



Designing Fire & EMS Stations A Comprehensive Guide

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PDH: 10

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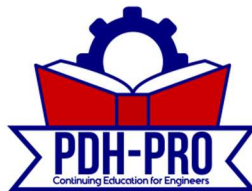
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Chapter 1: Introduction

Station-related deaths

The National Fire Protection Association (NFPA) reports that there were 115 firefighter line-of-duty deaths (LODDs) in fire stations for the 10-year period of 2006 to 2015. The causes of death were as follows:

- † Sudden cardiac deaths — 89.
- † Internal traumas — 14.
- † Strokes — 10.
- † Suicides — 2.

Included in these numbers are the following incidents:

- † Two members struck their heads and passed away after suffering medical emergencies (one from a heart attack and one from a seizure).
- † Seven died from falls.
- † Four were struck by apparatus.
- † One was trapped under an apparatus.
- † One died from an explosion.
- † One died from a physical altercation with another member.
- † One died from septic shock approximately three months after injuring his elbow in a station training session.

The majority of members (66) were engaged in normal activities when their fatal injuries occurred. Cardiac deaths, strokes, seizures and blood clots accounted for 58 of those 66 deaths. Of the internal trauma deaths, two fell from ladders; one died from a leaking propane tank that ignited and exploded; one fell in the kitchen and struck his head on an appliance; one was crushed between the header of the bay door and the rail of an aerial apparatus while attempting to get a piece of equipment that was stuck overhead; and one lost his balance and fell, striking his head on the ground.

The primary activity being conducted during the LODDs was training (32). Cardiac arrest accounted for 24 of these, and five were the result of stroke. Seven members died while performing maintenance activities. One member was crushed against the wall by a brush unit when it lunged forward during maintenance. Another member was crushed while performing maintenance underneath an apparatus, and the jack used to elevate the apparatus failed.

Four members passed away while performing or preparing for community events at the facility. One passed away after falling from an antique apparatus while it was being loaded onto a trailer. Another one passed away from cardiac arrest while doing construction work on a new station, and one was struck by an aerial boom while assisting an insurance adjuster who was inspecting hurricane damage to the station. No specific information was provided on the fourth fatality.



Additional information about fire and emergency services LODDs can be obtained from the following:

National Fire Protection Association
One-Stop Data Shop
1 Batterymarch Park
Quincy, MA 02169-7471
www.nfpa.org
Email: osds@nfpa.org
Phone: 617-984-7451

Station-related injuries

Firefighter and Emergency Medical Services (EMS) personnel injuries at the station are much more common than recognized by the industry. Unfortunately, firefighter injury statistics, specifically for station injuries, are not collected consistently on a national level. However, this information can be obtained for individual departments when injury information is maintained in computer databases that allow location searches. Any analysis of available data gathered on emergency personnel injuries and deaths that occur at the station clearly show there are plenty of opportunities to make changes in the station design.

Most personal injuries at fire and emergency services stations consisted of strains, sprains and lacerations. While these injuries may not be severe, many cause lost time. Some, such as lower back strains, can result in extensive lost time and can be debilitating. A sprain or strain of moderate severity can cost a career department close to \$50,000 in lost time, workers' compensation, medical charges, and overtime hiring.

Station-related illnesses

Station-related illnesses are widespread and result from various chemical, biological and environmental exposures. Cancer has become the leading illness in the fire services. Fire and EMS personnel are constantly exposed to carcinogens at the scene of a fire. They also bring particulates back with them. For example, continued exposure to diesel exhaust may partially explain the high incidence of certain cancers among firefighters. The Occupational Safety and Health Administration (OSHA) and other agencies have clearly stated that diesel exhaust is a confirmed carcinogen, but there are additional carcinogens found in stations as well, including polycyclic aromatic hydrocarbons (PAHs), polybrominated diphenyl ethers, and polychlorinated biphenyls. With the rate of cancer in the fire services rapidly increasing, it is no surprise that more states are passing presumptive laws concerning firefighter cancer. As of the end of 2016, 36 states have enacted some form of cancer-presumptive legislation.

Fire and EMS stations also contribute to infectious disease risks. Due to the nature of their work, fire and EMS personnel are at an increased risk of exposure to bloodborne and airborne pathogens. These pathogens can make their way into fire stations that neglect the proper procedures and areas for decontamination/disposal of medical clothing and equipment. One study (Sexton & Reynolds, 2010) showed high levels of Methicillin-resistant *Staphylococcus aureus* (MRSA) in station furniture, while another study (Roberts, 2014) found MRSA in both apparatus bays and in living quarters.

Fire and EMS personnel are also at an increased risk of noise-induced hearing loss from alarm tones and engine noises in the station. In relation to station noise, station alerting systems contribute to firefighter heart disease. Studies have shown that heart rates are elevated among firefighters responding to alarms. While at the station, a firefighter's heart rate becomes elevated within 15 to 30 seconds after the alarm. One study found that firefighters' heart rates rise near 80 percent of the predicted heart rate maximum during the first 90 seconds following the alarm. A 2016 study by MacNeal, Cone and Wistrom concluded that small but significant decreases in the amount of tachycardic response to station alerting are associated with simple alterations in alerting methods. Station-specific and ramp-up tones improve perceived working conditions for emergency responders.

Some other major health illnesses that may result from the station include reactions to mold, which can cause respiratory illnesses. Exposure to carbon monoxide and diesel exhaust have been shown to increase risk for cardiovascular disease, which may be contributing to sudden cardiac death in firefighters. Also, cellular towers have become a new concern, as they are being placed on fire stations throughout urban areas. Firefighters working in these stations have reported neurological problems, such as headaches, irritability and sleep disturbance.

The U.S. Fire Administration (USFA) recognizes that many emergency response personnel have needlessly died and have been injured because of accidents at emergency services stations. This recognition is further heightened by the rising number of occupational health exposures to emergency responders.

Federal, state and local regulations have endeavored to curb exposures to diesel emissions, noise abatement, indoor air quality, hazardous materials, waste exposure, toxins, and infectious material. These are all exposures that emergency response personnel are subjected to every day they work. Unfortunately, compliance with these regulations is not consistent throughout the fire and EMS communities.

General requirements

Many emergency response organizations are familiar with NFPA standards. NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, defines a fire department facility as any building or area owned, operated, occupied or used by a fire department on a routine basis, that may include fire and rescue stations, training academies, and communication centers (**see Figure 1.1**). Fire department facilities do not include those facilities not normally under fire department control. Chapter 10 of the standard, Facility Safety, requires an organization's facilities to do the following:

- ⌋ Comply with all legally applicable health, safety, building and fire code requirements.
- ⌋ Provide facilities for disinfection, cleaning and storage in accordance with NFPA 1581, *Standard on Fire Department Infection Control Program*. NFPA 1581 provides facility requirements for:
 - Ÿ Hand washing.
 - Ÿ Food storage.
 - Ÿ Kitchens.

Figure 1.1 — NFPA 1500 sets the benchmark for fire service safety issues.

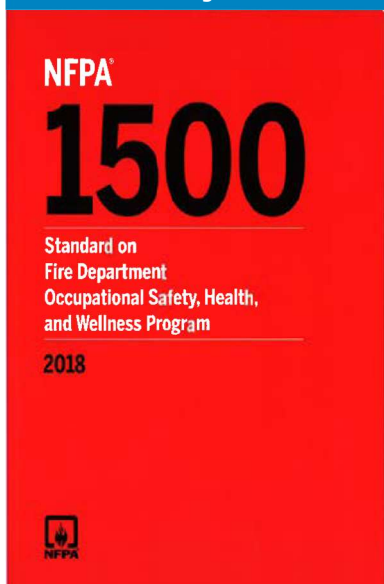


Photo courtesy of Yvonne Smith, NFPA.

- Shelving.
- Bedrooms.
- Bathrooms.
- Equipment storage.
- Personal protective equipment (PPE).
- Contaminated storage.
- Cleaning areas.
- Disinfecting areas.
- Disposal areas.

• Comply with NFPA 101, *Life Safety Code*®, or locally adopted requirements of the building code.

• Provide smoke detectors outside all sleeping areas, in the immediate vicinity of bedrooms, and on every level of the facility, including basements. Also, install smoke detectors in every bedroom, unless the facility has a supervised automatic sprinkler system installed in accordance with NFPA 101. Smoke alarm activation must cause an automatic evacuation signal for the entire facility.

• Be designed with provisions for the ventilation of vehicle exhaust emissions from fire apparatus (and other vehicles) to prevent exposure to firefighters and to prevent contamination of all areas of the facility (**see Figure 1.2**).

• Have carbon monoxide detectors in all sleeping and living areas.

• Have fully-automatic sprinkler system in all new facilities.

• Be a smoke-free facility.

Figure 1.2 — A typical apparatus exhaust system connection.



Photo courtesy of Mike Wieder, Stillwater, OK.

- ⌋ Prohibit contaminated PPE in any sleeping and/or living area.
- ⌋ Guards and/or covers for slide pole openings to prevent accidental falls through the opening.
- ⌋ Be inspected annually to determine compliance with all legally applicable health, safety, building and fire code requirements. These inspections must be documented and recorded.
- ⌋ Be inspected monthly to identify and document/correct any safety or health hazards.
- ⌋ Have an established system to maintain facilities and to promptly correct any safety or health hazards, or code violations.

Fire and emergency services organizations are strongly advised to get a copy of NFPA 1500 for complete guidance and explanatory language of the standard's requirements. In addition, the USFA strongly recommends that stations be protected with automatic sprinkler systems.

NFPA 1581, *Standard on Fire Department Infection Control Program*, requires that fire and emergency services facilities comply with all relevant health and infection-control laws and regulations (**see Figure 1.3**). Specifically, the standard requires the following:

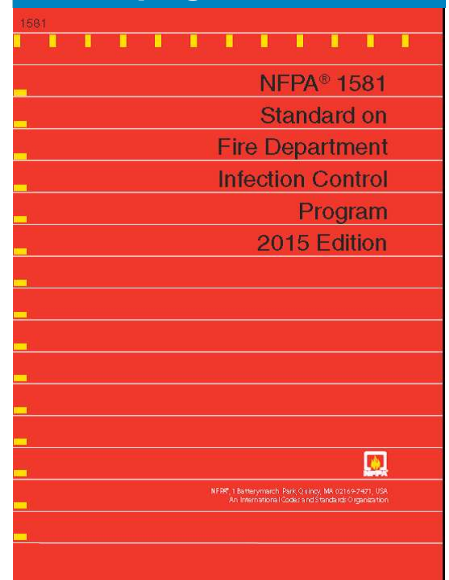
⌋ Hand washing:

- Ÿ Hand washing facilities anywhere contaminated materials are stored, cleaned, disinfected or laundered.
- Ÿ Soap and water are preferred, but if they are not available, you can use waterless cleaners, sanitary wipes or other available skin cleaning products.
- Ÿ Hand cleaning should occur prior to members entering living, sleeping and eating areas, if the member has been contaminated with infectious agents.

⌋ Kitchens:

- Ÿ All food prep areas and surfaces used for holding/hanging containers and utensils be made of nonporous material.
- Ÿ Dish-washing areas equipped with shelving or racks for drip-drying of food containers.
- Ÿ Shelving and racks made of nonporous materials.
- Ÿ Drainage from shelving and racks designed to drain into the sink or pan that empties into the sanitary sewer or septic system.
- Ÿ Kitchens equipped with double-basin sinks or two sinks.
- Ÿ A sprayer attachment for the kitchen sink.
- Ÿ Sinks, countertops and backsplashes all made of nonporous

Figure 1.3 — NFPA 1581 provides direction on infection control programs.





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