

# INTRODUCTION TO FIRE PREVENTION

EIGHTH EDITION

**James C. Robertson**  
**Michael Love**





# ROBERTSON'S INTRODUCTION TO FIRE PREVENTION

8th Edition

**Michael T. Love**

**James C. Robertson, MIFireE**

**PEARSON**

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# CONTENTS

Memorial Tribute	ix
Preface	x
Acknowledgments	xii
About the Author	xiii

## **Chapter 1** History and Philosophy of Fire Prevention 1

---

Fire's Early Impact	2
Early Fire Prevention Measures in North America	4
Tragedy: A Spur to Regulations	7
Variables in the Philosophy of Fire Prevention	17
Summary	18
Review Questions	18
End Notes	19

## **Chapter 2** Status of Education, Engineering, and Enforcement in the United States 22

---

Community Risk Reduction	23
Prevention Intervention	24
The Traditional "Three Es"	24
Education	25
Engineering	28
Enforcement	36
Economic Incentives	38
Emergency Response	38
Summary	39
Review Questions	39
End Notes	40

## **Chapter 3** Public Fire and Life Safety Education Programs 42

---

Scope of Fire and Life Safety Education Programs	43
Home Safety Surveys	46
Fire Prevention Education Through Business, Community, and Civic Organizations	47

Fire Safety Clinics and Seminars	48
Community Events	49
Fire and Life Safety Education in the Schools	49
Wildfire Prevention	51
Local Government and Community Collaborations	53
Publicity Programs	53
Media Publicity	56
Smoke Alarm Programs	58
Fire Prevention Week	58
Volunteer Fire Departments	58
Review of Successful Programs	59
Summary	60
Review Questions	60
End Notes	61

## **Chapter 4 Enforcing Fire Safety Compliance 63**

---

Publicity for Fire Codes	64
Plan-Review Program for Fire Code Enforcement	65
Control of Sales and Use as a Means of Fire Code Enforcement	70
Structural Control as a Means of Fire and Building Code Enforcement	72
Control of Ignition Sources	74
Control of Occupancy as a Means of Fire Code Enforcement	75
Legal Aspects of Fire Code Enforcement	76
Condemnation of Unsafe Structures	77
Fire Safety Considerations in Special Occupancies	79
Summary	83
Review Questions	83
End Notes	84

## **Chapter 5 Fire Safety Inspection Procedures 85**

---

Preparation for Inspection	86
Identification and Permission to Inspect	88
The Inspection Tour	89
Correcting Violations During Inspection	93
Discussing Inspection Findings	94
The Exit Interview	94
Report of Inspection	95

Reinspection and Procedures to Enforce Compliance	96
Classification of Hazards	96
Hazards in Various Types of Occupancies	97
Legal and Moral Responsibilities of the Inspector	101
Conflicts with Other Agency Inspections	103
Summary	106
Review Questions	107
End Notes	108

## **Chapter 6** Preparing Fire Service Personnel for Fire Prevention Duties 109

---

Lack of Emphasis on Fire Prevention	110
Fire Prevention Training for All Fire Service Personnel	111
Master Plans for Fire Protection	112
Recruit Training Programs	113
Prefire Planning	114
Fire Prevention Training Assignments	115
Training in Fire Prevention Inspection	116
National Professional Qualifications Board	119
Summary	122
Review Questions	122
End Notes	123

## **Chapter 7** Organization and Administration of Municipal Fire Prevention Units 125

---

The Place of Fire Prevention in Municipal Government	126
Fire Service Administration in Local Government	128
Fire Prevention Functions	128
The Fire Prevention Bureau	129
Sources of Conflict Within the Fire Department	134
Fire Prevention Advisory Committee	134
Intensive Inspection Program	135
Fees for Services	136
Personnel Trends	137
Program Goals	137
State Responsibilities	138
The Relationship of a Fire Prevention Entity to Other Municipal Agencies	138

Case Study: Morgantown, West Virginia, Fire Prevention Program 143  
Summary 146  
Review Questions 147  
End Notes 147

## **Chapter 8 Instilling Positive Fire Reaction 149**

---

Individual Decisions When Fire Occurs 150  
Fire Reporting Procedures 151  
Home Fire Drills 151  
School Fire Drills 152  
Institutional Fire Drills 153  
Industrial Fire Drills 153  
Proper Use of Fire Extinguishers 154  
Large Residential Occupancies 154  
Measures to Facilitate Successful Evacuation 155  
Human Behavior in Fire 158  
Fire Safety Manuals 159  
Fire Reaction in Housing for Older Adults 160  
Fire Reaction in High-Rise Structures 162  
Terrorist Activities 163  
Summary 165  
Review Questions 166  
End Notes 166

## **Chapter 9 Fire Prevention Efforts of the Private Sector 169**

---

Organizations with Primary Fire Prevention Functions 170  
Organizations with Allied Interests in Fire Prevention 174  
Risk Management 179  
Underwriters Laboratories Inc. 179  
Private Organization Efforts in Fire Prevention 180  
Summary 182  
Review Questions 183  
End Notes 183

## **Chapter 10 Fire Prevention Responsibilities of the Public Sector 184**

---

U.S. Department of Defense 186  
U.S. Department of Justice 186

U.S. Department of the Interior	187
U.S. Department of Agriculture	188
U.S. Department of Commerce	189
U.S. Department of Labor	190
U.S. Department of Health and Human Services	191
U.S. Department of Housing and Urban Development	192
U.S. Department of Transportation	192
U.S. Department of Homeland Security	193
Independent U.S. Government Agencies	196
State Agencies	197
County Agencies	203
Municipal Government	204
Support Agencies	204
Summary	205
Review Questions	205
End Notes	206

## **Chapter 11 Fire Prevention Through Arson Suppression 207**

---

The Crime of Arson	208
Model Arson Laws	211
Motives for Arson	213
Investigation of Suspected Arson	214
Arson and Civil Unrest	223
Arson Arrests	225
Arson-Related Research Projects	227
Arson Control Needs	228
Summary	229
Review Questions	230
End Notes	230

## **Chapter 12 Fire Prevention Research 233**

---

U.S. Forest Service Fire Prevention Research	234
Public Fire Education Research	237
National Institute of Standards and Technology Research	238
University Research	240
Canadian Research Activities	242
United Kingdom Research	242
Underwriters Laboratories Research	243



National Fire Academy Research 246  
Other Research Activities 250  
Summary 251  
Review Questions 251  
End Notes 252

## **Chapter 13 Proving Fire Prevention Works 255**

---

Measurement of Fire Prevention Effectiveness 257  
Recording Fire Safety Activities 261  
Fire Prevention Inspection Records 262  
Recording Fire Deaths and Injuries 262  
Recording Loss Statistics 263  
National Fire Incident Reporting System 264  
Use of Computers 265  
Systems Analysis 267  
Approaches to the Fire Problem 267  
Summary 272  
Review Questions 272  
End Notes 273

## **Appendix Answers to Review Questions 275**

---

**Glossary 276**  
**Index 281**

Over the last year, as this edition was being finished, co-author James C. “Robbie” Robertson was slowly ebbing away from us. It was painful to observe and yet, right up until the end of his 84 years on this earth, Robbie remained passionate about the fire services, the fire protection disciplines, and his country. All across North America, he was recognized for his keen sense of fairness and willingness to help anyone committed to public service and safety.

It seemed that in our “world of fire,” all those he knew were embraced as members of his family. Few in U.S. fire protection history ever had the far-reaching impact on persons of all ages and from a broad range of diverse backgrounds that Robbie Robertson did. Just like the seven earlier editions of this text, which for decades was *the* standard for fire prevention in college-level fire science and fire technology programs and was often referenced in fire officer promotional exams, this edition brings forward the latest insights, happenings, and techniques in all aspects of fire prevention.

Robbie was firm in his convictions about this nation and his sense of history, graciously offering to share what he knew. He was an avid collector of fire texts from near and far, even overseas, which he described as important in producing the various editions of this text. Additionally, his work on so many levels took him from coast to coast many times, all the while observing and making both mental and written notes, from which he affirmed and confirmed how groups dealt with service delivery expectations, wildly differing resources, and, of course, change.

The word *change* often engenders resistance and, when used with the term *new fire prevention*, initiatives similarly included push-back. It is intriguing to see prevention methodologies and advocacy now gaining acceptance in the hearts and minds of our colleagues who may have been criticized for such approaches only a few short years ago. Robbie’s texts and constant promotion of prevention were significant in this evolution.

Whether as a volunteer or career firefighter, state fire service training instructor, state fire marshal, college professor, Commander in the U.S. Coast Guard Reserve, international representative of a prestigious fire safety association, or a member of numerous committees and study groups, Robbie’s involvement made for great strides that continue forward today. He loved to travel and interact with others, often reporting in the following days and weeks that he “just had a great visit with . . .”. The blank was always a who’s who in our respective fields. He seemed to be able to recall everything and helped remind us of the need to be comprehensive and thoughtful in our work.

In his passing, one thing that has surprised even those who knew him well is just how involved he was in so many different yet interrelated parts of the fire safety puzzle. Be it on matters of public policy or advancing the cause of training and education, he could be counted on for important reminders drawn from what he had seen firsthand and had also done during his many travels and in his many multifaceted roles. Robbie’s friendship and influence will be missed, but his work was important and lives on. Thank you, Robbie.

**R. Wayne Powell, Executive Director, National Fire Heritage Center,  
Emmitsburg, Maryland**

This Eighth Edition of *Robertson's Introduction to Fire Prevention* represents over 38 years of service to the students of fire science. Despite the passing of author James C. "Robbie" Robertson in 2013, his legacy of introducing students to an awareness of and general familiarity with fire prevention lives on in this edition. *Robertson's Introduction to Fire Prevention*, Eighth Edition, is updated to sustain a strong core of fire prevention history and some of the latest information in fire prevention research, statistics, and progress in fighting the fire problem. It is equally useful to the first-year fire science student, as a midcareer reference for fire officer promotional exams, and as a go-to reference on the shelf of fire chiefs.

*Robertson's Introduction to Fire Prevention* is a general survey of the many concepts associated with the fire prevention industry. Other publications provide more specifics on the technical side of managing fire prevention programs. Along with a historical perspective, the book offers insight into the philosophy behind efforts to prevent fires or to reduce their impact and then narrows its focus to subsets of elements of the fire prevention discipline. Elements covered in the book include, for example, the status of the "Three Es" of fire prevention and the addition of two new "Es"; the organization and administration of local-government fire prevention units; public fire education programs; fire investigation and arson investigation; and the means of proving when fire prevention efforts work.

The reader will find in this edition of *Robertson's Introduction to Fire Prevention* the most current information available relating to fire prevention. In addition, the chapter on international fire prevention perspectives has been moved out of the book to a new online resource that will include much more in the way of supplemental material, links to key resources, and articles that offer a bit more depth. More information will be available on this new feature in the future.

Readers will find some useful tools in *Robertson's Introduction to Fire Prevention* that will help them to navigate through the book and to readily recognize key information by way of boldface and defined terms. The Table of Contents offers an intuitive design to make clear the main sections of each chapter. Within each chapter, readers will recognize immediately what they should learn from that chapter by reading the list of objectives. When they have finished reading, they can test their knowledge with the summary questions at the end of the chapter. Each chapter also includes end notes that offer the student an opportunity to find more detailed information about notable areas of study. Many of the end notes have online World Wide Web addresses that allow readers to find the original sources of quotes and critical information, as well as more discussion of the subject. A glossary at the end of the book lists the critical terms used throughout the book, with definitions. The index identifies one or more pages where key concepts appear.

In addition, readers will find updates reflecting current conditions and statistics, as well as new and emerging concepts in fire prevention. Some examples are an introduction to the evolving concept of Community Risk Reduction (CRR). This integrated approach to managing community safety is just starting to show positive outcomes. Readers will learn how communities have taken fire safety

directly to people, with home safety visits, workshops in assembly occupancies, and public information. They will also read about the latest efforts to increase the acceptance of fire safety technology by creating incentives for installing residential fire sprinklers.

Readers will find many examples of innovation, sometimes resulting from shortages in funding and resources and possibly related to a dangerous fire trend emerging in their own communities. Asheville, North Carolina, is one of these examples, where funding pressure led to a reengineering of the inspections process and created more opportunity for improved customer service. Another example is the research work of Fire Chief Brian Crawford, who brought about changes in Shreveport, Louisiana, that address some of the inherent fire risk associated with poverty.

Readers will discover what researchers have learned about typical human reactions to being threatened by fire. The discussion of the latest information on fire and arson investigation offers up-to-date statistics from the FBI and describes new approaches to arson-related investigative techniques, as well as a view of expert testimony in arson cases.

Readers will also learn of the continuing advancement in fire science and fire safety, from the urban residential areas of London, England, to the remote wild-land areas of the United States. They will explore some of the principles of evaluating fire prevention programs and will discover just some of the positive outcomes available from fire safety organizations proving that fire prevention works.

# ACKNOWLEDGMENTS

The contribution of a number of people who reviewed certain chapters and suggested revised wording is greatly appreciated. They include Marty Ahrens, Meri-K Appi, Charles Burkell, Brian Crawford, Michael A. Donahue, Cheryl Edwards, Rita Fahy, Wayne Hamilton, J. Frank Hodges Jr., Dean Hunt, David Icove, Chris Jelenewicz, Tom Lia, Lorne MacLean, Daniel Madrzykowski, Mary Marchone, Brian Meurer, Lori Moon, James G. Munger, Robert Neale, Jon Nisja, Joe Pierce, Fred Prather, Vincent Quintero, Tammy Roddey, Steve Sawyer, Phil Schaenman, Edwina Scott, L. Charles Smeby Jr., Mark V. Smith, and Ken Tennant. Other contributors are recognized in endnotes. A big thanks to Billy Morris who stepped in late in the process to help acquire and organize photos. Special recognition is due to Kim Borofka, whose experience from the 7th Edition and early work on the 8th Edition helped us get moving and kept us on track. I would also like to thank Monica Moosang and Stephen Smith from Pearson. Through her editorial excellence, Development Editor Jo Cepeda helped us create a manuscript that is clear, readable, and correctly composed.

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## ABOUT THE AUTHORS

**James C. Robertson**, MIFireE, was a consultant on fire protection for various cities and countries. He received an A.S. in Fire Protection at Oklahoma State University and a B.S. with specialization in Fire Administration from the University of Southern California. He served in the U.S. Coast Guard Reserve, retiring as Commander. He served as both a career and a volunteer firefighter for 15 years. Robertson was an instructor for the University of Maryland's Fire Service program and an Assistant Fire Chief in Gainesville, Florida, and he represented the National Fire Protection Association (NFPA) in the southern and midwestern states. Robertson served as Maryland's State Fire Marshal for 18 years.



**Michael T. Love** worked as a firefighter for Montgomery County, Maryland, for over 33 years. He served in a diverse range of positions that included extensive experience as an operational company officer, a firefighter, and an instructor; Field Battalion Chief; Assistant Chief, commanding one of three shifts of county-wide operations; Chief of Emergency Medical Services; and Special Operations Chief, Supervisor of Dispatch. Most recently, he commanded a division that included the Fire Marshal's Office, Public Information, Community Outreach, Recruiting, and Planning and Research. As Division Chief, Love served as the Montgomery County Fire Marshal. He is a graduate of the University of Maryland with a bachelor's degree in Fire Science, a graduate of the Executive Fire Officer Program, and a Certified Public Manager. Love is currently a freelance planning consultant and technical writer and is a member of the Maryland Fire and Burn Safety Coalition.



The following grid outlines Fire Prevention course requirements and where specific content can be located within this text:



Course Requirements	1	2	3	4	5	6	7	8	9	10	11	12	13
Define the national fire problem and main issues relating thereto.	X	X	X		X			X			X	X	X
Recognize the need for, responsibilities of, and importance of fire prevention as part of an overall mix of fire protection.		X					X						
Recognize the need for, responsibilities of, and importance of fire prevention organizations.		X							X	X			
Review minimum professional qualifications at the state and national level for Fire Inspector, Fire Investigator, and Public Educator.						X					X		
Define the elements of a plan-review program.				X									
Identify the laws, rules, codes, and other regulations relevant to fire protection of the authority having jurisdiction.	X	X		X	X						X		
Discuss training programs for fire prevention.			X	X		X					X		
Design media programs.			X						X				
Discuss the major programs for public education.		X	X			X						X	X

# History and Philosophy of Fire Prevention



Tom Reel/Thomson Reuters (Markets) LLC

## KEY TERMS

**conflagration**, p. 15

**curfew**, p. 2

**fire-resistive**, p. 5

**fire exits**, p. 6

**fire prevention**, p. 17

**fireproof**, p. 12

**fire safety**, p. 3

**public assembly**, p. 7

## OBJECTIVES

After reading this chapter, you should be able to:

- Identify tragedies that have led to regulations in specific types of occupancies.
- Identify contributing factors leading to fires of historical impact.
- List five contributing factors to loss of life in fires.
- Identify ways that arsonists have been punished for this crime in the past.
- Describe ways that early governments managed the fire risk of commonly found fuel.
- Identify early fire prevention measures and make the connection to modern fire prevention practices in some cases.
- Identify the major classifications of occupancies.



## Fire's Early Impact

A great deal can be learned by studying the historical development of fire prevention. The brief review given here will assist the reader in recognizing and understanding the reasons for certain procedures that are followed in the field today.<sup>1</sup>

As early as 300 BCE, the Romans established a “fire department,” which was composed primarily of slaves. The response of those individuals is reported to have been quite slow. Little else is known about their procedures. However, the program apparently was so unsuccessful that it was necessary to convert the department into a paid force in the year 6 CE.

This conversion apparently proved successful, and by 26 CE the full-time fire force in Rome had grown to approximately 7,000. Those individuals were charged primarily with a responsibility for maintaining fire prevention safeguards. The population of Rome at the time was just under 1 million.

The fire brigades of Rome patrolled the streets to make sure people followed proper fire prevention procedures. Granted the authority to administer corporal punishment to violators of fire codes, they were provided with rods. Records indicate that “most fires are the fault of the inhabitants.”<sup>2</sup> As an interesting sideline, in addition to their fire prevention duties, the fire brigades of Rome had the responsibility of keeping a watchful eye on the clothing of individuals who were using the public baths, and they were required to make inspections of the baths on a regularly scheduled basis to prevent theft.

In 872, according to history, a bell was used in Oxford, England, to signal the time to extinguish all fires. The Anglo-Norman word *covrefeu*, which means “cover fire,” evolved into the English word **curfew**. Records from 1066 indicate that during their occupation of England, the Normans strongly enforced the requirements for extinguishing fires at an early hour in the evening. Because construction at the time allowed dwelling fires to spread easily, this preventive measure was an effective safeguard.

As an added means of fire prevention, certain building code requirements were imposed. Fitzstephen, writing in 1189 during the reign of Henry II, stated: “The only plagues of London were immoderate drinking by idle fellows and often fires.”<sup>3</sup> This comment suggests London had a severe fire problem in those early days. In an effort to control the fire situation, the lord mayor of London issued an order in 1189 to the effect that “no house should be built in the city but of stone and they must be covered with slate or tiled.”<sup>4</sup> This requirement was apparently vigorously enforced in structures built from that day on.

In 1190, Oxford imposed a requirement for firewalls to be placed between every six houses. This is another early example of a major city's efforts to rapidly control a fire and limit its spread.

The Scottish Act of 1426 emphasized fire prevention. For example, it ordered “no hemp, lint, straw, hay or heather, or broom be stored near a fire.”<sup>5</sup> Edinburgh merchants selling such wares were permitted to use lanterns, but not candles, and citizens in general were forbidden to carry open flames from house to house.

Fire precautions figured prominently in the Edinburgh Improvement Act of 1621. It ordered noncombustible roofs and required tradespeople who kept “heather, broom, whins, and other fuel”<sup>6</sup> in the center of town to remove the material to remote areas.

High-rise buildings were a problem in 17th-century Edinburgh. In those early times the use of many-storied buildings introduced considerable fire risk because

### curfew

■ an official action intended to restrict some activity; derived from the Anglo-Norman word *covrefeu*, which means “cover fire.”

there were limited means of egress and no limits to fire spread, not to mention the incredible increase in combustibility of the high buildings, which enabled fire spread and conflagration. Some buildings in Edinburgh reached 14 stories. As a result, the Scottish Parliament issued a regulation in 1698 restricting new buildings to a height of 5 stories. The regulation did not, however, affect existing buildings.<sup>7</sup>

Arson was a problem during riots in the early days of England. In 1272 in Norwich, for example, 34 rioters involved in arson and looting were captured. Their punishment consisted of being dragged about town until dead. One woman arsonist was burned alive as punishment for her act. Arson laws were just as severe 300 years later: In 1585 a 15-year-old boy in Edinburgh was judged responsible for setting fire to peat stacks and was burned alive as punishment for his act.

Specific punishments for fire prevention violations are also noted in historical documents. The city records of Southampton, England, contain a late-1500s case in which a baker was fined 2 shillings for having combustibles too close to an oven. A 1566 law forbade Manchester bakers to keep gorse (barley) “within two bays of the ovens.”<sup>8</sup>

Charles II in 1664 gave authority for imprisoning those who contravened building regulations. The regulations related, then as now, to **fire safety**.<sup>9</sup> A 1763 act prohibited the piercing of fire walls.<sup>10</sup>

Among fire prevention recommendations issued to the public in England was one in 1643 that suggested candles be placed in water-based holders. The thought was that an unattended candle would burn down and go out before causing trouble. Before that, an act of Parliament in 1556 had required bellmen to patrol the streets and cry out, “Take care of your fire and candle.”<sup>11</sup>

In 1212 a fire in London caused 3,000 deaths. No fire recorded before then had caused such a great loss of life. More than 400 years later, in 1666, another major fire struck the city. Referred to as the Great Fire of London, it burned for four days and destroyed five-sixths of the city. Amazingly, only six deaths occurred. The effectiveness of the previously imposed fire prevention requirements undoubtedly had a bearing on the reduced number of deaths. Although thousands of structures were destroyed, the progress of the fire was retarded long enough to allow the occupants to vacate their premises.

As a further indication of efforts in the fire prevention field, in 1722 an English citizen named David Hartley secured a patent for a fire prevention invention. The invention consisted of steel plates with dry sand between them, meant as a means of reducing fire spread from one floor to another. Hartley’s construction innovation was used successfully in some buildings prior to his securing a patent. Mr. Hartley’s invention was considered noteworthy enough that a statue was erected in his honor.<sup>12</sup>

In 1794, theater fire protection was given a boost by the placement of a water tank on the roof of a theater in England. The tank provided a curtain of water in the event of a fire. In addition, an iron safety curtain was provided to separate the theater patrons from fire on the stage.<sup>13</sup>

A February 1849 fire involving a burning piece of paper and a small gas leak caused 65 fatalities, mainly of young people in a Glasgow, Scotland, theater. Many tripped and fell as they tried to escape.<sup>14</sup>

The Birmingham, England, fire brigade issued a requirement in 1884 for inhabited tall buildings to have two staircases. This requirement was considered a progressive fire protection measure.<sup>15</sup>

#### fire safety

- the concept of actions planned and taken that reduce the risk of human exposure to fire.

# Early Fire Prevention Measures in North America

During the 1600s, America's colonists generally reacted to fire danger by implementing stringent regulations.<sup>16</sup> For example, chimneys were a major fire problem then. So, in 1631, as a result of a serious fire in Boston, Massachusetts, Governor John Winthrop issued an order that simply prohibited wooden chimneys and thatched roofs.<sup>17</sup>

Fire inspections in the New World probably began in 1648 when the New York governor, Peter Stuyvesant, appointed four fire wardens to inspect wooden chimneys of thatched-roof houses in New Amsterdam (later New York City). The fire wardens were also empowered to impose fines for chimneys that were improperly swept.<sup>18</sup>

The following statement from *WNYF*, New York's official training magazine, discusses early fire prevention practices in the United States, including inspecting chimneys and punishing offenders, in an effort to avoid the dire consequences of even small fires, as follows:

Far from being a new concept, the principle of fire prevention in this country dates back to the days of our earliest settlers. As we scan the aged and yellow pages of books dealing with fires in Olde New York, we note that mention is often made of men assigned to inspect chimneys and hearths, and report if they were inadequately constructed.

There seems to be little doubt that taking precautions against fire received high priority as far back as the early 1600s. The records indicate that even when a small fire occurred, it usually resulted in the destruction of many buildings before being brought under control. In an attempt to curb the problem, lists were published naming persons who maintained faulty chimneys and hearths. If the owner failed to correct the condition leading to his violation order, a heavy fine was levied.<sup>19</sup>

Other examples of early American attempts to prevent fires related to chimneys include the following:

- In 1663, Salem, Massachusetts, imposed a fire safety ordinance requiring that chimneys be swept each year.<sup>20</sup>
- In 1696 Philadelphia found it necessary to prohibit burning out chimneys in order to clean them. In addition, colonists were not allowed to smoke on the street at any time, and the possession of more than 6 pounds of gunpowder within "forty paces of any building or dwelling" was prohibited.<sup>21</sup>
- In 1731, Norfolk, Virginia, prohibited wooden chimneys.<sup>22</sup>
- In 1791, Easton, Maryland, required chimneys to be built of brick or stone.<sup>23</sup>
- In 1796, New Orleans, then a Spanish province, passed an ordinance against the use of wooden roofs.<sup>24</sup>

Rhode Island's first fire prevention law was enacted in 1704. It banned the setting of fire "in the woods in any part of this colony on any time of the year, save between the tenth of March and the tenth of May annually nor on the first or seventh day of any week." A subsequent measure enacted in 1731 prohibited unauthorized bonfires.<sup>25</sup>

Fire prevention enforcement measures were initiated in many communities during the early days of our country. As an example, in 1785 a city ordinance in

Reading, Pennsylvania, imposed a fine of 15 shillings for each chimney fire that occurred in the city.<sup>26</sup> The fine was collected by the city and turned over to the fire company that had responded to the alarm. This ordinance was later repealed. Another requirement in Reading was the alteration of chimneys in blacksmith shops to make them **fire-resistive**, with a fine of \$20 for violation.<sup>27</sup>

In addition, an 1807 ordinance in Reading prohibited the smoking of cigars on the street after sunset.<sup>28</sup> It also forbade people to sit on porches or in the doorway of any house with a lighted cigar or pipe without the consent of the owner. A \$1 fine was imposed for violations of this ordinance. The use of firecrackers was also prohibited, with a fine of \$1 or 12 hours in jail for violators. A duty was imposed on the citizens of Reading to confiscate and destroy fireworks found in the possession of a child.

The Board of Aldermen in Pensacola, Florida, passed an ordinance in 1821 requiring chimneys to be kept swept. A \$10 fine was levied against the owner of any house whose roof caught fire.<sup>29</sup>

Jamestown, New York, imposed fire prevention regulations in 1827. Fire wardens were required to examine all chimneys, stoves, and other fireplaces used within Jamestown and to direct “such reasonable repairs, cleansings, removals, or alterations as shall be in his or their opinion best calculated to guard against injury by fire.” Fines were imposed for failure to comply or for refusal of entry to the warden. Occupants of shops or other places in Jamestown where rubbish might accumulate were required to remove accumulations as often as the warden saw fit. Fines were imposed for each day the violation continued.<sup>30</sup>

The first fire safety ordinance in Greensboro, North Carolina, enacted in 1833, required each household to have two ladders on its premises to remove accumulations of combustible materials from the roof, “one which shall reach from the ground to the eaves of the house, the other to rest on top of the house, to reach from the comb to the eaves.” Two inspectors were appointed to enforce this requirement and to ensure that all rubbish and nuisances were cleared from backyards. A \$5 fine was imposed for each violation.<sup>31</sup>

In most newly formed towns, fire suppression forces were organized before the advent of fire prevention efforts. However, in 1860 in Auraria, a section of what is now Denver, Colorado, the legislative council appointed six fire wardens “to inspect buildings and their chimneys and to prevent the accumulation of rubbish” as the result of a large livery barn fire. The first firefighting company was formed there in 1866.<sup>32</sup>

More comprehensive fire prevention regulations were imposed in New York City in 1860 subsequent to a tenement building fire in which 20 people were killed. The ordinance required all residential buildings built for more than eight families to be equipped with fireproof stairs and fire escapes.<sup>33</sup>

Several major fires occurred in the early 1800s in Montpelier, Vermont. As a result, “the village appointed a committee of three to report a code of by-laws for the preservation of buildings from fire. The bailiffs were required to inspect every house in their ward to see that there was no fire hazard and that each place had, as the by-laws required, a fire bucket and ladder.” Another by-law required that no fire be left burning in a house unoccupied between the hours of 11:00 P.M. and 4:00 A.M., if adjacent to another.<sup>34</sup>

Pierre, South Dakota, had its first major fire in 1884. Thirty buildings were destroyed. The city council immediately passed an ordinance creating a fire

#### **fire-resistive**

■ a term currently used for some buildings that can resist and even prevent the spread of fire and products of combustion.

district covering much of the downtown area. New buildings were to have 8-inch-thick brick walls. Roofs were to be “fireproof.”<sup>35</sup>

Fire escapes and exits attracted the attention of the Boise, Idaho, city council in 1887, when it imposed a requirement that doors on halls in theaters be made to swing outward. The council was concerned about the possibility of a disaster at a performance in one of the city’s places of assembly.<sup>36</sup>

Fire alarms and fire escapes, of course, had been invented, but they were not yet generally accepted. In fact, in 1897 the Illinois legislature attempted to enact a fire escape law, one that would have replaced earlier, ineffective legislation. The 1897 act required fire escapes in all buildings more than four stories high and in all buildings higher than two stories if the structures were used as manufacturing places, hotels, dormitories, schools, or asylums. According to the *Centennial History of Illinois*, this act was bitterly fought by the Manufacturers’ Association of Illinois. When passed, it proved impossible to enforce and was repealed in 1899. As late as 1912, a total of 308 fire deaths were reported in Illinois, with slightly fewer than half occurring in Cook County alone. Most victims were trapped in burning buildings. This entrapment suggests a continuing problem with **fire exits** and escapes, although the circumstances of the deaths were not individually reported.<sup>37</sup>

An 1896 fire that destroyed a saloon and hotel brought about the first fire prevention code in West Palm Beach, Florida. The ordinance established a fire district in which no building could be erected unless it was of brick, brick veneer, or stone construction.<sup>38</sup>

As early as 1900 captains of steam fire engine companies in Memphis, Tennessee, performed inspections to locate and correct rubbish conditions in buildings, dangerous stovepipes, obstructed fire escapes, and defective chimneys and flues. The great amounts of cotton stored in vacant lots and on streets further contributed to the fire problem.<sup>39</sup>

Formal fire prevention measures in Tulsa, Oklahoma, apparently began with a 1906 requirement that owners of all buildings with three or more stories install fire escapes. Failure to comply by a set date resulted in a fine of \$15 per day. Storeowners were prohibited from using rubber tubing for gas connections. Failure to comply resulted in the installation of steel piping at the owner’s expense.<sup>40</sup>

Fire chiefs in the United States have long had an interest in fire prevention. Conflagrations in Chicago, 1871 (approximately four square miles of buildings destroyed); Boston, 1872 (65 acres of the central business district destroyed) and again in Chicago, 1874 (approximately 16 acres with 800 buildings destroyed) peaked the fire chiefs’ interest and elevated fire prevention as a high priority agenda discussion within their trade. In Boston in 1873, at the First Annual Conference of the National Association of Fire Engineers (predecessor to the International Association of Fire Chiefs), the first general topic on the agenda was fire prevention. The association considered a number of subjects related to fire prevention as they became more aware of the threat of fire in the growing urban areas of the United States. It was becoming evident that fire safety was more than just preventing a single fire from starting.<sup>41</sup>

The National Association of Fire Engineers’ (NAFE) considered a number of subjects within their general fire prevention discussion that included for example fire protection systems for buildings, flammability of structural components, the increasing flammable building contents of 19th century industry, concern for fire safety in

#### fire exits

■ exits specifically identified and maintained as a means of egress, often a door or other opening that provides occupants a safe way out of a building or other structure.

high-rise buildings, design of passive resistance to fire movement in buildings, improved construction of heating equipment, the need earlier detection and fire department notification through human surveillance, improved emergency egress from buildings and the need to investigate cause of all fires and prosecution of maliciously set fires.<sup>42</sup>

The increasing density of urban business districts and increasing height of combustible buildings concerned fire chiefs. Impact from recent urban conflagrations in Chicago and Boston increased concern that fires were beyond their capacity to stop them. Essentially they were beginning to identify the first outlines of building codes to increase fire safety. This discussion included that tall buildings be equipped with vertical waterways that were large enough to support firefighting hoses and have reliable valves on each floor landing. It also included discussion of improved egress from these tall buildings, as it had been observed that fire escapes of early design were not serviceable for people that were not ambulatory or not of the best level of fitness or physical strength. This discussion also considered an interest into segregating residential units in multi story buildings to self-contained compartments that would restrict the spread of fire within the building. The fire chiefs also were interested in pursuing a detailed system of immediate and objective investigation of every fire not only to determine the fire's cause but also to discover ways that the fire could be avoided in the future.<sup>43</sup>

The use of fire suppression personnel for prefire planning inspections was discussed by the Salt Lake City fire chief at the 1901 conference. At the 1902 conference, fire chiefs discussed developments in fire-retardant paint and slow-burning wood.<sup>44</sup>

In Milwaukee, Wisconsin, in 1888, the first fire prevention requirements were imposed on places of **public assembly**. Apparently, they were the only regulations of a fire prevention nature in effect. Violations of the regulations carried fines of \$5 to \$100. By 1913, Milwaukee had a force of 30 men, strictly devoted to fire prevention duties in the city's 90,000 buildings and paid entirely through the returns from an insurance premium tax. By 1919, more than 250,000 inspections were being conducted each year by this fire prevention bureau.<sup>45</sup>

**public assembly**

■ a type of area where at least fifty people tend to congregate, such as theaters, churches, auditoriums, dance halls, nightclubs, and restaurants.

Fire prevention bureaus were started after 1900 in a number of larger cities. Long Beach, California, established such a bureau in 1917, and Phoenix, Arizona, started its in 1935. At that time Phoenix had a population of 46,500.<sup>46, 47</sup>

The development of water distribution systems has played a major role in community fire defense. In Houston, Texas, the first fire engine arrived in 1839. However, a public waterworks did not come about for many years. By the mid-1870s, most businesses had cisterns for fire protection. In late 1878 the city of Houston signed a contract for the development of a water distribution system, which was in service by the following summer. This pattern of water system development is typical of North American cities.<sup>48</sup>

Unfortunately, some fire safety provisions were not effective, as noted in the following report from Evansville, Indiana:

As time passed without a big fire, the city grew lax. In spite of the ordinance against frame buildings within the fire limits, the Council routinely allowed variances. Other builders simply violated the building codes. The tightly packed frame buildings were rightly perceived as a fire hazard. In June 1850 the Council required the city marshal to begin investigating all building code violations within the fire limits. They also asked the city attorney to determine whether they could prosecute carpenters, brick and stone masons, and "other mechanics" who violated the codes.<sup>49</sup>



# Tragedy: A Spur to Regulations

It has been said that “in the realm of fire ‘the law’ is a thing mothered by necessity and sired by great tragedy.”<sup>50</sup> The truth of this statement becomes clearer in a review of some of the major fires that have occurred through the years within the context of the development of fire safety regulations and procedures in the United States.

## PUBLIC ASSEMBLY

On December 5, 1876, a major fire consumed the Brooklyn Theater in New York. In this fire a stage backdrop was ignited and 295 people were killed under conditions similar to those in Chicago’s Iroquois Theater fire 27 years later.<sup>51</sup>

The Iroquois fire, notorious among public assembly fires, occurred in 1903 during a Saturday matinee of a new play, *Mr. Bluebeard*. There were 2,000 people present for the performance. The Iroquois was Chicago’s newest theater and was also considered its safest; in fact, it was advertised as being “Absolutely Fireproof.” Arc lamps were used in the theater. A light set a curtain on fire, and flames and smoke rapidly made the structure untenable. Despite heroic efforts, panic ensued, and human logjams developed at each of the doors. No fire extinguishers were provided. The curtains were combustible, and exits were improperly marked and swung inward. No venting was provided for the stage area and there was no way to immediately remove hot gases and smoke. This tragic fire took 603 lives and provided a great impetus to the fire prevention movement, especially in the field of public assembly occupancies.

On an earlier date, the day after Christmas in 1811, some 600 people were in Virginia’s Richmond Theater when scenery caught fire and 72 perished, including the governor of the state. The 200th anniversary of this disaster was commemorated in Richmond in 2011.

In 1940 in Natchez, Mississippi, a fire in a small dance hall, the Rhythm Club, took 207 lives and caused injuries to 200 more. Combustible decorations and one exit with the door opening inward were the factors responsible for the tragedy. More than 700 patrons had been packed into the one-story building, which measured only 120 feet by 38 feet.

During the early days of World War II a major fire struck the Cocoanut Grove nightclub in Boston, Massachusetts. On the night of the fire, November 28, 1942, the club had approximately 1,000 occupants, many of whom were people preparing to go overseas on military duty. A lighted match used by an employee changing a light bulb was considered a likely cause of this tragic fire, which took 492 lives. Almost half of the occupants were killed and many were seriously injured. Flammable decorations spread the fire rapidly. Men and women were reported to have clawed inhumanly in an effort to get out of the building. The two revolving doors at the main entrance had bodies stacked four and five deep after the fire was brought under control. Authorities estimated that 300 of those killed might have been saved had the doors swung outward. It should be noted that the capacity of the structure had also been exceeded.

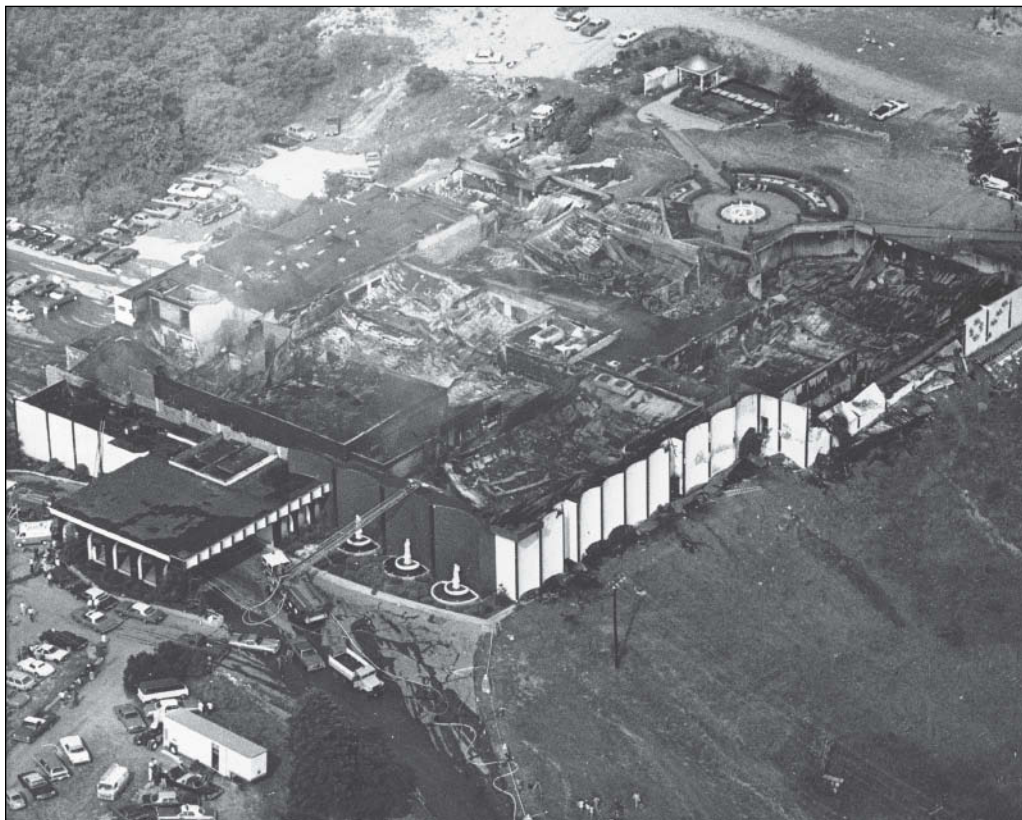
The Cocoanut Grove fire prompted major efforts in the field of fire prevention and control for nightclubs and other related places of assembly. Immediate steps were taken to provide for emergency lighting and occupant capacity placards in places of assembly. Exit lights were also required as a result of the concern generated by this fire.

On July 6, 1944, fire protection under the big top received attention as the result of the fire that struck the Ringling Bros. and Barnum & Bailey Circus. The circus was playing in Hartford, Connecticut. Seven thousand people attended the daytime performance. The circus tent, which measured 425 feet by 180 feet, was apparently not properly flame-retardant, and the fire caused 163 deaths and 261 injuries. After the fire, many states and municipalities gave more attention to circus fire safety requirements. It is ironic that the fire occurred in Hartford, a city that had had an outstanding fire prevention program for many years.

On May 28, 1977, a tragic fire struck the Beverly Hills Supper Club in Southgate, Kentucky. At the time of the fire, which took 165 lives, the club was occupied by 3,000 to 3,400 people. The building, which had an area of 54,000 square feet, was of unprotected, noncombustible construction. Fire separations, automatic sprinklers, and other safeguards were lacking. Exits were insufficient for the capacity crowd. Interior furnishings were made of combustible materials.

The Beverly Hills fire spurred new demands for improved fire safety measures, including inspection improvements. Many of the patrons in the club at the time of the fire were from other jurisdictions that strongly enforced codes for public assembly occupancies. National political leaders raised the question of the propriety of citizens of one jurisdiction being exposed to fire danger when visiting an area where code enforcement is not as stringent. The impact of this fire would be felt for many years to come. Destruction was thorough and the site of the club remains unused over 35 years later (Figure 1-1). The cause remains a subject of conjecture.

On February 17, 2003, Chicago was again in the national news, when 21 people were killed and 57 injured as they attempted to leave a nightclub where



**FIGURE 1-1** A fire in the Beverly Hills Supper Club in 1977 killed 165 people due to inadequate exits for the number of people in the club. The site of the club remains unused at the time of publication.

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