CHAPTER 17

FIRE IMPACT MANAGEMENT

General

Chapter 17 provides objectives, functional statements, and performance requirements for managing the impact of a potential fire event that can occur in a building or facility. This chapter assumes that a fire can occur in the facility despite any "prevent fire" measures that are being taken. The objective is to limit the impact of a fire to an acceptable level on the occupants, the general public, and the facility, including its contents, use, and processes. Other inherent objectives in this section are to provide some level of protection for the facility's mission and revenue stream and the community tax base. In general, those are the underlying themes of building and fire regulations in the United States.

1701.1 Objective

The objective of this section is identical to the objective of Part II, Section 602, because both these sections are intended to manage or limit the impact of a fire event to an acceptable level of fire-safety performance. See the discussion in Section 602 of this user's guide. The key operative phrase is "acceptable level of fire-safety performance," which is very broad in scope. The Committee felt that this was a more appropriate expression of society's expectations of a building's performance in response to a fire event.

1701.2 Functional statements

However, the functional statements in Section 602 and Chapter 17 are different. Section 602 was written to address those requirements generally and historically found in building codes as they relate to fire impacts upon a structure. Chapter 17 was written to cover the issues more often found in fire codes such as specific processes, equipment, maintenance issues, and existing facilities. For this reason, a different set of functional statements was developed to clarify the application of the different sections. However, the general functional statement in this section is the same as that in Section 602.2. The general functional statement sets a single performance level for fire life-safety but sets multiple upper limits for property damage based on the performance group classification of the facility. See the user's guide for Section 602.2.

A functional statement was added to Chapter 17 to place specific emphasis on providing a level of fire safety for occupants with physical or mental disabilities that is comparable to that provided for the general population. This functional statement is not contained within Section 602, but generally the code applies to all occupants regardless of their physical or mental abilities.

1701.3 Performance requirements

The performance requirements within Section 602 and Chapter 17 were very similar; therefore, the performance requirements from Section 602 were combined into the requirements found in Section 1701.2. This was done in an effort to provide correlation and consistency between the building and fire provisions. Instead of replicating the applicable performance requirements in both chapters, it was decided to simply reference Chapter 17 from Section 602.3, which allows for a consistent application of the performance code no matter if the building is in the design stage, 50 years old, undergoing a process change, or undergoing a maintenance inspection.

The Fire Safety Concepts Tree, as published in NFPA 550, implies that fire safety requires either the prevention of a fire or the management of the impact of a fire that does occur. Managing the impact of a fire involves managing both the fire and the occupants of the facility that are exposed to that fire. In this document, managing the exposed occupants is addressed in Chapter 19: Means of Egress, so those performance requirements are found there. The performance requirements in Section 1701.3 address the other strategies of controlling combustion or controlling fire spread. The general performance statement first makes a link back to the performance level stated in the functional statement by declaring, "Facilities or portions thereof shall be designed, constructed and operated to normally prevent any fire from growing to a stage that would cause life loss or serious injury." This section also states that facilities should sustain local fire damage, remain intact as a whole, and not be damaged to an extent disproportionate to the local damage. For instance, a small wastebasket fire in a large open warehouse should not impair the structural integrity of the building or cause significant damage to the stored commodities. The remaining performance requirements refer to the more detailed elements of the building or facility such as interior finishes, concealed spaces, and vertical openings.

Fire management includes both active and passive fire protection strategies. Passive strategies include compartmentation using fire barriers and structural fire resistance, while active strategies include fire detection systems, automatic fire suppression systems, and manual fire fighting. In this document, the provisions addressing manual fire fighting by emergency response personnel are

covered in Section 1701.3.3 as well as in Chapter 20: Emergency Notification, Access and Facilities, and Chapter 21: Emergency Responder Safety.

A fire can be managed by controlling the combustion process and the fire loading to restrict the size and rate of growth of the fire, or it can be controlled by limiting the spread of fire through the building and to adjacent buildings using active or passive means. Fire management can also be accomplished by a combination of the two approaches.

Controlling the combustion process and the fire environment involves limiting, where possible, the fuel loading in the facility to reduce the potential size and growth rate of a fire that does occur. Prescriptive fire codes have usually dealt with the concept of managing fire impact by controlling the fuel loading within buildings for special hazards. An example of such provisions is the maximum allowable quantities of flammable liquids allowed in nonhazardous occupancies (Chapters 27 and 34 of the *International Fire Code*).

Limiting the spread of fire and products of combustion through a building is also a function of managing the fire. This can be accomplished through passive methods such as providing fire rated compartment barriers and opening protection, smoke barriers, shaft enclosures, and fire-resistance-rated construction isolating higher hazard areas. Active systems, such as automatic sprinkler systems, other fire extinguishing systems, and smoke management systems may also be relied upon to prevent the spread of fire and products of combustion throughout the building.

Fire detection and alarm systems may also be considered here as a means to initiate mitigation efforts to limit the spread of fire through the building, either by automatic activation, such as activation of smoke control systems or HVAC system shutdown, or by providing notification for initiating manual mitigation efforts by responsible employees or the public fire department. As indicated above, issues related to the notification, response, and operation of emergency responder personnel are covered in other areas of this document.

Managing the fire impact also applies to reducing the impact of a fire on adjacent properties, processes, and facilities. Features such as fire-resistance-rated exterior walls and exterior opening protectives, barriers to radiant heat exposure, water spray systems, etc., are intended to reduce the impact to these exposed facilities.

In addition to limiting fire spread to adjacent buildings, managing the fire impact also includes limiting the spread of fire to the building in question from an exposure fire. The use of fuel modification zones and special construction methods in wildland fire areas is a good example of this strategy. Providing adequate separation distances to aboveground fuel storage tanks is another tactic.

As stated above, a variety of strategies can be employed to manage the impact of a fire. Additionally, varying degrees of performance can be achieved. The necessary performance depends on many factors such as building use and construction characteristics, occupant characteristics, location of the building, etc. As noted earlier, the functional statement establishes a single level of performance for fire life-safety and provides upper limits for property loss, depending on the performance group designation of the building. To assist in the analysis, the magnitudes of possible fire events need to be established based on the fire load present and its impact evaluated against the specified level of performance.

Section 1701.3.15 and associated subsections specifically focus on the determination of the magnitude of events (i.e., fire scenarios) to be used in the analysis. This section requires the design fire events to realistically reflect the ignition, growth, and spread potential of fires and fire effluents. Unlike for a natural hazard event, many elements of the building and its contents must be taken into account when developing fire scenarios to be used in the analysis. This section provides specific guidance on how the analysis is to be undertaken with regard to ignitability, heat release rate, and overall fuel load. A key requirement is that the analysis must specifically look at a range of fire sizes to ensure that a small fire event does not create an unreasonable amount of damage and that a very large fire event satisfies the limits on the extent of damage based on the performance group. In no case should there be any anticipated loss of life or serious injury to persons not intimate with the initiation of the fire event, regardless of its magnitude.

The analysis with regard to fire will involve a single performance level for life safety and upper limits on property loss based on the performance group designation.

Fire-safety engineering and fire science currently involve a significant amount of uncertainty due to the lack of knowledge and accurate data in certain areas. Therefore, similar to the requirements of Chapter 5 for structural stability, one of the performance requirements specifies that design fires and fire scenarios be chosen that provide appropriate factors of safety or a given degree of redundancy between active and passive fire protection strategies. Addressing issues such as terrorism, in the wake of the September 11 World Trade Center disaster, makes such uncertainty greater. The prescriptive codes have not typically addressed such events; therefore, a specific decision to address such scenarios would need to be made either by the community or by an individual building owner. The ICC PC offers a better opportunity to factor in such issues than do the prescriptive codes.