

SECTION 1 - FIRE & PEOPLE

UNIT I - FIRE PROTECTION HISTORY

UNIT GOAL

To introduce the student to major events in fire protection from ancient times up to the end of the 20th century and how they have impacted society and how society has had an impact on those events.

UNIT OBJECTIVES

The Student by the End of the Semester Shall:

- Describe Fire Protection Effort Prior to the 19th Century
- Identify at Least Two [2] Large Loss Fires During the 19th Century
- Identify at Least Five [5] Large Loss Fires During the 20th Century

KEY TERMS

Corps of Vigles

Fire Marks

Great Fire of London

Peshtigo Fire

Triangle Shirtwaist Fire

Coconut Grove Fire

Beverly Hills Supper Club Fire

Rattle Watch

Great Chicago Fire

Texas City Fire

Iroquois Theater Fire

INTRODUCTION

How mankind has dealt with fire in the past has a direct impact on how he deals with it now and in the future. The history of fire protection is, at best, described as “reactionary”. When a crisis occurs we make changes.

Over the past five centuries many changes have occurred in the field of fire protection, most of them directly related to major fires that have occurred. In this unit we will look at some of these fires and other events that have shaped modern fire protection.

ANCIENT TIMES TO 15TH CENTURY

Organized fire protection has its beginnings with the creation of the *Corps of Vigles* by the Roman Emperor Augustus in 6 A.D. after a major fire had occurred in the city. This fire department was made up of Roman soldiers whose job it was to respond to fires in the city and try to extinguish them. The *Corps of Vigles* was in existence until the fall of Rome around 476 A.D.

During the Crusades a group of knight known as the “Knights of Malta” aided the injured on the medieval battlefields. Their symbol the “Maltese Cross” was adopted by the modern fire service as its official symbol.

Fire protection in Europe became prevalent again during the period of 1100 A.D. to 1600 A.D.. In England, William the Conqueror instituted several laws that were directly related to preventing fires. Some of these, developed by 1189 required citizens to have a ladder available to help their neighbors.

Another required all buildings to be built of stone to limit the spread of a fire. Another required that all fires be extinguished by dark to prevent the start of accidental fires after the occupants had gone to bed.

In 1666 a fire occurred in the Pudding Lane area of London, England that burned for several days and destroyed most of the city. This fire became known as the *Great Fire of London*. As a result of this better building codes were developed, fire insurance companies were created, and insurance company owned fire brigades were created. Each of the insurance companies had a *Fire Mark* [see figure 1] that was placed on the protected property. When a fire occurred the fire brigade that was owned by that insurance company would respond to that fire, if the mark on the building was not theirs they would not fight the fire, but would protect any of their own insured buildings.

In colonial America the Mayor of New York creates a building code and a group of fire wardens called the “*Rattle Watch*” in 1607. In Boston Mass. They purchased their first fire pumper in 1647

18th TO 19th CENTURY

in the early part of the 18th century fire societies were developed to respond to fires in the major cities in colonial America. In 1736, Ben Franklin helped to organize the first volunteer fire company in Philadelphia, Pa. This was known as the Union Fire Company and Franklin became the first chief. Over the next century these volunteer fire companies became commonplace in most American cities. Some of America’s most famous people were volunteer firemen. Some of these are George Washington, Thoms Jefferson, John Hancock, Samuel Adams. In 1752 Ben Franklin again contributed to fire protection by instituting the idea that insured building be indicated by *Fire Marks*. These fire marks were indicators of what volunteer fire company would respond to the fire.

Throughout the 18th and early 19th century the volunteer fire companies thrived and became very powerful. [See Figure 5] Many of them had strong political influence, such as the Americus No. 6 fire company of New York. This fire company became the jumping off point for one of the most powerful and corrupt political machines in America, Tammany Hall. As they became more powerful they also began to quarrel among themselves. When responding to a fire some companies would start fights to keep another company from getting to the fire. One such incident in Philadelphia, Pa. Caused several deaths and the calling in of federal troops. By the mid-19th century many city governments became unhappy with the volunteer system and began to create paid fire department under the control of the city government. The first of these occurred in Cincinnati, Ohio in 1853. This became the first paid fire department in the United States. Over the next 20 years most other large cities followed suit and the volunteer fire companies became more common in smaller towns and rural areas.

During this time many new development in fire protection occurred. The steam operated fire pumps began to replace the hand operated fire pumps of colonial days. [See Figure 3] Water distribution systems were developed in the early part of the 19th century . This was the first time since the aqueducts of the Roman Empire. The leather fire helmet was invented by a Andrew Gratacapto improve the safety of the firemen. [See Figure 4] A variation of this helmet is still used by numerous fire department today. In the 1870 San Francisco the first aerial ladder was invented by the Hayes company and reached a height of 85 feet. In 1878 Henry Parmalee patented the first automatic sprinkler head. This improved the fire protection in buildings a hundred fold. The first fire alarm systems were developed in the 1870s using telegraph lines. Studies in water supply and hydraulics occurred. Much of what we know of water movement was developed at this time. In 1896 the insurance industry pushed for the development

of standards for automatic sprinkler systems. This led to the creation of the National Fire Protection Association, [NFPA] a standards making organization that is still in existence today.

After the Civil War many of the returning veterans joined the ranks of the paid fire departments. With them they brought management and organization concepts used in the military. As a result the structure of the fire service changed greatly from a social format to a para-military format. These concepts of para-military are still common in the fire service today as seen by the fire department's organizational and rank structure.

During the 19th century many disastrous conflagrations occurred in our major cities. New York, Boston, Philadelphia all had them. One of the most famous occurred on October 8, 1871 in Chicago, Il, this has become known as the *Great Chicago Fire*. The fire supposedly started in the barn owned by the O'Leary family. When the fire was over on October 10, 1871 nearly 500 people were dead, 17,400 buildings were destroyed and 100,000 people were homeless. It has been considered the worst fire in our history. National Fire Prevention Week is celebrated in remembrance of this fire. Another fire that occurred at the same time is famous for being the highest loss of life fire in the United States. This fire known as the *Peshtigo Fire* occurred in the small lumber town of Peshtigo, WI. It was located to the north of Chicago. The fire destroyed over 1,000,000 acres of land and killed 1,162 people.

20th CENTURY

The 20th century brought many new developments in fire protection and fire safety as well as many tragedies. Many new development in fire prevention also occurred during this time. Some of these were use of adequate exits, sprinkler protection, limits on processes using flammable and hazardous materials. But not all of these changes came about without a cost. Some of most costly fires occurred during this century.

In 1903 over 600 people were killed at the *Iroquois Theater Fire* in Chicago, Il. Most died because basic concepts of fire prevention weren't met - inadequate or locked exits, no sprinklers, over crowding, no emergency plan. In 1904 a fire occurred in the city of Baltimore, Md. This fire brought to light the need for standardization of fire hose couplings, because the responding fire departments did not have the same hose threads as Baltimore. As a result they were unable to help fight the fire.

In 1906 an earthquake destroyed San Francisco, CA. As a result of this fire insurance industry pushed to implement building and fire codes. These building and fire codes are the fore runners of our modern building and fire codes. Through the National Bureau of Fire Underwriters [NBFU] a system was developed to assess a communities fire protection capabilities. This system with modifications is in existence today.

Other fires that had an influence on fire safety during this time were the General Slocum Ship Fire in New York in 1904. This fire left 1,030 dead and resulted in major changes in ship safety. In 1911 a fire occurred in New York at the *Triangle Shirtwaist Factory*. As a result of the fire 146 workers lost their lives. Many from jumping to their deaths. Many changes in fire safety and labor laws occurred as a result of this fire. The New York Fire Prevention Bureau was created as a direct result of the loss.

As the century progressed so did improvements in fire protection. The NFPA developed fire codes that

were designed to improve life safety in buildings [NFPA Std. 101], a standardized electrical safety code {NPFA Std. 70, The National Electric Code}. Motorized fire apparatus with larger and more reliable pumps replaced the horse drawn steam pumpers of the 19th century. [See Figure 3] New extinguishing agents came on the market - dry chemical, halons, and CO₂. Another improvement in fire protection equipment was the development of mechanical firefighting foam which was an improvement over the older chemical foam.

During the 1920s and 30s the fire service improved also. Better training systems were being developed with the help of the insurance industry. Insurance bureaus in the mid-west developed training manuals for fire departments. These became known as the “red books”. Today they are developed by the International Fire Service Training Association [IFSTA]. A training conference was also developed to provide new information to fire service training instructors. This was known as the Fire Department Instructor’s Conference [FDIC] and is still in existence today.

As America was struggling through the Great Depression disastrous fire still continued. In 1930 Over 300 inmates died at a fire in the Ohio State Prison, this led to improvements in prison fire safety. Another shipboard fire on the Morro Castle in 1934 left 134 dead and was cause for more improvements in ship board fire safety.

While the United States was involved in World War II several tragic fire occurred. In 1942 a fire occurred at a Boston, MA nightclub called the *Cocanut Grove*. 492 persons were killed and 500 injured. The reason for so many deaths were the same as the *Iroquois Theater Fire*. A result major changes were made to the NFPA Std. 101 - Life Safety Code. Other changes were made to thy type of materials that are allowed to be used in places of assembly. The second fire was the Hartford Circus Fire in 1944. This fire occurred during a performance of the Ringling Brothers and Barnum and Bailey Circus in Hartford, Ct. 144 person died, mostly from severe burns.

World War II brought about many improvement in the way the fire department fought fires. Some of these were the development of Self-Contained Breathing Apparatus [SCBA], fog or spray nozzles., use of two-way radios for communications and the use of diesel engines in fire apparatus for better efficiency.

Several fires that occurred just after World War II made changes on how deal with fire protection. Two fires at hotels, the LaSalle and the Wincoff, showed us that there is a need for better fire protection in high-rise hotels. And that the term fire-proof is no longer applicable to modern structures. The next fire showed us that we cannot assume something is safe just because it doesn’t have warning labels on it. In 1947 a fire and explosion in *Texas City* caused \$67,000,000 fire loss and the death of 468 people, including the entire Texas City Fire Department. The cause was an explosion on a ship called the USS Grandcamp that was carrying Ammonium Nitrate, a fertilizer. At the time it was generally thought to be a safe material, but after this it was now considered to be a hazardous material [**NOTE: THIS IS THE SAME MATERIAL THAT WAS USED IN THE EXPLOSIVE AT THE OKLAHOMA FEDERAL BUILDING IN 1996**].

The 1950s and 1960s saw many changes in fire protection. The way we design sprinkler systems changed, improvement in firefighting clothing occurred and the increase of fire service involvement in the Emergency Medical Service {EMS}. The development of newer and better extinguishing agents

such as Halon 1301, Purple K and Multi-class dry chemical agents also occurred.

In the 1960s the fire service was presented with a challenge in the urban centers of America. The number of fires increased dramatically during this period. Part due to the decay of our older cities, an increase in arson, and the civil unrest the predominant due to resentment to the Vietnam War and racial unrest throughout the county. New tactics were developed by the fire service to meet these problems. An increase in awareness of the causes of arson was also growing.

By the 1970s the fire protection community came to realize that we as a nation had a major fire problem on our hands. In 1970 a national qualification system was developed for the fire service to make the service more professional. In the earl 1970s a federal commission was created to look at the problem of fire in America. They considered the fire service, building and fire codes, EMS, fire prevention and arson control. In 1973 their report was published and called *America Burning*. Also during this decade two fire occurred that told us that the problems of the past were still with us. In 1973 a fire occurred in Chelsea, MA, this fire soon turned into a conflagration. The reasons for the fire spread were that same as what cause conflagrations in the early part of the century, closely built wooden structures, high fuel load, lack of fire code enforcement. It should be noted that Chelsea had recorded another conflagration in the first decade of the 20th century in the same area as this. The second fire was the *Beverly Hills Supper Club Fire*. This fire occurred in Southgate, Ky, just outside Cincinnati, OH. 165 person died in this fire and the reasons were the same as what killed 492 people in 1942 at the *Cocanut Grove* and the *Iroquois Theater* in 1903 where 602 people died. Both of these fire made us realize that even with all the technological improvements the same reason still exist for why fire start and this is where our concentration must occur.

The 1970s also brought about an awareness in hazardous materials. The fire service became very involved in the response and control of such incidents as our society became more aware of our environment. Improvements in firefighter clothing came about with the development of Nomex® fire retardant clothing. Firefighter safety came tto the forefront during this decade. The new OSHA regulations provided for a safer work environment for firefighters. The development of a unified incident command system for better control at emergency incidents. The establishment of a federal agency whose focus was fire protection - the United Sates Fire Administration. Also the establishment of a National Fire Academy to train the fire officers of America, and a National Fire Data Center to better track our fire problem. And lastly the use of a standardized National Fire Incident Reporting System [NFIRS] was put in place.

The 1980s saw an increase in fire in high-rise buildings and improvements in trying to control them. The realization that to improve the fire problem two areas need to be addressed. Better public fire education, and a reduction in the number of fire deaths in residential structures. Programs such as *Learn Not To Burn*, *Operation Edith*, and *Stop Drop and Roll* have helped to reduce the number of injuries. The development and use of residential sprinkler systems helped to reduce the number of fires, injuries, and deaths in residential buildings.

The development of the computer in the 1980s allowed for scientists and engineers to better study the dynamics of fire and improve better ways of controlling it. This decade saw the growth of college programs related to fire protection. Many community colleges offered two year degrees in fire science, fire administration and fire technology. Some four year schools also offered programs in fire science,

fire administration and fire engineering. This has led to the professionalization of the fire service.

The 1990s saw an integration of technology and fire protection. The fire service was using better designed SCBA, pagers and computers to relay information to firefighters. Better designed personal protective equipment was being designed that kept firefighters safer. New technology such as thermal imaging cameras are being used to locate fire and victims. The way apparatus is designed has improved. No longer do firefighters ride on the rear of the apparatus, but ride now in enclosed cabs. Studies are being done to determine the causes of high rates of cancer and cardiac problems in firefighters. Computers have allowed us to develop models of fires to better understand how they develop. This has led to improvements in the design of building materials and layouts to improve a person's chance in a fire.

The fire service has also seen a transformation from a firefighting force to an all hazard fighting force. In order to survive the fire service has branched out to become involved in hazardous materials, EMS, technical rescue, and anti-terrorism.

As the fire protection field enters the 21st century we are seeing new challenges in the areas of public fire education, improving fire and building codes to name a few.

FIRE PROTECTION TIME LINE

MILESTONES IN FIRE PROTECTION

- 6 A.D. Roman Emperor Augustus creates "Corps of Vigiles" to protect city of Rome from unwanted fires.

- 64 A.D. City of Rome burns for three days during the reign of Emperor Nero

- 1066 William the Conqueror establishes law in England requiring all house fires to be extinguished by night fall. This was called "couvre feu" in French and became known as "curfew" in English

- 1189 Law passed in London, England requiring all buildings be built of stone and covered with slate roofs.

- 1608 First major fire in New World Colonies occurs at Jamestown colony in Virginia.

MAJOR HISTORICAL EVENTS

1 A.D. BIRTH OF CHRIST

1492 - COLUMBUS DISCOVERS AMERICA

1647 Peter Stuyvesant, Mayor of New Amsterdam (New York) creates building code and a group of fire wardens known as the “Rattle Watch” after the rattles they carried to arouse people when a fire occurred.

1666 Great Fire of London, England occurs. Five-sixth of city destroyed in conflagration. Caused creation of building codes and fire insurance companies who developed fire brigades to protect their insured property. These protected properties were indicated by “Fire Marks” on the front of the building.

1679 First organized fire department created in Boston, Mass.

1736 Ben Franklin organizes the first volunteer fire company in Philadelphia, Pa. It was called the Union Volunteer Fire Company.

1775 - 1783 AMERICAN REVOLUTION

Early 1800s Major cities in United States began developing fire protection water systems using wooden water mains and a “fire plug”. This would eventually lead to development of the fire hydrant.
[See Figure 2]

1787 RATIFICATION OF U.S. CONSTITUTION

1853 Cincinnati becomes first fully paid fire department in United States. Between 1850 and 1880 many of the larger cities in America went from volunteer to paid. This was a result of the constant fighting and brawling that went on between the volunteer fire companies.

1861 - 1865 CIVIL WAR

1870 Hays Aerial Apparatus developed in San Francisco, Ca. It was manual in operation and had a reach of 85 feet.

1871 Great Chicago Fire occurs. Starts in

barn behind O'Leary's house. 17,450 buildings lost to fire, over 300 people lost in fire, and a dollar loss of 200 million. Sixty fire insurance companies went bankrupt as a result of the fire. Fire Prevention Week is celebrated on the anniversary of fire. Fire Occurs in Peshtigo, Wisconsin killing 1,162 people, happens the same time as fire in Chicago, Ill.

**1871 ALEXANDER GRAHAM BELL
INVENTS TELEPHONE**

**1875 THOMAS A. EDISON INVENTS
THE LIGHT BULB**

1878 First practical Automatic Sprinkler System installed using the Parmelee Sprinkler Head.

1896 National Fire Protection Association is organized.

1903 Iroquois Theater Fire, Chicago, Ill.

1904 Baltimore Conflagration, Baltimore, Md.

1904 General Slocum Steamship Fire, New York City, N.Y.

1906 San Francisco Earthquake, San Francisco, Ca.

1911 Triangle Shirtwaist Factory Fire, New York City, N.Y.

1910 -

1920 Motorized fire apparatus replaces horse drawn fire apparatus in many of the cities of the United States.

1914 - 1918 WORLD WAR I

1930 - 1940 GREAT DEPRESSION

1930 Ohio State Penitentiary Fire, Columbus, Oh.

1934 S. S. Moro Castle Cruise Ship Fire, New Jersey Coast

1939 - 1945 WORLD WAR II

1942 Coconut Grove Night Club Fire, Boston,

- Ma.
- 1944 Ringling Brothers & Barnum & Bailey
Circus Fire, Hartford, Conn.
- 1947 Texas City Explosion and Conflagration,
Texas City, TX
- 1949 St. Anthony's Hospital Fire, Effingham,
MA
- 1950 Fire Chief Lloyd Layman introduces his
theory of water fog as an extinguishing
agent at the Fire Department Instructors
Conference in Memphis, TN..
- 1953 General Motors Transmission Factory,
Livonia, Michigan
- 1958 Our Ladies of the Angles School Fire,
Chicago, Ill.
- 1962 Walter M. Haessler introduces his theory
of the "Fire Tetrahedron" and the
"Uninhibited Chain Reaction" theory of
fire.
- 1967 Apollo Launch Pad Fire, Cape Kennedy
- 1969
App. Halon 1301 is being installed as an
extinguishing agent in high risk
facilities. Works on theories developed
by Walter M. Haessler.
- 1970 Joint Council of Fire Service
Organizations organized to develop
professional qualifications for the fire
service
- 1973 National Commission on Fire Prevention
and Control publishes its report on the
"Fire Problem in the United States"
called "America Burning". This leads to
the creation of the United States Fire
Administration and National Fire

**1945 FIRST USE OF THE ATOMIC
BOMB AT HIROSHIMA, JAPAN**

1950 - 1953 KOREAN WAR

**1963 PRESIDENT KENNEDY
ASSASSINATED**

1969 FIRST LUNAR LANDING

1965 - 1973 VIETNAM WAR

Academy.

- 1977 Beverly Hills Supper Club Fire,
Southgate, Ky.
- 1979 Waldbaumb's Fire, Brooklyn, NY
- 1980 MGM Grand Hotel Fire, Las Vegas, NV.
- 1980 Stouffer's Inn Conference Facility Fire,
Harrison, N.Y.
- 1982 K-Mart Warehouse Fire, Falls Twp., Pa.
- 1988 Hackensack Car Dealer Fire,
Hackensack, New Jersey
- 1990 Happy Land Social Club Fire, New
York, NY
- 1991 Oakland-Berkeley Conflagration,
Oakland, Ca.
- 1991 Imperial Foods Products Fire, Hamlet,
NC
- 1993 World Trade Center Bombing, New
York, NY
- 1996 Oklahoma City Federal Building
Bombing & Fire, Oklahoma City, Ok.
- 1996 Night Club Fire, Manila, Phillipines
- 1997-
- 1999 Recall of Omega Sprinkler heads
- 1999 New "America Burning" Commission
convened
- 2000 50,000 acre Forest Fire near Los
Alamos, New Mexico

**1985 SPACE SHUTTLE CHALLENGE
DISASTER**

**1990-1991 FALL OF COMMUNIST
RUSSIA**

SYNOPSIS OF IMPORTANT 19TH AND 20TH CENTURY FIRES

Great Fire of London, England

DATE September 1, 1666

EVENTS Fire begins in a bakery on Pudding Lane near London Bridge in early morning. Fire spreads throughout city from burning embers and debris carried by very strong dry winds. Fire was extinguished three days later.

ACTIONS

TAKEN Caused creation of building codes and fire prevention code. Fire insurance companies who developed fire brigades to protect their insured property. These protected properties were indicated by "Fire Marks" on the front of the building.

LIFE & DOLLAR

LOSS 10.7 million British Pounds, over 13,000 buildings including St. Paul's Cathedral

Great Chicago Fire, Chicago, Ill

DATE October 8, 1871

EVENTS Had been very dry season for mid-west part of country. Several bad fires had occurred prior to the major of 10/8/71, causing the fire department to be exhausted. The fire began in barn belonging to O'Leary family that was located in the west division of the city. The fire was not reported for nearly an hour, this was because the O'Learys and neighbors tried to fight it by forming a bucket brigade. When the fire alarm was transmitted at 9:05 PM it was never received at city hall. When the glow of fire was seen by the fire alarm dispatch office they thought it was from the coal fire of the previous day. Fire apparatus was finally dispatched at 9:21 PM but was sent to the wrong address. Fire spread to area where several furniture factories were located and was at this time beyond the control of the fire department. Fire brands spread across the river and started fires in the south division. Employees of the Gas Works fearing that the fire would reach the Gas Works and explode shut down the valves to the gas which shut off the lights to the entire city. By 2:30 am fire had spread to north division of city. The fire continued until 10/10/71 and finally burned out about 2:00 am. Losses were 17450 buildings lost; at least 300 died; 900,000 people left homeless; 200 million dollar fire loss; about sixty insurance companies went bankrupt

ACTIONS

TAKEN When city was rebuilt it was done so to a plan the tried to limit fire spread as a result of buildings being built t close together. Less wood and other combustibles were used in construction and more non-combustible materials were used.

LIFE & DOLLAR

LOSS 17,450 buildings lost to fire, over 300 people lost in fire, and a dollar loss of 200 million

Peshtigo, Wisconsin (largest loss of life fire in United States History)

DATE October 8, 1871

EVENTS Very dry fall in the mid-west area of America. Peshtigo was a lumber town in the north

woods of Wisconsin, about 250 miles north of Chicago. Several forest fires had been burning over the days prior to this fire. Because of the warm dry winds and the dry foliage the area was ripe for a fire. Fire was noticed at about 9:30 PM. It quickly engulfed the town and overran the small fire department it had. The fire covered over 1 million acres of land and destroyed Peshtigo and several other small towns. An area of twenty miles from east to west and sixty miles north to south were burnt clean. About 1,200 people were killed. No heard about the fire for almost two days because of the major fire in Chicago that occurred on the same day.

LIFE &
DOLLAR

LOSS 1,162 people dead

Iroquois Theater Fire, Chicago, Ill.

DATE December 30, 1903

EVENTS Arc light above stage had blown causing sparks that ignited combustibles behind stage area. Flames began to spread quickly. The asbestos curtain was brought down on the stage but got stalled and left a 12 foot gap between it and the floor. Stage doors were open at this time causing a draft that intensified the flames. Panic set in and people rushed for the exits and were trampled. The theater was over crowded and had insufficient exits to handle the crowd which led to the high number of deaths. Some contributing factors to the catastrophe were

- No automatic sprinklers
- No effective first aid firefighting equipment
- Obstruction of the asbestos curtain
- Blocked and obscured exits
- Lack of exit signs
- Faulty exit plan
- Failure of electrical system
- Over crowding & more seats installed than was originally approved
- Allowing for an overage of standing room only far in excess of safe number

ACTIONS
TAKEN

Doors in public places must open outward, “panic” hardware was installed on exit doors. Exits must be clearly marked and unobstructed. Theater personnel were to be trained in evacuation procedures. Automatic sprinkler systems were to be installed.

LIFE &
DOLLAR

LOSS 602 dead

Baltimore Conflagration, Baltimore, Md.

DATE February 7, 1904

EVENTS Fire department responded to a “small” fire in a “fire-proof” building. While firefighters were working at fire some celluloid material ignited with explosive force and caused the fire to spread to upper floors via an elevator shaft. High winds drove the fire to other

buildings as the fire spread. Shortly after arriving at the scene, the fire chief was killed by being electrocuted. As additional fire companies arrived, some from as far away as New York City, to help fight the fire, it was discovered that the hose threads from these distant companies did not match the hose threads of the Baltimore Fire Department. The fire was finally “contained” late on February 8.

ACTIONS

TAKEN

As a result of this fire standards were written to try to standardize fire hose threads. This is still a problem in the fire service today. The fire and insurance also took another look at “fire-proof” construction and have since re-evaluated what “fire-proof” and “fire-resistive” are.

LIFE & DOLLAR LOSS

1 firefighter death, 50 million dollar loss

General Slocum Steamship Fire, New York City, N.Y.

DATE June 15, 1904

EVENTS

The General Slocum was an excursion boat that was taking a Sunday school group from St. Mark’s German Lutheran Church on a picnic. The boat was over-crowded for its size. People on shore first noticed smoke coming from the bow of the boat, but were unable to make anyone on the General Slocum aware of it. When the smoke was finally noticed coming from a door to the cabin, a crew member opened the door and caused oxygen to feed the smoldering fire making it more intense. As crew members tried to use the fire hose on the boat to extinguish the fire they discovered the hose was rotted and fell apart. As fire boats and land-based engine companies rushed to the fire to give assistance the captain of the general Slocum continued to steer up the middle of the river and into the wind, which fanned the fire. As the fire intensified people began jumping overboard to escape the flames and many drowned before they were rescued. The boat was finally beached and the fire was extinguished.

ACTIONS

TAKEN

This fire brought to light the lack of concern for safety equipment on pleasure boats and ships. There was a lack of training on the part of the crew to fight fires. The crew did nothing to aid the passengers. There was also found corruption on the part of inspectors who approved the boat as “safe” for use. As a result requirements were made for firefighting training for crew members, regular inspection of safety equipment, and adequate safety equipment to aid passengers in leaving the boat in an emergency.

LIFE & DOLLAR LOSS

1,030 dead

San Francisco Earthquake, San Francisco, Ca.

DATE April 18, 1906

EVENTS

A massive earthquake caused the rupture of gas lines and water mains. Large fires were started throughout the city, but with out adequate water and a fire department that was in as much shock as the rest of the population the fires spread quickly. Fire breaks were

created by setting fires to unburnt buildings and dynamiting other buildings to slow the spread of the fire. Four days later the fires were under control after a torrential rain helped with the extinguishment of the fires. The earthquake destroyed over 25,000 structures and left 300,000 people homeless. This also caused the bankruptcy of numerous insurance companies.

ACTIONS

TAKEN As the city was rebuilt the concern for earthquake resistive building codes were developed to protect structures, municipal water systems and gas lines.

LIFE &
DOLLAR
LOSS

500 dead; 350 million dollar loss

Triangle Shirtwaist Factory Fire, New York City, N.Y.

DATE March 25, 1911

EVENTS The fire occurred in the Asch Building, a ten story “loft factory”. The Triangle Shirtwaist Company employees were working that day when at 4:45 PM a small fire was noticed by the employees, mostly immigrant worker that the majority were women, as they tried to extinguish the fire with buckets of water the fire got into the paper and cloth scraps that were on the floor and rapidly spread. At the time of the fire there were approximately 600 people working. As the fire intensified the employees rushed towards one of the two exits from the eighth floor. The one exit was narrow so the owners could check the employees when they left at end of shift for possible pilfering. At the end of the exit was two small elevators and a narrow stairway. The other exit was bolted shut in an effort by management to stop employees from sneaking out for breaks. The majority of the eighth floor employees escaped. On the ninth floor the fire had set most of the cloth and other highly combustible material ablaze. These employees were not able to get to the stairway or elevators, many of them tried to jump for safety to the ground, nine stories, below. As firefighters arrived to fight the fire there was little they could do, because their aerial ladders could only reach the sixth floor. It took 18 minutes to control the fire, but by then 146 people had died.

ACTIONS

TAKEN A Factory Investigating Committee was created, 36 new labor laws were passed in New York, the Fire Prevention Bureau was formed in the New York City Fire Department to inspect buildings such as these. The changes that came about as a result of this fire are a direct cause for many of the fire prevention laws that exist today and many of the labor laws.

LIFE &
DOLLAR
LOSS

146 dead

Ohio State Penitentiary Fire, Columbus, Oh.

DATE April 21, 1930

EVENTS A fire began in some scaffolding and was reported to a guard by an inmate who had a history of “telling tales” so the guard disregarded the story. About forty minutes later the fire alarm was sounded. At the time of the fire the prison was more than 3,000 inmates

over what it was designed to hold. As the prisoners were returning from dinner and learned of the fire they began to fight with the guard to let them go. The guards had not been trained in what to do in a fire situation and since they were not sure how bad the fire was they delayed releasing the inmates. At this time strong winds had caused the fire to spread to the combustible roofing material on the cell block. As the fire intensified the guards tried to release the inmates from their cells but many of the locks had been warped by the heat and could not be opened so many of the inmates were left to their fate. As the inmates were led out to the courtyard to be kept under watch the fire department had arrived. At this point the inmates rioted and attacked the firefighters, who were forced to retreat. This caused a two hour delay before the fire was brought under control.

ACTIONS

TAKEN Improvements of fire safety in prisons throughout United States.

**LIFE &
DOLLAR**

LOSS 320 dead

S. S. Moro Castle Cruise Ship Fire, New Jersey Coast

DATE September 8, 1934

EVENTS A fire was discovered in the early morning hours in the writing room. Because of ineptness on the part of the crew the fire spread quickly. The captain of the ship did not believe in fire drills because they caused “panic” among the guests, just prior to the fire the captain had died suddenly. The door to the fire room had been allowed to stay open, thus supplying more oxygen to the fire. When crew members tried to combat the fire they discovered that the captain had previously ordered the hose removed and the connection capped because a woman had sprained her ankle on the slippery floor and sued the ship’s owners. As the fire intensified the acting captain ordered the ship to steer into a 20 mile an hour wind causing the fire to spread even faster. It was not until fifteen minutes after the fire was out of control that the acting captain authorized an SOS signal to be sent out. Panic gripped both crew and passengers, many of whom jumped in to the ocean with only a life preserver or life jackets. Of the life boats that were released, most of the occupants were the crew members. The ship finally ran aground off the New Jersey coast.

ACTIONS

TAKEN Led to improvements in ship board fire safety practices. These included crew members trained in fire safety drills, mandatory fire drills, adequate amount of firefighting equipment, that was in working order, on board ship.

**LIFE &
DOLLAR**

LOSS 134 dead

Coconut Grove Night Club Fire, Boston, Ma.

DATE November 28, 1942

EVENTS A large number of people were attending, what was supposed to be a victory celebration for a football game between Boston College and Holy Cross. Boston College had lost,

but approximately 1,000 people showed up anyway. The Coconut Grove was designed to accommodate 600 people. The building was originally a garage that had been converted into a nightclub that had a tropical island motif, complete with fake palm trees, blue satin representing blue skies and other very combustible materials. A small fire was discovered in the blue satin ceiling covering in the Melody Lounge part of the night club that was downstairs. People watched the fire move along the satin very slowly at first, then panic set in. 200 people tried to scramble up the narrow stairway that lead to the ground floor. At the same time the lights went out and placed the nightclub in darkness which intensified the panic. By now the fire was flashing above the patrons and creating volumes of thick black smoke. One of the doors to the street at the top of the stairs was welded shut to prevent non-paying customers from leaving. Main entrance was a single revolving door that had jammed shut. The exit door to the side of it was locked. The other two doors that lead to the street opened inward. Because of these blocked exits the people were jamming up against them creating a wall of human bodies that prevented other patrons from escaping. Of the 1,000 patrons, 492 died, over 400 were injured. Because of the toxic fumes given off by the burning material and the speed at which the fire traveled, some patrons were found still sitting at the bar. The vast majority of the 492 deaths occurred within 12 minutes of the fire starting.

ACTIONS TAKEN

As a result of this fire major changes were made in the fire codes, both in Boston and through out the country. These changes were the following.

- No place of public assembly should be filled beyond the authorized capacity.
- No combustible material should be used for decorating in places of public assembly
- Every building designated as a place of public assembly and any section of it must be provided with at least two means of egress that are remote as possible from each other.
- If a building can accommodate 600 people at least three exits must be available, for 1,000 people at least four exits must be available.
- Exits must be maintained free and unobstructed, and be provide with adequate lighting & clearly marked.
- Exitways must provide a clear path of travel to the street and exit doors must swing open in the direction of exit travel.

LIFE & DOLLAR LOSS

492 dead

Ringling Brothers & Barnum & Bailey Circus Fire, Hartford, Conn.

DATE July 6, 1944

EVENTS The circus tent was 425 feet long by 180 feet wide. The seating capacity of the tent was 9,048. At the time of the fire there were approximately 8,300 people in the tent area including circus staff. Just prior to the fire starting the animal acts had completed their part of the show and the cages and the cage runways were blocking the main north aisle, which was a main exitway. The fire began on the outside of the tent near the ground on the canvas. It spread upward and into the tent, many of the spectators saw the flames but

thought it was part of the show. A short time later the fire began to burn through the support ropes holding the tent up. As the support poles began to collapse panic began to set in as people tried to escape. The exitways were not large enough to sustain the number of people in the tent and because of a number of loose chairs in the aiseways the exits were further blocked. Most of the fatalities were a result of burns, in contrast to the Coconut Grove fire where most of the fatalities were a result of suffocation.

ACTIONS

TAKEN

Because the tent was not properly flame proofed the fire was allowed to spread quickly. As a result flame tests on material were required prior to permits being given for circuses. The number of exit ways were increased as a result of the fire to compensate for the number of people attending.

LIFE &

DOLLAR

LOSS 163 dead

Texas City Explosion and Conflagration, Texas City, Tx.

DATE April 16, 1947

EVENTS

A small fire was discovered at about 8:00 AM in Number 4 hold of the S.S. Grandcamp, a former liberty ship that was carrying a cargo of ammonium nitrate. The ship was docked at the piers of the Monsanto chemical plant in Texas City. The crew of the ship and some longshoreman tried to extinguish the fire by first using small quantities of water and then by sealing the hold and injecting steam, a method that was common for extinguishing ship hold fires. The Texas City Fire Department responded to the fire and began applying water using hose streams. An explosion occurred at 9:15 AM that destroyed the S. S. Grandcamp and the 26 members of the fire department and their four fire trucks. The fire and explosion caused major damage to the surrounding area, including to large concrete piers that collapsed and, many buildings at the Monsanto plant. The explosion cause a 15 foot tidal wave to lift a 150 foot steel barge and move it 200 feet inland. Two other ships, the S.S. High Flyer and the S. S. Wilson B. Keane collided with one another. The following day the S.S. High Flyer, which also contained ammonium nitrate exploded and further complicated the disaster. It is approximated that about 468 people were killed in the explosion and the dollar lost is estimated at 67 million dollars. The fire continued to burn for about one week after the explosion.

ACTIONS

TAKEN

Ammonium nitrate prior to this had not been considered a hazardous material. After this incident it was reclassified and firefighting techniques were changed to reflect the changes.

LIFE &

DOLLAR

LOSS 468 dead, 67 million dollar loss

Beverly Hills Supper Club Fire, Southgate, Ky.

DATE May 28, 1977

EVENTS

The nightclub was considered the largest in the country at the time. It was originally built in 1937 and had many additions put on over the years. The building had no sprinkler system, fire alarm system or smoke/fire detection system as required by code.

At the time of the fire there were 2,600 people in the night club. 1,200 people were in the Cabaret Room to see the evening's show. The fire began in a wall space of the Zebra Room. Several employees tried to control the fire but were unable to. There was a 15 minute delay of alarm to the fire department. There was also a delay in notifying the patrons of the fire and evacuating them. When the patron were notified, during a comedy routine, they thought it was part of the show. A very short time later thick black smoke entered the Cabaret Room. Because of the narrow aisles and closeness of tables the evacuation was not orderly. There were not enough exits for the number of patron in the building, also the exits were not adequately marked. The major cause of death was smoke inhalation. The toll was 165 dead and 70 injured

ACTIONS
TAKEN

The causes for this disaster were the following.

- Delay in alarm
- No emergency evacuation plans
- No fire drills
- No fire protection
- Unsuitable and highly combustible interior finish
- Lack of exits
- Blocked exits
- Overcrowding

LIFE &
DOLLAR
LOSS

165 dead

MGM Grand Hotel Fire, Las Vegas, NV.

DATE November 21, 1980

EVENTS

The fire was discovered in the deli-restaurant on the casino level of the hotel. The fire department was notified immediately, but notification of the guests was cut short when the hotel telephone operators were forced to flee because of the smoke. The fire reached flashover conditions very early and spread quickly through the casino area and out the west side doors of the casino. The smoke and heat spread very quickly to the upper floors through elevator shafts, seismic joints and stairwells. Those guests who were alerted early on or who were awake were able to escape without harm. Those who were not alerted either stayed in their rooms or gathered with other guests in their rooms. Of the 85 deaths, 14 were in the casino area, 29 in guest rooms, the rest in corridors, elevators or lobby areas.

ACTIONS
TAKEN

The need for evacuation plans to be practiced, a trend to more compartmentized construction to limit fire spread.

LIFE &
DOLLAR
LOSS

85 dead

BEVERLY HILLS SUPPER CLUB FIRE - MAY 28, 1977

MAIN POINTS

- ✓ 165 PERSONS KILLED
- ✓ 70 INJURED
- ✓ ORIGINAL BUILDING BUILT IN 1937, ADDITIONS ADDED OVER THE YEARS
- ✓ NO SPRINKLER SYSTEM
- ✓ NO SMOKE/FIRE DETECTION SYSTEM
- ✓ 2,600 PEOPLE INSIDE CLUB AT TIME OF FIRE; 1,200 IN CABARET ROOM
- ✓ MAIN CAUSE OF DEATH - SMOKE INHALATION (CARBON MONOXIDE POISONING)
- ✓ PANIC WAS NOT A MAJOR FACTOR IN FIRE DEATHS
- ✓ INTERIOR FINISH IN MAIN CORRIDOR CONTRIBUTED TO RAPID SPREAD OF FIRE
- ✓ CONSTRUCTION OF CLUB WAS UNPROTECTED NON-COMBUSTIBLE

CONTRIBUTING FACTORS

- ☞ BUILDING WAS A PUBLIC ASSEMBLY AS PER NFPA 101, LIFE SAFETY CODE
- ☞ TOTAL NUMBER OF PEOPLE IN BUILDING WAS TWO TIMES MORE THAN COULD BE SAFELY ACCOMMODATED
 - ☞ TOTAL NUMBER INSIDE CABARET ROOM WAS THREE TIMES THE ACCEPTABLE LIMIT
- ☞ ADDING OF ADDITIONAL WINGS TO BUILDING ELIMINATED EXITS TO BUILDING
- ☞ **LIFE SAFETY CODE DEFINES OCCUPANCY AS THE NUMBER OF PEOPLE THAT CAN BE SAFELY ACCOMMODATED IN A ROOM/BUILDING BASED ON THE NUMBER OF EXITS AND THEIR SIZE**
 - ☞ **THE MORE EXITS YOU HAVE THE MORE PEOPLE CAN BE ACCOMMODATED, BUT THE EXITS MUST LEAD TO A SAFE AREA**
- ☞ CURVED, OPEN, UNENCLOSED STAIRWAY FROM FIRST TO SECOND FLOOR WAS LIFE SAFETY HAZARD
- ☞ THE MAJOR PROBLEMS LEADING TO THE FIRE DEATHS: INADEQUATE NUMBER OF EXITS; OVERCROWDING

CAUSES FOR THE DISASTER

- DELAY IN ALARM
- NO EMERGENCY EVACUATION PLANS
- NO FIRE DRILLS
- NO FIRE PROTECTION (SPRINKLERS, ETC.)
- UNSUITABLE INTERIOR FINISH
- LACK OF EXITS
- BLOCKED EXITS
- OVERCROWDING

RECOMMENDED REFERENCES

- Fire In America, Lyons, 1976, NFPA
- Principles of Fire Protection, by Cote & Bugbee, 1976, NFPA
- Triangle Fire, Stein, 1962, Lippincott
- Great Fires In America, Backes, 1973, Country Beautiful Corp.



Figure 1 - Examples of Fire Marks

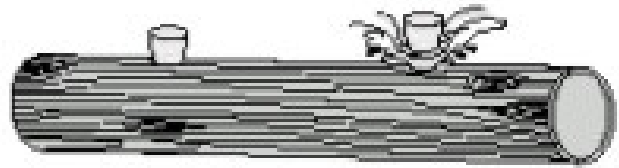
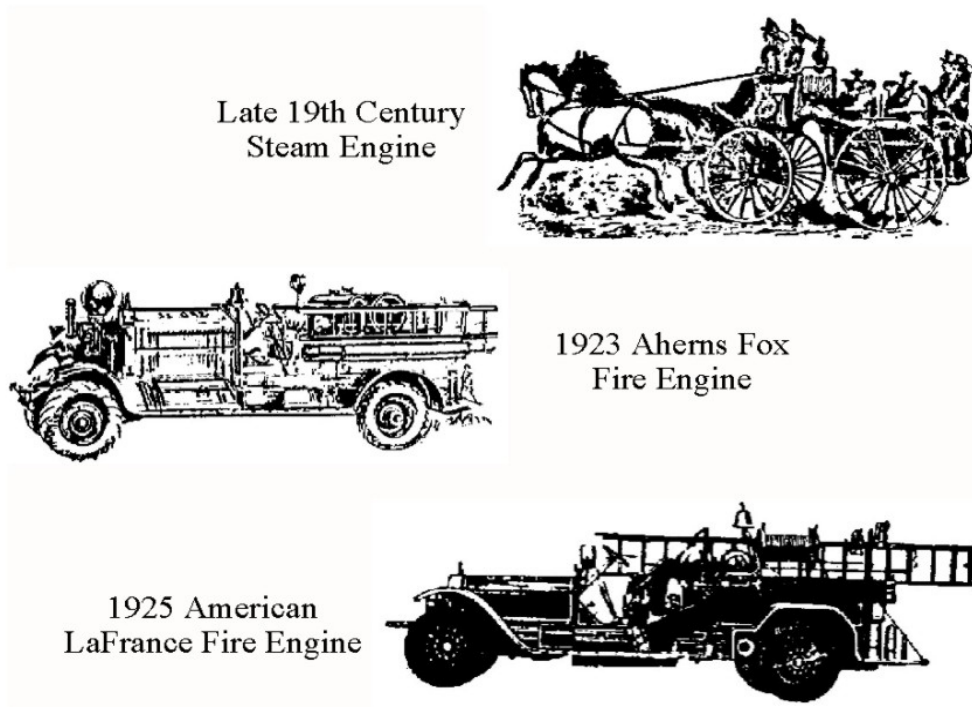


Figure 2 - Example of a “Fire Plug”



Late 19th Century
Steam Engine

1923 Aherns Fox
Fire Engine

1925 American
LaFrance Fire Engine

Figure 3 - Examples of Early Fire Engines

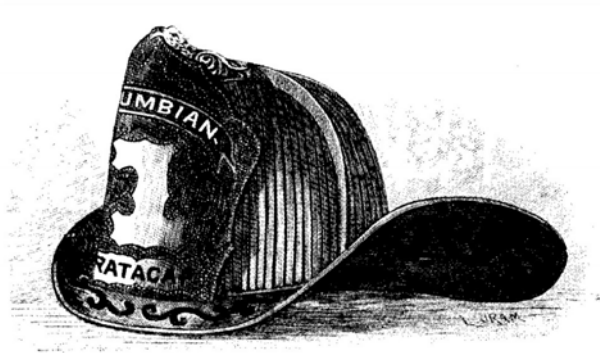


Figure 4 - Example of Early Fireman's Helmet



Figure 5 - Example of 19th Century Firefighter