source with capacity sufficient to support the emergency response plan established for the specific premises.

24.6.5 Transmission. Signals shall be capable of being automatically or manually transmitted to a regional or national emergency response center or to other nearby facilities that have a need to be alerted of the emergency.

24.6.6* Other Systems. The central control station shall be capable of interfacing with and controlling other notification systems, such as telephone dialers, tone alert systems, computer network alerting systems, pagers, facsimile machines, textual devices, and other visual control signs, as determined by the emergency response plan.

24.6.7 Inspection, Testing, and Maintenance. Inspection, testing, and maintenance shall be performed on a periodic basis, as described in Chapter 14, to verify and ensure proper system operation and readiness.

24.7* [Title & Organization no Clear] The requirements of Section 24.7 shall apply to mass notification systems designed to recognize performance-based practices.

24.7.1 Goals and Objectives. The performance-based design shall meet the following goals and objectives:

- (1) The risk analysis, design criteria, design brief, system performance, and testing criteria are developed in accordance with this section. [ROP-456]
- (2) The system disseminates information to the target audience in an accurate and timely manner.
- (3) The design and performance criteria are specific to the nature and anticipated risks of each location.
- (4) The system is capable of withstanding various scenarios and survives even if some damage has already occurred.
- (5) Message initiation can be effected by all responding entities responsible for the safety and security of occupants.

24.7.2* Qualifications. The performance-based design and risk analysis shall be prepared by a design professional certified or approved by the authority having jurisdiction.

24.7.3 Independent Review. The authority having jurisdiction shall be permitted to require an approved, independent third party to review the proposed design brief and provide an evaluation of the design to the authority having jurisdiction.

24.7.4 Final Determination. The authority having jurisdiction shall make the final determination as to whether the performance objectives have been met.

24.7.5 Maintenance of Design Features. The design features required for the system to continue to meet the performance goals and objectives of this Code shall be maintained for the life of the building.

24.7.6 Performance Criteria.

24.7.6.1 General. All designs shall meet the goals and objectives specified in 24.7.1 and shall be considered equivalent, provided that the performance criterion in 24.7.6.2 is met, the design team concurs with the design, and the risk analysis considers the following factors:

- (1) Number of persons to be notified
- (2) Occupancy characteristics
- (3) Anticipated threat
- (4) Staff capabilities
- (5) Coordination with the emergency response plan

24.7.6.2 Performance Criterion. The performance criterion shall include timely and accurate notification of all persons within the boundaries of the mass notification system in a medium to which they can respond when given directions by responding entities.

24.7.6.3* Design Team. The design team shall be comprised of the design professional, the owner or owner's representative, representatives of the authority having jurisdiction, and representatives of the responding entities.

24.7.7 [Title and Organization Not Clear]. [ROP-377]

24.7.7.1 The design of the mass notification system shall be based upon a risk analysis prepared in accordance with Section 24.7 specific to the nature and anticipated risks of each facility for which it is designed.

24.7.7.2 The design of the mass notification system shall include the preparation of a design brief that is prepared utilizing recognized performance-based design practices. [ROP-377]

24.7.7.3 Operational Status and System Effectiveness. The performance of the system shall reflect the documented performance and reliability of the components of those systems or features, unless design specifications are incorporated to modify the expected performance.

24.7.7.3.1 Staff Assistance. The inclusion of trained employees as part of the mass notification system shall be identified and documented.

24.7.7.3.2 Emergency Response Personnel. The design shall consider the characteristics or other conditions related to the availability, speed of response, effectiveness, roles, and other characteristics of emergency response personnel.

24.7.8* Design Brief.

24.7.8.1 Clear Statement. Design specifications and briefs used in the performance-based design shall be clearly stated and shown to be realistic and sustainable.

24.7.8.2 Testing. Specific testing requirements that are necessary to maintain reliable performance shall be stated in the design brief