

Fire Protection System Design

Course# FP201

*EZ-pdh.com
Ezekiel Enterprises, LLC
301 Mission Dr. Unit 571
New Smyrna Beach, FL 32128
800-433-1487
helpdesk@ezpdh.com*

**FIRE PROTECTION DESIGN MANUAL
DEPARTMENT OF VETERANS AFFAIRS
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**FIRE PROTECTION DESIGN MANUAL
DEPARTMENT OF VETERANS AFFAIRS**

INTRODUCTION

The primary goal of this manual is to provide an environment for occupants that is reasonably safe from fire and products of combustion. To achieve this goal, the objectives are to protect occupants who are not intimate with initial fire development for the time needed to take appropriate action, and to improve the survivability of occupants who are intimate with initial fire development.

The secondary goals of this manual are to provide a reasonable level of building usability and property protection from the effects of fire and products of combustion. To achieve these goals, the objectives are to increase the likelihood that, in the event of a fire, critical operational functions are not interrupted for longer than 24 hours and the loss of real or personal property does not exceed \$500,000.00.

The criteria in this manual are based on the assumption of a single fire source.

1. GENERAL

1.1 Scope:

- A. This manual contains fire protection engineering design criteria to meet the goals identified above, by protecting patients, visitors, and staff; maintaining the continuity of important clinical and administrative activities; and protecting VA property. This generally will require the installation of automatic sprinkler protection in VA owned buildings. In VA occupied buildings, sprinkler protection shall be required to protect VA property or for compliance with the Life Safety Code or the Federal Fire Safety Act PL-102-522. See [Section 6.1](#). (Note: Protection shall not be required to limit the loss of non-VA property.)
- B. This manual applies to all categories of VA construction and renovation projects, station level projects, and acquisition of all VA property (including leases).
- C. This manual supersedes new construction criteria contained in VA Circulars, Information Letters, and Directives, which are dated prior to the publication date of this manual.
- D. This manual is intended to apply to new construction. It can be used as guidance with respect to existing features.

1.2 Application:

- A. Use this manual in conjunction with the Scope of Work paragraph in the Architect/Engineer (A/E) Package and PG-18-15, Minimum Requirements for A/E Submissions, which defines the information to be shown on drawings and work to be completed at each stage of design. In addition, coordinate with requirements from other applicable VA criteria listed in Appendices C and D.
- B. The facility shall solicit the services of a third party with knowledge of applicable fire protection criteria such as the respective Network Safety Manager, Network Safety and Fire Protection Engineer (SFPE), or other qualified fire protection engineering consultant during design in order to insure the project as designed by the A/E complies with such criteria. Obtaining these third party services early in the design process is strongly recommended. The third party entity shall be involved in reviewing the design, but may also be involved with reviewing contractor's submissions, conducting pre-occupancy life safety inspections, and/or witnessing final fire protection acceptance testing.

- C. For code interpretation and enforcement, the Authority Having Jurisdiction (AHJ) for all VA projects is ultimately the Deputy Under Secretary for Health for Operations and Management (10N), with the Safety and Fire Protection Engineer (10NA8) acting as the VA Fire Marshal. At the Medical Center and Veterans Integrated Service Network (VISN) level, the respective Network Safety Manager or Network Safety and Fire Protection Engineer (SFPE) has the option to act as the AHJ representative on behalf of 10NA8 and make local AHJ decisions in areas where they are competent.

1.3 Fire Protection Codes and Standards:

- A. The Public Buildings Amendment Act (PL 100-678) requires all federal agencies to follow the latest editions of nationally recognized fire and life safety codes. It also requires federal agencies to give local fire protection officials the opportunity to review and comment on projects for compliance with local regulations and compatibility with local fire fighting practices. All reviews by local fire protection officials shall be at no cost to the Government. Designers should meet with local fire authorities during early stages of design to incorporate local requirements to the extent practical; however, recommendations made by local officials should be reviewed for adequacy, cost, and nationally accepted practice before being incorporated into project design.
- B. VA has adopted the National Fire Codes (NFC) published by the National Fire Protection Association (NFPA), which establish a minimum acceptable level of life safety and property protection. Life safety requirements are specifically addressed in the Life Safety Code, NFPA 101. Where conflicts exist between codes, the designer shall follow the code specified in the text under the subject section of this manual. Fire Protection design shall be based on the latest editions of the NFC at the Date of Award of the contract to the Architectural/Engineering (A/E) firm (or Design/Build firm). Under special circumstances, the VA will require compliance with a more recent code edition when significant changes to the code have occurred between the Date of Award to the A/E and the Date of Award to the prime contractor for construction.

Note: Special circumstances would include a situation where a designed project sat “on the shelf” for an extended period of time, or where a significant change to the code was made and where incorporating that change would improve safety in the opinion of the AHJ.

- C. Fire protection features not addressed by the NFC or otherwise addressed by this document shall be designed to comply with the requirements of the latest edition of the International Building Code (IBC). Other references are listed in Appendix B.
- D. For design features that are addressed by both the IBC as well as by NFPA 101 or a document referenced by NFPA 101, the requirements of NFPA 101 or the document referenced by NFPA 101 shall be used exclusively (this applies even if the IBC requirements are different).

Note: VA buildings must meet the requirements of NFPA 101 and documents referenced by NFPA 101 in order to comply with the accreditation requirements of the Joint Commission. It is intended that life safety and fire protection features will be designed in accordance with the requirements of NFPA 101 and documents referenced by NFPA 101. Other building features (including, but not limited to, structural strength, stability, sanitation, adequate light and ventilation, and energy conservation) will be designed in accordance with the IBC and documents referenced by the IBC or as identified in VHA Program Guide PG-18-3, Topic 1 – Codes, Standards, and Executive Orders.

- E. Strict compliance to codes and standards is mandatory for new construction. If equivalent protection is proposed by the designer for renovations, submit requests and supporting rationale through the respective Network Safety Manager or SFPE to the Safety and Fire Protection Engineer (10NA8) in VA Central Office.

1.4 Fire Protection During Construction:

- A. Coordinate with the facility prior to and concurrent with design.
- B. Fire protection during construction shall comply with VA Master Construction Specification (VAMCS) 01 00 00, General Requirements. (Note: VAMCS 01 00 00, General Requirements, addresses NFPA 241, Joint Commission Interim Life Safety Measures, Hot Work Permits, etc. This specification section was formerly section 01010.)
- C. Separate all occupied areas from demolition, renovation, or construction activities by temporary smoke-tight construction partitions of gypsum board or other approved non-combustible or limited-combustible material. Partitions shall be full height, extending through suspended ceilings to the floor slab or roof deck above and shall be one-hour fire rated, unless sprinklers are installed and are operational on both sides of the temporary partition whereupon the partition may be permitted to terminate at the ceiling in accordance with NFPA 241. Where the ceiling on one side of the temporary construction barrier has been removed, the temporary partition must extend to the deck above.

Note: This requirement is due to the inherently greater potential for fire or hazardous materials incidents associated with the combustibles and operations of demolition/construction. This risk is made worse by the likelihood of compromised fire protection systems and fire/smoke resistant construction. This does not obviate the need to provide other protective measures to contain dust and debris as specified by VAMCS 01 00 00 section 1.8(D)(2). Sprinklers are considered to be operational when they are installed in accordance with NFPA 13 (spacing, protection, distance from the ceiling, etc.) and there is a sufficient automatic water supply. If the ceiling was removed and the sprinklers remain at the original ceiling level, they would likely not be considered operational.

- D. Phase construction as necessary to ensure that obstruction of exits is minimized or avoided. If exits are obstructed during construction, provide alternate exit routes during each phase of construction and identify the alternate routes on the construction drawings.
- E. Minimize or avoid disruptions to fire alarm and sprinkler systems. Delineate phasing of construction to ensure that installations of new systems are expedited, and where possible, maintain existing systems in service until the replacement system is operational. If fire protection systems are to be disrupted, ensure procedures are incorporated to maintain equivalent levels of fire protection and provide formal notification to the facility while systems are down.

1.5 Americans with Disabilities Act (ADA): Fire Protection requirements of ADA do not apply to federal agencies; however, VA is required to comply with the ABA (Architectural Barriers Act) Accessibility Standard for Federal Facilities.

2. BUILDING FEATURES

2.1 Types of Construction:

- A. For each construction type, design fire resistive ratings of structural members in accordance with NFPA 220.
- B. For other than parking garages, comply with the following:
 - 1) For buildings where NFPA 101 provides construction requirements for one or more of the occupancies within the building, the type of construction as well as the height for the building shall comply with the most restrictive occupancy construction requirements of NFPA 101.
 - 2) For buildings where NFPA 101 does not provide construction requirements for any of the occupancies within the building, the construction type as well as height and area limitations for the building shall comply with the requirements of the IBC.

Note: The height and area limitations found in the IBC will apply only to those buildings where all occupancies within the building have no construction requirements in NFPA 101. For example, use of the IBC will restrict the height and area of a Type V building containing a business occupancy while NFPA 101 would permit the building to be of unlimited height and area. Typically, new construction in the VA will require the building to be sprinkler protected and the limitations in the IBC for fully sprinkler protected buildings should not be overly restrictive.

- C. For parking garages, the construction type as well as height and area limitations shall be as follows:
 - 1) Portions that are open parking structures, as defined in NFPA 88A, shall be in accordance with NFPA 88A.
 - 2) Portions that are enclosed parking structures, as defined in NFPA 88A, shall be in accordance with the IBC.

2.2 Building Separation:

- A. For other than parking garages, the requirements for fire resistance ratings of exterior walls, maximum area for exterior wall openings, and opening protection shall comply with the IBC (see Note 1) except as follows:
 - 1) There are no requirements for separation or openings between VA buildings when both (all) buildings are fully sprinkler protected (see Notes 2 and 3). This exception does not apply to VA buildings that are adjacent to non-VA property lines.
 - 2) As permitted under Section 2.9 of this design manual.

Note 1: Building separation requirements are found in Table 602 and opening requirements are found in Table 705.8 of the 2009 Edition of the IBC. With greater than 60 feet of separation between buildings (or greater than 30 feet of separation between a building and a property line), there are no requirements in the IBC. With ≤ 60 feet of separation between buildings (or ≤ 30 feet of separation between a building and a property line) and where any one building is not fully sprinkler protected, the requirements in the IBC must be followed.

Note 2: Buildings that are sprinkler protected throughout are not considered to be an exposure hazard in accordance with NFPA 80A.

Note 3: If buildings touch each other, additional requirements might apply. (i.e. construction type, occupancy separation, etc.)

- B. For parking garages, building separation and requirements for rated exterior walls and openings shall comply with the requirements of NFPA 88A.

2.3 VA Hospital Building System (Interstitial): Fire protection requirements for facilities designed using the VA Hospital Building System (VAHBS) shall comply with the following:

- A. Design walk-on decks in accordance with the lightweight insulating concrete assembly tested and reported in NBSIR 85-3158 or NISTIR 5560, except that sprayed fire-resistive material protecting the bottom of purlins supporting walk-on decks shall be sprayed to a minimum thickness of one-inch with fireproofing suitable for exposed applications. Wire mesh may be omitted from the bottom flange of the purlins supporting the deck.
- B. Steel in interstitial space supporting functional floors shall not be fireproofed, with the exception of columns, which are sprayed throughout their entire height, and structural members supporting mechanical room floors (required to maintain continuity of the two-hour membrane separating interstitial spaces from functional floors). Clearly identify these features on design details and in specifications.
- C. Two-hour fire resistance rating is required between floors; the separation runs in a horizontal plane along the mechanical equipment room floor, then vertically along the wall separating the mechanical equipment room from functional spaces, then it continues along the interstitial deck. Columns, girders, and trusses supporting more than one floor within interstitial spaces and structural members in the mechanical room shall also have two-hour fire resistance rating.
- D. Interstitial space need not be subdivided horizontally into fire or smoke compartments. Horizontal exits or smoke barrier walls located below in occupied space need not be extended up into interstitial space.
- E. In interstitial space, a fire resistive rating is only required for two-hour fire rated shafts (elevators, chases, stairs, etc.) and one-hour rated mechanical equipment rooms adjacent to interstitial spaces.
- F. Neither fire nor smoke dampers are required where ducts penetrate the one-hour rated partition separating the mechanical room from the interstitial space; however, smoke dampers are required at air handlers to comply with NFPA 90A. Fire dampers are not required in ducts for openings in the interstitial deck less than 150,000 sq. mm (225 sq in), including supply ducts from interstitial spaces to functional spaces, exhaust ducts, and return ducts from functional spaces into the interstitial space. Flexible duct work (UL 181, Class I) is permitted in interstitial space for connections less than 2.4 m (8 ft) long and shall be no larger than 300 mm (12 in) diameter.
- G. Protect horizontal and vertical penetrations (ducts, cables, pipes, etc.) with through penetration protection systems.
- H. Provide fire alarm pull stations at exit doors from interstitial spaces and sufficient notification appliances so a fire alarm signal can be received throughout the spaces.
- I. Provide exit signs at exit doors and other locations to provide clear direction toward exits from interstitial spaces. Provide emergency lighting for adequate egress illumination in the event of a power outage.

2.4 Interior Finish:

- A. Wall and ceiling finishes and movable partitions shall conform to NFPA 101.
- B. Interior floor finish shall conform to NFPA 101.

2.5 Site Considerations:

- A. Provide access for emergency vehicles to new buildings and additions in accordance with NFPA 1.
- B. Design roads, fire lanes, and turn-arounds for the weight and turning radius of fire apparatus. Consult local fire department for fire apparatus requirements. At minimum, one of the long sides of every building shall be accessible to fire department equipment.

2.6 Insulation, including foam plastic: Comply with IBC.

2.7 Roof Coverings and Roof Deck Assemblies:

- A. Roof coverings shall be approved or listed by a nationally recognized testing laboratory for compliance with UL standard 790 and shall be Class B minimum.
- B. Roof deck assemblies shall be FM Class I approved, or shall be UL listed as Fire-Classified.

2.8 Roof Access: Comply with IBC.

2.9 Shelters, pavilions, or similar structures located near health care buildings:

- A. Shelters or pavilions with automatic sprinkler protection are not considered to present an exposure hazard. However, if of wood-frame construction, they may not be attached directly to a permanent building.
- B. Locate non-sprinklered combustible structures or non-sprinklered structures that have combustible roof assemblies a minimum of 7.5 m (25 ft) from the exposed building. The 7.5 m (25 ft) separation may be reduced to 0 when the exposed (permanent) building has at least a two-hour fire resistive rating and has no openings (windows, doors, or roof) within 7.5 m (25 ft) of the temporary structure; to 3 m (10 ft) when the exposed wall has a two-hour fire resistive rating and all openings within 7.5 m (25 ft) of the temporary structure are protected with one-hour protection; and to 4.5 m (15 ft) when all openings in the two-hour fire resistive rated exposed wall are protected with 3/4 hour rated assemblies.
- C. Because it is difficult to ignite polycarbonate and aluminum (bus stop type) shelters and they are likely to collapse shortly after becoming fully involved in a fire, they are given special consideration. Polycarbonate and aluminum shelters located next to buildings with automatic sprinkler protection shall be located 3 m (10 ft) or more from any unprotected openings. Such shelters located next to buildings without automatic sprinkler protection shall be located 6 m (20 ft) or more from any unprotected openings.
- D. Shelters or pavilions that are of masonry construction shall not be located within 3 m (10 ft) of any building opening.

- 2.10 Fire and Smoke Barriers: Fire and Smoke barriers shall be provided as required by NFPA 101. In accordance with PG-18-15, fire and smoke barriers shall be shown on all drawings. Specifically indicate the hourly rating of every barrier. Where possible, smoke barriers should not be configured to include corridor doors.

Note: Corridor walls and smoke barriers have different requirements.

- 2.11 Protection of Openings: Openings in fire rated barriers shall be protected according to NFPA 101, 80, and 90A. Doors in such openings shall be normally closed, unless equipped with electromagnetic door hold open devices arranged to close upon activation of the fire alarm system or smoke detector installed proximate to the door. Fire shutters shall be provided to protect openings in fire rated barriers designed to be normally open. Shutters shall be designed to close upon activation of a smoke detector proximate to the shutter. Such detectors shall close all shutters within a fire barrier served. Closing speed shall be in accordance with NFPA 80. Fire dampers shall be installed in fire rated barriers in accordance with NFPA 90A. Fire rating glazing, where used, shall meet applicable safety standards.

Note: Shutter includes rolling steel fire doors as well as service counter doors.

- 2.12 Suites: Corridor doors accessing suites in health care occupancies shall latch except power operated doors as identified in the Life Safety Code.

Note: The intent of this requirement is to ensure corridor doors accessing suites are equipped with latches just like other corridor doors. This would apply even if the suite doors were part of a smoke barrier, though this configuration is not advised. Often, operating room, ICU and recovery room suite doors are double leaf power operated automatic doors that do not normally latch. As of the 2009 Edition of the Life Safety Code, these doors do not have to latch provided there is 5lbf at the latch edge that will keep the door closed.

- 2.13 Exit Signs:

- A. Two exit signs are not required to be visible in an exit access corridor (see Healthcare Interpretations Task Force (HITF) 98-7).
- B. Exit signs with tritium are not permitted in VA facilities.

Note: Possession of tritium exit signs brings upon the facility legal responsibilities for compliance with Nuclear Regulatory Commission (NRC) regulations.

- 2.14 Door Locking Requirements: Doors are permitted to be locked in the direction of egress travel under conditions as identified in NFPA 101 (2009) as follows:

- A. Delayed Egress (7.2.1.6.1) where permitted by the occupancy chapter.
- B. Access Controlled (7.2.1.6.2) where permitted by the occupancy chapter.
- C. Elevator Lobbies (7.2.1.6.3) where permitted by the occupancy chapter.
- D. For the safety of the patients in healthcare occupancies
 - 1) Patient room doors (18/19.2.2.2.2)
 - 2) Means of egress for the clinical needs of the patients (18/19.2.2.2.5.1)

Where the permission to lock doors in accordance with NFPA 101, 18/19.2.2.2.5.1 is used, NFPA 101, 18/19.2.2.2.6 requires the following:

Doors that are located in the means of egress and are permitted to be locked under other provisions of this chapter shall have provisions made for the rapid removal of occupants by means such as the follows:

- Option A. Remote control of locks
- Option B. Keying of all locks to keys carried by staff at all times
- Option C. Other such reliable means available to the staff at all times.

VA Clarification for Options A, B, and C above:

For Option (A): The locked doors are required to be in the line of sight of the location of the remote operator.

For Option (B): Self evident

For Option (C): Card access security systems may be used provided that a mechanical key release is provided such that when the key is operated, it will directly interrupt the power to the locking mechanism independent of the card access system electronics and staff in the area carry keys at all times.

- 3) Means of egress where patient special needs require specialized protective measures (18/19.2.2.2.5.2)

Note: This locking permission was added in the 2009 edition of the Life Safety Code especially for pediatric wards. Pediatric wards were being locked to prevent babies from being stolen and the locking was not truly for the clinical needs of the patients. The use of section 18/19.2.2.2.5.2 should rarely be used in the VA since the doors could be locked under the less stringent requirements for clinical reasons on 18/19.2.2.2.5.1.

Addition criteria from NFPA 101 as follows {(1) through (5)(b) copied verbatim} is required to use this arrangement.

- (1) Staff can readily unlock doors at all times in accordance with 18/19.2.2.2.6.
- (2) A total (complete) smoke detection system is provided throughout the locked space in accordance with 9.6.2.9, or locked doors can be remotely unlocked at an approved, constantly attended location within the locked space.
- (3)The building is protected throughout by an approved, supervised automatic sprinkler system in accordance with 18/19.3.5.1.
- (4) The locks are electrical locks that fail safely so as to release upon loss of power to the device.
- (5) The locks release by independent activation of each of the following:
 - (a) Activation of the smoke detection system required by 18/19.2.2.2.5.2(2)
 - (b) Waterflow in the automatic sprinkler system required by 18/19.2.2.2.5.2(3)

Where the permission to lock doors in accordance with NFPA 101, 18/19.2.2.2.5.2 is used, NFPA 101, 18/19.2.2.2.6 requires the following:

Doors that are located in the means of egress and are permitted to be locked under other provisions of this chapter shall have provisions made for the rapid removal of occupants by means such as the follows:

- Option A. Remote control of locks

Option B. Keying of all locks to keys carried by staff at all times

Option C. Other such reliable means available to the staff at all times.

VA Clarification for Options A, B, and C above:

For Option (A): The locked doors are required to be in the line of sight of the location of the remote operator.

For Option (B): Self evident

For Option (C): Card access security systems may be used provided that a mechanical key release is provided such that when the key is operated, it will directly interrupt the power to the locking mechanism independent of the card access system electronics and staff in the area carry keys at all times.

4) Doors in non-healthcare occupancies for the safety of patients (18/19.1.2.6)

Note: From the NFPA 101 Handbook: Health care occupancy patients are sometimes moved to nonmedical areas — such as a chapel for religious services or an auditorium for recreation — that typically do not meet the provisions applicable to health care occupancies. Paragraph 18/19.1.2.6 permits such areas to be regulated by the provisions applicable to the corresponding occupancy (which would be an assembly occupancy, in the case of chapels or auditoriums). This paragraph addresses a subject similar to that addressed in 18/19.1.2.7 but adds the requirement that, where the clinical needs of the occupants necessitate the locking of doors, staff must be present for the supervised unlocking of doors and release of occupants. This additional requirement ensures that procedures are in place for the ready release of occupants.

3. SPECIAL PROTECTION

3.1 Storage:

- A. Storage rooms shall be considered hazardous areas and shall comply with appropriate occupancy chapter requirements of NFPA 101.

Note: It is not the intent to require protection for storage rooms that is greater than the protection required by the Life Safety Code. A storage room may be classified as a hazardous area in one occupancy chapter and not be considered a hazardous area in another occupancy chapter.

- B. Rooms containing medical records storage or moveable-aisle/mobile shelving shall be provided with automatic sprinkler protection and enclosed with a barrier having a one-hour fire resistance rating. Also see Section 6.1E.

3.2 Flammable and Combustible Liquid Storage:

- A. Comply with NFPA 30.
- B. Provide adequate space for flammable and combustible liquid storage cabinets.

3.3 Food Preparation Facilities: Provide fixed fire extinguishing systems for cooking operations in accordance with NFPA 96. Activation of the fire suppression system shall shut down the power/fuel source to the cooking equipment and shall be connected to the building fire alarm system. Fire protection systems shall be wet chemical type and shall comply with UL300 in accordance with NFPA 17A.

3.4 Compressed Gas/Cryogenic Liquid Storage:

- A. Location, construction, and arrangement of compressed medical gas storage areas shall comply with NFPA 99.
- B. Bulk oxygen supply systems or storage locations having a total capacity of more than 566 cu m (20,000 cu ft) of oxygen shall comply with NFPA 50.
- C. Liquid oxygen storage tanks shall not be located on or within 4.5 m (15 ft) of asphalt or bituminous pavement. Provide non-combustible joints and crack fillers around these tanks.

3.5 Laboratories:

- A. Do not locate laboratories containing Class I flammable liquids in basements.

Note: Class I flammable liquids are not permitted in basements and are not permitted to be stored in basements, per NFPA 30, 2008 edition, sections 9.3.6 and 9.7.3.

- B. Laboratories using flammable or combustible liquids in buildings with inpatients, or outpatients incapable of self-preservation shall comply with NFPA 99. These laboratories shall be enclosed with a barrier having a one-hour fire resistance rating.

Note: The type and quantities of flammable liquids are subject to change during the life of the laboratory. For this reason, the added protection of a one-hour fire rated enclosure has been added.

- C. Other laboratories using flammable or combustible liquids shall comply with NFPA 45.

3.6 Casework (including non-moveable, built-in cabinetry, wardrobe, etc.):

- A. No restrictions in buildings provided with automatic sprinkler protection.
- B. Provide metal casework in non-sprinklered buildings in patient care rooms.

3.7 Information Technology Telecommunication, and High Cost Equipment Rooms:

- A. Mission-essential information technology, telecommunication, and high cost equipment rooms and infrastructure, with the potential for high dollar loss and/or business interruption, shall be provided with wet pipe automatic sprinkler protection and shall be designed to comply with NFPA 75 as described in this design manual.
- B. Additional guidance is provided in PG-18-3, VA Design and Construction Procedures, Topic 10.
- C. Head End Equipment Rooms as defined in the VA Electrical Design Manual shall be provided with sprinkler protection and smoke detection.
- D. Telephone Equipment Rooms (TER) and Main Computer Rooms (MCR) as specified in the VA Electrical Design Manual are to be designed in accordance with Section 3.7 E, Data Centers. A Telephone Equipment Room is to be considered a Tier I facility.
- E. Data Centers:
 - 1. Tier I, Tier II, Tier III and Tier IV data centers are defined in “Data Center Standards,” April 2004, VHA Enterprise Management Center, Office of Information. The following is extracted from that document:

Tier I Data Center

Basic

A Tier I data center is susceptible to disruptions from both planned and unplanned activity. It has computer power distribution and cooling, but it may or may not have a raised floor, a UPS, or an engine generator. If it does have UPS or generators, they are single-module systems and have many single points of failure. The infrastructure should be completely shut down on an annual basis to perform preventive maintenance and repair work. Urgent situations may require more frequent shutdowns. Operation errors or spontaneous failures of site infrastructure components will cause a data center disruption.

Tier II Data Center

Redundant Components

Tier II facilities with redundant components are slightly less susceptible to disruptions from both planned and unplanned activity than a basic data center. They have a raised floor, UPS, and engine generators, but their capacity design is “Need plus One” (N+1), which has a single-threaded distribution path throughout. Maintenance of the critical power path and other parts of the site infrastructure will require a processing shutdown.

Tier III Data Center

Concurrently Maintainable

Tier III level capability allows for any planned site infrastructure activity without disrupting the computer hardware operation in any way. Planned activities include preventive and programmable maintenance, repair and replacement of components, addition or removal of capacity components, testing of components and systems, and more. For large sites using chilled water, this means two independent sets of pipes.

Sufficient capacity and distribution must be available to simultaneously carry the load on one path while performing maintenance or testing on the other path. Unplanned activities such as errors in operation or spontaneous failures of facility infrastructure components will still cause a data center disruption. Tier III sites are often designed to be upgraded to Tier IV when the client’s business case justifies the cost of additional protection.

Tier IV Data Center Fault Tolerant

Tier IV provides site infrastructure capacity and capability to permit any planned activity without disruption to the critical load. Fault-tolerant functionality also provides the ability of the site infrastructure to sustain at least one worst-case unplanned failure or event with no critical load impact. This requires simultaneously active distribution paths, typically in a System+System configuration. Electrically, this means two separate UPS systems in which each system has N+1 redundancy. Because of fire and electrical safety codes, there will still be downtime exposure due to fire alarms or people initiating an Emergency Power Off (EPO). Tier IV requires all computer hardware to have dual power inputs as defined by the Institute's Fault-Tolerance. Tier IV site infrastructures are the most compatible with high availability IT concepts that employ CPU clustering, RAID DASD, and redundant communications to achieve reliability, availability, and serviceability.

Current Vista facility data centers would fall into the first three tiers, with some being Tier-I and very few at the Tier-III level. Ultimately, VA data center facilities should achieve an acceptable level of confidence (tier) within the VA's infrastructure in order to support enterprise-level systems such as HealtheVet systems. In order to establish and implement a minimum level of standards for VA data centers, a base set of standards must be established and used in a survey of facility data centers.

2. Tier I, II, III, and IV data centers shall be provided with wet pipe automatic sprinkler protection in accordance with NFPA 13. Sprinkler protection shall be installed utilizing standard response fusible link sprinklers.

Note: Standard response fusible link sprinklers will lessen the chance of a sprinkler being accidentally broken and will still provide structure protection since a standard response head is more robust and harder to break than a typical glass bulb quick response sprinkler.

3. Tier I, II, III, and IV data centers shall be protected with a gaseous fire suppression system when required by NFPA 75. Note that a gaseous fire suppression system is in addition to, and does not replace, the required wet pipe automatic sprinkler system.

Note: NFPA 75 provides risk criteria to establish the need for gaseous systems. Generally, Tier I systems would not require a gaseous system.

3.8 Paint Spray Areas: Comply with NFPA 33.

3.9 Atrium Smoke Control Systems: Comply with NFPA 92B. See the VA Design Manual for HVAC systems for additional design criteria.

3.10 VA Canteen Retail Stores: Retail stores located in health care occupancies shall be considered as hazardous areas and shall therefore be separated from adjacent spaces by one-hour fire rated construction.

3.11 Pharmacies: Pharmacies located in health care occupancies shall be considered storage areas and shall therefore be separated from adjacent spaces by one-hour fire rated construction. Fire or service counter shutters shall be provided to protect openings where medication is dispensed or other transactions occur.

3.12 Chutes: Linen chutes and waste chutes shall comply with the provisions in NFPA 82 for limited access gravity chutes.

3.13 Parking Garages: Parking garages shall comply with the provisions in NFPA 88A except for construction type, height and area limitations, and building separation, which shall comply with 2.1. and 2.2 of this manual.

4. OCCUPANCY CLASSIFICATION

4.1 General: Occupancy classifications are defined in NFPA 101 and as follows:

[See also the attached file for occupancy determination.](#) (Included at end of this document.)

Health Care Chapter 18 & 20	Business Chapter 38	Residential Chapters 26, 28, 30 & 32	Industrial Chapter 40	Day Care Chapter 16
Hospitals	Psychiatric Outpatient Clinics	Blind Rehabilitation	Research Buildings	Child Day Care
Nursing Homes	Alcohol/Drug Outpatient Facilities	Alcohol/Drug (4)	Free Standing Laundries	Adult Day Care
Ambulatory Health Care Facilities (1)	Methadone Maintenance Clinics	Domiciliaries (5)	Power Plants	Day Treatment Centers
Alcohol/Drug (3)	Ambulatory Health Care Facilities (2)	Quarters Buildings, Hoptels	Free Standing Shops	
Domiciliaries (5)	Administrative Offices & Sleep Labs	Homeless Shelters		

- (1) Includes surgery centers, dialysis centers, imaging centers and cardiac catheterization centers
- (2) Includes buildings with occupants capable of self preservation
- (3) Medical detoxification facilities for Alcohol/Substance Abuse
- (4) Social detoxification facilities for Alcohol/Substance Abuse
- (5) Where staffing patterns do not meet health care requirements, Domiciliaries shall be protected in accordance with the appropriate residential occupancy requirements.

Note: Domiciliaries are surveyed by Joint Commission utilizing occupancy chapters 28 and 29 (Hotel/Motel/Dormitories) of the Life Safety Code. These chapters are often less representative than the Board and Care occupancy chapters for domiciliaries in the VA. Door closers are required on corridor rooms in the chapters that the Joint Commission follows, while exceptions for the omission of closers may exist for the board and care occupancies. However, Joint Commission has granted a VA-wide equivalency for the closers when the following features are present: (1) sprinkler protection, (2) single station smoke alarms are provided for the sleeping rooms, (3) staff is present and trained to close doors, (4) fire drills are conducted, and (5) the fire alarm system is connected to transmit a signal to the fire department. Where the board and care occupancy chapters are followed, an equivalency may have to be obtained from Joint Commission to prevent the facility from receiving a type I recommendation from Joint Commission for the lack of door closers on sleeping room doors.

4.2 Multiple Occupancies: Buildings containing multiple occupancies shall be considered mixed or separated as required by NFPA 101. Buildings containing occupancies that are not incidental to the primary occupancy shall comply with the most restrictive requirement of the occupancies involved, unless separated by barriers having fire resistance ratings as required by NFPA 101.

Note: Hoptels are locations in which lodging accommodations, similar to a hotel, are provided. Determination of occupancy classification of Hoptels located in health care occupancies should be done on a floor or area basis when calculating occupant loads of sleeping residents. Requirements for corridor wall construction or sleeping room door closers should be evaluated for an equivalent approach, See the following table (note 7) for guidance. Hoptels within health care occupancies may be considered part of the health care occupancy provided staff is responsible for ensuring safe relocation and/or evacuation of residents.

Hotels and the Life Safety Code (2009 Ed.)

Number of Occupants Sleeping ¹	Life Safety Code - Occupancy Chapter	Construction Requirements	Corridor requirements	Rated Corridor Door	Closer Required	Latching Required	Smoke detection in corridor required?	Single Station Smoke Alarm Required? ²	Direct Connection to FD required?	Other ^{3, 4}
NA	Ch.19 ⁵ without sprinklers	Yes	1/2 hour	20 minute equivalent	No	Yes, or closing device to keep the door closed.	No	No	Yes	
NA	Ch. 19 ⁵ with sprinklers	Yes	Smoke resistant	20 minute equivalent	No	Yes, or closing device to keep the door closed.	No	No	Yes	
>16	Ch. 28 without sprinklers ⁶									
>16	Ch. 28 with sprinklers ⁶	None	1/2 hour ⁷	20 minutes ⁸	Yes	Yes	No	Yes	Yes	
≤16	Ch. 26 without sprinklers ⁹									
≤16	Ch. 26 with sprinklers	None	Smoke resistant	No	No	Yes, or closing device to keep the door closed.	No	Yes	No	
≤ 3	Ch. 24 ¹⁰ without sprinklers	None	None	No	No	No	No	Yes	No	
≤ 3	Ch. 24 with sprinklers	None	None	No	No	No	No	Yes	No	

¹ This should be addressed on an area basis (i.e., if there are multiple floors in a health care building, treat each zone/floor separately). This table assumes that the Hoptel is going into an existing health care occupancy. Where separate buildings are provided, they shall comply with the appropriate chapter in the Life Safety Code. See footnote 10.

² In guest rooms which have been specifically designed for the hearing impaired, a visible fire alarm signal shall be provided.

³ Signage including a floor plan shall be provided on the guest room doors to explain emergency egress for the floor/area. Fire safety information shall be provided to all residents to explain emergency egress actions.

⁴ All residents should be advised of the medical center smoking policy. For buildings with non-residential occupancies, the building fire plan must be revised to reflect that some of the occupants are residents sleeping overnight.

⁵ Health care chapters are provided for comparison purposes only.

⁶ New Hotels and Dormitories are required to be sprinklered throughout with QR heads (See NFPA 101, 28-3.5).

⁷ The corridor walls are required to extend from floor slab to floor slab, or, if the Hoptel is located within a sprinklered health care occupancy, the walls may terminate at a smoke resistant ceiling. Health care occupancies have minimum construction requirements as well as an automatic response from emergency forces that compensate for the wall not extending slab to slab.

⁸ Existing 1-3/4 inch solid bonded wood core doors are considered equivalent to 20 minute doors and are acceptable.

⁹ New Lodging and Rooming Homes are required to be sprinklered.

¹⁰ Chapter 24 shall not be used for Hoptels located within health care occupancies. As a minimum, the requirements in Chapter 26 shall be followed for Hoptel rooms located in health care occupancies.

5. WATER SUPPLY FOR FIRE PROTECTION

5.1 Adequacy of Water Supply: Assess adequacy of the existing water supply. Perform water supply flow testing of fire hydrants and/or fire pumps. If data is available from the facility, the designer must verify the locations involved as well as the quality and accuracy of the data.

- A Provide a secondary fire suppression water supply if required in either of the Physical Security Design Manuals for VA Facilities.

Note: VA has published two Physical Security Design Manuals that cover Mission Critical Facilities and Life Safety Protected Facilities. As of 3/2011, only the Mission Critical Facilities are required to have a secondary water supply for fire protection.

- B. Design the secondary water supply to meet the largest expected fire demand (sprinkler system plus fire hose requirements) for the duration specified in paragraph 5.4. See also 5.2 below and the capacity requirement of the Physical Security Design Manual.
- C. Water storage tanks shall be designed in accordance with NFPA 22 “Standard for Water Tanks for Private Fire Protection.”
- D. New water storage tanks shall be provided with a high and low level water switches that are connected to the site fire alarm system and initiate supervisory alarm signals.

5.2 Capacity:

- A. Non-Sprinklered Buildings: Provide minimum fire flow as shown in Table 5.0. Partially-sprinklered buildings shall be considered non-sprinklered. Typical building occupancies are shown for each NFPA 13 hazard classification. Flow demand depends primarily on the type of construction, occupancy, exposure to the building, access to the building site, and fire department response. Fires in non-sprinklered buildings require more water because application of water by fire department hose streams is less efficient and begins later than sprinklers. Use professional judgment to modify these requirements on a case-by-case basis depending on the following favorable and unfavorable conditions:

Note: It is recommended that any deviations be forwarded to the respective SFPE for review prior to incorporating the modification.

- 1. Favorable Conditions
 - a. Non-combustible construction
 - b. Limited exposures
 - c. Ready access to entire building site by fire department apparatus
 - d. Quick response by adequately staffed fire department
- 2. Unfavorable Conditions
 - a. Combustible construction
 - b. Moderate or serious exposures
 - c. Hindrance to fire department apparatus access to building site
 - d. Delayed response or inadequately staffed fire department

Table 5.0 - Minimum Fire Flows for New Non-Sprinklered Facilities and New Underground Water Systems (at 138 kPa (20 psi)).

NFPA 13 Hazard Classification	Favorable Conditions	Unfavorable Conditions
<u>Light Hazard</u> Patient Buildings, Offices, Quarters	79 L/s (1250 gpm) ⁽¹⁾	95 L/s (1500 gpm)
<u>Ordinary Hazard</u> Laboratory Buildings, Shops, Laundries	79 L/s (1250 gpm) ⁽¹⁾	126 L/s (2000 gpm)
<u>Extra Hazard</u> Warehouses	95 L/s (1500 gpm)	190 L/s (3000 gpm)

(1) Based on the minimum required by NFPA 14 and fire department pumper capacities.

- B. Sprinklered Buildings: The required fire flows and pressures for buildings provided with automatic sprinkler protection shall comply with NFPA 13 and other applicable NFPA standards. Also provide a minimum hose stream allowance for total combined inside and outside fire fighting to comply with NFPA 13.

5.3 Fire Pumps:

- A. When a fire pump is necessary to supplement fire flow and pressure, size it to comply with NFPA 13 and 14. Where hose is not installed or otherwise provided in the facility, the fire pump will be sized only for the sprinkler system requirements. The local responding fire department will provide the necessary flow and pressure for manual fire fighting operations. The capability of the fire department to handle the manual fire fighting requirements shall be verified and documented.

Note: Standard operating procedures for most fire departments do not allow fire fighters to use occupant hose lines within buildings since the fire fighters are generally not aware of the condition of the hose, and use of the hose could potentially result in a dangerous situation. Fire department procedures also generally require fire fighters to connect a pumper truck to the fire department connection to augment the pressure to the sprinklers and standpipes. Hence it is the VA position that the building fire pump be sized only for the sprinkler system demand and to let the fire department supply the flow and pressure for manual fire fighting. The fire pump should be sized to handle manual fire fighting requirements in NFPA 14 only where the fire department pumper truck cannot provide the necessary pressure, and this is not anticipated at any VA facility. The designer must verify that the fire department can adequately supply the manual fire fighting requirements.

- B. Separate fire pumps from all other areas of the building by fire resistant rated construction in accordance with NFPA 20. In new construction the fire pump shall be in a separate room from other mechanical and electrical equipment.
- C. Design the fire pump installation to comply with the details in the Appendix to NFPA 20. Provide a test header and a flow meter. The test header is to be piped to an exterior straight type header that can be tested without damaging landscaping, etc. Provide a bypass with normally open valves. All fire pump system valves shall be electrically supervised by tamper switches. However, padlocks and chains may be substituted in lieu of tamper switches for normally closed valves on a case by case basis.

- D. Pumps shall start automatically at 69 kPa (10 psi) below jockey pump start pressure. Pumps shall be manually shut down.

Note: Manual shut down of the fire pump will ensure that the pump does not shut down prematurely before controlling the fire. In addition, someone at the facility should go to the fire pump upon alarm to ensure that it is operating properly. NFPA 20 does not permit automatic shutdown where the fire pump constitutes the sole source of water for a sprinkler or standpipe system.

- E. Pumps shall be electric motor driven, horizontal split case centrifugal type unless this is not feasible. Power transfer switch and fire pump controller shall be factory assembled and packaged as a unit. Separate transfer switches are not permitted. Controller shall be monitored by the fire alarm system. Protect feeder circuit to comply with NFPA 20.
- F. Provide primary and emergency power to fire and jockey pumps protecting health care occupancies serving inpatients from the life safety branch of the essential electrical system as defined in NFPA 70.
- G. Provide jockey pumps to supply no less than 3.8 L/s (60 gpm). This will allow the jockey pump to supply the flow equivalent of one sprinkler to permit water flow switch testing and will permit tests to be performed without shutting down the fire pump. The jockey pump shall maintain pressure as required to prevent the fire pump from operating to maintain system pressure.

Note: Assuming a pressure of 125 psi is maintained on a system, a 60 gpm jockey pump will provide enough water to handle the water flow testing of the flow switches without the need to shut down the fire pump. Some installations with fire pumps cannot test water flow switches without shutting down the fire pump due to hammering open dry pipe valves or discharging water onto roads or sidewalks during the winter seasons. A larger jockey pump ensures that the fire pump will be in service when needed.

- H. Design electrical feeders to the fire pump to comply with NFPA 20. Feeders shall be outside the building except in the fire pump room and electrical room of origin.
- I. Relief valves, where installed, shall discharge to the atmosphere and shall not be recirculated back to the suction side of the fire pump

5.4 Duration:

- A. Non-Sprinklered Buildings: Fire flows as required by Table 5.0 shall be available for a duration of 60 minutes minimum for favorable conditions and 120 minutes minimum for unfavorable conditions (see Section 5.2).
- B. Sprinklered Buildings: Fire flows shall be available as required by NFPA 13 for the required occupancy classification. However, duration for health care occupancies shall not be less than 60 minutes.

5.5 Distribution System: Installation shall comply with NFPA 24 and NFPA 1141 except as follows:

- A. Mains shall be 200 mm (8 in) minimum. Mains supplying only fire hydrants (laterals) shall be permitted to be 150 mm (6 in).
- B. Provide valves in underground water distribution lines to isolate leaks and to allow water to supply the remainder of the loop. Locate isolation valves so that not more than four discharge points (sprinkler systems, hydrants, or standpipe systems) will be taken out of service by any one break in the line.

- C. To increase available water flow and reliability, loop water distribution piping and provide dual feeds when cost effective. Avoid dead-end mains. A second connection to the public water utility system or an elevated water tank may be needed in order to provide redundancy.

5.6 Hydrants: Design installation to comply with NFPA 24 and NFPA 1141 except as follows:

- A. Contact the responding fire department for hydrant requirements.
- B. Maximum spacing between hydrants shall not exceed 300 ft. Locate hydrants such that every portion of the exterior of every building shall be within 300 ft of a hydrant, with consideration given to accessibility and obstructions. When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R (as applicable), the distance from the exterior of the building shall be permitted to be increased to 450 ft. Nominal distance between a fire hydrant and the building fire department connection shall be 50 ft.
- C. Wet barrel hydrants are preferred where piping is not subject to freezing.
- D. Valve all hydrant connections at the supply main.
- E. Locate hydrants adjacent to paved areas, no closer than 3 ft and no farther than 7 ft from roadway shoulder or curb line, accessible to fire department apparatus. Barrels shall be long enough to permit at least 18 inches clearance between center of pumper connection and grade. Pumper connection shall be perpendicular to street to allow straight line connection to pumper.
- F. Protect hydrants located adjacent to parking areas or other vehicle traffic areas by bollards.
- G. Design site grading for surface drainage away from hydrant.
- H. Mark hydrants to comply with NFPA 291 if local fire department has no preference.

5.7 Signage: Furnish appropriate signage for all post indicator valves, fire department connections, and sectional valves. Signage shall indicate specific building and/or zone/area served.

6. FIRE EXTINGUISHING SYSTEMS

6.1 Sprinkler Systems:

- A. Automatic sprinkler systems shall be installed for any of the following:
1. When required to meet the goals or objectives stated in the [Introduction](#) to this document including the following:
 - a. So that critical operational functions are not interrupted for longer than 24 hours; or
 - b. So that the loss of real or personal property does not exceed \$500,000.00.
 2. When required by [Section 1](#) of this document.
- B. Installation shall comply with NFPA 13, NFPA 13R, or NFPA 13D as applicable, except as indicated in 6.1.B through 6.1.R.
1. In NFPA 13 systems, sprinkler protection shall be provided in all spaces including, but not limited to, elevator machine rooms, walk-in freezers and cold rooms, computer rooms, telephone switch rooms, radiology and MRI suites, loading docks, electrical rooms*, plumbing or utility closets, audiometric booths, vaults, paint spray booths, dry type lint collectors, dust collectors, and generator rooms. Exception: Sprinklers are not required where specifically exempted by NFPA 13, 13R, and 13D, and as specified in paragraphs 6.1.B.2 and 6.1.B.3 below:

* *Note: While NFPA 13 allows the omission of sprinkler protection in electrical rooms within buildings under specific conditions, the VA does not permit the use of this exception. The VA requires sprinkler protection in all electrical rooms except stand alone buildings dedicated to electrical service where applicable FM data sheets are followed.*
 2. Sprinklers are not required in interstitial spaces, except
 - a. Sprinklers are required in electrical closets, signaling rooms, etc., located within interstitial spaces, and
 - b. A single line of sprinklers is required above the tracks of electric track vehicle systems (ETVS) in interstitial spaces.
 3. New audiometric booths installed in a sprinkler protected building shall be protected with sprinklers since they are occupiable spaces within a sprinkler protected building. Existing audiometric booths without sprinkler protection may be permitted to be kept in service without sprinkler protection provided the booths are constructed and listed with a one-hour fire rating, and are equipped with 45-minute self- or automatic- closing doors.

Note: Field experience has shown that self-closing audiometric booth doors frequently do not operate properly so that the doors do not close completely. Where it is unlikely that the doors can be made to operate properly, sprinkler protection should be provided.
 4. CPVC piping shall not be used in the VA except that CPVC piping may be used in Type V (wood construction) residential applications if there are no fire or smoke barriers and permission is obtained in writing from the Chief Engineer.

Note: Numerous chemicals typically found in commercial construction are known to be incompatible with, and detrimental to, CPVC pipe and fittings. Some chemicals have been shown to be the cause of failure of the CPVC piping. The continuous effort required for the life of the installed system to police all of the chemicals that may affect the CPVC piping makes this piping material a bad choice for use in the VA.

Typically, in Type V residential applications most of the piping will be installed in concealed spaces and incompatible chemicals are less likely to be found in this type of construction. Fire and smoke barrier penetrations need to be sealed and the known compatibility issues with fire barrier sealants would make CPVC use an unwise choice. See the documents and links below (also included at end of this document):

[CPVC Chemical Compatibility](#)

[Potential Damage to CPVC Fire Sprinkler Systems From Spray Foam Insulation](#)

[Potential Damage to CPVC Fire Sprinkler Systems From Connection to Anti-Bacterial Corrosion Lined Metal Piping](#)

[Flameguard Jobsite Notice](#)

[FlameGuard Turnover Notice](#)

http://www.harvelblazemaster.com/caution_areas/chemical_compatibility.asp

http://www.harvelsprinklerpipe.com/caution_areas/pdf/chemical_compatibility.pdf

http://www.spearsmfg.com/flameguard/FGW-A-0408_0408_web.pdf

http://www.spearsmfg.com/flameguard/FGW-B-0408_0408_web.pdf

<http://www.spearsmfg.com/flameguard/FlameGuard%20Jobsite%20Notice.pdf>

<http://www.spearsmfg.com/flameguard/FlameGuard%20CPVC%20Fire%20Sprinkler%20Turnover%20Document.pdf>

- C. Design wet pipe sprinkler systems, unless installed in areas subject to freezing. Dry pendant or sidewall sprinklers, dry pipe, or antifreeze systems may be used in areas subject to freezing. Propylene glycol shall be used if antifreeze systems need to be installed. Do not use pre-action type systems.

Note: NFPA 25 requires dry sprinklers to be removed and tested every 10 years due to the extremely high failure rates of these types of sprinklers. They are not recommended.

- D. Sprinkler systems shall be hydraulically calculated by any design approach allowed by NFPA 13, except that the Special Design Approach shall not be used in Health Care. Pipe schedule systems may be used for extension of existing pipe schedule systems where water supply is adequate. Sprinkler systems shall be designed based on available water supply without the fire pump operating, where possible. A safety factor shall be included by calculating the demand to a point no greater than 10% below the available water supply curve. Or, a ten percent safety factor shall be provided (subtract 10% from the available water supply curve) for each sprinkler demand including the required hose streams.
- E. Sprinkler densities shall comply with NFPA 13, except in rooms containing movable/mobile shelving (high density storage) where the density shall be Ordinary Hazard (Group 2).

- F. Delineate on the drawings special conditions such as storage racks/shelving location, height and configuration (including mobile shelving); atria; open ceilings, or architecturally sensitive areas; audiometric booths; walk-in freezers and cold rooms; computer rooms and raised flooring; loading docks and exterior canopies; residential sleeping etc. which may have an impact on sprinkler design and installation.
- G. Coordinate with the facility and show smoke zone boundaries, hazard classification, density, and other special requirements on drawings. Sprinkler zones shall coincide with all smoke zone boundaries within health care occupancies.

Note: Since the sprinkler contractor is required by NFPA 13 to hydraulically calculate the system and provide working drawings, this effort should not be duplicated by the A/E. Some items commonly not identified on the drawings that create problems are drain terminations, hazard classification, smoke zone boundaries, and water supply hydraulic information. The contractor needs to know where to start, what water supply is available, the commodities being protected, what area is supplied by each flow switch, and special circumstances such as areas subject to freezing and combustible concealed spaces.

- H. Rooms containing bulk supply storage shall be classified as required by NFPA 13. If provided by the contract, storage racks shall utilize open shelving systems. Ensure shelving which obstructs sprinkler water from penetrating down through racks is not used.
- I. Provide seismic protection when the building is in an area of Moderate High, High, or Very High seismicity as identified in the map below taken from VA Seismic Design Requirements H-18-8. (Refer to H-18-8 for updated requirements. See <http://www.cfm.va.gov/til/etc/seismicmap.pdf> for latest version.)

- J. Install quick response sprinklers (QRS) in all areas, except where specifically prohibited or noted elsewhere in this document. (e.g., in areas requiring high temperature heads where no quick response sprinklers are listed, data centers, electrical switchgear rooms, elevator shafts, or elevator machine rooms) On retrofit projects, replace existing standard response sprinklers with QRS within the smoke compartments being modified.

Note: It is permissible on a case by case basis to install standard response sprinklers in spaces within smoke zones that are protected by quick response sprinklers, such as in a main electrical switch gear room or a data center. (It is generally not permissible to mix standard and quick response sprinkler heads within a room or corridor). The risk of an accidental discharge due to physical damage of the sprinkler is lessened with the installation of standard response sprinklers since they generally have an operating element that is more massive than the operating element of quick response heads. The advantage gained in response time by installing quick response sprinklers would not be worth the increased risk to the electrical equipment and personnel due to possible accidental discharge of a QR sprinkler. (It is easier to break a quick response glass bulb head by striking it from the side than it is to break a standard response glass bulb head).

- K. Sprinklers to be installed in VA facilities are required to be Factory Mutual (FM) approved as quick response except as identified below. At the present time, concealed sprinklers are not permitted to be used for new construction in VA facilities because there are none that have passed the FM test for quick response (see Exceptions 2 and 3). On retrofit projects, replace existing standard response sprinklers with QRS within the smoke compartments being modified.

Exception 1. "Institutional" type sprinklers in accordance with Paragraph (L) below.

Exception 2. Concealed sprinklers that are UL Listed quick response and FM approved standard response are permitted in clean rooms (e.g., USP 797 designed rooms) provided that the rooms are not designed under negative pressure (e.g. USP 797 rooms for hazardous drugs are required to be under negative pressure).

Note: Factory Mutual test requirements are different than Underwriters Laboratories Inc. (UL) test requirements. One example of this is the test for quick response concealed sprinklers. At the present time, there are no concealed sprinklers that have passed the FM test for quick response. Even those that are UL listed quick response concealed sprinklers have not passed the FM quick response test.

Note: The VA recognizes the need for concealed sprinklers where the surfaces of the rooms have to be cleanable. However, concealed heads are not permitted by the manufacturers to be used in a negative pressure room.

Exception 3. In special instances, concealed sprinklers that are UL Listed quick response and FM approved standard response may be used with the approval of the VHA Central Office Fire Protection Engineer or the CEOSH Fire Protection Engineer.

Note: Examples of special instances where non-FM approved concealed sprinklers might be appropriate include closets or audiometric booths with low ceilings.

Exception 4: FM Approved standard response sprinklers shall be permitted where quick response sprinklers are prohibited. (e.g., elevator shafts or elevator machine rooms) and as noted below.

Note: It is permissible on a case by case basis to install standard response sprinklers in spaces within smoke zones that are protected by quick response sprinklers, such as in a main electrical switch gear room. (It is generally not permissible to mix standard and quick response sprinkler heads within a room or corridor). The risk of an accidental discharge due to physical damage of the sprinkler is lessened with the installation of standard response sprinklers since they generally have an operating element that is more massive than the operating element of quick response heads. The advantage gained in response time by installing quick response sprinklers would not be worth the increased risk to the electrical equipment and personnel due to possible accidental discharge of a QR sprinkler. (It is easier to break a quick response glass bulb head by striking it from the side than it is to break a standard response glass bulb head).

- L. Install UL listed or FM approved “institutional” type quick response sprinklers in psychiatric areas where sheet rock or plaster ceilings are required by PG-18-14, Room Finishes, Door and Hardware Schedule. Installation of “institutional” sprinklers in psychiatric areas with lay-in acoustical tile ceilings may be appropriate where constant supervision by staff is not provided. Consult facility for locations and for additional requirements. Show these areas on drawings.

Note: For additional requirements concerning mental health facilities, consult with the facility patient safety manager or suicide prevention coordinator and obtain a copy of the VHA Mental Health Environment of Care Checklist (MHEOCC). Note: The issue of where to place “institutional” sprinkler heads should be taken to the facility safety committee/patient safety/risk management group. Staff supervision of the patients, other institutional building features, and clinical diagnoses will all play a part in whether “institutional” type sprinklers are required.

There are no standardized tests that are used to qualify a sprinkler as an “institutional” type sprinkler. “Institutional” is a marketing term used by the manufacturers of the sprinklers. At the present time, there are no FM approved sprinklers that are marketed as “institutional” type. At the time of design, it is recommended that the market be surveyed and that the sprinkler model with the most favorable characteristics be specified.

The following features are typically characteristic of an “institutional” sprinkler:

- *Tamper resistant construction including a tamper-resistant escutcheon to reduce the possibility of the escutcheon being removed and used as a weapon.*
- *Components designed to break away to reduce the possibility of being used as an anchor for hanging. (Tyco TFP MAX [Pendent & Sidewall] 75lbs dynamic load, Viking VK410 [Pendent] 30lbs at 6 inches, Viking VK412 [Sidewall] 40lbs at 6 inches, Reliable XL INST [Pendent and Sidewall] 50lbs at 1 inch). {Information above is for quick response institutional sprinklers as of 4/02/2007}.*

Note: While institutional fire sprinklers may be designed to break at pre-determined static or dynamic loads, it is possible for compression of the jugular or carotid arteries to occur with as little as 4 pounds causing death. Therefore it is very important that fire sprinklers and their appurtenances not provide any element that could serve as an anchor point for a lanyard or ligature.

- *Installation instructions and sprinkler components designed to reduce the possibility of the escutcheon being used as an anchor for hanging. One design approach involves a retaining collar that is attached to the sprinkler pipe with set screws. This design is intended to prevent the escutcheon from being pulled away from the ceiling surface. This design would not be appropriate where the ceiling surface is a lay-in ceiling. A lay-in ceiling allows access to numerous anchor points by the removal of or punching through a tile. Another design approach involves an escutcheon installed with spacers. This design is also intended to prevent the escutcheon from being pulled away from the ceiling surface. This approach may be compromised if there is deflection in the sprinkler piping such that the escutcheon can be pulled away from the ceiling surface. If this approach is to be used, plastic pipe should not be permitted (plastic pipe is not permitted for new VA facilities) and a hanger should be installed at each sprinkler drop to prevent pipe deflection.*
- M. Install standard response sprinklers with intermediate temperature rating 93°C (200°F) or higher in elevator shafts, elevator pits, and elevator machine rooms. Install sprinklers in elevator shafts and pits only where required by NFPA 13. (Note: See Section 7 for necessary power shutdown requirements.)
- N. Do not use flow control (on/off) sprinklers.
- O. Where buildings are required to be sub-divided into smoke compartments, segregate sprinklers into zones that correspond to the smoke compartments. Coordinate sprinkler zones with smoke (compartments) and fire alarm evacuation zones. Provide a flow switch, isolation valve, tamper switch, and pressure gage for each zone. Provide separate zones for paint spray booths, dust collectors, and lint collectors.
- P. Route the drain pipes for each sprinkler riser and test connection to the building exterior to facilitate testing. Do not terminate at service sinks as their drains are inadequate for test flow. Drain piping shall be 50 mm (2 in) minimum to accommodate discharge from full flow tests at maximum system pressure. Design exterior drains to prevent flooding or damage to landscaping, and to prevent wetting of walkways.
- Q. Specify non-ferrous piping for all areas within Magnetic Resonance Imaging (MRI) suites.
- R. Determine and identify on drawings the location of fire pump, risers, all valves, fire department connections, drains, and points of connection with underground fire service main.

6.2 Standpipes and Fire Hose Connections:

- A. Standpipes shall be installed in all buildings where required by NFPA 101, NFPA 45, or NFPA 1, except as modified by the following paragraphs.
- B. Install Class I hose connections per NFPA 14.
- C. Wet standpipes are preferred.

- D. Flow and pressure requirements shall comply with NFPA 14 except as modified in Section 5.3, Fire Pumps.

Note: If the facility is a high-rise building, defined by NFPA 14 as a building more than 75 feet from the lowest level of fire department access to the floor of the highest occupied level, an automatic standpipe system is required by NFPA 14. It is the position of the VA that the building fire pump be sized only for the sprinkler system demand and to let the fire department supply the flow and pressure for manual fire fighting. The fire pump should be sized to handle the automatic standpipe fire fighting requirements in NFPA 14 only where the fire department pumper truck cannot provide the necessary pressure, and this is not anticipated at any VA facility. The designer must verify that the fire department can adequately supply the manual fire fighting requirements.

- E. For seismic requirements, refer to Section 6.1.I.

6.3 Gaseous Systems (Clean Agent, Carbon Dioxide, etc.): Reserved.

6.4 Portable Fire Extinguishers:

- A. Do not provide fire extinguishers. Locate fire extinguisher cabinets to comply with NFPA 10. Locate additional fire extinguisher cabinets in the surgical suite, high value IT (Information Technology) equipment and telephone switch rooms, and in elevator machine rooms.
- B. Size fire extinguisher cabinets to accommodate a 9.5 L (2-1/2 gallon) pressurized water extinguisher. Recessed cabinets are preferred. Specify conspicuous marking of recessed cabinets.

6.5 Extinguishing Systems for cooking facilities/equipment: Provide wet chemical fire extinguishing systems in accordance with UL 300 and NFPA 17A. See Section 3.3. Dry chemical systems shall not be installed.

7. FIRE ALARM SYSTEMS Fire alarm systems shall be installed in buildings when required by this section.

7.1 Purpose:

- A. The primary purpose of a fire alarm system is to notify the appropriate people and initiate the proper response from those people who are notified.
- B. The secondary purpose is to initiate fire safety functions, which are building and fire control functions that are intended to increase the level of safety for occupants or to control the spread of the harmful effects of fire.
- C. The fire alarm system operation must be coordinated with the facility fire plan.

Note: This does not preclude the fire plan from being modified to meet the fire alarm system operation.

7.2 General Requirements:

- A. The fire alarm system shall be installed where required by NFPA 101 and shall be designed to meet the requirements contained in NFPA 72, National Fire Alarm Code, and this manual.
- B. For the purposes of this manual, VA facilities will fall into one of the following three categories:

Note: The proper categorization of a building or an area of a building will help to identify the type of notification required as well as the correct placement of notification appliances as indicated later in this section.

- 1. Health Care (excluding free standing Ambulatory Health Care)
 - 2. High Rise, non-Health Care
 - 3. Other, including free standing Ambulatory Health Care
- C. Do not combine fire alarm systems with other systems such as building automation, energy management, security, etc. Down time for any of these non-life safety systems will also take the fire alarm system out of service. This is not acceptable to the VA.
 - D. All fire alarm wiring shall be installed in raceway separate from all other systems.
 - E. Wiring installed in metal raceway within buildings that are protected throughout by sprinklers shall be considered to meet the requirements for Pathway Survivability Level 2 in accordance with NFPA 72(2010) as a 2-hour performance alternative that has been approved by the authority having jurisdiction and shall be permitted for voice communication systems in VA facilities.
 - F. Wiring for local building fire alarm systems shall be specified as defined in NFPA 72 as follows:

Initiating Device Circuits (IDC): Class B.

Signaling Line Circuits (SLC): Class B.

Notification Appliance Circuits (NAC): Class B.

Communications between building fire alarm control units: Class X.

Note: Class B signaling line circuits (these are not initiating device circuits by definition) are preferable for local building fire alarm systems because it permits the circuits to be t-tapped and the allowable length of the circuits are not shortened. No clear advantage is seen for running Class A circuits except where signaling line circuits are run between building fire alarm control units. Where signaling line circuits are run between fire alarm control units in separate buildings, fiber optic circuits are preferred because they are not susceptible to damage from lightning strikes. Where Class X copper circuits are installed, provide isolation modules that will ensure that only one building is lost (will not respond) during any type of fault. Although desirable, it is not required that Class X circuits be run in separate conduits from each other.

- G. Analog addressable systems are encouraged where many smoke detectors are required to be installed. These systems do not require the frequent sensitivity testing for smoke detectors that the hard-wired systems require and the savings in testing will pay for the extra cost of the system.
- H. Fire alarm design shall include a single line riser diagram that denotes location and device type.

7.3 Typical Operation:

- A. Table 7.3 is provided to identify the typical operation required by the respective fire alarm systems. A table similar to this should be added to the contract documents to indicate the specific operation required of the system.

TABLE 7.3 Fire Alarm System Input Output Matrix

OUTPUT → INPUT DEVICE ↓	1. Sound general building alarm for Other and High Rise (non-Health Care). See Section 7.2.1	2. Notify necessary staff for response for Health Care and High Rise buildings only (alarm signal may be different on different floors).	3. Notify Fire Department.	4. Initiate supervisory signal to a 24-hour manned point for immediate response.	5. Close associate smoke barrier doors on the floor.	6. Close dampers on fan proximate to detector.	7. Shut down air handler served by the detector.	8. Recall elevator.	9. Initiate elevator shut down and disconnect elevator power.	10. Open ** locked egress doors on floor of fire origin.	11. Disconnect fuel source from cooking equipment.
Duct Smoke Detector*				X		X	X ^a				
Area Smoke Detector*	X	X	X							X	
Door Release Smoke Detector*	X	X	X		X	X				X	
Elevator Smoke Detector*	X	X	X					X			
Manual Pull Station	X	X	X		X					X	
Elevator Machine Room Heat Detector	X	X	X						X		
Generator Room Heat Detector	X	X	X							X	
Sprinkler Waterflow / Pressure Switch	X	X	X		X					X	
Water Control Valve Tamper				X							
Fire Pump (Any alarm condition required by NFPA 20)				X							
High/Low Pressure Dry-Pipe Sprinkler System				X							
Kitchen Hood Suppression System	X	X	X		X					X	X
Gas Extinguishing Systems	X	X	X		X					X	
Dry-Pipe Valve Room Temperature Alarm				X							
Dedicated Fire Water Storage Tank Low Level				X							
Dedicated Fire Water Storage Tank Low Temperature				X							

*While NFPA 101 does not require some detectors to notify building occupants, VA requires all smoke detectors, other than duct smoke detectors, to notify building occupants. Only install smoke detectors when required by the Life Safety Code or its references.

** Those doors that are required to be tied to the fire alarm system such as delayed egress and access controlled doors.

a – Do not provide duct detectors in dedicated (100%) exhaust fans, they should continue to run.

- B. Notification of staff for response shall be by digital voice (speaker) systems unless not warranted by existing conditions (e.g., small extensions to an existing coded system). For new systems, do not use coded or taped voice systems. Where speakers are installed as the notification appliance, the fire alarm system shall be designed such that it is possible to manually broadcast an emergency voice message simultaneously to all buildings provided with speakers. Selectable switches shall also be provided at the fire alarm voice control panel so that a manual voice message can be communicated to each connected building individually. As a minimum, provide one switch per building. Additional switches (e.g., one switch per floor or zone) are optional.
- C. Coordinate fire alarm zones with smoke compartments and sprinkler zones (See Section 6.1.N).
- D. Provide initiating devices in accordance with NFPA 101, NFPA 72, and provide additional manual pull stations adjacent to the nurse's stations in health care occupancies.
- E. Provide institutional style (key to operate or locking covers) pull stations in psychiatric areas. Provide covers on pull stations in child care centers to prevent children from initiating unwanted alarms. Coordinate with the facility.
- F. Notification Appliances: Placement and spacing of notification appliances shall be in accordance with NFPA 72 and shall be selected based on the purpose of the notification (i.e., general evacuation or staff response) as follows:
 - 1. **General Evacuation** (See output 1 of Table 7.3): Where general evacuation is required, the audible signal shall conform to ANSI S3.41, Audible Emergency Evacuation Signal (i.e., temporal three pattern).

Note: These requirements are based on the building or area of the building being evacuated upon alarm. Many areas in a health care setting should be designed as general evacuation areas since there will be few or no trained staff to direct traffic. For example, cafeterias, basements, and administration sections could be considered to be general evacuation areas. For small stand-alone buildings, systems using bells or horns should be provided unless communication from the main hospital building using a voice system is desired. See the discussion under Section 7.3.F.2, Staff Response.

- a. Provide audible notification appliances to be heard in all locations throughout the protected premises (building).
- b. Provide visible notification appliances in all public accessible areas of the building such as corridors, auditoriums, cafeterias, open assembly rooms $\geq 750 \text{ ft}^2$, canteens, retail stores, etc. Exception: Visible notification appliances are not required in the following spaces which are not considered to be public accessible:
 - 1) Individual office spaces unless the space is known to have a hearing impaired person stationed there.
 - 2) Closets (janitor's, clothes, etc.)
 - 3) Utility shafts.
 - 4) Crawl spaces.
 - 5) Normally unoccupied rooms $\leq 100 \text{ ft}^2$.
 - 6) Normally unoccupied storage spaces where no regular activities take place other than placement and retrieval of storage.
 - 7) Stairway enclosures and elevators.

8) Patient exam/treatment rooms.

Note: Though the U. S. Access Board has rendered an opinion that requires strobes in examination and treatment rooms, the VA modifies this recommendation and does not require strobes in examination and treatment rooms since patients will only be in these rooms with permission of the staff. This is in line with the last paragraph of Technical Bulletin # 2 enclosed (included at end of this document).

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2. **Staff response** (See output 2 of Table 7.3):

Note: These requirements are intended for the defend-in-place requirements of the health care occupancy where staff need to know what is happening so they can give direction to those who need it. Patients are considered to be in need of help for evacuation and evacuation itself will only be undertaken as a last effort.

Fire Alarm System Operation for Health Care Occupancies - Background:

What is required? How does VA meet the requirements? Why do it this way? Other Issues, General Requirements.

What is required?

The Life Safety Code states, "For health care occupancies, the proper protection of patients shall require the prompt and effective response of health care personnel." It goes on to say, "The basic response required of staff shall include the following:

- (1) Removal of all occupants directly involved with the fire emergency*
- (2) Transmission of an appropriate fire alarm signal to warn other building occupants and summon staff*
- (3) Confinement of the effects of the fire by closing doors to isolate the fire area*
- (4) Relocation of patients as detailed in the health care occupancy's fire safety plan."*

The fire alarm system in a health care occupancy should immediately notify the staff in the zone of alarm origin to take action (e.g., "RACE") and simultaneously summon adequate staff remote from the zone of alarm origin to respond to assist staff in the zone of alarm origin.

How does VA meet the requirements?

The VA takes the following approach for implementing the requirements of the code for health care facilities:

- a. Upon operation of a fire alarm initiating device, the fire alarm system will, **in the zone of alarm origin only**,
 1. Notify staff/occupants by activating a temporal three alarm signal and
 2. Activate the visible appliances (strobes).
- b. Simultaneously the fire alarm system will send a voice message to the rest of the building and other buildings as necessary to notify enough staff to respond to the zone of alarm origin. No visible appliances will be activated outside of the zone of alarm origin.

Note: For Health Care Occupancies, an adequate number, as a minimum, is considered to be one staff member for each two nonambulatory patients within a smoke zone in buildings that are not fully sprinklered, and one staff member for each four nonambulatory patients for fully sprinklered buildings. Nonambulatory patients are considered to be those who are incapable of taking action for self-preservation under emergency conditions without assistance from others. Nonambulatory patients include behaviorally impaired patients. For further guidance, see VHA Directive 2005-037, Planning for Fire Response.

- c. Subsequent activations of initiating devices in the same zone of alarm origin will not initiate any new alarm outputs, but will appear at the fire alarm control unit and printer. Subsequent to the original alarm, activation of initiating devices in a different zone will initiate the temporal three signal and visible appliances in the new zone and will initiate a new voice message to the locations as determined above, to identify the new location of alarm.

Note: It is anticipated that personnel will respond and take control of the system before too many initiating devices are activated.

- d. The temporal three signal is to be designed to the private operating mode requirements contained in NFPA 72.

Note: This should be interpreted to mean that the sound pressure level is not so loud that staff cannot communicate during the alarm, but loud enough to hear that an alarm is sounded in the zone. The speakers do not have to meet the sound pressure levels for public operating mode identified in NFPA 72. There may be some parts of the building where the speakers would be tapped to meet the public mode sound pressure levels where the intent is to have occupants evacuate in that section of the building. Occupant notification requirements should be carefully reviewed during the design, taking into account the training (or lack of training) of staff and activities that are expected to take place in the space.

Clinic spaces can often be addressed the same as in-patient ward spaces since staff will have the same level of fire safety training and the clinic operations are very similar to that which would be found in a typical in-patient ward with the exception that the hours of operation may be only during normal business hours.

Attached warehouses, shops, and mechanical penthouses are areas where the sound pressure levels may need to be designed for public operating mode, especially if routine events occur during which there are no trained staff to respond and direct occupants.

- e. The strobes are to be installed as outlined below and synchronized if necessary within the zone in accordance with NFPA 72. Both audible and visible signals are to be programmed to continue to operate for five minutes or until the system is acknowledged and turned off/silenced by an operator. The strobes are only to be activated in the zone of alarm origin and not in the zones where the voice message is used.

Note: This will allow staff to be trained to take action as if the fire is in their zone when they see the strobes or hear the temporal three signal.

Generally, the voice message is sent only to the remainder of the building in which the alarm occurs. However, in some cases, the message must be sent to additional buildings to summon sufficient numbers of staff to help relocate patients.

- f. The voice message is to be preceded by a tone alert. No less than three rounds of a voice message to bring staff to the zone of alarm origin is required to be announced.

For Example: (tone alert) “Code Red, First Floor Center, Code Red, First Floor Center, Code Red, First Floor Center.” The message content is to be coordinated with the local VA Medical Center Staff.

- g. Manual operation of the voice system will override all automatic voice messages in the system.

Why do it this way?

The operation provided above will elicit a more rapid response from staff in the zone of alarm origin since this is the only location where visible strobes and the temporal three signal are activated. The strobes and temporal three signals require no interpretation and staff can immediately respond. In older coded systems and in voice systems, the occupants/staff must take time to interpret what the code is or what the voice message says before carrying out their defined duties in a fire event.

Since most health care buildings in the VA are actually mixed occupancies, the arrangement above works well for those buildings that contain mixed occupancies. If the alarm originates in an area (this could be an entire floor) of a health care building that is a business occupancy or equivalent, the alarm system would generate a temporal three signal and activate the visible appliances throughout the area. This would be the proper signal for untrained occupants to evacuate. If there are staff in the area, they will be trained to take appropriate action for the signal received.

Other Issues

- h. To help ensure that the alarm is initiated in the zone of alarm origin, smoke detectors that are installed to hold open smoke barrier doors at smoke zone barriers shall be installed on both sides even though NFPA 72 allows, in some cases, a detector to be installed on one side only. Detectors shall then be programmed for their respective zone to initiate the proper alarm as well as to close the door served.

Note: It should be noted, and it is recognized, that there is always a possibility that the smoke from a fire would set off a detector in an adjacent zone first, or a staff member may activate a manual box in an adjacent zone.

There are other systems that can be utilized to help summon staff during a fire alarm activation. These include paging and radio systems. In some instances it may be beneficial to tie the fire alarm system outputs to summon staff by way of these systems.

- i. While fire alarm voice communication systems are not permitted to be used as general paging systems, they may be used for emergency communications other than fire emergencies where the operators are trained in the use of the system.

General Requirements

- j. Provide speakers to be heard in all locations throughout the protected premises from where staff must respond. This may include more than one building if the number of staff within a building is not adequate. For health care, nursing ward areas should be utilized for responders since areas other than nursing wards (e.g., administration areas) will generally be occupied only during normal business hours.
- k. Speakers shall be installed and arranged so they are clearly heard and understood by staff under normal working conditions. A rule of thumb for speaker layout is to install them every twenty-five to thirty feet on center and not to expect them to be clearly heard through more than one wall.

Note: The SFPE Handbook of Fire Protection Engineering provides guidance on the placement of audible notification appliances.

- 1) Do not locate audible notification appliances within surgical operating rooms. However, ensure that the temporal three signal can be heard within all surgical operating rooms.
- 2) Provide subdued audible notification appliances in critical care areas.

1. Provide visible notification appliances in the following areas:

Note: Strobes are activated only in the zone of alarm origin. Strobes in areas outside of the zone of alarm origin provide no help to staff to identify the location to which they are to respond. Strobes are to be located to assist staff to react immediately without having to interpret the signal. That is, if staff see that the strobes are activated then staff know that they are within the zone of alarm origin.

- 1) Spaces subject to noise, such as mechanical equipment rooms, where the message delivered by the audible appliance might not be heard or might be unintelligible.
- 2) Audiometric booths (not required if the light from the appliance can be seen from within the booth.)
- 3) Public restrooms.
- 4) Public accessible areas of the building such as corridors, auditoriums, cafeterias, open assembly rooms $\geq 750 \text{ ft}^2$, canteens, retail stores, etc. Exception: Visible notification appliances are not required in the following spaces which are not considered to be public accessible:
 - a) Individual office spaces unless the space is known to have a hearing impaired person stationed there.
 - b) Closets (janitor's, clothes, etc.)
 - c) Utility shafts.
 - d) Crawl spaces.
 - e) Normally unoccupied rooms $\leq 100 \text{ ft}^2$.
 - f) Normally unoccupied storage spaces where no regular activities take place other than placement and retrieval of storage.
 - g) Stairway enclosures and elevators.
 - h) Patient exam/treatment rooms.

Note: Though the U. S. Access Board has rendered an opinion that requires strobes in examination and treatment rooms, the VA modifies this recommendation and does not require strobes in examination and treatment rooms since patients will only be in these rooms with permission of the staff. This is in line with the last paragraph of Technical Bulletin # 2 enclosed (included at end of this document).

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- 5) Do not provide visible notification appliances inside critical care areas, surgical operating rooms, or patient sleeping rooms.

- 6) Do not provide visible notification appliances in any health care occupancy where their presence would interfere with patient treatment (such as psychiatric areas). Consult with the facility.
- G. Flash rate shall not exceed one flash per second (1 Hz) for visible appliances. Strobes that operate on adjacent zones on each floor shall be synchronized with one another as required by NFPA 72.
- H. Provide fire department notification by any of the allowed methods identified in NFPA 72. Where direct connections to the fire department are permitted by the fire department, they shall be acceptable as long as the circuit is supervised for grounds, shorts, and opens.

Note: The four types of connections identified in the Life Safety Code are auxiliary, central station, proprietary, or remote station. When there is a VA fire department on site that receives the signal, it is generally considered to be a proprietary system. The typical VA loop system is connected to the fire department via an auxiliary connection (masterbox) or a positive non-interfering and succession (PNIS) module in the control panel. A proprietary system requires the VA fire department or other VA forces to respond to all signals, alarm, supervisory, and trouble. Some may have a direct connection to a non-VA fire department, but these connections are not normally installed in accordance with any requirements contained NFPA 72. Central station has its own niche and that is for highly protected risk (HPR) facilities. The VA, in most instances, connects via a Digital Alarm Communication Transmitter (DACT) to a listed central station for monitoring purposes only. This is a remote station service as defined in the code. A telephone operator's phone call to the fire department is not sufficient (however, per VA policy, a phone call from the telephone operator is required in addition to one of the four types of connections).

- I. All building fire alarm systems having outputs in column 2 of Table 7.3 shall be designed, at a minimum, to be capable of performing the output functions specified in columns 1, and 4 through 11 when communications outside of the building are lost.

Note: As a minimum, buildings will stand alone as a general evacuation alarm system when communications are lost to other networked buildings. Some designs require a signal from a remote building to operate properly. Where that communication is lost, the building should default as indicated to provide a general evacuation signal.

- J. Fire fighter telephones: Where required by the Life Safety Code and where hand-held radios are ineffective for communication by emergency personnel within a building, two-way telephone communication service shall be provided in accordance with the Life Safety Code and National Fire Alarm Code. A telephone jack shall be provided at the fire pump in addition to the telephone jack locations identified in the codes.

7.4 Special Requirements

- A. Locate the main fire alarm panel at the front entrance or at a 24-hour location coordinated with the facility. This will allow the fire department to utilize the panel as an annunciator where no occupants are present.

Note: Care should be taken when determining which locations are staffed on a 24-hour basis. For example, locations such as the VA Police office or VA Fire Department station house might not be staffed continually.

- B. Provide space for fire alarm terminal cabinets (if required) and conduit risers.

- C. In accordance with NFPA 72 and 101, provide smoke alarms in domiciliary resident sleeping rooms, family/staff quarters, on-call staff sleeping rooms, hoptel sleeping rooms, and other sleeping rooms in non-patient areas. ABA and ADA require a minimum of 1 unit, and 1 out of each 25 rooms in each occupancy category, to be provided with visible appliances (strobe lights) activated by the smoke alarm. Facilities are encouraged to provide additional visible notification appliances (combination smoke detector/visible notification appliance) up to 100%, where possible. See NFPA 72 for light intensity and mounting instructions.

Note: If visible notification appliances are provided in only 1 in 25 rooms, the facility will have to ensure that hearing-impaired persons are assigned only to those rooms where accommodation (visible notification) is provided. Installing strobes in all rooms will allow a hearing-impaired person to occupy any room. In addition, for every room which contains a strobe light activated by a smoke alarm and where a building fire alarm system is present, the room must also contain a strobe light activated by the building fire alarm system.

- D. Smoke detectors are to be installed only where required by the National Fire Codes, this design manual, or where required by an equivalency. All smoke detectors shall be photoelectric type only. Alarm verification shall not be used for smoke detectors installed for the purpose of early warning. Nurses stations that are not staffed 24/7 are considered spaces that are open to the corridor and might require smoke detection in accordance with NFPA 101.
- E. Heat detectors are not required unless used in conjunction with elevator shutdown, where used as a substitute for smoke detectors in environments unsuitable for smoke detectors, or where used to protect emergency generators that are not equipped with automatic sprinklers. Exception: Heat detectors are not required in small remote buildings that house emergency generators. Provide heat detectors in all generator rooms in non-sprinklered buildings. The heat detector shall be fixed temperature, extra high temperature (325-375 °F) rating. It is anticipated that most generator rooms will be sprinkler protected and will not require heat detectors.
- F. Indicate the capacity of all air-handling units. Duct smoke detectors are to be installed only where required by NFPA 101 or NFPA 90A. Where duct a smoke detector is located above a ceiling or in a difficult to reach location, provide a remote indicating lamp and a test key switch on nearby wall at 7 ft AFF to facilitate testing.
- G. When an annunciator is required, it shall be located at the building entrances where the fire fighters will respond. The main control panel can act as an annunciator. Coordinate the location with the local fire department. Circuits from the fire alarm control panel to a remote annunciator shall be supervised.
- H. Elevators: Elevator fire protection shall comply with the requirements of NFPA 13, NFPA 70, NFPA 72, and ANSI/ASME A17.1 or A17.3 as applicable.

Note: Designers are reminded of the requirement in Chapter 7 of NFPA 101 for independent ventilation or air conditioning systems to maintain proper temperature during elevator fire fighters service operation for elevator machine rooms that contain solid-state equipment for elevators having a travel distance of more than 50 feet above the level of exit discharge or more than 30 feet below the level of exit discharge, and the requirement that when standby power is connected to the elevator, the machine room ventilation or air conditioning shall be connected to standby power.

Note: Elevators have been an ongoing fire protection problem, not only for the VA, but also for the entire industry. Many conflicting requirements seem to exist at any given time. Although other methods are permitted in the National Fire Alarm Code for power shut down when sprinkler protection is present, the VA uses the heat detector option as identified in the National Fire Alarm Code and as clarified below.

1. Provide smoke detection for Phase I recall for new elevators. Provide smoke detection for Phase I recall for existing elevators that have a travel distance of 25 feet or more above or below the level of fire department response (this is generally a building greater than three stories).

Note: The requirements for Phase I recall do not apply when the hoistway, or portion thereof, is not required to be fire-resistive construction, the travel does not exceed 6 ft 8 in, and the hoistway does not penetrate a floor.

- a. Provide smoke detectors in the elevator lobbies, in elevator machine rooms, and elevator machine and control spaces to initiate Phase I recall. Provide smoke detectors at the top of the elevator hoistway to initiate Phase I recall only when sprinklers are installed at the top of the hoistway.

Note: Smoke detectors are only required above the elevator machine room equipment in larger rooms that contain other mechanical equipment. Some rooms have a lot of space that is not dedicated to elevator equipment smoke detection would not be required for that space.

- b. Provide three supervised control circuits from the fire alarm system to a point within three feet of the elevator controller for the purpose of providing an interface with the elevator system. When actuated, the three circuits will, respectively, 1) initiate recall to the alternate floor, 2) initiate recall to the designated floor, and 3) initiate flashing of the firefighter helmet symbol in the elevator car.

2. Where sprinklers are installed in elevator machine rooms or elevator hoistways, provide heat detection to remove power from the elevator prior to water discharge from these sprinklers. In non-combustible hoistways and where cars meet the flammability requirements of ASME A17.1, the sprinkler at the top of the hoistway should be omitted. Sprinklers can be omitted from elevator pits of enclosed, noncombustible shafts where there are no combustible hydraulic fluids contained in the shaft. Sprinklers, when installed in the pits, shall be sidewall type installed no more than 2 feet above the floor.

Note: Elevator cars which were built to the requirements of the ANSI code since 1985 have a flame spread no greater than 75 and a smoke developed rating no greater than 450 (Class B, per ASTM E 84 / NFPA 255). Where the elevator cars meet these requirements, NFPA 13 allows sprinklers to be omitted from the top of the hoistway as well as from the pit as indicated. When sprinklers are omitted from the top of the hoistway, NFPA 72 does not require, nor does it permit, a smoke detector to be installed at the top of the hoistway due to the difficulty experienced with performing testing and maintenance.

- a. Elevator main line power shutdown (commonly known as “shunt trip”): Power to the elevator must be removed prior to or immediately upon release of water from a sprinkler in the elevator machine room (including machine space, control room, or control space) or hoistway. Operation of a heat detector used to initiate shunt trip shall cause the shunt breaker to operate, thereby removing power from the elevator(s) within the common hoistway or controlled by equipment in a common machine room. Cars sharing the same hoistway or the same machine room shall have power removed independently from cars within other hoistways or those controlled from equipment in other machine rooms.

Note: The industry expects that the removal of elevator power (caused by operation of the heat detector) will not trap any occupants on the elevator because sequences under Phase I operation will have already moved the car(s) to the recall level and placed the doors in the open position. Smoke detection required for Phase I initiation is provided at all of the spaces where heat detection is provided for power shut down.

- b. Provide 57° C (135° F) rate compensation heat detectors within two feet of each sprinkler in the elevator machine room and hoistway in accordance with NFPA 72. Do not provide a heat detector for the pit sprinkler. Higher temperature rated heat detectors may be used where local conditions warrant; however, the heat detectors must have a lower temperature rating than the sprinklers. The sprinklers in the elevator machine rooms and hoistways must be standard response type; quick response sprinklers are prohibited in these areas.
- c. Provide a supervised control circuit from the fire alarm system to a supervised relay within three feet of the shunt breaker. This signal is the input to remove the mainline power to the elevator.
- d. Provide a 110-vac power source to the shunt breaker independent of the elevator controller. This power circuit shall be supervised by the fire alarm system as a supervisory signal.

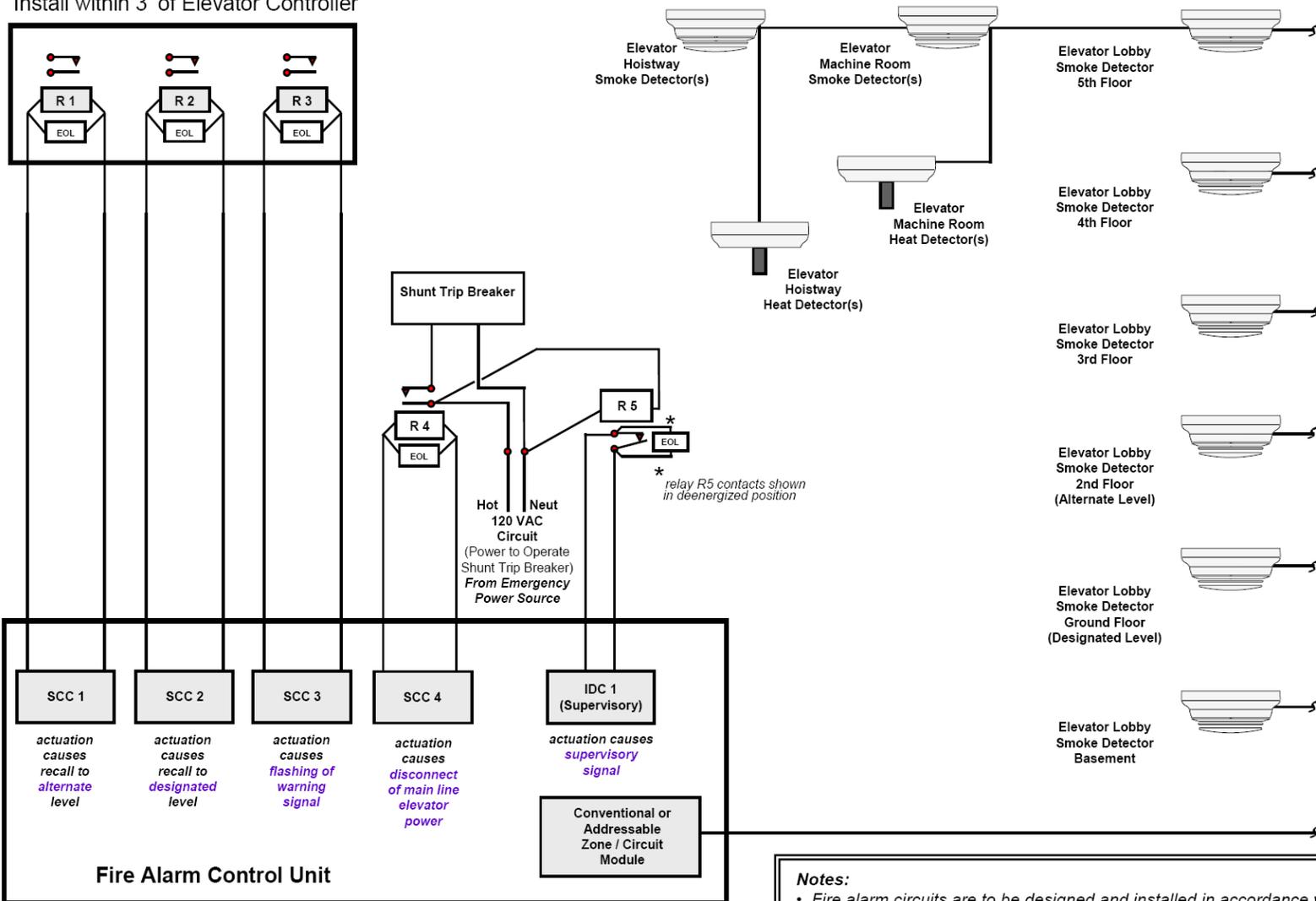
Note: The shunt breaker requires 110-vac to operate and the source must be independent of the elevator in accordance with ANSI A17.1. The intent of the code is to have to a reliable power source and not to rely on one that may be on fire. Without supervision of the 110-vac power circuit needed for the shunt breaker, the condition of the power necessary for the shunt breaker to operate during a fire is unknown. There have been instances where the breaker to the 110-vac power source for the shunt breaker has been turned off and the elevator power would not shunt upon operation of the heat detector.

3. Fire alarm system elevator interface summary: As described above, there will be five supervised control circuits from the fire alarm system that will interface with the elevator system. They are as follows (see following pictorial and the accompanying notes):
 - a. Input to elevator controller for Phase I recall to the designated level from actuation of smoke detectors other than at the designated level lobby.
 - b. Input to elevator controller for Phase I recall to the alternate level from actuation of a smoke detector at the designated level lobby.
 - c. Input to elevator controller to flash the firefighter helmet signal when recall is initiated by a smoke detector in the elevator machine room or hoistway.

- d. Input to elevator main line power shunt trip breaker for power shut down from actuation of heat detectors in the hoistway or machine room.
- e. Supervision of the 110-vac power source to the shunt breaker.

Pictorial Representation of Fire Alarm Interface with Elevators

Interface Relays
Install within 3' of Elevator Controller



Notes:

- Fire alarm circuits are to be designed and installed in accordance with NFPA 72, National Fire Alarm Code and NEC 70, National Electrical Code
- Refer to accompanying page which provides explanation and details of intended operation

Explanation of Fire Alarm Interface with Elevators

Notes:

- There can be many variations of the accompanying “Pictorial Representation of Fire Alarm Interface with Elevators.”
- In this example, the smoke and heat detectors are addressable initiating devices and the operating relays are “hardwired.”
- To achieve supervision, the relay circuits are operated from supervised control circuits. Sometimes NACs (Notification Appliance Circuits) are used to accomplish this function.
- The supervisory initiating device that monitors the power for the shunt trip circuit is connected to a supervisory IDC (Initiating Device Circuit).
- The scenario assumes that:
 1. There is a sprinklered elevator hoistway.
 2. Means to disconnect the main line power to the elevator is via a shunt trip breaker.
 3. System operation is in accordance with NFPA 72.
 4. Relay (R5) and an IDC (Initiating Device Circuit) have been included to provide indication (via a supervisory alarm) of absence of voltage (power) to operate shunt trip breaker.

Components Function

- R1 ----- Signal to elevator controller for recall to designated level.
- R2 ----- Signal to elevator controller for recall to alternate level.
- R3 ----- Signal to elevator controller for firefighter notification.
- R4 ----- Signal to activate shunt trip relay.
- R5 ----- Supervisory relay to monitor presence of voltage (power) to operate shunt trip breaker.

- SCC1 ----- Supervised Control Circuit for operating R1.
- SCC2 ----- Supervised Control Circuit for operating R2.
- SCC3 ----- Supervised Control Circuit for operating R3.
- SCC4 ----- Supervised Control Circuit for operating R4.
- IDC1 ----- Initiating Device Circuit to supervise R5 contacts (monitoring power to operate shunt trip breaker).

4. Operation of the hoistway vent as required by the VA CAD Standard SD-230923-08 in PG-18-4 will be independent of the fire alarm system unless a system smoke detector is required to be installed at the top of the hoistway for elevator recall purposes as identified above.
- I. Fire alarm systems shall monitor each water storage tank dedicated only for fire protection use (if applicable) for low level and low temperature and shall provide supervisory signals (monitoring is not required if the water storage tank is for combined fire protection and domestic use).

7.5 Communications between Buildings:

- A. Buildings shall communicate trouble, supervisory, and alarm signals to a main 24-hour staffed location such as the telephone operator or VA police. This is in addition to VA fire department notification. Provide a printer to make a hard copy of all signals and operator responses. A backup printer is recommended at another 24-hour staffed location. Coordinate with the facility.

Note: Trouble and supervisory signals will be handled at the 24-hour staffed location. The facility will have to institute a system to handle supervisory signals immediately as required by the National Fire Alarm Code.

- B. Where staff response to carry out the fire plan is required from more than one building, provide notification to other buildings. Coordinate with the facility.

-----END-----

APPENDIX AAbbreviations Used in this Design Manual

ABA	Architectural Barriers Act
ADA	American with Disabilities Act
AFF	Above Finished Floor
AGV	Automatic Guided Vehicle
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
A/E	Architect/Engineer
C	Celsius
CT	Computerized Tomography or CATSCAN
cu	cubic
F	Fahrenheit
FACSL	Fire Alarm Certificate Service
FM	Factory Mutual
FMERC	Factory Mutual Engineering and Research Corporation
ft	feet
gpm	gallons per minute
HITF	Healthcare Interpretations Task Force
HVAC	Heating Ventilating and Air Conditioning
HVD	Hoistway Vent Damper
Hz	Hertz (cycle per second)
IBC	International Building Code
in	inch
kPa	Kilopascals
kVA	Kilovolt Amps
L	liters
L/m	liters per minute
L/s	liters per second
m	meter
mm	millimeter
MRI	Magnetic Resonance Imaging
NBSIR	National Bureau of Standards Information Report

NFPA	National Fire Protection Association
NFC	National Fire Codes
PG	Program Guides
psi	Pounds Per Square Inch
PL	Public Law
QRS	Quick Response Sprinklers
SFPE	Safety and Fire Protection Engineer
sq	square
UL	Underwriters Laboratories
VA	Department of Veterans Affairs
VAC	Volts Alternating Current
VAHBS	VA Hospital Building System
VAMCS	VA Master Construction Specifications