PDHonline Course G327 (2 PDH)

NFPA 101 - Life Safety Code

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PDH Online | PDH Center

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Course Description

Life safety is the most important consideration in all engineering designs. The *Life Safety Code*® (LSC), published by the National Fire Protection Association (NFPA), is a compilation of fire safety requirements for new and existing buildings. This course helps you understand the goals of life safety, know the key concepts within life safety, understand the requirements of fire separation, and learn both fundamental and general life safety requirements such as means of egress, fire resistance rating, and fire protection features.

This course includes a multiple-choice quiz at the end, which is designed to enhance the understanding of course materials.

Learning Objectives

At the conclusion of this course, students will be able to:

- Understand the goals of life safety;
- Know the key concepts within life safety;
- Grasp the means of egress requirements;
- Identify different fire protection features;
- Learn both basic and general life safety requirements; and
- Produce better design.

Intended Audience

This course is designed for architects, engineers, geologists, land surveyors, contractors, safety and health professionals, or anyone who would like to learn more about life safety codes and standards.

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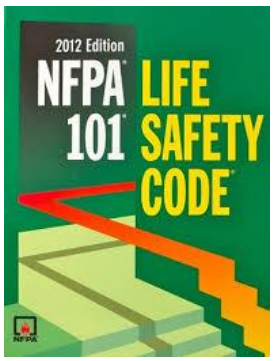
Understanding Life Safety Code®

ACE GROUP LLC

Introduction



The *Life Safety Code*® (LSC) is a compilation of fire safety requirements for new and existing buildings, and is updated every three years by the National Fire Protection Association (NFPA). It covers those construction, protection, and operational features designed to provide safety from fire, smoke, and panic. Many states, municipalities, and federal agencies have adopted the *Life Safety Code*® as a part of their regulations.

The purpose of this article is to help you become familiar with some background information about the NFPA and LSC, key concepts within life safety, fire protection strategies and methods, and relevant terminologies so that you will have a better understanding of the *Life Safety Code*®.

For simplicity, the *Life Safety Code*® is often referred to as the *Code* or *the LSC* in the discussion below.

History of NFPA and LSC

The National Fire Protection Association (NFPA) has been in existence since 1896. The origin of *Life Safety Code*® dates back to 1913. The *Code* exists today primarily because of a number of devastating, catastrophic fires that happened throughout the 20th century. They focused national attention on the fire problem and the inadequacies of life safety features in buildings. The following list contains some of the historic commercial fires that have made significant impact on building/fire codes:

- *Iroquois Theater Fire,* Chicago, 1903: 602 deaths
- *Triangle Shirt Waist Company Fire,* New York, 1911: 146 deaths
- *Coconut Grove Night Club Fire*, Boston, 1942: 492 deaths
- *La Salle Hotel Fire*, Chicago, 1946: 61 deaths
- *Winecoff Hotel Fire*, Atlanta, 1946: 119 deaths
- *MGM Grand Hotel & Casino Fire*, Las Vegas, 1980: 85 deaths

Over the years, NFPA has produced many publications. Its *Life Safety Code*® is published as NFPA 101. NFPA 101 is unique among NFPA codes because it addresses existing construction in addition to new construction.

It is important to understand that the *Code* has no legal authority, unless it has been adopted as law within the jurisdiction of the governing body where buildings or structures are located. When a code or standard becomes a part of local, state, or federal laws, it enters the public domain.

This course is based on the 2012 edition of NFPA 101, which has been adopted by many states, municipalities, and federal agencies. In 2016, the Centers for Medicare & Medicaid Services (CMS) adopted the 2012 NFPA 101 as their fire safety standard for Medicare- and Medicaid-participating hospitals, critical access hospitals (CAHs), long-term care facilities, intermediate care facilities for individuals with intellectual disabilities (ICF-IID), ambulatory surgery centers (ASCs), hospices which provide inpatient services, religious non-medical health care institutions (RNHCIs), and programs of all-inclusive care for the elderly (PACE) facilities.

Goals of Life Safety

Life safety has two primary goals:

1. Provide an environment that is safe from fire and other emergencies;
2. Get building occupants out of the building as safely and quickly as possible in the case of emergency.

While fire is the primary concern, the *Code* provisions may also benefit building occupants in other emergencies such as floods, blackouts, tornados, earthquakes and terrorism. However, this *Code* is not a building code. It does not address the prevention of fire and the preservation of property from loss due to fire.

Organization of the Life Safety Code

The 2012 edition of NFPA 101 consists of 43 chapters and 3 annexes. Chapters 1 through 6 provide the administrative provisions and general requirements of the code. Chapters 7 through 10 provide detailed design requirements for means of egress, fire protection features, building services, fire protection equipment, interior finish, building contents, and furnishings. Chapter 11 provides design requirements for high-rise buildings and special structures such as towers, piers and membrane structures. Chapters 12 through 42 provide life safety requirements for 30 classes of occupancies. Chapter 43 addresses provisions and requirements for building rehabilitation.

Compliance Options

Since the 2000 edition of the *Code*, building owners and designers have two options to comply with the fire safety regulations:

1. Prescriptive-based compliance (design "by the book" - in accordance with fundamental and general provisions in the NFPA 101)
2. Performance-based compliance (design by performance – in accordance with provisions in Chapter 5 of the NFPA 101)

The 2012 *Code* may be divided into 6 parts as shown in the table below:

Part	Chapters	Content
1	1 through 4, 6 through 10	Core or fundamental requirements - Prescriptive-based compliance
2	5	Performance-based compliance
3	11	Special structures and high-rise building - Prescriptive-based compliance
4	12 through 42	Occupancy-specific requirements - Prescriptive-based compliance
5	43	Building Rehabilitation - Prescriptive-based compliance
6	Annexes A, B & C	Useful additional information

Fundamental Requirements

The following fundamental concepts of building design and operation for life safety serve as the basis for the prescriptive requirements of the *Code*:

- Safety to life should not depend solely upon any single safeguard.
- Construction is sufficient to provide structural integrity during a fire while occupants seek safe refuge or escape to the building exterior.
- Every building or structure shall be provided with adequate means of egress and other safeguards.
- At least two means of egress must be provided in all situations where occupants would be endangered attempting to use a single means of egress.
- The means of egress should be arranged to minimize the possibility that they might be rendered impassable by the same emergency.
- Egress paths must be maintained free, continuous and unobstructed.
- Every exit should be clearly visible, or the route to reach each exit conspicuously indicated.
- Each means of egress, in its entirety, must be arranged or marked so that the way to a place of safety is indicated in a clear manner.
- Egress facilities must be adequately lighted.
- Means of egress should be accessible to the extent necessary to ensure the safety of those having impaired mobility.
- Fire alarms or other systems must be provided, when necessary, to warn occupants of the existence of fire.
- Vertical openings must be enclosed or protected to prevent the spread of fire, smoke, or fumes from floor to floor.
- Any fire protection system, building service equipment, feature, or safeguard must be designed, installed, and approved in accordance with all applicable NFPA standards.
- Devices, equipment, or other features required for complying with NFPA 101 must be maintained.
- Design criteria that exceed the scope of the *Code* are permitted.
- Provisions in NFPA 101 do not preempt other codes & standards of safety during normal occupancy conditions.

General Requirements

Chapters 7 through 11 contain a series of general requirements that apply to all buildings and structures.

- Means of egress (Chapter 7).
- Fire protection features (Chapter 8).
- Building services and fire protection equipment (Chapter 9).
- Interior finishes, contents, and furnishings (Chapter 10).
- Special structures and high-rise buildings (Chapter 11).

Some of these general requirements are outlined and discussed below.

Means of Egress

Egress is synonymous with exiting. Chapter 7 – Means of Egress is the most essential part of the *Code,* as is evidenced by the title *"Building Exits Code"* of the earliest editions of the *Code.* This chapter specifically covers the components, number, size, arrangement, lighting, and identification of means of egress.

The means of egress is an important consideration when it comes to life safety. The *Code* establishes minimum criteria for the design of egress facilities so as to permit prompt escape of occupants from buildings or, when desirable, into safe areas within buildings.

Egress needs to be continuous, unobstructed and possible from any point in the building. Egress should lead to a public way, which is a public area outside that is a minimum of 10 feet wide. Some examples include a street, alleyway, or park.

Egress consists of three elements:

1. The Exit Access

The exit access is the portion that leads to the exit. Exit access can include aisles, corridors, hallways and intermediate rooms, among others. Exit access may or may not be fire-protected, but the important thing to remember is that the length of the exit access is measured and regulated.

2. The Exit

The exit is the portion that provides a protected path between the exit access and the discharge. Exits must be fully enclosed and made of fire-resistive construction (walls, doors, windows). Exits are either 1-hour or 2-hour rated, depending on the building specifics.

3. The Exit Discharge

The exit discharge is the portion between the exit and the public way. While they are usually outside, common exit discharges include balconies and exterior stairways. Some building lobbies qualify as exit discharge areas, with some conditions.

Although each chapter in the *Code* contains its own provisions for means of egress, there is one chapter in particular that addresses most of the egress-related provisions. It is Chapter 7, which contains the following sections:

7.1 General

7.2 Means of Egress Components

7.3 Capacity of Means of Egress

7.4 Number of Means of Egress

7.5 Arrangement of Means of Egress

7.6 Measurement of Travel Distance to Exits

7.7 Discharge from Exits

7.8 Illumination of Means of Egress

7.9 Emergency Lighting

7.10 Marking of Means of Egress

7.11 Special Provisions for Occupancies with High Hazard Contents

7.12 Mechanical Equipment Rooms, Boiler Rooms, and Furnace Room

7.13 Normally Unoccupied Building Service Equipment Support Areas

7.14 Elevators for Occupant-Controlled Evacuation Prior to Phase I Emergency Recall Operations

Common Path of Egress Travel

The common path of egress travel is the part of the exit access that is taken before two separate paths to two different exits becomes available, similar to the path before a fork in the road. The common path of egress travel distance is based on the occupancy type.

Most occupancies have a maximum common path of egress travel distance of 75 feet. Some occupancies increase that distance to 100 feet if the building is sprinklered. Assembly and hazardous occupancies do differ from the norm, so be sure to check the code requirement.

Another factor to keep in mind is that all paths of egress must meet accessibility codes.

Maximum Travel Distance

Also known as travel distance, maximum travel distance is the distance an occupant must travel from the most remote point of the exit access to the nearest exit. Again, the maximum allowable distance is based on occupancy type and whether the building is sprinklered or not. In most cases, the maximum travel distance to an exit may be increased by at least 25% by adding an automatic sprinkler system.

Number of Exits Required

The number of exits required is largely based on the occupancy type, the occupancy load of the space itself, and limitations on the travel distance length. Every room must have at least one exit.

When two exits are required, they must be located at a distance not less than 1/2 the length of diagonal dimension of the room. In other words, if the room diagonal measures 150 feet, the two exit doors must not be less than 75 feet apart from each other. (If the building is sprinklered, the minimum distance is reduced to 1/3). This ensures that exit doors are well distributed in the room.

Width of Exits

Minimum exit width dimensions are calculated by multiplying the occupant load by the figures below. Note that the dimension calculated cannot be less than minimum widths specified elsewhere in the code, like the 44-inch minimum corridor width.

- 0.3 per occupant in stairways
- 0.2 per occupant in other egress components, like corridors

If there two or more exits are required, the total width must be divided so that if one exit becomes unusable, the capacity of the other exit is not reduced by more than 50% of the overall required capacity.

Fire Protection Features

Chapter 8 provides the basic requirements for structural features of fire protection:

- Buildings must meet the minimum construction requirements defined for the occupancy (e.g., multi-story hospitals must be either Type I or Type II construction).
- Where required by occupancy chapters, buildings must be divided into compartments using fire barriers.
- In multiple-story buildings, floors should be constructed as smoke barriers and vertical openings protected with fire barriers unless specifically exempt from these requirements.

The above requirements are applicable to both new and existing construction.

This chapter specifies a menu of protection options, which are mandated to varying degrees by specific occupancy chapters. However, some provisions of this chapter apply as requirements to all occupancies.

Fire Barrier

Fire barriers play an integral role in managing a fire by preventing the spread of smoke, toxic gases, and fire itself from one area to another.

According to Section 7.2.4.3.1, fire barriers separating building areas between which there are horizontal exits shall have a 2-hour fire resistance

rating and shall provide a separation that is continuous to ground. Any fire barrier must be complete both horizontally and vertically, the latter meaning that the wall extends from the floor slab through any suspended ceiling and is tight against the floor or roof above.

Fire doors are fundamental to the integrity of fire barriers, because any time there is an open doorway to a compartment, a fire barrier is temporarily broken. To prevent breaks in fire protection, fire doors must be self-closing and be equipped with proper latching devices so as to provide as much resistance as possible to the spread of fire, smoke, and toxic gases.

Fire-protection-rated dampers are required in ducts that penetrate fire barriers with a fire resistance greater than one hour.

Smoke Barrier

A smoke barrier is a continuous vertical or horizontal membrane, such as a wall, floor or ceiling assembly (with or without protected openings) that is designed and constructed to restrict the movement and passage of smoke. Smoke barriers usually have a fire-resistance rating specified in the code. In new health care occupancies, for example, the smoke barrier must have a one-hour fire-resistance rating. In existing health care occupancies, the requirement is reduced to a half-hour fire-resistance rating. Any penetrations of the smoke barrier must be sealed to maintain the fire resistance and to ensure that the barrier is relatively smoke-tight. The doors in the smoke barrier may or may not be required to be fire-protection-rated. Duct penetrations of smoke barriers will generally require smoke dampers that are operated by smoke detectors.

Smoke Partition

A smoke partition is a continuous membrane that is designed to form a barrier to limit the transfer of smoke, usually less restrictive than a smoke barrier. A "smoke partition" was originally intended to trap heat long enough to activate a sprinkler head in an incidental use area that is protected by sprinklers instead of rated walls. Smoke partitions generally do not have a fire-resistance rating and may terminate at a ceiling. The doors do not have to be fire-protection-rated but they must be self-closing. No dampers are

required in duct penetrations. Most common smoke partitions are used in the following locations:

- Corridor walls
- Elevator lobby (high-rise buildings and I-2, I-3 occupancies)
- Walls separating dwelling units (apartments, dorm rooms, etc.)
- Walls separating tenants in covered shopping malls
- Walls separating guests' rooms in residential (R-1, R-2)

Fire/Smoke Compartment

A fire/smoke compartment is a space within a building that is enclosed by fire/smoke barriers on all sides, including the top and bottom.

Where a barrier acts as both a fire barrier and a smoke barrier, they must comply with both sets of requirements.

Building Service and Fire Protection Equipment

Chapter 9 divides the types of equipment in buildings into two categories: building service and fire protection. It provides cross-references to other codes and standards that provide design guidance for building service equipment. It also provides menus of the general provisions for fire protection equipment such as fire alarms, communications systems, or automatic extinguishing systems.

Building Service

Building services include utilities, such as gas and electricity, elevators, and heating and air conditioning. Building service equipment shall meet all industry-specific codes and standards, such as NFPA 54 - National Fuel Gas Code and NFPA 70 - National Electrical Code.

Fire Protection Equipment

Fire protection equipment includes the following:

- Fire extinguishers
- Audible/visible fire alarms
- Emergency lighting

- Smoke detectors
- Sprinkler systems
- Exit signs (ceiling-mounted or door-mounted)

Occupancy Requirements

Occupancy-specific provisions are provided in Chapters 12 through 42 to supplement the general requirements provided in the other chapters of NFPA 101. These provisions address the unique life safety concerns that arise in each type of occupancy. If specific requirements contained in the occupancy chapters differ with the general requirements, the occupancy-specific requirements govern.

The following are the fifteen major occupancy categories in the *Code*:

- Assembly
- Educational
- Day Care
- Health Care
- Ambulatory Health Care
- Detention and Correctional
- One- and Two- Family Dwellings
- Lodging and Rooming Houses
- Hotel and Dormitories
- Apartment Buildings
- Residential Board and Care
- Mercantile
- Business
- Industrial
- Storage

Within these categories, there may be subcategories such as new or existing occupancies or special uses that receive separate treatment.

The above occupancy categories are similar, but not identical, to those in the *International Building Code*.

Type of Construction

To fully understand the Life Safety Code, one also needs to understand the types of construction specified in the *International Building Code (IBC)*.

Type	Description
I & II	Building elements are of noncombustible materials.
III	Exterior walls are of noncombustible materials and the interior building elements are of any material permitted by the code.
IV	H. T. (Heavy Timber) - Exterior walls are of noncombustible materials and the interior building elements are of solid or laminated wood without concealed spaces.
V	Structural elements and exterior and interior walls are of any materials permitted by the code.

Each type of construction is further divided into two classes:

Class A: Fire-resistance rated construction.
Class B: Non fire-resistance rated construction.

Fire Resistance Rating

Fire resistance rating is the period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests. The fire resistance of a structural component is a function of dimensions and various properties of the materials used, including combustibility, thermal conductivity, and chemical composition. The required fire resistance rating for building elements in different occupancies can be found in the adopted building code.

Building elements in different types or classes of construction have different fire-resistance rating requirements. For example, floor construction in Type I construction, regardless of class, requires 2-hour fire resistance rating while interior bearing walls in Type II Class A construction needs 1-hour rating.

Navigating Through the Code

To apply the *Code*, it is important to understand its layout and content. With nearly 500 pages, the 2012 *Code* is an extensive and complex document to navigate and understand for someone who is not familiar with it. The following table is designed to help you navigate through the *Code* step-by-step.

Navigating Through the Life Safety Code	
Step	**Action (Reference)**
1.	Determine the occupancy classification (Chapter 6)
2.	Determine if the building or structure is new or existing (Chapter 3)
3.	Determine the occupant load. (Section 7.3.1 and Section *.1.7 section of Chapters 12 through 42. * refers to the relevant chapter number)
4.	Determine the hazard of contents. (Section 6-2)
5.	Refer to the applicable occupancy chapter of the Code (Chapters 12 through 42)
6.	Determine the occupancy sub-classification or special use condition, if applicable.
7.	Proceed through the applicable occupancy chapter, verifying compliance with each referenced section, subsection, paragraph, subparagraph, and referenced codes, standards, and other documents.
8.	Where two or more requirements apply, the occupancy chapter generally takes precedence over the core Chapters 1 through 10.
9.	Where two or more occupancy chapters apply, such as in a mixed-use building, the most restrictive code provisions apply.
10.	Operating feature requirements (Chapters 12 through 42)

Course Summary

Life safety is the most important consideration in all engineering designs. This course covers a host of topics related to reducing the spread of fire in buildings and providing adequate means of egress from buildings when necessary. By becoming familiar with the layout and content of the Life Safety Code and understanding how to navigate through the LSC, you will have a thorough understanding of how proper application of the LSC can minimize the effects of a devastating fire or other emergency.