सत्यमेव जयते

FIRES IN INDIA:
LEARNING LESSONS FOR URBAN SAFETY

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Resilient India - Disaster free India

National Institute of Disaster Management (NIDM)
(Ministry of Home Affairs, Government of India)

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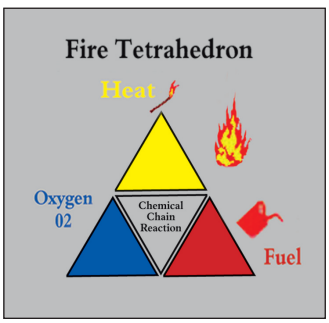

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FIRES IN INDIA:
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नित्यानन्द राय
NITYANAND RAI

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गृह राज्य मंत्री
भारत सरकार
नार्थ ब्लाक, नई दिल्ली – 110001

**MINISTER OF STATE FOR
HOME AFFAIRS
GOVERNMENT OF INDIA
NORTH BLOCK,
NEW DELHI - 110001**

संदेश

दैनिक मानव जीवन का अभिन्न अंग अग्नि मानव सभ्यता के समक्ष आने वाली सर्वाधिक विनाशकारी आपदाओं में से भी एक है। आग की घटनाओं के परिणामस्वरूप मौतों, चोटों और संपत्ति को क्षति के रूप में भारी नुकसान होता है। यह जीवन के सभी पहलुओं में व्याप्त और अक्सर घटित होने वाले जोखिमों में से एक है। समस्त भारत में हर वर्ष आग की अनेक घटनाओं का सामना करना पड़ता है। आग की घटनायें महलों और झोपड़ियों, कस्बों तथा महानगरों में कोई भेद नहीं करती। देश के शहरी और औद्योगिक क्षेत्रों में आग के प्रकोप का सर्वाधिक खतरा बना रहता है। आग की घटनाओं के कारण भारत में प्रतिवर्ष औसतन 10,000 मौतों के मद्देनजर जोखिम प्रबंधन रणनीतियों को समग्र रूप से विकसित करने की आवश्यकता है।

प्रत्येक आपदा की घटना आपदा राहत प्रदाताओं और आपदा प्रबंधकों को बहुमूल्य सबक देती है, जिनके अनुपालन से ऐसी घटनाओं की पुनरावृति को रोका जा सकता है। इसलिए प्रत्येक घटना को गंभीरता से लिया जाना चाहिए ताकि उससे सबक लेकर आपदाओं को इस तरह से नियंत्रित तथा प्रबंधित किया जाए कि जान-माल की न्यूनतम हानि हो। **"भारत में आग की घटनाएं : शहरी अग्नि सुरक्षा के लिए सीखने का अवसर"** विषय पर राष्ट्रीय आपदा प्रबंधन संस्थान के इस प्रकाशन के माध्यम से स्कूल, अस्पताल, मंदिर, बाजार इत्यादि जैसी विभिन्न जगहों में आग के प्रकोप की सात घटनाओं का दस्तावेजीकरण किया गया है ताकि जोखिमों और कारणों की पहचान हो सके। इस पुस्तक का उद्देश्य आग की घटनाओं के कारणों के बारे में व्यापक दृष्टि प्रदान करना और शहरी क्षेत्रों में आग के आपदा जोखिम न्यूनीकरण कार्य में संलग्न पेशेवरों के लिए एक मार्गदर्शक के रूप में कार्य करना है।

इस प्रकाशन के माध्यम से अग्नि आपदाओं के इस महत्वपूर्ण मुद्दे को उठाने के लिए मैं राष्ट्रीय आपदा प्रबंधन संस्थान को बधाई देता हूं। मुझे विश्वास है कि इस दस्तावेज से अग्नि सुरक्षा क्षेत्र से जुड़े पेशेवर, नीति निर्माता, छात्र, शोधकर्ता और सभी हितधारक लाभान्वित होंगें।

(नित्यानन्द राय)

अगस्त, 2020
नई दिल्ली।

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Resilient India - Disaster free India

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राष्ट्रीय आपदा प्रबंधन संस्थान
(गृह मंत्रालय, भारत सरकार)

Maj Gen Manoj Kumar Bindal
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Executive Director

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Foreword

The march of human civilization from cave dwellers to inhabitants of megacities and conurbations has come with its share of adverse events and disasters. Fire is one such hazard which often has its origins in faulty/inappropriate human actions.

History has shown how the discovery of fire gave momentum to the human civilization to explore and grow. However, fires have often proved to be the cause of destruction and devastation of human achievements.

The fires that destroyed great cities like Rome or London, in recent times, have brought the world to a standstill. Recent incidents of wildfires in Australia, the Amazon, California and Uttarakhand in India have lost the world its biodiversity, laying bare huge tracts of land to degradation and causing loss of homes, assets and lives. It is acknowledged that most wild fires have an anthropogenic origin. In densely packed urban areas, devastating fires are the most predominant risks and fire incidents continue to occur with repetitive regularity every year.

India has seen many devastating fire disasters in various settings viz. temples, hospitals, schools, markets, factories, cinema halls etc resulting in preventable deaths and disability. Essential services and places of large congregation have been hit by fires, causing huge losses. In all these preventable incidents, the causes were a combination of factors. There is thus an urgent need to document these events and identify the risks and causes so that requisite course correction can be made.

This book has documented eight devastating fire incidents that occurred in various parts of the country primarily in places of human congregation and critical infrastructure like temples, markets, theatres, schools and hospitals in an effort to learn lessons and take preventive action. It is only by learning from the past that we shall be able to create a safe and resilient future.

MKBindal

(Major General Manoj Kumar Bindal, VSM)
Executive Director,
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New Delhi, India

Acknowledgement

Discovery of fire was a critical step in the history of humankind. However, fires, if uncontrolled, also cause huge damage and destruction over vast areas of land. Fires have created and destroyed lofty symbols of human achievement and glory. From entire cities to towering buildings, slums, markets, places of worship, fires cause damage and destruction with unfailing regularity.

Every disaster brings with it an opportunity to learn and enforce preparedness measures for the successive events. Through this document, the authors have attempted to study some large fire incidents that were catastrophic and left a mark on the psyche of the people. The aim of the study was to document the event, the lessons and the path traversed in terms of policy and practice.

The authors acknowledge the contribution of many experts in preparation of this compendium. First of all, we would like to thank the Executive Director of NIDM, Major General Manoj K. Bindal, VSM who took a keen interest in the outcome, mentored and guided us with his comments and directions. Prof. Santosh Kumar, HOD, helped us design and execute the study through his inputs; colleagues and staff of NIDM were always there to help and facilitate.

We also thank our reviewers, Shri A.K. Sharma, former Chief of Delhi Fire Services and Shri Anup Karanth for their extensive comments and suggestions, which helped in giving final shape to the document.

We hope that the book shall be useful to all those who work and dream of a resilient nation; we dedicate the book to them. The responsibility for any flaw, however, lies entirely with the authors.

Bandyopadhyay

(Dr. Chandrani Bandyopadhyay Neogi)
Assistant Professor

Mohana Manna

(Ms Mohana Manna)
Young Professional

Contents

ABBREVIATIONS

AIIMS	:	All India Institute of Medical Sciences
BIS	:	Bureau of Indian Standards
CAG	:	Comptroller & Auditor General of India
CBI	:	Central Bureau of Investigation
CHCs	:	Community Health Centres
CISF	:	Central Industrial Security Force
CTIF	:	International Association of Fire and Rescue Services
DFS	:	Delhi Fire Services
DMRC	:	Delhi Metro Rail Corporation Limited
DVB	:	Delhi Vidyut Board
IPC	:	Indian Penal Code
IRS	:	Indian Risk Survey
MCD	:	Municipal Corporation of Delhi
MHA	:	Ministry of Home Affairs
MPD	:	Master Plan of Delhi
NDMA	:	National Disaster Management Authority
NDMC	:	North Delhi Municipal Corporation
NDRF	:	National Disaster Response Force
NIDM	:	National Institute of Disaster Management
NSSP	:	National School Safety Program
PESO	:	Petroleum and Explosives Safety Organisation
SMC	:	Surat Municipal Corporation
WHO	:	World Health Organization

Chapter 1

INTRODUCTION

1.1 BACKGROUND

Fire is among one of the early discoveries of humankind. It is believed to have been discovered in the Early Stone Age by our ancestors Homo erectus. The discovery of fire was the turning point for human evolution. Fire has always been an integral part of our daily lives since the primitive age. It acted as a source of warmth for early humans making their survival easy in harsh weather conditions that allowed them to settle in temperate areas from tropical and sub-tropical areas. It also acted as a source of light and an aid for protection from animals in the dark permitting them night-time activities. Some believed that fire initiated the sense of sharing and communal behaviour in early humans. Fire was also used for cooking bringing about a shift from raw food to cooked diet. The discovery of the fire led to the extraction of metals using smelting techniques and manufacturing of tools, weapons and machinery from the extracted metals. This results in succession to the Metal Age from the Stone Age.

Mythologies across the world depict the utility of fire. It is considered the strongest force in the universe and is often associated with divine origin. For instance, the Chinese and the Hebrews believed the fire to be a symbol of divinity, while it was considered as a symbol of superiority and control in Egypt. The ancient Greeks believed that Prometheus donated fire to the humans for civilisation by stealing it from the Gods. Worshipped as the God 'Agni' in Hinduism, fire signifies the primordial power to consume, transform and convey and forms a part of the "Panchabhuta" which is the basis of material existence. Fire is treated as a symbol of purity in many religions and mythologies. It is believed that fire and agricultural implements helped the early Vedic people to change from pastoral to agriculturists and laid the foundation of the Aryan civilization. Through the medieval and modern times, fire has helped human civilization to flourish and prosper.

While playing the role of harbinger of civilization as we know it, fire has also proved to be one of the most destructive phenomena known to humankind. Fire can be extremely harmful if not dealt with carefully. It can cause a huge number of deaths, injuries and property loss. As said, fire is a very good servant but a ruthless master. It can even adversely affect the environment and the ecosystem by generating a large amount of smoke pollution and releasing greenhouse gases. Such has been the destructive nature of fire, that it has been acknowledged in many religions like Christianity and Judaism as the wrath of God. The great Indian epics like Ramayana and Mahabharata depict fires (Lankadahana and Jatugriha respectively) as the turning point of the narrative,

which subsequently led to the conquest of good over evil. Fire is also symbolised as the sufferings of a person in Buddhism to depict the destructive nature of the fire.

The genesis of fire hazards in modern time is closely related to the Industrial Revolution. Prior to this, the pattern of the human settlements was scattered and dispersed. People used to live in their farms separated from each other by large fields and so the chances of spreading of the fire were remote in case of any fire outbreak. Fire outbreaks, then, was just a concern of individual families. During the industrial revolution, people started settling in urban areas in compact spaces that increased the risk of fire spreading in case of an outbreak. This changed the perception of fire outbreaks from individual concern to a threat for the whole community as a fire in any house or shop could burn the entire neighbourhood. With industrialization, the frequency of fires also started increasing due to the explosions and outbreaks in the factories and mills because of the failure of machinery and equipment.

Another type of fire hazards stem from wildfires or forest fires or bush fires, known differently in different areas. Forest fires are critical hazards, responsible for significantly affecting 1% of forests annually, on an average. About 35 million hectares of forest land in India are affected by fires annually, of which 95% have an anthropogenic origin (Satendra & Kaushik, 2014).

1.2 FIRE AS A PHENOMENON

Fire or combustion is defined as a "process involving rapid oxidation at elevated temperatures accompanied by the evolution of heated gaseous products of combustion and the emission of visible and invisible radiation" (www.firesafe.org.uk). Early research on combustion identified three pre-requisites to starting a fire, collectively termed as Fire Triangle. However, recent research points to a fourth element viz. chemical chain reaction, explained by the Fire Tetrahedron, as shown in Figure 1.1. It also demonstrates the interdependence of these ingredients in creating and sustaining fire and teaches us that removing any one of these elements would prevent or extinguish the fire.

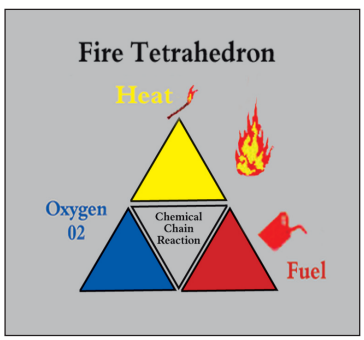


Figure 1.1: Diagrammatic representation of Fire Tetrahedron

Fuel: For a fire to start there must be a material to burn — and this is referred to as the fuel. Fuel is any kind of combustible material, including paper, oils, wood, gases, fabrics, liquids, plastics and rubber. The fuel for a fire is usually characterised by its moisture content, size, shape and quantity and this will determine how easily the fuel will burn and at what temperature.

Heat: In addition to a fuel source, heat must be present for ignition to take place. All flammable materials give off flammable vapours which combust in the presence of heat. Heat is also responsible for the spread and continuation of fire as it removes the moisture from nearby fuel, warming the surrounding area and pre-heating fuel in its path, enabling it to travel and develop with greater ease.

Oxidiser: In addition to fuel and heat, fires also need oxygen to stay alight. Ambient air is made up of approximately 21 percent oxygen and, as most fires only require at least 16 percent oxygen to burn, it acts as the oxidising agent in the chemical reaction. This means that when the fuel burns, it reacts with the oxygen to release heat and generate combustion.

Chemical Chain Reaction: It is described as a series of reactions where the products of the initial reaction contribute to another reaction as reactants. This process of continuous transformation allows a reaction to continue with little outside influence (University of Calgary, 2018).

1.3 FIRE AS HAZARD

Fire is one of the most common risks worldwide that is present in all areas of life. It can occur in workplaces, factories, industries, residential area, areas of mass gathering, etc. It has been identified as one of the major hazards in the United Nation Global Assessment Report 2018.The Emergency Management Division of Washington has defined fire as "*uncontrolled burning in a residence or building from natural, human or technical causes*" (Emergency Management Division – Washington, 2002). The National Disaster Management Authority (NDMA) of India has also identified fire as a human-induced disaster. Approximately 1.5 deaths per 100,000 persons due to fire hazards have been reported globally in the year of 2017, while the total number of incidents reported in the same year is around 3.1 million (Centre of Fire Statistics, 2019).

Fire is considered the deadliest hazard because of its side effects apart from burning. It depletes oxygen from the surrounding event and most of the victims in a fire die of asphyxiation due to smoke and lack of oxygen. There could be release of toxic gases from burning of materials due to fire that cause choking of lungs and breathing problems for the victims. In addition, the heating effect of fire results in expansion of liquids, gases and various metals, which often lead to explosions and bursts.

1.3.1 General Causes of Fires

Fire is the oldest technology invented by man and has played a crucial role in evolution of human civilization. The use of fire is so widespread today that most of our energy is produced by controlled fires, which subsequently produce the maximum pollution (Centre for Fire and Hazard Science, University of Central Lancashire). However, fires are quick to become conflagrations and disasters.

Most uncontrolled fires are caused due to relatively simple incidents. For instance, the Great London Fire of 1666 is known to occur from an unattended oven in a bakery. The most common causes of fire disasters can be classified into the following:

i) **Faulty appliances and leads**: Faulty equipment and weak wiring cause large number of fires in homes, offices and other establishments. The fire incidents in commercial and institutional buildings are mostly attributed to faulty electrical wiring, short-circuits, failure of electrical equipment, etc. (www.fireco.uk).

ii) **Faulty fuel supply/leak**: Leakage in gas/fuel supply lines cause fires which prove to be difficult to subdue. They may also be caused by acts of arson.

iii) **Misuse of equipment or appliances**: Unattended cooking utensils, use of flammable materials for interiors and furniture are major causes of fire outbreaks. Placing flammable articles too close to heat may cause overheating and fires. Fires due to bursting of cooking gas cylinders are also common in commercial complexes with kitchens, restaurants or cafes.

iv) **Human error/arson**: Human actions like smoking, negligent actions like overcharging and overheating of electrical appliances, lack of knowledge of correct procedures for use of flammable materials cause fires to occur with regular frequency. High density urban living then acts as a catalyst to spread the fire.

v) **Natural and climatic causes**: Natural weather phenomena like lightning, extreme heat with low humidity cause fires. Lightning may cause forest fires, which may then spread to inhabited areas. Conversely, human-induced fires can also start forest fires. It is estimated that the bush fires of Australia of 2019-20 has destroyed more than 46 million acres, among which 80% of the Blue Mountains World Heritage and 53% of the Gondwanaland World Heritage areas were destroyed. The general loss estimates are 1.3 billion USD of insured claims in addition to huge loss of biodiversity, fauna and livestock (www.disasterphilanthropy.org). Earthquake induced fires or those caused by volcanic eruptions are other fires caused by natural causes.

vi) **Accident/collision related fires**: Vehicular accidents or collisions may cause local fires which may then spread to other areas. Mine fires are also accidental fire disasters.

1.3.2 Fire Hazards during Ancient Period

The fire outbreaks in built settings had been common from the ancient time itself. Many of the major cities even have been largely burnt to the ground,

and some have been burnt repeatedly. Constantinople, which is now known as Istanbul, has been burned nearly 5 times within the period of 406 – 1204 (Danelek, 2011). The reasons behind such outbreaks were mostly natural which got aggravated due to poor construction techniques, extensive use of flammable materials like wood, and lack of fire-fighting systems. The Great Fire of Rome in 64 AD is another incident of urban fire in the ancient period. The fire began, according to the Roman historian Tacitus, in a shop where flammable goods were stored on the night of July 19. The city kept burning for five and a half days leading to the destruction of 10 out of 14 districts of Rome.

1.3.3 Fire Hazards during the Medieval Period

During the transition from the ancient period to the medieval period, there has also been a change in the nature of the causes of fire hazards. While the fire outbreaks in the Ancient Period were mostly triggered by natural factors, the reasons behind fire outbreaks in the medieval age were use of highly flammable materials, poor design and construction techniques and the unavailability of technologically advanced fire-fighting equipment. The city of London, like Constantinople, is another city that has faced repeated fire outbreaks. The city has been known to get burned at least half a dozen times between the year of 1130 CE and 1666 CE followed by Ratcliff Fire in 1794 and Tooley Street Fire in 1861 among the major ones. With the beginning of industrialization in the 18th century, the frequency of fire outbreaks further started increasing. The mills and factories were often found to have fire outbreaks due to faulty machinery and equipment. Industrialization also led to the growth of poor-condition workers housing near the factories aggravating the fire risks.

Cases of Repeated Fire Outbreaks during Medieval Period

1. Amsterdam (1421 and 1452)
2. Copenhagen (1728 and 1795)
3. Moscow (4 times between 1547-1812)
4. New York City (1776 and 1835)
5. New Orleans (1788 and 1794)
6. London (more than 6 times during 1130-1666, 1794 and 1861)

1.3.4 Fire Hazards during the Modern Period

In the post-industrialization period, the vulnerabilities to fire hazards have become more complex because of the rapid and unplanned urbanisation over the world. The structural irregularities, unpreparedness, violation of safety norms, inaccessibility, etc. are the current vulnerabilities that need to be reduced. Around 21.9 percent of the urban fires across the globe are reported to be structural fires (Centre of Fire Statistics, 2019). The fire outbreaks in the modern period also cause

Major Historic Fire Outbreaks after 18th Century

1. Peshtigo Fire in 1871
2. Chicago Fire in 1871
3. Boston Fire in 1872
4. San Francisco Fire in 1906
5. Halifax Fire in 1917
6. Tokyo Fire in 1923
7. Texas City Fire in 1947

huge economic losses. The Boston Fire of 1872 is such an incident and it was declared America's most expensive fire hazard in terms of property damage. Exposure of more people to fire hazards due to urbanisation further adds to the complexities. Fire, if coupled with natural hazards, can get highly destructive and cause complex emergencies. The fires triggered by the Kobe Earthquake in 1995 resulted in more loss than the earthquake itself. The earthquake caused more than 6000 deaths, while 148 separate fires destroyed 6513 buildings (www.nfpa.org)

1.4 FIRE HAZARDS: GLOBAL SCENARIO

The occurrence of fire hazards has become an area of concern for both the developed and developing nations. According to the International Association of Fire and Rescue Services, *Comité Technique International de prevention et d'extinction de Feu* (CTIF), an average of 3.5 million fire incidents has been reported annually at the global level during the year of 2013 to 2017. The World Health Organisation (WHO) reported in 2016 that there are around 71 countries that have more than 300 deaths per year due to fire, heating and hot substances (Centre of Fire Statistics, 2019). Figure 1.2 illustrates the country-wise distribution of annual deaths due to fire. The United States alone has reported 1.3 billion fire incidents in the year 2017 topping the list of countries with maximum fire outbreaks, followed by Italy and France with 0.33 billion and 0.31 billion fire outbreaks respectively (Centre of Fire Statistics, 2019). The United States has also reported property damage of 23 billion USD in the year 2017 (Evarts, 2018). Figure 1.3 lists the countries with the highest number of fire outbreaks in the year 2017.

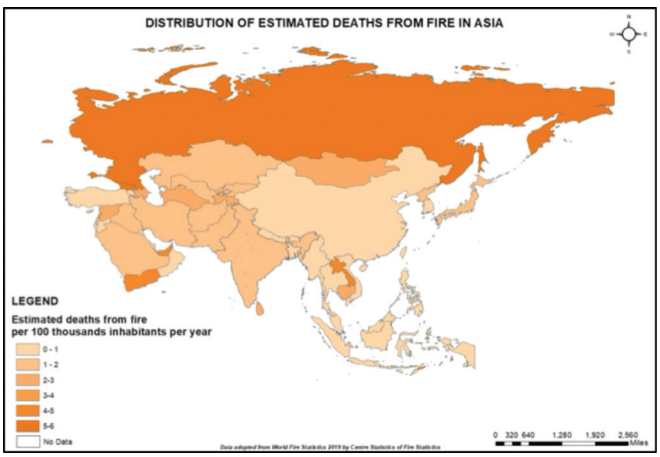


Figure 1.2: Distribution of estimated deaths from fire, heat and hot substances per 1000 inhabitants as reported by the World Health Organisation (WHO)

Source: (Adapted from Centre of Fire Statistics, 2019)

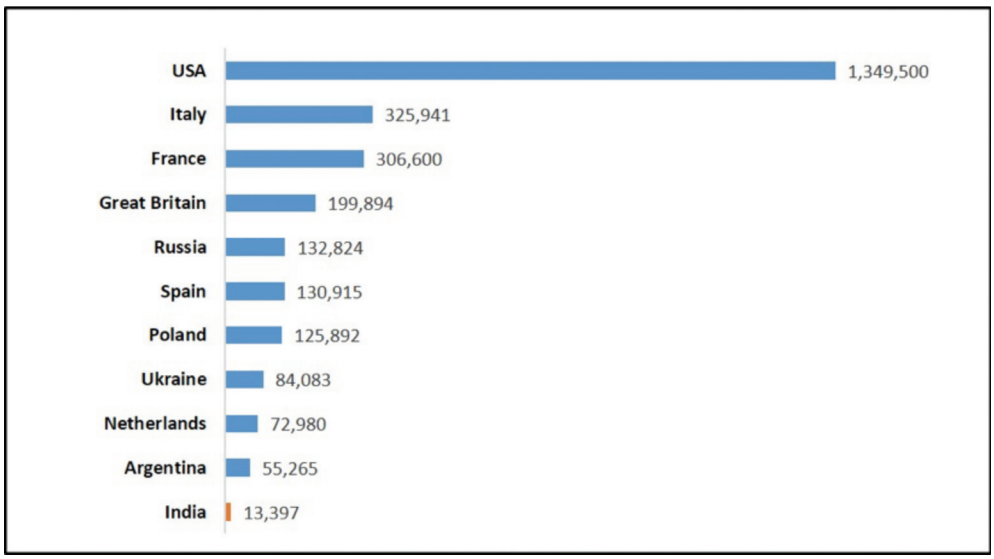


Figure 1.3: Number of fire incidents in the year 2017

Source: (Centre of Fire Statistics, 2019)

Note: *The above chart is based on the data provided by the national governments to the International Association of Fire and Rescue Service (CTIF). Many of the countries failed to give their recent data to the CTIF.*

According to the 2019 report of the CTIF, Russia has witnessed 7,816 deaths and 9,355 injuries in the year of 2017. The United States has reported 3,400 deaths in 2017, which is just 1 death per 100,000 persons. In spite of the highest number of fire outbreaks and huge property damage, the fatality rate is low pointing to the preparedness measures taken by the nation. This shows that preparedness actions can prevent fire hazards from becoming fire disasters. Figure 1.4 shows the countries with the highest number of deaths recorded per 100,000 persons according to the data provided by the administrative authorities of the countries to CTIF.

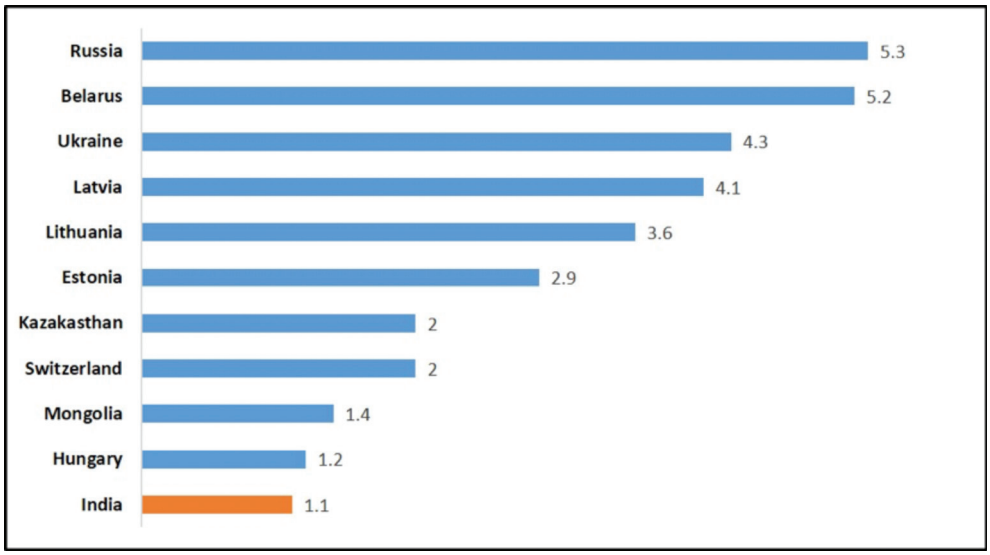


Figure 1.4: Graph showing the highest number of deaths per 100,000 persons recorded in the year 2019

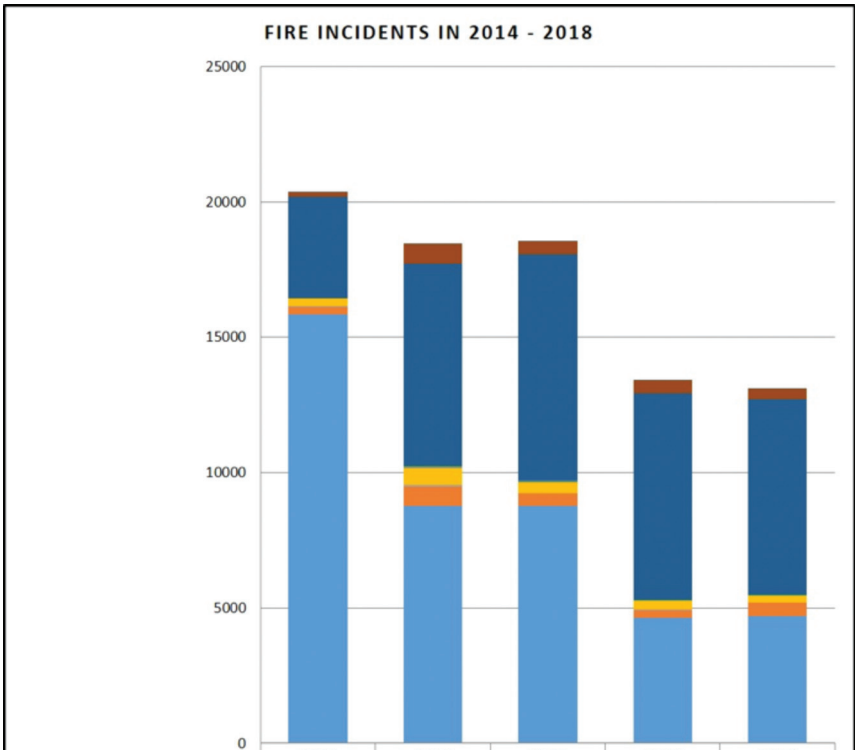
Source: (Centre of Fire Statistics, 2019)

Note: *The above chart is based on the data provided by the national governments to the International Association of Fire and Rescue Service (CTIF). Many of the countries failed to give their recent data to the CTIF.*

1.5 FIRE HAZARDS: INDIAN SCENARIO

Fire is one of the most frequently occurring disasters in India, especially in the hot dry summer months. The country has been a victim of fire incidents numerous times across all states. The urban areas, especially the towns and cities, along with the factories and industries are extremely vulnerable to fire. The highest number of deaths in the country is due to fire hazards. Around 83,872 fire incidents have been recorded in India during the year 2014 to 2018 (Ministry of Home Affairs; Department of States; National Crime Records Bureau, 2018).

Figure 1.5 shows the number of fire incidents reported in the year of 2014 and 2018.The state-wise distribution of fire outbreaks for the year 2018 reveals that the highest number of outbreaks have been witnessed in Madhya Pradesh (1,992 outbreaks) followed by Maharashtra (1,888 outbreaks) and Gujarat (1,172 outbreaks) as illustrated in Figure 1.6.



	2014	2015	2016	2017	2018
School Buildings	12	10	21	6	7
Commercial Buildings	179	716	463	446	367
Residential Buildings	3736	7493	8359	7660	7241
Government Buildings	11	35	48	13	24
Mines	4	25	28	26	13
Factories	286	622	404	311	235
Accidental Fire in Trains	13	58	8	8	9
Accidental Fire in Vehicles	288	719	458	286	502
Others	15848	8772	8772	4641	4701

Figure 1.5: Graph showing the number of fire incidents reported in the year from 2014-18

Source: (Ministry of Home Affairs; Department of States; National Crime Records Bureau, 2018)

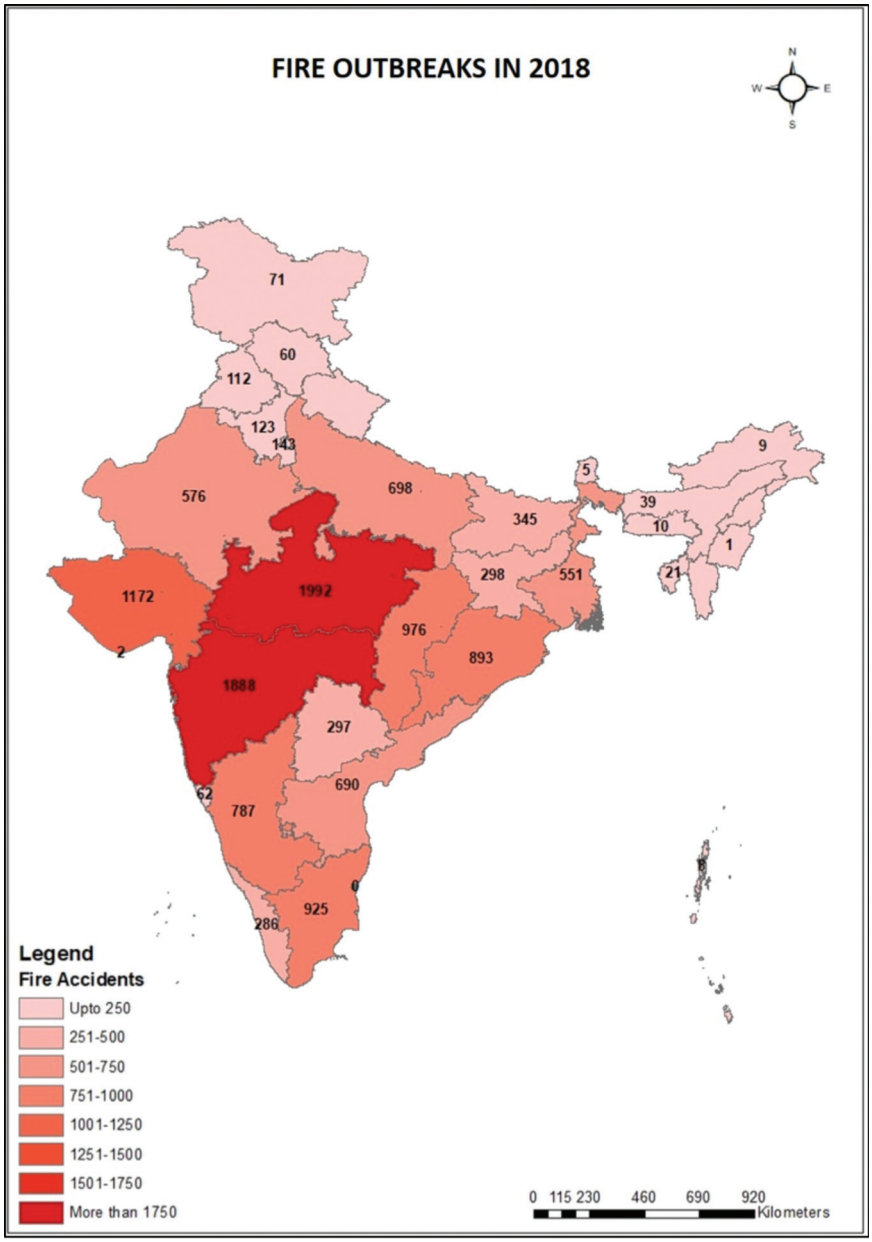


Figure 1.6: Map showing the state-wise distribution of fire outbreaks in the year of 2018

Source: (Ministry of Home Affairs; Department of States; National Crime Records Bureau, 2018)

India, as a nation, has witnessed a large number of deaths due to fire hazards over the last few years. The Accidental Deaths and Suicides in India (ADSI) Report of 2018 reveals that 13,099 cases of reported fire accidents caused 12,748 deaths and injuries to 777 persons. Figure 1.7 shows the number of fire deaths recorded in India during 2013 to 2018, which though decreased but still requires preventive measures to reduce such occurrences.

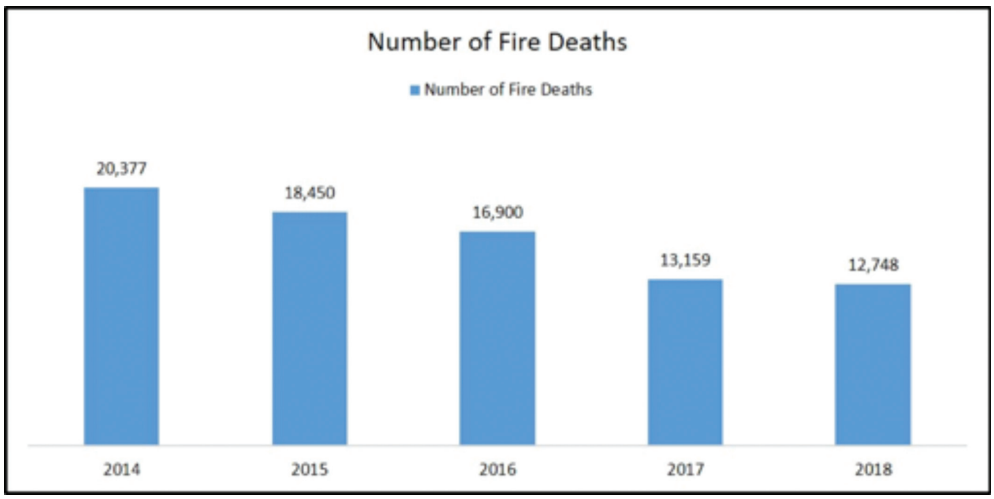


Figure 1.7: Graph showing the number of deaths caused due to fire during 2014-18

Source: (Centre of Fire Statistics, 2019)

India Today reported in June 2018 that the city of Mumbai has seen 12 major fire outbreaks in the period of January to June 2018 resulting in 22 deaths and several injuries. Mumbai was also witness to the devastating Kamal Mills Fire Tragedy on 29th December, 2017 and the several fire incidents that happened after that like Crystal Tower Fire in August 2018, Cama Industrial Estate in April 2019, MTNL Tower fire in August 2019 among others. The case of other metro cities is no different. The National Capital Territory of Delhi witnesses on an average of 2 to 3 serious fire incidents every year, the recent being the Karol Bagh Hotel Fire resulting in deaths of 17 people. The Delhi Fire Service (DFS) has attended 27,089 calls during the financial year of 2015-16. Figure 1.8 shows in detail the number of fire calls received by the DFS from the year 2003 to 2019. The National Capital has faced a loss of 3.27 billion rupees from 2003 to 2009 because of fire outbreaks. The deaths and injuries caused by the fire outbreaks during the period of 2003 to 2016 have been shown in *Figure 1.9*.

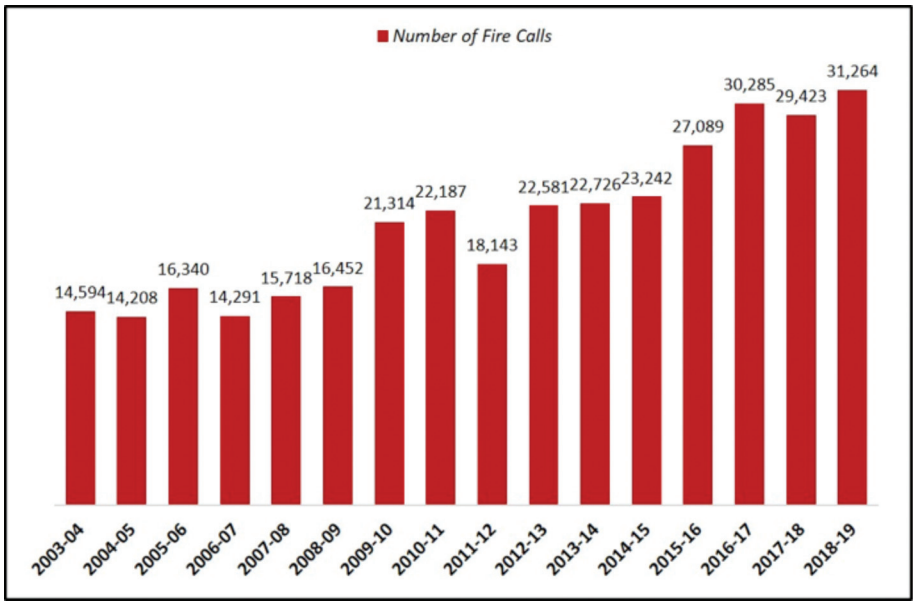


Figure 1.8: Number of Fire Calls received by the DFS from 2003 to 2019

Source: (Delhi Fire Services, 2020)

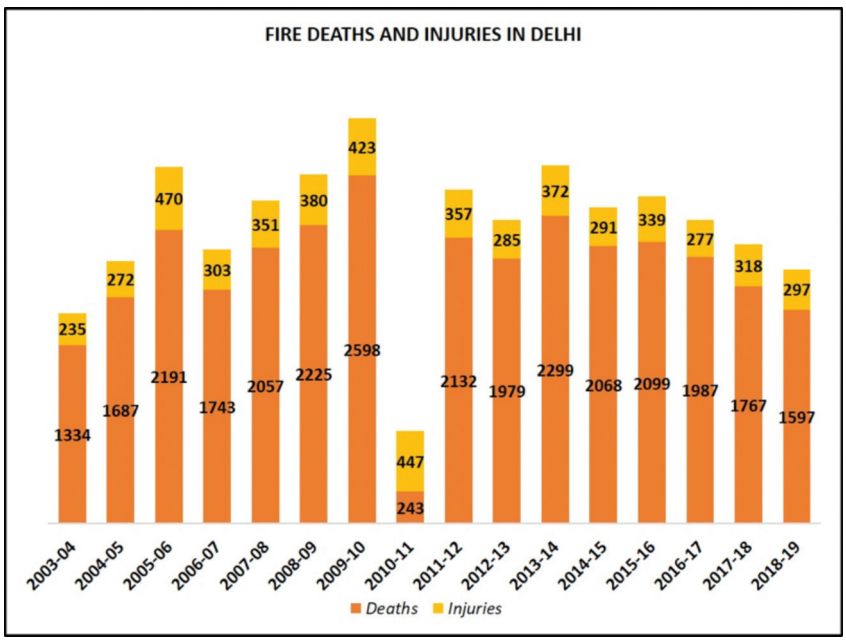


Figure 1.9: Deaths and Injuries caused by fire outbreaks in Delhi during the period of 2003 to 2019

Source: (Delhi Fire Services, 2020)

Kolkata is already famous for its tinderbox pockets and structures after the repeated serious fire outbreaks in Stephen Court in 2010, AMRI Fire in 2011, Surya Sen Market Fire in 2013 and Bagri Market Fire in 2017. Bangalore has the third-highest number of deaths (132 deaths) in the country after Kanpur (147 deaths) and Allahabad (134 deaths) among the major cities monitored by National Crime Record Bureau (NCRB) (Sengupta & Pandey, 2019). All the six metros along with 14 non-metros, had recorded 81 percent of deaths due to building fire in the year of 2015. The Pune Fire Brigade Services for example, received 4,100 calls in 2015 due to fire and burns, electrical short-circuit and leak of gas and oil. Figure 1.10 illustrates the number of calls received by Pune Fire Brigade Services.

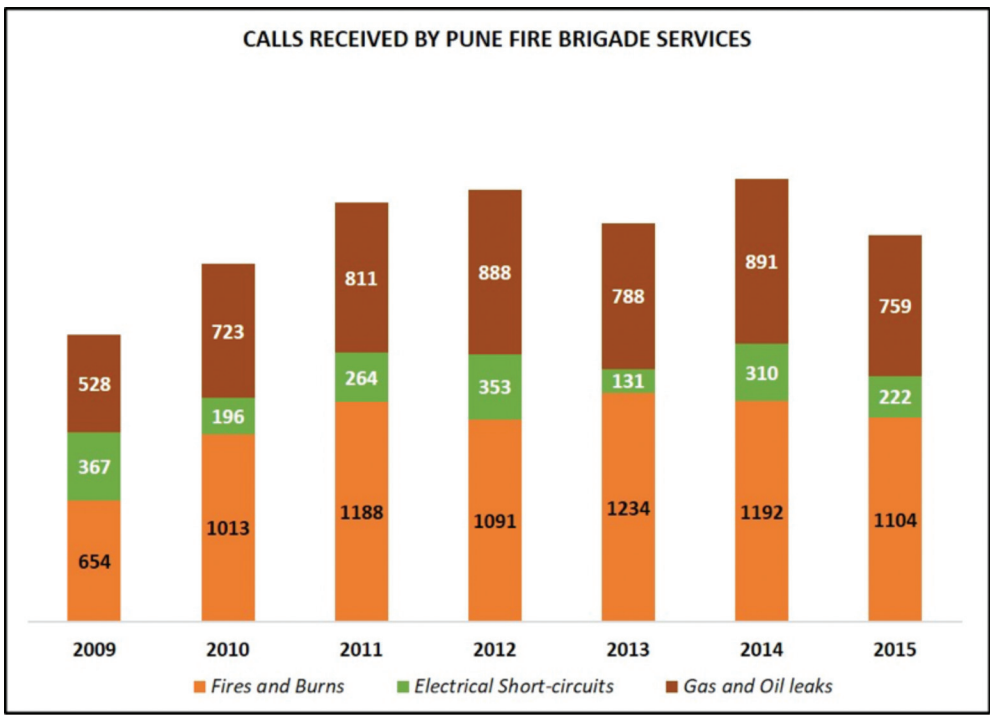


Figure 1.10: The number of calls received by the Pune Fire Brigade Services from the year of 2009 to 2015

Source: (Pune Fire Brigade Services)

Among the Indian States, Madhya Pradesh witnessed 1,986 fire deaths, which was the highest in the year of 2018, followed by Maharashtra and Gujarat with 1,896 and 1,194 fire deaths respectively, as illustrated in Figure 1.11.

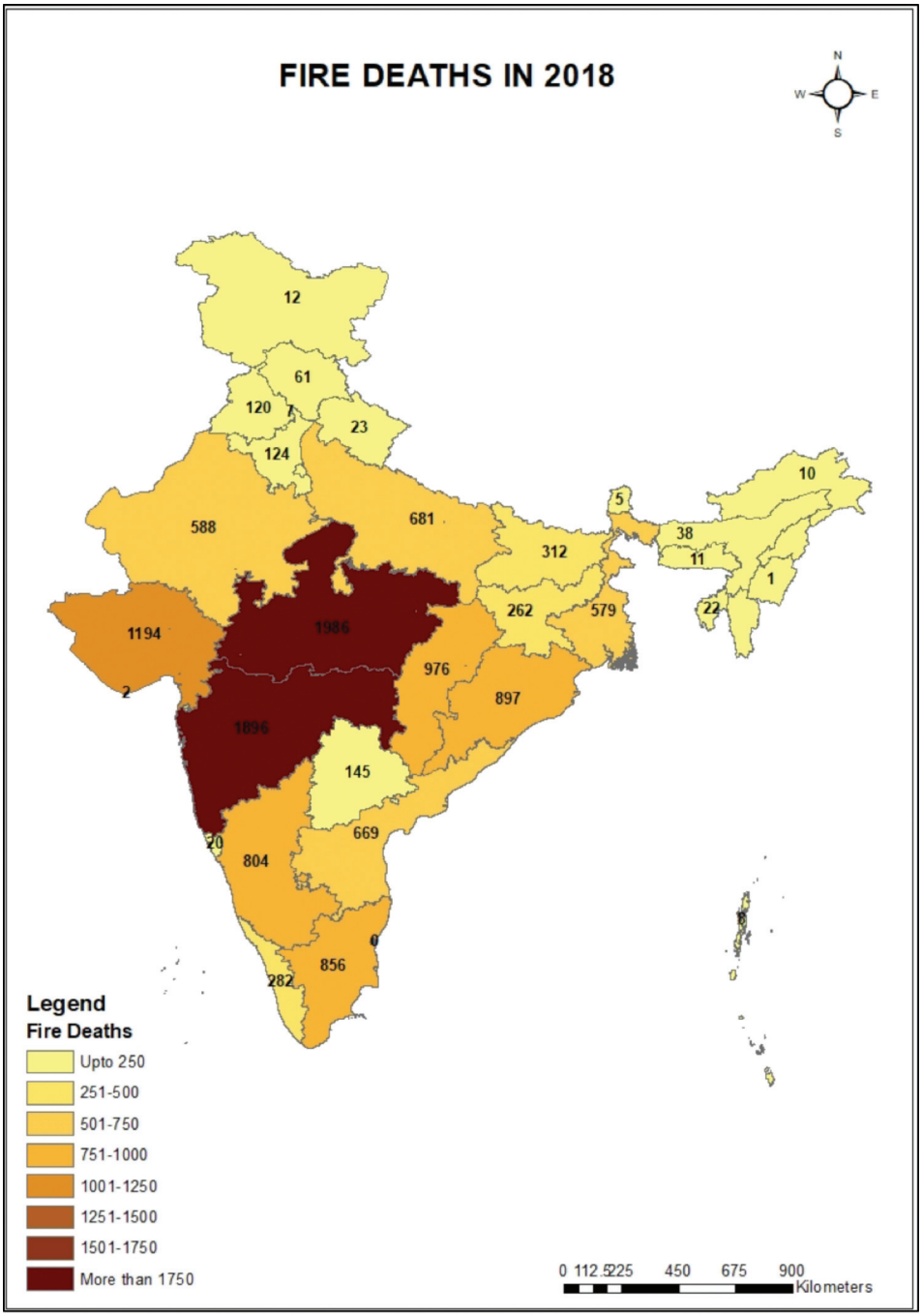


Figure 1.11: Map showing the state-wise distribution of fire deaths in the year of 2018

Source: (Centre of Fire Statistics, 2019)

The economic losses caused by fire incidents are huge. The incidents of fire outbreak have been a serious concern for many of the urban livelihood sectors as it stalls the business for days. The India Risk Survey (IRS) in 2018 has declared fire outbreak as the third largest threat to business continuity while it was found at the eighth position in terms of risk in IRS 2016 (Sengupta & Pandey, 2019). For instance, the losses incurred due to the Bagri Market Fire at Kolkata in September 2017 had been estimated to be around 20-25 crore rupees while hampering the livelihood of nearly 5,000 people.

1.6 URBANISATION AND INCREASING FIRE RISKS

With increasing population, rapid urbanisation has become a concern for the developing and underdeveloped nations. Rapid and unplanned urbanisation, predominant especially in Asia and Africa has resulted in development of poor-quality housing, unauthorized and illegal constructions, encroachment, poor wiring, use of old and obsolete machinery, etc. increasing the vulnerabilities to multiple hazards. Concentration of population and activities in urban areas lead to vulnerable conditions and exposure to various hazards, including fire. The high density of urban settlements resulting in narrow and constricted circulation spaces also adds to the urban fire vulnerabilities. Tightly packed dwelling units in slums and squatter settlements are high risk areas in cities. Slums are often made up of flammable materials and cheek-by-jowl tenements, a small fire can become a conflagration in no time. The narrow alleys hinder quick response to the fires. Slum fires are a common occurrence in the hot dry summer months in India every year. The high use of electrical equipment and machinery in urban areas leads to higher chances of faulty electric connections and gadget failures amplifies the risks further. Urban fires therefore occur in complex risk settings, with one or more factors coming in to play simultaneously. According to a report by the Ministry of Home Affairs (2012), there is a considerable gap in operational capabilities of fire and emergency services in Indian cities. It states that there is a requirement of 1347 fire stations in urban areas and 4272 in rural areas leading to an overall gap of 65% at the national level and 31% in urban centres. The report identifies a gap of 67% in vehicles and 89% in special equipment in urban areas. This is significant as growing high-rises in urban areas necessitate procurement of specialised equipment for fire fighting.

1.6.1 Rationale for Case Studies

India, being a rapidly urbanising nation, is facing increasing risks of fire disasters. The nation loses a huge number of human lives, property and resources due to fire hazards every year. Urban fires that start in the aftermath of a disaster as in post-earthquake fires have a compounding impact on the communities. With increasing number of fire accidents, it is the need of the hour to be aware of and reduce the fire risks in our surroundings. The authorities, institutions and

other civic bodies should learn from the mistakes of the previous incidents and get prepared to deal with their shortcomings.

Each disaster provides us with lessons to prevent future occurrences. With an aim to identify and record comprehensive insights about the underlying causes of the fire incidents in the country, seven fire incidents of different categories have been selected for this study. The categories of fire incidents that have been covered in this study are fire outbreaks at places of mass gathering like cinemas, commercial complex, hospitals, coaching centres, and business district. The primary aim has been to critically examine fire incidents in places with high footfall and vulnerable people. The case studies examined are the Dabwali Fire Tragedy of 1995, the Uphaar Cinema Fire of 1997, the AMRI Hospital Fire of 2011, the Sivakasi Factory explosion of 2012, the Kolkata Market Fire of 2013, the Puttingal Devi Temple Fire of 2016 and the Surat Fire of 2017. Each study has aimed to highlight the lacunae and the lessons that can be learnt from each of those incidents to avoid such disasters in future.

Chapter 2

DABWALI FIRE

Incident	**Dabwali Fire**
Location	**Rajiv Marriage Palace, Dabwali, Haryana**
Date/Time	**23rd December, 1995, 1:45 pm**

2.1 INTRODUCTION

Mandi Dabwali is a Municipal Committee town located in Sirsa district of Haryana. It is located on the border between Haryana and Punjab. According to the Census report of 1991, the Municipal Corporation had a population of 36,197. The town is also known for manufacturing and marketing of modified open jeeps.

Rajiv Marriage Palace located in Chautala Chowk, Mandi Dabwali was the venue chosen by the DAV Centenary Public School, which was known to be a leading educational institute in the state, for hosting its Annual Prize Distribution function. The DAV College Managing Committee then used to supervise over 650 colleges and institutions. High walls surrounded the three sides of the venue and the fourth had a row of rooms (Refer Figure 2.1). It consisted of a temporary canopy, which had a steel superstructure with GI sheets on top and a false ceiling supported by bamboo sticks partially covering three of its sides. The entire ceiling was made of cotton clothes and thick cotton curtains covered the sides. There were two exit gates for the complex, one of which was locked for school VIPs. The floor of the venue was covered with coir mats and the chairs in the venue had plastic netting. As per the charge sheet submitted by the Central Bureau of Investigation (CBI), 12 electrical circuits were provided to the canopy. The alleged frequent power tripping had led the owners of the venue to arrange two generator sets for uninterrupted power supply. (Refer Box 2.1)

2.2 THE EVENT/DISASTER

2.2.1 Description of Event

On December 23, 1995, DAV School was hosting its annual day function at Rajiv Marriage Palace at Dabwali in the state of Haryana. The setup was a temporary tent, which had a capacity of 400 people. However, on a particular day, the venue housed over three times the actual capacity with over 1200 invitees.

According to eyewitnesses, the fire broke out around 1:45 pm to the right of the single exit. The alleged cause of the fire was an electrical short-circuit. Soon, the synthetic material, which covered the top (the kind that sticks to the skin once melted) of the tent, began collapsing from the fire. This trapped under it the people who had gathered for the function. Many people rushed towards the only escape route that had to be forced open (the other having kept locked for VIPs). The resultant stampede led to several losing their lives.

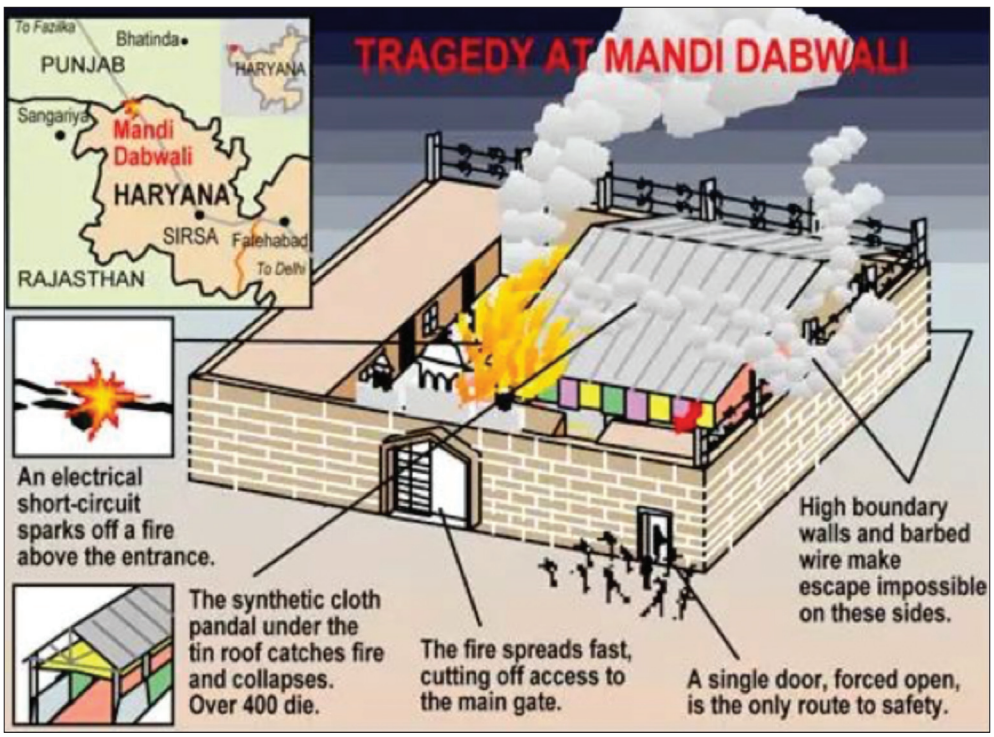


Figure 2.1: Dabwali Tragedy

Source: (Retrieved from https://smedia2.intoday.in)

Since the fire engulfed the area with immense speed, only around 500 out of the gathered people of over 1200 could manage to escape through the exit. Within about seven minutes, the whole place was gutted. The ones who were trapped inside were either charred to death or suffered from severe burns/ injuries that either made them disfigured beyond recognition or led to the amputation of their limbs.

Box 2.1: Lighting arrangements as described in CBI charge sheet

"The pandal was provided with 12 electrical circuits through the switch board installed in the switch room towards eastern side. There were 25 jhumar lights with electric bulbs of 100 watts each hanging from the false ceiling of the pandal. Beside, two halogen lights over the stage and other 2 halogen lights near the entry/exit gate of the pandal were also fixed. Due to frequent power tripping in Dabwali, the owners of the Rajiv Marriage Palace (pandal) had arranged two generator sets to ensure uninterrupted power supply at the function on 23.12.1995 in the Pandal. The switchboard fitted in the switch room of the premises had been provided with the arrangements of power supply from HSEB (Haryana State Electricity Board) as well as from the generators. In addition, the lighting arrangements inside the pandal also include an arc light in crude form fitted with two carbon electrodes and a reflector fitted above the first ceiling near the central portion of entrance gate facing the dais. Accused Rajender Kumar and Devi Lal of M/s ChachaBhatija Light Service were deployed for managing the electrical arrangements, operating generators etc. on the day of function i.e. on 23.12.1995. Besides, a number of temporary/loose connections were also provided in the pandal on the date of function by Rajendra Kumar and Devi Lal by tampering with the electrical fittings inside the pandal".

2.2.2 Impact/Loss

The fire resulted in 446 deaths and nearly 200 burn injuries (Punjab & Haryana High Court, 2009). It is reported that one percent of the population of the town had perished in the incident (NDTV, Jan 2013). The majority of the lives claimed were of children and the parents who had accompanied them for the function.

As the people inside were forced to escape through the single exit, the resultant stampede claimed the lives of several children. Limbs crushed by the stampede and amputated, faces disfigured beyond recognition by burns, other severe disabilities were the major human impacts of the disaster (See Box 2.2).

2.2.3 Response/Rehabilitation

Even though the fire-fighters had reached the spot around 2 pm, the fire had doused itself after charring everything in its way. The water was hence put to use to comfort the burning bodies.

Despite the intensity of the incident, it is alleged that there was a lack of civil machinery. As the local administration was in dismay following the death of the area sub-divisional magistrate in the incident, voluntary organisations were left to handle the relief manoeuvres. The people of Dabwali also supported relief operations. Telephone booths were open to all people; fuel was made available in petrol pumps, and medicine distributed by the pharmacies free of cost.

Figure 2.2: The remains of chairs after the incident.

Source: (https://www.tribuneindia.com)

Manav Seva Sanstha, a voluntary organisation had its members gathered at hospitals to donate blood. Privately owned automobiles were made accessible in the Community Health Centres (CHCs) for those who wanted to take bodies out of the incident site. Farmers from neighbouring areas also came in with their trackers loaded with logs required for the pyres. It was an example of the regions spirit of resilience when K. K. Sethi, the president of the Dabwali Citizens' Forum himself was involved in the relief activities even after losing his own sister-in-law and two nieces to the incident (India Today, Jan 1996).

Box 2.2: Testimonials of Survivors

"It was all over in minutes. The fire started at the main entrance and spread along the cables – like lightning."

—M.P. Bidlan, Deputy Commissioner, Sirsa. (India Today, Jan 1996)

(Mr. Bidlan was on the stage as the Chief Guest for the function and among the first to witness the fire)

"I have 100 per cent disability and I am still working... There are people who are living without any limbs... Life will go on... Life was there before this incident and remained after it as well and it will continue for thousands of years... The world will never stop... Problems do come."

—Umesh Gupta, Survivor (NDTV, 2013)

(Umesh was hardly 12 years old when he lost both his hands in the incident)

"Till date, our family has received a total of Rupees 11 lakh as compensation, including the death claims of my mother and brother. The money was provided three years ago. We are still struggling to get the second instalment."

—Anmol Parihar, 21 (Hindustan Times, 2013)

(Anmol was a nursery student in 1996 and suffered 64% disability in the incident. Her mother and brother had lost their lives on the spot)

"I was in class 5 at that time. I have done B.Ed. now and cleared the state teacher's eligibility test, but I am still struggling to get a job. Also, my marriage prospects have been shattered because of my disfigurement,"

—Suman Kaushal, 28 (Hindustan Times, 2013)

(Suman is 100% disabled and has undergone over 40 surgeries.)

2.2.4 Aftermath

At the dawn of December 24, families and relatives rushed to CHCs to identify the bodies. Funeral pyres in dozens were arranged in the adjoining field in addition to the cremation ground, which could not house more.

The Punjab and Haryana High Court in November 2009 decided on a sum of Rs. 46 crores along with interest to be paid as compensation to the victims. Out of this, 45% was to be paid by the government, and 55% by the DAV managing committee.

Figure 2.3: The Dabwali Fire Tragedy Memorial Gate
(This was built in memory of the people who lost their lives in the incident)

Source: (https://indianexpress.com)

2.3 LESSONS LEARNT

The lessons learnt from Dabwali Fire disaster needs to be examined so that future events like these are avoided. The contributing factors need to be examined for identifying the preventive actions required

i) **Unauthorized construction and lack of enforcement of guidelines for temporary structures**: The owners of the halls had themselves claimed that the set up was temporary and hence do not require licenses. According to the then State Home Secretary too, there was no provision to regulate such structures. However, the Bureau of Indian Standards first published codes of practice for fire precautionary measures in temporary structures and pandals for public use in 1978, which were subsequently revised and issued in 1993 (IS 8758:1993) and 2013 (IS 8758: 2013). The *Fire Precautionary Measures in Construction of Temporary Structures and Pandals: Code of Practice (IS 8758:2013)* has detailed guidelines on construction on design and construction of pandals for public use. Lack of enforcement of available codes and standards was a primary contributor to the catastrophic fire. Various State Governments like that of West Bengal, Assam, Andhra Pradesh etc., have developed special guidelines for the setting up of pandals during religious festivals. A comprehensive NOC from Police w.r.t security and fire is required to be taken from Delhi Police in the National Capital.

ii) **Use of flammable Materials**: It is reported that highly flammable material was used in the construction of the tent. The materials were such that the fire spread quickly and the material would stick to the skin once melted. Most of the fire outbreaks are worsened by the excessive use of highly flammable materials. The available IS Code should be enforced strictly while erecting such structures.

iii) **Invitations that exceeded the venue capacity**: The venue had a capacity of only 400 persons; however, the school authorities had invited over 1200 persons who came to attend the function. This complemented by the single exit led to the stampede thereby claiming several lives. IS 8758 (1993 and 2013) provide guidelines on the capacity of temporary structures and pandals. The capacity of such temporary structures should not exceed the norms in current practice.

iv) **Violation of safety norms**: As per the report of the one-man Commission of Justice T.P. Garg appointed for an inquiry into the incident, the owners had not acquired the No Objection Certificate from the Fire Officer and had occupied the building without the sanction of the Municipal Authorities. In addition to this, there was no provision of fire-fighting equipment before the venue was put to use.

v) **Negligence of Authorities**: The Fire Officer of the Municipal Committee had also not cared to investigate as to whether the owners had obtained the No Objection Certificate or had the required fire-fighting equipment.

vi) **Violation of Electricity Norms**: In addition to this, in the investigations by CBI, it was found that the venue was consuming over 11.15 KW load as against the sanctioned load of 5.980 KW. The overloading of electrical circuit is a major issue in our country. A special division for regular inspections could be formed in all the electricity boards.

6 CAPACITY

6.1 The Capacity of any temporary structure or pandal or enclosure for outdoor assemble shall be the number of fixed seats plus an allowance of one person for each 0.50mΛ of floor area designated or used as standing space or for movable seats. A distance of 450 mm along any undivided bench or platform shall constitute one seat in computing capacity. The floor area or ramps, aisles, passageways or spaces within such structures of enclosures used for access or circulation shall not be considered in computing the capacity of a place of outdoor assembly, and shall not be used for access or circulation and shall not be considered in computing the capacity of a place of outdoor assemble, and shall not be used for seats or for standing.

Source: IS 8758:2013

vii) **Lack of dedicated Burn Units**: Availability of dedicated burn units are limited to larger hospitals in large cities. Even these are not equipped to treat large number of patients from a big fire incident. This compromises quick medical response, leading to loss of greater number of lives.

2.4 IMPLICATIONS ON POLICY AND PRACTICE

There were no provisions in the then existing municipal laws that allowed or regulated the construction of marriage halls similar to the Rajiv Palace. As an aftermath of the incident, the then Chief Minister Shri Bhajan Lal promised regulatory measures such as by-laws and safety guidelines for such halls. The high-level inter-departmental committee was set up by the then government to formulate these by-laws. An ex-gratia payment of Rs.1 lakh and Rs. 50,000 each to the families of the deceased and those who lost a limb respectively was ordered along with free treatment to those who suffered injuries.

The Directorate General, NDRF and CD (Fire), Ministry of Home Affairs, had commissioned a study on Fire Hazard and Risk Analysis, Infrastructure and Institutional Assessment, and Key Recommendations which identified the fire risks in the country and highlighted the gaps in fire infrastructure. The National Disaster Management Authority (NDMA) issued Guidelines on Scaling, Type of Equipment and Training of Fire Services. The National Disaster Management Division under the Ministry of Home Affairs (MHA) along with National Institute of Disaster Management (NIDM) has published a Handbook on School Safety in 2004. The Government of India (GoI) then approved the National School Safety Program (NSSP) in June 2011 as a consequence of the Dabwali Fire Tragedy followed by Kumbakonam School Fire in 2004. The NDMA and the NIDM have jointly developed a Training Module for Master Trainers on School Safety in the year of 2015. The NDMA, under the provision of NSSP, has also come up with policies and implementation guidelines on School Safety in 2016. In addition, guidelines for "Managing Crowd at Events and Venues of Mass Gathering" have been issued in the year of 2014 by NDMA. The state of Haryana has also notified a policy on "Safety Measures in Government and Private Aided & Un-aided Schools".

2.5 CONCLUSION

The Dabwali incident was an example of how a single spark of fire can lead to devastating effects in such a short span of time. The neglect of the venue and school authorities in accommodating more people than the venue's capacity and not looking into the safety aspect of the venue can be cited as the main cause behind the incident.

The event gains more importance owing to the fact that the incident had taken place during a school function where hundreds of children participated. The safety of the invitees, which included the students and their parents, was clearly the responsibility of the host. Had the safety measure been taken, it would not have ended up in the long list of man-made disasters in the nation.

However, from the relief and rehabilitation measures, we can find that there has been a community spirit of resilience, which is of utmost importance in case of any disaster.

Chapter 3

UPHAAR CINEMA FIRE

Incident	**Uphaar Cinema Fire**
Location	**Uphaar Cinema, Green Park, Delhi**
Date/Time	**13th June, 1997, 3:30 pm**

3.1 INTRODUCTION

Uphaar Cinema Hall is located in South Delhi's Green Park, one of the posh localities in the heart of Delhi. The five-storeyed building is situated on a plot of 2480 sq. yards at Green Park Extension Shopping Centre, New Delhi. The Ansal Brothers jointly owned it. The building had a 750-seater cinema auditorium and a 250-seater balcony located on the first and second floors respectively. The ground floor comprised of a parking lot along with three rooms on the western side one of which housed a 500 KVA electric transformer and another a 1000 KVA transformer installed and maintained by the Delhi Vidyut Board (DVB).

Figure 3.1: Uphaar Grand Complex

Source: Hindustan Times (Sept 2018)

3.2 THE EVENT/DISASTER

3.2.1 Description of the event

Early in the morning on June 13, 1997, one of the transformers that were housed in the ground floor of the Uphaar building had caught fire. The DVB and the Fire brigade were immediately informed and the fire was doused. Upon inspection, it was found that three low-tension cables of the transformer had burnt partially. Inspectors from DVB later repaired this after which the transformer was recharged.

The alleged loose connections in the transformer even after the repairs caused sparking. Later, these loose cables came off and dangled along with the radiator, burning a hole in the radiator fin. Transformer oil leaked through this hole. The heat generated by the loose cable touching the radiator reportedly ignited a flame at about 4:55 pm on the same day. The absence of an oil soak pit led to the oil spreading out to the parking lot where cars were parked not farther than a meter from the room where the transformer was stored.

Chronology of Events in Uphaar Cinema — June 13, 1997

- 6.55 am: Fire broke out in the transformer installed by the DVB.
- 7.25 am: The fire brought under control
- 11.30 am: Electricity restored after repairs were carried out by DVB staff
- 4.55 pm: Another fire during the matinee show, killing 59 and injuring over 100

The cinema complex was having a matinee screening the movie "Border" during the hour. Soon enough the cars were on fire and the thick smoke started moving in all directions, and even to the staircase that led to the cinema hall. The air conditioning ducts further sucked the smoke and filled the hall in toxic smoke, suffocating the people inside the hall.

As the Shift in charge of the DVB, Green Park Complaint Centre was alerted, the All India Institute of Medical Sciences (AIIMS) grid (that supplied electricity to the particular transformer) was turned off, disconnecting the power supply in the building. This ended up in total chaos in the building with people trying to get out of the cinema hall, which did not have emergency lights or well-marked [1]exits, in pitch darkness. The resultant suffocation and stampede ended up taking the lives of 59 people, which included 23 children, and injuring over 100.

[1]The description of the event has been adapted from the Supreme Court Judgement of Sushil Ansal vs. State Through SBI (2010), https://sci.gov.in/jonew/judis/41301.pdf

What aggravated the problem?

- No Functional Public announcement System to guide the public out of the hall.
- Complete darkness in the hall due to absence of emergency lights, foot lights etc.
- The hall had unauthorized constructions blocking the gangways.
- Many of the exit doors were locked.
- The exit of the staircases were also locked trapping many victims.
- Unauthorised shops were being run from spaces supposed to be empty.
- In violation of the Indian Electricity Rules, no periodic maintenance, no fire extinguishers, no isolation device were there. The electric cables were also haphazard.

Adapted from http://www.legalserviceindia.com/legal/article-752-uphaar-cinema-case-study.html&https://www.casemine.com/judgement in/5609aeefe4b0149711415361#72

3.2.2 Impact/Loss

The fire in the ground floor led to thick smoke entering the cinema hall via the air-conditioning ducts. As the smoke began to fill in the 750 people in the first floor ran to safety. The illegal extensions, obstructions, extra seats and closed exits made it difficult for the people in the balcony to escape. 59 people lost their lives due to Asphyxiation and stampede and over 100 were injured. Of the people who died in the incident, 23 were children.

Figure 3.2: Fire Response Services at work
Source: (India Times)

Figure 3.3: Rescue operations at Uphaar

Source: (India Times)

3.2.3 Response/Rehabilitation

After the Delhi Fire Services received the complaint from the manager, the fire tenders from the Bhikaji Cama Place and Safdarjung Fire Stations initiated rescue operations. It took the fire tenders around 1 hour to douse the fire and rescue the persons locked in the balcony. The doors were opened and the collapsed and injured were taken to the hospitals. As per the prosecution, no member from the staff or management was present at the spot to take part in the rescue operations.

3.2.4 Aftermath

16 persons including the theatre owners were accused in the CBI charge sheet under sections 304, 304A and 337 of the Indian Penal Code. The trial court convicted the owners in 2015 but spared them imprisonment due to their age. The owners, though, were fined 30 crore rupees each. Later in 2017, the Supreme Court sent Gopal Ansal to jail for a year while Sushil Anshal was spared because of his age.

As an aftermath of the tragedy at Uphaar, The Association of the Victims of Uphaar Tragedy (AVUT) was formed on 30th June, 1997, which brought together 28 families. The association gave them the space to share their grief while also taking the steps to prevent such tragedies in the future. Apart from fighting for justice of the victims, the association's aims included augmenting central accident and trauma services and setting up of emergency services to respond

when the need arises. The association won Rupees 25 crore as compensation in the civil compensation suit it had filed in the Delhi High Court.

Figure 3.4: Kin of the victims at an AVUT meeting

Source: (India Times)

3.2.5 Current Status

Over two decades after the incident, the building stands to be one of the most expensive case properties in Delhi. The complex has been sealed since the incident and has presently become home to vagabonds, homeless and drug addicts.

Figure 3.5: Uphaar Cinema Hall

Source: (https://uhrfinternational.org)

On February 2020, the Supreme Court dismissed the curative petition filed by the Association of the Victims of Uphaar Tragedy (AVUT) for prolonging the imprisonment of Ansal Brothers and freed them from further imprisonment.

3.3 LESSONS LEARNT

The disaster at Uphaar cinema was completely man-made and avoidable, had the necessary precautions been taken. The incident is truly a case of neglect and lack of preparedness.

The key areas to be noted here are :-

i) **Violation of Fire Code and Delhi Cinematograph Rules**: The cinema complex clearly violated fire safety norms. There was no public announcement system to lead the patrons to safety. Exit lights, footlights that could have helped the people find their way during the blackout were absent. The middle exit was illegally obstructed for the construction of an 8-seater box. There were also additional seats to the right gangway against the statutory provisions. This had hindered the movement of the patrons during the emergency.

ii) **Structural deviations**: There were illegal deviations in the structure of the cinema hall. Only three out of the four legally required exits were provided in the balcony. There was the construction of refreshment counters that inhibited free passage (Violation of para 10(1) of First Schedule of DCR, 1956).

As for the parking lot, 18 cars along with 8-10 official cars were parked against the officially admissible number of 15. A 16 feet wide passage was also to be maintained along with the transformer rooms as to allow for easy passage of the vehicles. However, the cars were reportedly parked only 3-4 feet away from the transformer room.

iii) **Violation of Indian Electricity Rules**: The transformer installed by DVB showed serious violations such as lack of insulator and fire extinguishers. Regular maintenance had not been carried out. The cables were haphazard. The transformer did not have an oil soak pit that had led the oil to spread towards the parking area. The repairing work of transformer carried out by DVB was not proper and that led to the fire.

iv) **Lack of Enforcement of Rules**: The officers of the Municipal Corporation of Delhi (MCD) had granted No Objection Certificate for running the hall despite the present structural deviations and violations for the years 1995-96 and 1996-97. This was indeed turning a blind eye to the violations and the harm caused to public safety thereby.

v) **Lack of Preparedness Measures**: A cinema hall with large crowds in confined spaces for long hours should have had advance preparedness measures, especially related to evacuation. Evacuation protocols and other preparedness measures were not available.

3.4 IMPLICATIONS ON POLICY AND PRACTICE

The Delhi High Court, in 2003, suggested various measures for fire safety in cinema halls and public places. An important recommendation was that every cinema hall would screen a documentary to inform patrons about escape routes, exit signs and what the public should do in case of a fire. Another important recommendation was that the inspection and enforcement of the statutory norms to be under control of a specialised multi-disciplinary body to deal with all aspects of licensing of public spaces.

The Supreme Court of India has laid down guidelines in 2014 for the cinemas and theatres in India stating that the owners of every cinema/theatre should draw up an emergency evacuation plan and getting it approved by the licensing authority. The other directions of the Supreme Court included the provision of training of the staff members for the evacuation procedures. It further orders the theatre to telecast a small advisory at the starting of every screening showing the escape routes and emergency exits and explaining the do's and don'ts in case of an emergency. Half-yearly inspections have also been made mandatory and at the same time, a fire-safety rating would be provided to each of the theatres by the fire services. The Supreme Court has also highlighted that separate guidelines should be formed for the theatres in multiplexes.

3.5 CONCLUSION

The Uphaar Fire Tragedy stands to be one of the deadliest fire tragedies in India. The contrasting fact here being the complex located in one of the posh localities in Delhi. Lack of preparedness and neglect are the main reasons that can be cited behind the disaster. The case clearly depicts violations of the law on the part of the owners, as well as the civic authorities, i.e., the MCD and DVB. The incident highlights the need for regular inspection and maintenance of electrical connections and equipment. The incident calls for a need to infuse a culture for risk prevention in India and to treat the fire safety norms with due seriousness.

AMRI HOSPITAL FIRE

Incident	**AMRI Hospital Fire**
Location	**Dhakuria, Kolkata, West Bengal**
Date/Time	**9th December, 2011, 2:30 am**

4.1 INTRODUCTION

Cities have always tended to show a higher density of population in terms of density per house. Kolkata is a city with the highest number of persons per household (11 per household) in the country (Pal et al, 2014) making it highly vulnerable in case of a fire because of the high exposure of people. Fire incidents in high-rise buildings and local markets are not rare in the city. At least 10 major cases, such as the Stephen Court Fire in March 2010, have been reported from 2008 to 2011 in the city (Bhattasali, A, 2011). Kolkata, also being one of the old cities in India, has many old and dilapidated buildings that are extremely vulnerable to fire. The city also has many typical urban neighbourhoods with extreme narrow roads. These narrow roads often act as a bottleneck for the fire services in case of an outbreak.

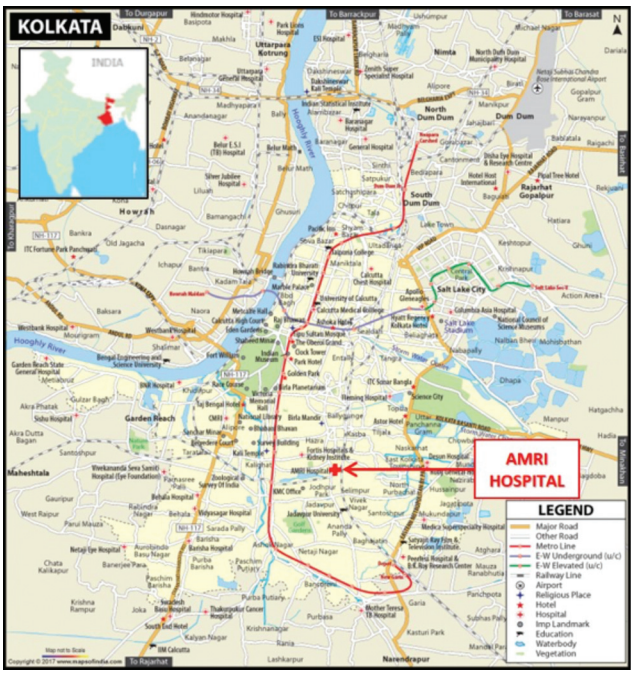


Figure 4.1: Map showing the location of AMRI Hospital in Kolkata
Source: Maps of India

Advanced Medicare and Research Institute (AMRI) is a privately-owned hospital chain co-founded in 1996 by the Emami Group and the Shrachi Group of companies

with a partnership of Government of West Bengal. The hospital chain has its head office and 6 branches in Kolkata, West Bengal. The Dhakuria branch of AMRI hospital is situated in a densely inhabited area in South Kolkata. Figure 4.1 shows the location of the hospital on the map. Adding to the vulnerability was the fact that there was only a narrow lane as access to the hospital.

Figure 4.2: AMRI Hospital Dhakuria Branch
Source: Wikipedia

4.2 THE EVENT/DISASTER

4.2.1 Description of the Event

Figure 4.3: The fire reached to the top floors of the AMRI Hospital
Source: (P. & Vijayalakshmi, 2014)

On December 9, 2011, the annexe-I building of Advanced Medicare and Research Institute (AMRI) Hospital, Dhakuria, Kolkata, witnessed a massive fire at early in the morning. The fire is believed to have started in the basement of the hospital around 2:30 am in the morning where a pharmacy and a godown were located (The Kolkata Tragedy, 2011). The local residents had noticed the fire at around 3.30 am and the Fire Control Room was informed at about 4.10 am.

The basement was allegedly stored with highly inflammable material like diesel, motor oil and wooden furniture spreading the fire quickly as shown in Figure 4.3 (P. & Vijayalakshmi, 2014). All the floors of the hospital were stored with flammable goods required at the hospital. As soon as the fire started due to combustible materials in all floors thick density of dark coloured smoke, fumes and toxic substances produced, it starts to move basement to the upward direction along with the fire flame (P. & Vijayalakshmi, 2014). What worsened the situation were the air conditioning ducts that sucked the poisonous smoke and carried it all through the floors of the building causing suffocation to the patients and staff.

Further, all the exterior finishes of the windows were constructed by glass materials, which were all blocked, keeping the smoke trapped in the rooms. Soon enough, the seven-storeyed building was filled with toxic smoke, suffocating and burning patients and staff to death. Since most of them were either asleep or not in a position to move to safety, the incident ended up taking 90 lives and leaving several badly injured (NDTV, 2011).

The lack of local fire containment measures and the smoke detectors and fire alarms, which were kept non-operational, contributed to the severity of the event. The power that went out made the lifts, which would have acted as a lifesaver, non-operational. There was no emergency evacuation plan or exits and patients struggled to get their way out in the dark. Figure 4.4 has described the event in detail.

4.2.2 Impact/Loss

According to a hospital spokesperson, there were around 160 patients in the hospital including 40-50 of them in the Intensive Care. Since the event had occurred in the early hours of the morning, most of the inmates were asleep, immobile or on life-support. 93 deaths were reported (National Association of Fire Officers, 2011). Among the victims were persons from Bangladesh, Bihar, Tripura and Kerala. Two nurses from Kerala who bravely rescued 8 of the 9 patients in the female general ward also succumbed to the heat and smoke. The worst affected were the fourth and fifth floors. The fourth floor housed the ICU and NITU while the fifth floor had the operation theatre, equipment and electric room.

As per the reports of the Tapan Mukherjee Commission, the damage caused by death cannot be assessed in terms of money. The relatives of the departed claimed compensation of Rs. 26,53,72,000 and Rs. 27,24,454 as compensation towards treatment.

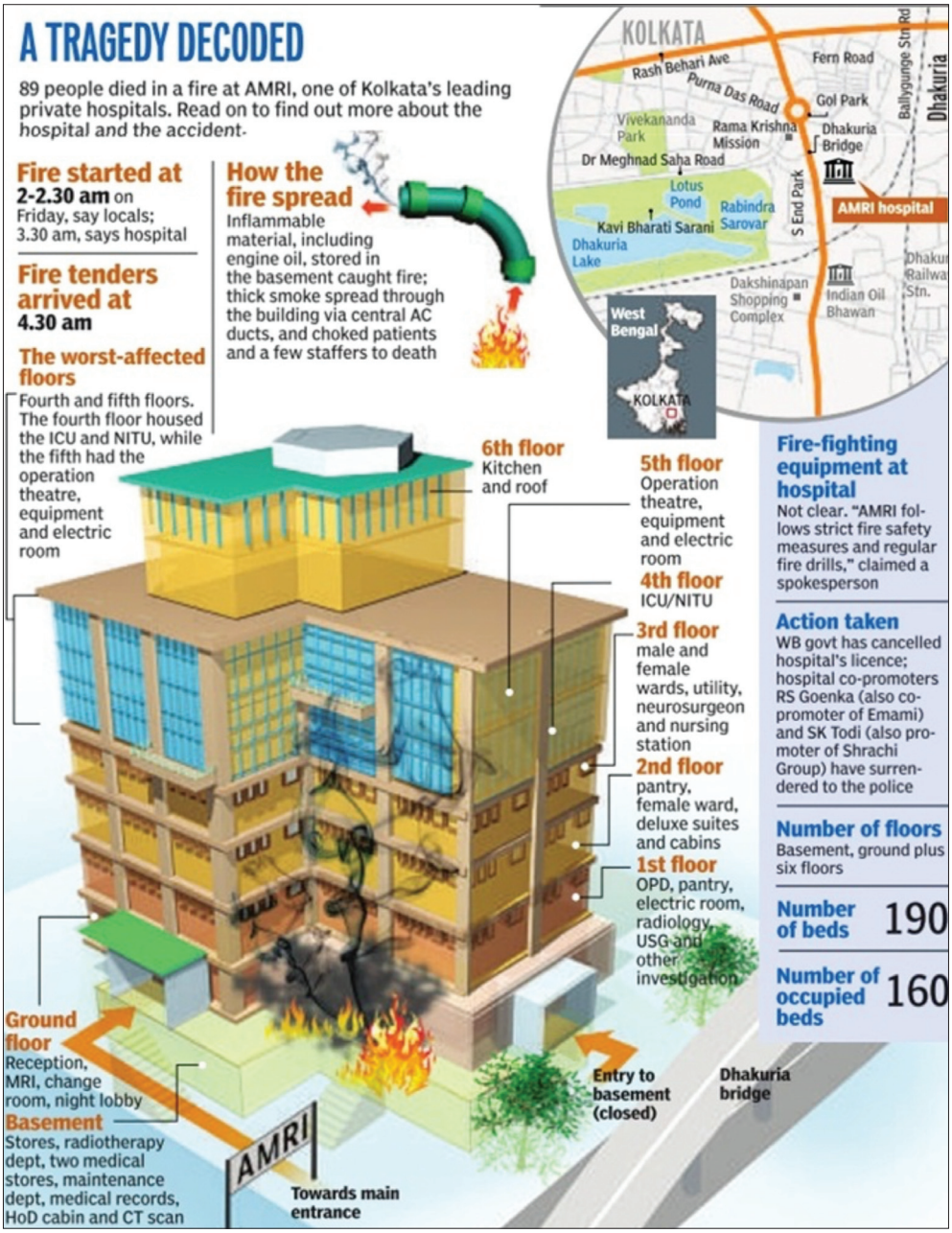


Figure 4.4: Details of the AMRI Tragedy along with the building layout

Source: (The Kolkata Tragedy, 2011)

4.2.3 Response/Rehabilitation

> "The windows were sealed, the power had been switched off, it was pitch dark inside. And, of course, they were all patients."
>
> — *Civil Defence Officer*

According to the NDTV reports, The Fire Response Team had allegedly reached the spot in 20 minutes after getting the distress call from Lal Bazar Police Control Room. The locals from the nearby slum were prevented from doing any rescue operations until the Fire Response team reached the spot to avoid further casualties. The Fire department rushed to the spot with the available equipment. The fire tenders could not reach close to the building as the approach road was partially blocked with DG set and a Gas Bank. The emergency vehicles could not turn through the narrow passage (National Association of Fire Officers, 2011). Around 25 fire engines and hydraulic ladders were put to use for rescue and dousing of fire, the process of which took around five hours. Since there were no windows, the firefighters had to break open the fixed glass walls to let the smoke out. The rescue technique was also dangerous, with rope ladders from outside the building, as seen in Figure 4.6. Chucking out smoke from building to outside took four hours after breaking the glasses by the fire professionals (P. & Vijayalakshmi, 2014).

Around 11:00 am, there was an alarm regarding alleged radiation leakage from the biomedical department in the basement that stored radioactive material for treatment of cancer patients. National Disaster Response Force (NDRF) and their Anti-Radiation Team checked the area and reported no leakage. It was further confirmed by the team of officers and scientists directed by the Government of India from Atomic Energy Regulatory Board, Emergency Response Centre, Kolkata and Meghnad Saha Institute. The survivors were shifted to five hospitals as directed by the Department of Health and Family Welfare, Govt. of West Bengal. The Police Control Room had confirmed the death of 89 people and reported 57 injured people by 8:00 pm of the same day. By midnight, the death toll had crossed 90.

Figure 4.5: Locals and relatives of patients taking part in Rescue Operations
Source: (Pal et al, 2014)

Figure 4.6: Fire Services of West Bengal and NDRF in Rescue Operation
Source: (Pal et al, 2014)"

The Government announced ex-gratia pay of Rupees 2 lakh in death cases and provision of employment in cases where the earning member died in the incident. Funeral/cremation expenses of Rupees 10,000 was also announced to be paid to the next kin. The Prime Minister's Office announced a grant from the PM National Relief Fund to the tune of Rupees 2 lakh to the next of kin of every death victim and Rupees 1 lakh each to the severely injured. On December 12, the Government of West Bengal took the decision that made one willing member each from the family of deceased persons eligible for jobs against Group C or Group D vacancies.

4.2.4 Current Status

Immediately after the fire incident, six board members were arrested including the co-founders of the hospital SK Todi and RS Goenka. The license of the hospital was cancelled and the state government ordered an enquiry, to be headed by the retired high court judge, Shri Tapan Mukherjee on 15th December 2011. The hospital began its operations two years later when it received clearance in November 2013.

The commission's report was sent to the state Govt. in May 2017 and tabled in the state Assembly on July 2018. A total of 16 persons who were accused were charged with culpable homicide not amounting to murder (IPC Section 304) and attempt to commit culpable homicide (Section 308).

4.3 LESSONS LEARNT

The AMRI Hospital Fire was a devastating incident. It has been an eye-opener for various authorities across the nation. The accident could have been easily avoided if the following points were taken into consideration prior to the incident.

i) **Not conforming to safety norms and regulations**: The 2011 fire in AMRI hospital was the second fire that the hospital witnessed in three years. The fact that the hospital encountered two fire cases within a short period shows the apathy or plain ignorance of the hospital authorities regarding the safety aspect of the hospital.

ii) **Violation of Rules and Regulations**: The upper basement of the hospital was constructed for the purpose of car parking only. Instead it was used by the authorities as a dumping area of mainly combustible materials like portable LPG cylinders, Electrical PVC cables etc. as observed by the commission. This change was made without procuring the required permission from the concerned department. A specialized system like a hospital has specific pattern of allocation of functional spaces.

The hospital had ignored the warning it had received from the Fire Services Department in September regarding the usage of the basement.

(Refer Box 4.1). The hospital had also failed to comply with the demands by the given deadline of December 5th, 2011. Compliance with the norms is essential for efficient functioning of a hospital.

iii) **Enforcement of laws and norms**: The Fire and Emergency Department of the Government of West Bengal, even being fully aware of the lack of preparedness of the hospital did not prevent it from renewing their No Objection Certificate (NOC) in August of the same year. This points to a lackadaisical approach in enforcement of laws and inadequate local governance practices.

iv) **Lack of Preparedness**: The sprinklers were not working and the fire alarms were switched off to avoid disturbance and hospital functioning. The dampers in the Air-conditioners did not work, as the alarms did not go off. No fire extinguishing system was operational. The case also reminds us how crucial frequent examination of the working condition of fire dousing equipment, smoke alarms etc. is, for fire incidents are often unforeseen and devastating. The hospital also did not have an emergency plan for evacuation.

v) **Structural and Planning Irregularities**: The hospital was located alongside a busy flyover on an arterial road connecting the southern parts of the city. The hospital site was on a narrow road under the bridge. This constricted the access to the hospital, which hindered quick response. During the incident, this acted as a barrier for the access of fire services. Siting of critical infrastructure like hospitals and access planning are crucial for safety considerations during fire outbreaks and other emergencies. This shows how proper city planning could have reduced the risk factor largely. The access road also lacks pedestrian pathways that can delay the exit of the trapped victims in case of an emergency.

The hospital was centrally air-conditioned with glass façade walls and no windows. No emergency exits were available. Mechanical ventilation, which is a critical component to the disposal of smoke from the upper floor areas, was also missing. Fire-rated doors were also not available/ installed.

4.4 IMPLICATIONS ON POLICY AND PRACTICE

The fire incident led the Government of West Bengal to reform the existing West Bengal Act XXVI of 2010 to draft "The West Bengal Clinical Establishment Rules 2012". Post the incident, the fire authorities conducted audits in several hospitals across the country to find that the fire safety audit of many major hospitals in Delhi and Mumbai lack fire prevention measures (more than 50%). The case was similar with respect to high-rise buildings. It has been observed that most of the buildings do not follow to fire prevention measures as described

under the National Building Code of India. Since it does not entail any major penalty, most of them do not even care to procure no-objection certificates from the concerned authorities.

Box 4.1: "The West Bengal Municipal (Building) Rules, 2007", Section 12(6) (B)

For buildings exceeding 14.5 meters in height — The building plan shall, in addition to the provision of sub-rule (1) also show:—

(a) special requirements as to access, circulation, building services and safety, human health and Fire based on occupancies or use group as laid down in National Building Code of India, and in the West Bengal Fire Services Act, 1950; Act XVIII of 1950.

(b) parking layout plan showing parking spaces, driveways together with ingress or egress arrangements;

(c) width of main and alternate staircases along with balcony approach, corridor, ventilated lobby approach;

(d) location and details of lift enclosures;

(e) location and size of fire lift;

(f) smoke-stop lobby or door, where provided;

(g) details of exits including provision of ramps in the case of hospitals and for special risks;

(h) location of smoke exhauster and fan;

(i) location of smoke exhauster in basement;

(j) details of fire alarm network;

(k) location of centralized control connecting the alarm system, built-in fire protection arrangements and public address system;

(l) location and dimensions of static water storage tank and pump room along with fire service inlets for mobile pump and water storage tank;

(m) location and details of fixed fire protection installations such as sprinklers, wet risers, hose reels, drenchers and carbon dioxide installation;

(n) location and details of first aid equipment;

(o) special requirements, if any, of occupancies for residential building, educational building, institutional building, assembly building, business building, mercantile building, storage building, industrial building and hazardous building under these rules;

(p) location for installation of a sub-station for electric supply, transformer, generator and switch gear room;

(q) location of the air-conditioning plant room, if any;

(r) plan for installation of boilers, if any;

(s) refuse chutes and refuse chamber, if any;

(t) location for signs and outdoor display structures, if any;

(u) conveniences for physically challenged personnel.

Further, the following amendment has been made in sub-rule (3) of rule 49 in the year of 2015 to ease the access and exit which was a major challenge in case of AMRI fire:

Width of Means of Access (in meter)	Maximum Permissible Height (in meter)	Permissible Height of the Building (in meters) In case of gifting of strip of land having a width of 2.5m throughout the frontage of the entire plot.
(i) Above 2.4 upto 3.00	7.0	Nil
(ii) Above 3.0 upto 5.0	10.0	12.5
(iii) Above 5.0 upto 7.0	12.5	15.5
(iv) Above 7.0 upto 9.0	20.0	25.5
(v) Above 9.0 upto 12.0	40.0	—
(vi) Above 12.0 upto 15.0	60.0	—
(vii) Above 15.0	No restriction	—

Source: The West Bengal Municipal (Building) Rules, 2007, The Kolkata Gazette, www.wbdma.gov.in

4.5 CONCLUSION

The risk of 'Fire' has ranked up three positions to be on the fifth in 2015 (India Risk Survey 2017). What is of utmost importance is the ignorance the people in general and the authorities have regarding the safety aspect, particularly when it comes to a critical institution like a hospital, which aims to serve the sick and the wounded.

The key issues we need to consider are:

(i) Awareness of people in general and authorities in particular regarding various risk factors and the importance of countermeasures.

(ii) Enforcement of safety laws.

(iii) Regular examination of safety equipment.

(iv) Town Planning and Regulatory Framework so that critical health infrastructure is serviced by approach and peripheral roads with 20 m turning radius for fire tenders and capable of taking 40 tons load of these vehicles (National Association of Fire Officers, 2011).

(v) Modernization of fire departments.

Chapter 5

SIVAKASI FACTORY EXPLOSION

Incident	**Sivakasi Factory Explosion**
Location	**Sivakasi, Tamil Nadu**
Date/Time	**5th September, 2012, 12:15 pm**

5.1 INTRODUCTION

The Fireworks manufacturing industry is more vulnerable to fire risks and is well known to be hazardous. This is owing to the fact that hundreds of workers are involved in the manufacturing process while being exposed to harmful chemicals and combustible materials. The workers usually face problems such as lead poisoning, impairment of central nervous system. In addition, the industry is infamous for its unhygienic conditions, inappropriate training and child labour. Well known as "Kutty Japan" which means 'Mini Japan', Sivakasi town in Virudhunagar district of Tamil Nadu as shown in Figure 5.1, is India's biggest fireworks manufacturing hub housing around 600 major and hundreds of small and minor units operating with over 30,000 employees. Sivakasi's fireworks factories provide direct employment to around 70,000 workers and indirect employment to around 1 lakh people. (BBC, 2012) It is also known as the "Fireworks Capital" of India.

Figure 5.1: Location of Sivakasi in Tamil Nadu
Source: (www.tamilselvi.com)

Producing around 90% of India's fireworks, it plays a major role in India procuring the position of the world's second-largest producer of fireworks, after only Liuyang in Hunan province of China. Almost all of the production goes into domestic consumption. Apart from fireworks manufacturing, Sivakasi is also known for its matchbox and printing industries. (India Today, BBC 2012) The relatively dry climate and lack of rainfall make the region ambient for fireworks and match industries to thrive.

Figure 5.2: Children working with chemicals in a fireworks factory in Sivakasi

Source: (https://www.tribuneindia.com)

"According to a state government study sponsored by the UN Children's Fund, 33,000 children of the age group of 6-14 years worked in Sivakasi."

—Frontline,2000

"According to Dr. M Kathiresan, the Chief Medical Officer at the local govt. hospital, 22 workers have lost their lives while 50 were injured prior to this accident in the prior 12 months."

—BBC, 2012

An average of 20-25 workers lose their lives every year in fire accidents associated with the industry while contrastingly the pay is as low as $3 per day. A total of 237 lives have been lost and 200 injured in 88 fireworks units located in Sivakasi in the period between 2000-2012 (India Today, 2012).

The Om Shakti Fireworks Industries, located in Mudalipatti near Sivakasi, consisted of a single larger factory unit and 48 ancillary units. It has been known for manufacturing fancy fireworks of 'A1' brand that are considered more dangerous when compared to the crackers of other brands that are intended to make loud noise only (Rajan, 2012).

5.2 THE EVENT/DISASTER

5.2.1 Description of Event

On September 5, 2012, Sivakasi witnessed the biggest explosion it had in history at Om Shakti Firework Factory, located in Virudhunagar district in south Tamil

Nadu. The event occurred around 12.15 pm while the workers were busy mixing the chemicals for the manufacturing of the fancy fireworks. The friction between the chemicals supposedly led to an explosion at one unit which set a deadly chain of explosions that shattered all the 48 sheds that were located within the premises of the factory, trapping over 300 persons who were at the unit (Rajan, 2012). The chemicals used in the fancy crackers spread very fast and is one of the reasons that the entire premises caught fire from the origin point of explosion. The entire production of the factory was also stored in the godowns at the premises, which was an infringement to the safety norms, resulting in intermittent explosions for around 3 to 4 hours after the initial blast. It is reported that the sound of the explosion could be heard even upto a radius of 2 kilometres (The Hindustan Times). The strong wind on that day further added to the severity of the situation.

Figure 5.3: Om Shakti Factory at Sivakasi during explosion
Source: (The Hindu)

Even after reaching the spot in time, the fire-fighters and the relief team were helpless, as they could not enter the place in fear of another explosion. Even after two hours after the explosion, rescue operations could not be initiated

Figure 5.4: Smoke spreading from the spot of explosion at Sivakasi
Source: (BBC India)

as the rooms were still burning and there was a danger of another explosion from the stacked chemicals. Many local people from neighbouring villages who initially rushed to help the victims either were trapped or endured injuries from the ongoing explosions. The burning of a variety of chemicals used in pyrotechnics crackers resulted in thick and suffocating smoke also restricting the entry of the rescue and relief team. The onlookers and the eyewitnesses, as reported to the Economic Times, said the smoke originated could be seen few kilometres away from the spot of the blast. Figure 5.4 showing the smoke erupting during the explosions. By the time the fire subsided, the entire factory was razed to the ground.

"With only two months to go, Deepawali festival is close at hand and to meet the demand for crackers these units increase the pace of production manifold. Now, we have to clear the debris to ascertain the exact number of deaths,"

—Najmul Hoda, Virudhunagar District Police Superintendent (India Today)

5.2.2 Impact/Loss

The explosion led to the flattening of over 40 sheds under the unit in the area where over 300 people were reportedly present. Figure 5.5 shows the conditions of the factory premise after the explosion.

Figure 5.5: Site of Om Shakti Fireworks after explosion

Source: (India Today)

The death toll rose to 54 as the debris was removed to find the trapped victims while the count of injured persons rose to more than 40 (V Mayilvaganan, 2012). They were either charred to death or trapped under the debris. Most of the injured victims were reported to have more than 50 percent burns.

5.2.3 Response/Rehabilitation

The first explosion was reported around 12:15 pm after which the villagers of Mudalipatti and workers from an adjacent blue metal crusher unit dashed to the scene. Many of them even entered the factory premises to rescue the trapped victims eventually being trapped themselves. The small force of police that reached the spot could not stop the crowd comprising of 500 people. An unexpected explosion around 1:00 pm caused the debris to fly across a wide distance and injuring them seriously.

"We rushed to the spot immediately, but, could not step in since the explosions went on like a chain reaction. Besides, 60 fire and rescue service personnel, 10 fire-tenders were brought to the site,"

—Najmul Hoda, Virudhunagar District Police Superintendent

Figure 5.6: Najmul Hoda, Superintendent of Police, Virudhunagar inspecting the flattened shed where the fire had allegedly originated.

Source: (The Hindu)

After seeing the grievous nature of the burns on the victims, even the police and fire-fighters were reluctant to enter the premise initially. Ten fire tenders, which included some from Tirunelveli, Tuticorin and Madurai districts were parked outside the unit and entered the scene only at around 3.30 pm – 4.00 pm after the debris was cleared from the entrance. The injured persons who were

flung away due to the impact of the explosion were immediately rushed to the nearby government hospitals in Sivakasi and Madurai.

Chief Minister J. Jayalalithaa also formed a ministerial team led by her senior cabinet colleague, O. Panneerselvam, to coordinate rescue and relief operations. She also announced a cash relief of Rs. 2 lakh for the family of the killed victims while expressing her grief about the incident. The relief cash of Rs. 25,000 and Rs.10,000 respectively have also been announced for the victims with serious and simple injuries (Rajan, 2012).

5.2.4 Aftermath

A total of eleven persons were arrested in connection with the explosion at the manufacturing unit after which the Chief Minister of Tamil Nadu Jayalalithaa ordered a magisterial probe into the blast. The previous records reveal that the license of the Om Shakti Fireworks had been suspended only 2 days prior to the incident owing to their failing safety standards. The owners of the factory did not want to compromise with production as the festive season of Diwali was approaching.

"Our officials had conducted an inspection at Om Shakthi a few days ago and found it was overstaffed and stocked excess explosives. We initiated steps to suspend the license."

—B Rangasamy, Deputy Chief Controller of explosives (Times of India, 2012)

The incident led to the raids in the factories by eight teams formed by the district authorities and controller of explosives. According to Virudhunagar SP, more than 689 licensed factories were raided and violations were found in 611 of them. Licences of over 57 factories were suspended. The Union Commerce and Industry Minister demanded a probe into the incident. As per Section 9(a) of the Explosives Act 1884 Shri Chaitanya Prasad, IAS was appointed to conduct the probe.

The State Govt. allotted Rs. 1.13 crores to establish a burns ward at the Sivakasi Govt. Hospital. Equipped with an ICU, Operation Theatre, a Plastic Surgery Unit, an Orthopaedic Unit etc. the hospital would be under the control of the Madurai Medical College Hospital.

5.3 LESSONS LEARNT

There are few key points to be considered in cases like the Sivakasi Factory explosion in 2012. These factors can be considered to be aggravating the risk factor of the area.

i) **Nature of the workers employed**: Fireworks manufacturing employs over 300 workers out of which most of them are inexperienced, contract workers or children. They often do not have any knowledge about the chemicals they are working with and the harmful effects on their health;

neither are they provided with adequate training. They are also often unaware of the risk factors associated with them. Moreover, since the workers are paid based on how much they produce per day, the emphasis is on the speed rather than the safety.

"I will work fast only then can earn money. I am paid Rs. 8.50 per roll of cracker I make."

—Rajalakshmi, Factory Worker (India Today, 2012)

ii) **Casual attitude of workers and employers**: Owing to the lack of knowledge regarding the risk factor, the workers usually have a casual attitude towards the process. They often do not adhere to precautionary measure such as wearing masks or gloves while handling the chemicals. Use of rubber mats as a basic safety precaution is also absent in many of these factories.

"When we started our factory in 1982, my brother and I mixed chemicals and filled them in tubes, but we never faced any health problems."

—P Ganesan, Director, Vinay Crackers

The owners of the factories are profit-oriented and focussed on meeting the high demand and do not bother to adhere to the safety standards and norms. They even, sometimes, do not provide their employees with basic safety gears like gloves, masks, headgears, etc. The technical head of one of the factories surveyed reported to the BBC India that wearing gloves slows down the process and hence, the employers do not provide them.

iii) **Violation of safety rules**: In Sivakasi, the small units of fireworks manufacturing are not even registered. As for the fireworks manufacturing units that have been registered, applying for and procuring a license is just for namesake. They mostly do not comply with the legal requirements for handling explosive materials. The Petroleum and Explosives Safety Organization (PESO) reportedly had suspended the license of the unit just one day prior to the incident.

"A shocking fact here is that, the explosion had occurred in a cracker factory owned by the President of Tamil Nadu Fireworks Manufacturing Association, a trade body governing over more than 700 units in Sivakasi and the surrounding areas."

—The Pioneer, 2013

In the case of Om Shakti, more than 300 workers were employed against the norm of 200 workers. Around 45 sheds were put up against the permitted number of 35 in order to produce more than their capacity

in order to meet the Diwali demands. According to A P Singh, the deputy chief controller of explosives, Sivakasi, the explosions were a result of violations of all safety norms prescribed under the Explosives Act, 1884 and the Explosives Rules, 2008.

"Rules are only in books. Even the leading companies don't follow the rules."

—Vijaya Kumar, Social Activist

iv) **Lack of Enforcement of Law**: While clearly there is non-compliance to safety norms on the part of these manufacturing units, there has also not been proper enforcement measures on the part of the authorities including PESO. The National Factories Act, 1948 and The Tami Nadu Fire Service Act, 1985 both give safety inspectors and fire service officers the power to mandate the factory owners to cease operations or follow the safety norms. In this case, it has not been followed. It also has to be taken into account that there are often thousands of factories and hundreds of units under the supervision of merely four officers that can affect the efficiency of law enforcement. In addition to this, government officials allotted often lack the technical qualifications for the job (BBC, 2012).

v) **Lack of Preparedness**: Even though the industry qualifies to be highly hazardous, we can barely find factory units adequately prepared for a disaster. Fire extinguishers or any such equipment are usually absent in these manufacturing units.

It also has to be noted that the mishap had occurred shortly after the then CAG Vinod Rai had criticized both the Central and State Governments for lack of disaster preparedness after a Performance Audit of Disaster Preparedness in India was conducted during May 2012 to September 2012. According to the CAG's report of the Performance Audit to the Parliament, there are critical gaps in the level of preparedness for various disasters. He also had pointed out that NDMA headed by the Prime Minister needed to be more stringent in monitoring the disaster risks and the level of preparedness. The report also pointed out that the Tamil Nadu State Disaster Management Authority did not meet even once after its constitution in 2008 till the date the report was tabled.

It is to be noted that the fireworks mishaps have been very common in Sivakasi. There have been numerous incidents previous to the explosion (refer to Box 5.1). Similar mishaps such as the blast at Krishnasamy Industries in September 2018 (Ganesh, 2018) are still occurring showing the inefficiency and negligence of the authorities as well as the factory owners in preparedness.

vi) **Overcrowding**: As the festival seasons approach, there is a tendency in these factories to employ more workers to maximize production. They

often pack up to four people in small workspaces, which may double during the festival season. This often ends up in the temperatures going higher than the room temperature making the heat-reactive chemicals susceptible to explosion. This propensity to overcrowding has to be checked as a precautionary measure. The change of humidity level in such condition of workspace creates risks of explosions and fires.

"Even humidity level changes can set off a chemical decomposition and a volatile reaction."
—Senior Officer, PESO

5.4 IMPLICATIONS ON POLICY AND PRACTICE

A group personal accident insurance scheme with coverage of Rs. 50,000 is being implemented by the State Government, making it compulsory on the part of the employer to provide relief to the injured workers in both Match and Fireworks Factories in Tamil Nadu in the event of death, loss of limbs, eyesight or any other physical disability. About 1.11 lakh workers were covered in the period between July 2011 and March 2012 (The Hindu, 2012). The site has been identified by the district administration for the establishment of training institute as reported by The Hindu in 2012.

Box 5.1: Mishaps in Sivakasi Until 2012

April 19, 2005: Two persons were killed in an explosion at a cracker manufacturing unit near Madurai.

July 2, 2005: 12 persons were killed and 22 injured in a fire accident at Anuppankulam in Sivakasi.

April 20, 2006: Four people including a woman were killed in a blast in a cracker unit in Sivakasi.

July 7, 2009: Seventeen workers of a cracker factory were burnt to death in a fire accident in the Madurai district of Tamil Nadu.

July 20, 2009: Eighteen people were killed and 33 injured 23 of them seriously, when a fire swept through the unit which makes crackers at Namaskarichanpatti in Virudhunagar District.

August 5, 2010: An eight-year-old boy was killed in a fire accident reportedly at an illegal cracker unit functioning in a house near Sivakasi.

August 26, 2010: A fireworks employee was killed in a fire accident in a cracker unit near Virudhunagar.

January 21, 2011: Eight workers were charred to death and sixteen, including five women, were injured in an explosion that took place at a fireworks unit near Virudhunagar.

August 6, 2011: Six women workers were killed in an accident following an explosion that took place in a fireworks factory near Sivakasi.

December 28, 2011: Four workers were killed on the spot and two others injured in an explosion at a cracker-manufacturing unit near Sivakasi.

February 28, 2012: Two labourers of a firecracker-manufacturing unit, who were seriously injured in a blast died at a private hospital in Madurai.

May 10, 2012: A 70-year-old man was burnt to death in an explosion at a fire cracker manufacturing unit in Sivakasi in Virudhunagar District.

March 27, 2012: Two workers who sustained serious burn injuries in a blast at a fireworks unit in Sankarapandiapuram near Sattur succumbed to the injuries at a private hospital in Madurai.

September 05, 2012: At least 38 people were killed and over 60 injured in one of the worst fire tragedies in Om Sakthi Fireworks, a private cracker manufacturing unit in Mudhalipatti.

Adapted from New Indian Express. (2012, September 06). Chronology of major fire accidents in Sivakasi. Retrieved July 25, 2019, from http://www.newindianexpress.com

5.5 CONCLUSION

Fireworks industry is the one where precaution becomes necessary. The owners and the workers have to be made aware of the hazards that can occur and trained to handle the same. Safety rules need to be strengthened and transgressors penalized.

Some experts recommend automation of the fireworks industry. Factory owners can incorporate automation in various phases of production. This can help in maximizing production, reducing the pressure per worker, and reduce risk caused by human errors to a great extent. Another suggestion is the setting up of Industrial Estates for Fireworks Industries (Sekar T et. al.). This can keep a check on unauthorized units being set up in unsuitable locations while also improving the working conditions and earnings.

KOLKATA MARKET FIRE

Incident	**Surya Sen Street Market Fire**
Location	**Kolkata, West Bengal**
Date/Time	**27th February, 2013, 3:50 am**

6.1 INTRODUCTION

Kolkata, the capital of West Bengal, is the second densest city after Mumbai in the country. The city of Kolkata, as per Census 2011, caters to a population of around 4.5 million, while the suburban areas around the city cater to around another 9.6 million people. Kolkata, being one of the old cities and the second densest in the country, has several congested urban pockets with narrow streets. The local markets often termed, as 'bazaars' in Indian context typically functions as congested urban pockets. These places are the most vulnerable sites with respect to urban fire incidents mainly because of the narrow circulation spaces and overcrowding.

Figure 6.1: Location of Surya Sen Market in Kolkata

Source: (Maps of India)

Surya Sen Street Market, located at Sealdah area in Central Kolkata, is one of the most crowded markets of the city. It was a five-story shopping complex housing godown-cum-offices and shops storing mainly plastics and paper. The market complex has been catering the local residents from the last 25 years. Figure 6.1 shows the location of the market in the city.

6.2 THE EVENT/DISASTER

6.2.1 Description of the Event

Figure 6.2: Smoke coming out from Surya Sen Market till late in the morning
Source: (PTI)

On the night of 27th February 2013, the Surya Sen Market got engulfed in fire. The local residents first detected the fire around 3:50 am in the morning (PTI, 2013). The victims of the incident were mostly the labourers working in the market who stay overnight. 12 of the victims were reported to be suffocated to death during a fire when they were fast asleep. Few of them tried to escape

Figure 6.3: Charred victims being rescued by the Fire Department
Source: (The Times of India)

but failed as all the five exits on the ground floor were blocked (Sen, Dasgupta, & Ghosh, 2013). The fire officers reported to The Times of India that the blaze started on an illegal mezzanine floor that is connected to the rest of the building by just one staircase. This staircase was also reported to be blocked with plastic goods (PTI, 2013). Most of the victims were in this part of the building as this floor houses the godowns where the labourers usually sleep during the night (Sen, Dasgupta & Ghosh, 2013). The godowns being stacked with highly flammable materials like highly combustible paper and plastic goods became a death trap for the victims. The fire engulfed the stairwell and the ground floor of the building and the other parts in a short time. Some of the local residents claimed to The Times of India that many outsiders also slept inside the market. A short-circuit due to an old refrigerator is the reason behind the fire ignition (Roy, 2013). The fire got controlled around 10 am in the morning. Smoke and toxic fumes were reported to be coming out till late in the morning by the local residents and the passers-by as shown in Figure 6.2 (PTI Kolkata, 2013). There were around 56 gas cylinders, as reported, present in the building during the incident, which did not explode saving many more lives (Roy, 2013).

6.2.2 Impact/Loss

"I found my mother near the staircase."

—Biswajit Saha, son of Jyotsna Rani Saha, 80, the lone woman who died in the fire (The Telegraph)

The blaze killed 20 victims while injuring 12 victims seriously (PTI, 2013). One of the injured victims with more than 80 percent burn lost his life later in the hospital making the death toll reach 21 (PTI, 2013). The victims were labourers who were either from the state of West Bengal and the neighbouring states of Jharkhand and Bihar (PTI Kolkata, 2013). An old lady, maintaining a shop, was the lone woman casualty of the fire.

The complex kept burning for around 6 hours gutting more than 200 shops in the complex (PTI Kolkata, 2013). The ground and the first floor of the complex is reported to have the maximum damage where the godowns were located (PTI, 2013). The shopkeepers lost their entire inventory kept in the godowns along with their shop and offices. The economic loss to each shopkeeper was huge, though the exact figure could not be estimated due to the lack of official record of the inventories.

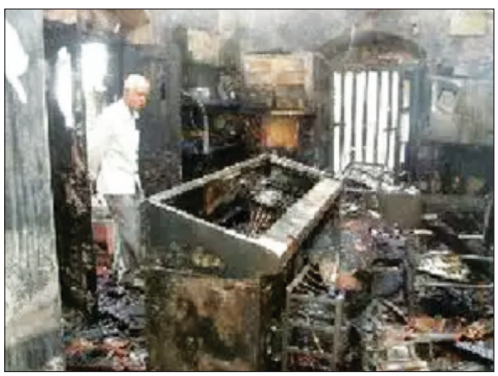


Figure 6.4: A gutted shop at the Surya Sen Street Market after Fire

Source: (The Economic Times)

Figure 6.5: Fire personnel carrying out rescue work after the Surya Sen Market Fire

Source: (PTI Kolkata)

6.2.3 Response and Relief

On reaching the spot of the incident, the police team cordoned off the area to facilitate faster rescue operation. 26 fire tenders were used to fight the blaze. The then Fire Service Minister Javed Khan himself rushed to the spot and supervised the rescue operation (PTI, 2013). He reported to India Today that it took around three hours to get the fire under control.

Six of the victims were rescued in an unconscious state. The injured were immediately rushed to the nearby state-run government hospitals like NRS Medical College and Hospital & Medical College and Hospital, Kolkata. The Chief Minister of West Bengal declared compensation of 2 lakhs and 50,000 rupees for the kin of the dead and injured victims respectively.

6.2.4 Aftermath

The fire in the Surya Sen Street Market brought memories of AMRI Hospital Fire of 2011 in the city. The public got agitated due to the negligence of the authorities, while the later claimed that the warning had been issued to all the

illegal and vulnerable structures after the AMRI incident and still they many of them have failed to comply with the fire safety norms. An FIR was lodged with charges of gross negligence and lack of fire arrangements in the building. The Chief Minister, as reported by The Hindu, directed a survey immediately after the incident for the identification of all vulnerable buildings in the city. She also declared a three month's period to all the owners of the structures to comply with all the rules especially those who have been previously warned or notified during the last survey (The Hindu, 2013). She also ordered the civic authorities to come up with solutions after discussing with the traders and shopkeepers for fire safety in the typical marketplaces of the city.

6.3 LESSONS LEARNT

The sheer negligence and the casual attitude were the sole two factors responsible for the fire outbreak in the Surya Sen Street Market Fire. Had the following lacunae been addressed, this incident could have been easily avoided.

i) **Negligence and Casual Attitude of Users**: The staircases were blocked with the goods and products obstructing the circulation paths to escape in case of an emergency. The emergency exit of the building was also not functional and was reported to be out of maintenance for the last 15 years prior to the incident. The godowns of the shops were filled with highly flammable and combustible materials like plastic, paper and clothes, whereas no fire safety precautions were taken. It also contained around 56 gas cylinders during the incident. The building was also reported to not have a security guard to look after the structure. The building permitted for commercial use was used by the workers for staying at night instead of using the government provided night shelters.

ii) **Planning and Structural Irregularities**: The structure was located at one of the congested pockets of Kolkata. The narrow streets constricted the movement of fire vehicles during the incident. The seven-storeyed complex was having only one functional entry and exit route. The floor plans of the buildings were also missing making the rescue operation more difficult for the fire-fighters.

iii) **Violation of Norms and Regulations**: The mezzanine floor of the buildings was constructed illegally (Sen, Dasgupta & Ghosh, 2013). Out of the shops present in the complex, only 136 shops in the market had trade licenses (PTI, 2013). The fire permits of the building were also missing. The owners and the users paid no heed to the notice issued by the authorities earlier, in spite of previous fire outbreak in the same structure (Sen, Dasgupta & Ghosh, 2013). Safety measures like fire alarms and extinguishers were missing in the building (The Telegraph, 2013).

iv) **Electrical Safety**: Old and faulty wiring in dilapidated buildings, congested alleyways and storage of combustible materials create a mélange of fire risks. Multiple ownership and tenancy often result in lack of maintenance of electrical wiring and fixtures.

v) **Fire Safety Installations**: Lack of fire extinguishers and other fire safety equipment in establishments cause fires. This also hampers or delays fire response.

6.4 CONCLUSION

The markets dealing with flammable materials should have been more careful with the fire-safety precautions. The casual attitude of traders and shopkeepers cost 20 lives and their livelihood. The following are some of the suggestive measures for this kind of scenario:

- Control and restriction on the construction of illegal extensions in the structures;
- Regular monitoring by the authorities regarding issuance and renewal of permits and licenses;
- Creating awareness of the users towards the vulnerabilities of the structure;
- Developing a disaster management plan especially for buildings, which are old and located in congested areas, through stakeholder consultation;
- Regular maintenance and inspection of the fire safety measure in such structure.

Chapter 7

PUTTINGAL DEVI TEMPLE FIRE

Incident	**Puttingal Devi Temple Fire**
Location	**Puttingal Devi Temple, Paravur (Kollam District), Kerala**
Date/Time	**10th April, 2016, 3:30 am**

7.1 INTRODUCTION

Puttingal Devi Temple is located at Paravur in Kollam District of Kerala. It is nearly 70 kilometres south from the State Capital Thiruvananthapuram. The presiding deity of the temple is believed to have been discovered in an anthill. The temple, thus, derived its name from the Malayalam word 'Puttu' that means anthill. The main festival celebrated in the temple is on the day of Bharani in Meenam. On this day, the fireworks show is usually arranged to please the god along with other cultural functions.

Figure 7.1: Puttingal Temple at Paravur in Kollam District, Kerala

Source: (https://upload.wikimedia.org)

7.2 THE EVENT/DISASTER

7.2.1 Description of the Event

The fire tragedy occurred at Puttingal Devi temple during the celebration of the festival of Bharani Star. The incident occurred on the 10th of April in 2016, Sunday, around 3:00 am. More than 10,000 people were present in the temple premises during the fire tragedy due to the celebration of the festival. The tragedy was caused as a result of a cracker popularly known as 'amittu' (a spherical shaped cracker which goes up in the sky and bursts to show colourful sparks ending with a sound), accidentally falling into a fireworks stockpile towards the end of the show. It resulted in intermittent explosions that ripped through the concrete buildings and even ignited the temple in the fire. The fire spread in the entire premise rapidly. The locals reported that the blast could be felt at a distance of 1 kilometre away from the temple (BBC India, 2016). As the gathered mass of spectators tried to flee from the explosions, incidents of stampede occurred. It is reported that the temple did not have clearance to conduct a firework show, that too a competitive firework show, from the State Government of Kerala (Stalin & Koshy, 2016).

Figure 7.2: Fire explosions at Puttingal Temple

Source: (Deccan Chronicle, 2016)

7.2.2 Impact/Loss

According to reports, 106 people died and around 400 were severely injured (BBC, 2016). The death toll reached to 111 after two days as some of the injured victims failed to survive after being taken in hospital (BBC, 2016). Out

of the injured victims, 24 of them were reported to be in critical condition even after two days while around 351 victims were still going under treatment (BBC, 2016). Several of the victims were hurt by the debris coming out of the concrete structures during the explosion. The whole temple premise was heavily destroyed, as illustrated in Figure 7.3. It is reported that around 150 houses were destructed in the area due to the blast (Reuters Editorial, 2016). Several wells at the nearby locality caved in under the impact of explosion (Mathrubhumi, 2019).

"Our house is unliveable. Everything is blown off... If we had stayed in our house last night, we would have all died".

—Anitha Prakash, Resident (BBC Hindi)

Figure 7.3: The destroyed temple complex after the explosion

Source: (https://dc-cdn.s3-ap-southeast-1.amazonaws.com)

7.2.3 Relief and Response

The emergency team, on reaching the spot, had to use bulldozers to clear the area to search for the survivors. A team of specialist doctors was sent from AIIMS, Delhi to assist in the local hospitals for the treatment of the burn victims. The rescue teams were reported to be reached late to the spot according to the locals (BBC India, 2016).

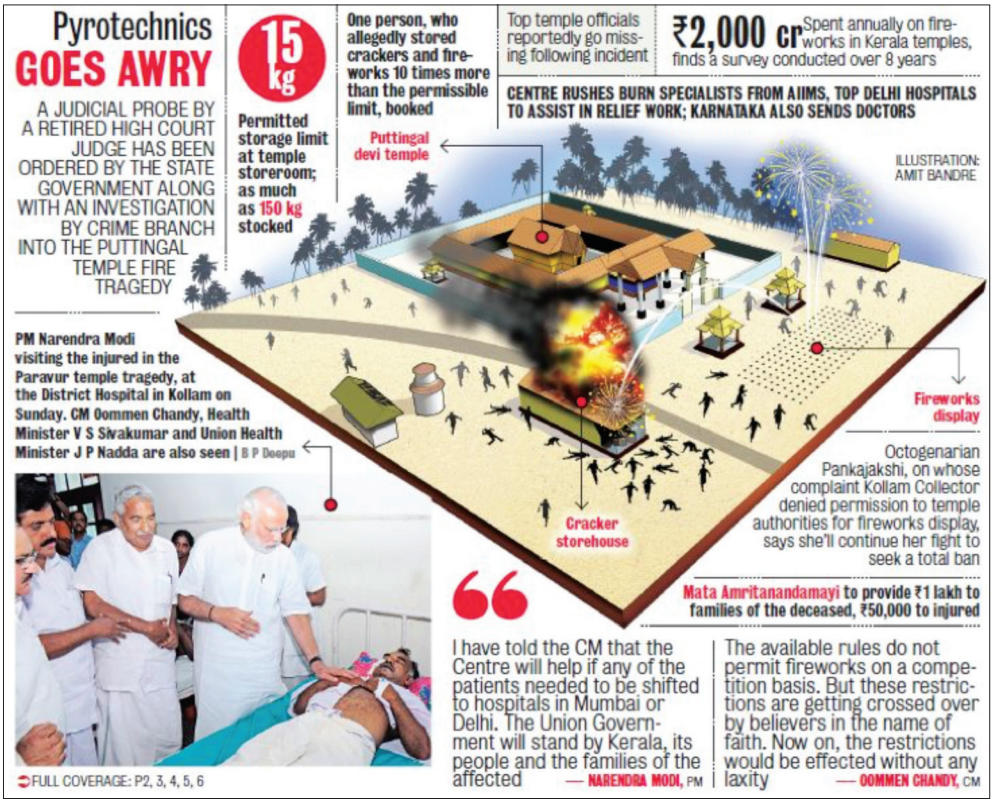


Figure 7.4: Detailed Analysis of the Tragedy

Source: (The Indian Express)

7.2.4 Aftermath

The state of Kerala had also witnessed a similar incident at Sabrimala Temple in the year of 1952 due to a fireworks explosion. The Government put an immediate ban on the fireworks shows in the State. An immediate investigation was ordered. According to the investigation and probe reports, the temples did not have clearance for the fireworks shows. The High Court of India, after two days of the incident, banned the use of high-decibel firecrackers between sunset and sunrise across the nation. The police had booked the person responsible for storing the crackers and fireworks that was ten times more than the permissible limit. The temple officials, according to the Indian Express, were reported to be missing.

7.3 LESSONS LEARNT

The Puttingal Temple Fire Tragedy was caused only because of negligence and strong violations of fire safety norms and regulations. Lack of preparedness is

another major reason. Following are the issues that caused this devastating incident:

i) **Violation of Safety Rules and Regulations**: The temple authorities had gone ahead with the show, despite the denial of permission by the district administration for the fireworks display on safety grounds. The situation could have been mitigated had the local authorities and festival organisers abided by the law.

ii) **No adherence to Fire Safety Measures**: No proper arrangement was done before conducting such event such as fire tender, first aid facilities etc. No zoning was done with respect to safety of people. There was no arrangement for managing the facility for a large crowd. The evacuation plan was not prepared even though more than 10,000 people were reported to gather for the event. The contractors in charge of the fireworks did not provide an adequate buffer zone between the area where the explosives were lit and the assembled crowd in spite of having guidelines on where the fireworks can be held, how people should be evacuated from such sites, and what are the safe distances to be kept. The most dangerous part was that different groups were competing with one another and made the event a test of their financial muscle and firepower. Banned substances were freely used.

iii) **Enforcement of Laws**: The district administration is also to be blamed. The district administration, with the help of the local police, could have taken action, but either they ignored the risks or were overcome by the popular interest. Had they inspected the sites, read the rules to the organisers and prevented unlawful storage and display of the explosives, the loss of lives and properties could have been avoided.

iv) **Structural Irregularities**: The temple and the surroundings were not disaster-proof, many people died from heavy concrete debris that fell on them because the fireworks ignited a warehouse of explosives. Demarcation of the space where the firecracker display was to take place was done without much thought about the fire risk and adherence to norms of NBC and PESO.

7.4 CONCLUSION

The temple tragedy could have been avoided if the temple authorities had paid attention to the local civic bodies. The mood of festivity overpowered the sense of fire safety costing the lives of hundreds. Even though accidents and tragedy are not uncommon during religious festivals in India, the authorities were not prepared to handle the emergency. The local authorities also did not bother to inspect and monitor whether their advisory had been considered even though a large crowd was expected in the complex.

SURAT FIRE

Incident	**Fire at Takshashila Arcade**
Location	**Surat, Gujarat**
Date/Time	**24th May, 2019, 3:30 pm**

8.1 INTRODUCTION

Surat, earlier known as Suryapur, located in Gujarat, India is the ninth populous (44,67,797 as per the Census 2011) city in the country. The city has a population density of 13680 persons/sq. km. Spread over an area of 326.515 sq. km, it is the fourth fastest-growing city in the world. Surat is nominated by the Government of India for the Smart City Mission in 2015.

Figure 8.1: Location of the complex

Source: (PTI)

The Sarthana Area is situated in the north-eastern part of the city with a population of 25,706 (Census 2011). Takshashila Arcade, located in the Sarthana Area as shown in *Figure 8.1*, was a four-storeyed commercial building complex with coaching centres on the third and fourth floors, while the lower floors primarily catered to different categories of shops. The fourth floor of this building was a makeshift dome-like structure built with plastic sheets as illustrated in *Figure 8.2*.

8.2 THE EVENT/DISASTER

8.2.1 Description of Event

On May 24, 2019, around 3.30 pm, a fire broke out in the ground floor of Takshashila Arcade located in the Sarthana area of the city. Students between the age of 15 and 19 were taking their coaching classes on the makeshift fourth floor. The alleged cause of the fire was reported to be an electrical short circuit in air-conditioner (Ranjan, 2019). The fire began at the ground

floor, quickly engulfed the building including the staircases forcing the students to take shelter on the terrace. They eventually were trapped in the terrace (India Today Webdesk, 2019). As the fire raged, as many as 22 died from the fire and the injuries they had sustained after jumping from the top floor as a means of saving themselves from the heat and fire (India Today Webdesk, 2019). Figure 8.3 illustrates the fire at Takshashila Arcade.

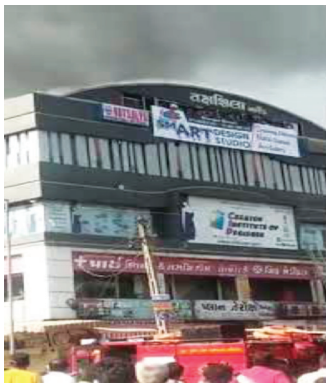


Figure 8.2: Takshashila Academy before Fire

Figure 8.3: Fire at Takshashila Arcade on May 24, 2019

Source: (India Today)

The coaching centre located on the top floor had walls and roof made of plastic. The ceiling of the coaching centre was only 5 ft. high. This prevented anybody from sitting on a chair. Hence, the owner had resorted to the use of tyres as chairs. The presence of combustible materials such as tyres and flexes were cited as causes that aggravated the fire. A wooden staircase to the top floor aggravated the risk.

"We were on the fourth and top floor. Suddenly, there was smoke all around. We found it extremely difficult to breathe. We shouted for help…I called out for my mother and rushed toward the only staircase. But stairs were also engulfed in fire…Like all others, I and my other friend rushed back to the room…we had no option but to jump. I saw others jumping off and followed them."

—Urmila Patel, Age: 15, Survivor (Hindustan Times)

8.2.2 Impact/Loss

According to eyewitnesses, there were as many as 50 to 70 students inside the complex when the fire started (ANI, 2019). As many as twenty-two lost their lives in the incident. Among the dead were 18 girls between the age group of 16 to 19 and four teenage boys. As per police reports, five persons had died from the injuries caused by jumping from the top floor while the remaining lost their lives to the blaze. The fire had also left several injured. There were about another 16 students and a child aged 3 to 4 years who had suffered from serious injuries and were admitted to hospital (Zee News, 2019). A fire official reported that the students suffered the most as they were trapped because of no available escape routes on the top floors (Financial Express, 2019). Many of the survivors were reported to be going through emotional trauma after the incident.

> **"There was smoke; I did not know what to do. I took the ladder, first helped the children get out of the place, managed to save 8-10 people. Later, I managed to rescue 2 more students. The fire brigade came after 40-45 minutes."**
>
> *—Student present in the building when the fire broke out (India Today)*

8.2.3 Response/Rehabilitation

According to fire officials, a total of 19 fire tenders and two hydraulic platforms were put to action. The eyewitnesses claimed that the fire services had reached the scene only 45 minutes after the blaze. It approximately took them an hour to douse the blaze. The locals supported the fire-fighters in the rescue operations.

The Chief Minister ordered a probe into the incident and declared financial aid of Rs. 4 lakhs each to the families of children who passed away. An FIR was

Figure 8.4: Fire Services at work

Source: (Al Jazeera)

registered against three people, which included the builders of the complex and the owner of the coaching centre that was located on the top floor.

> **"What I experienced was hell. I do not know for how long I was in the building and what made me jump off. All I remember was everyone was crying for help. After jumping off, I thought I was dead."**
>
> *—Happy Panchali, Age: 15, Survivor (Hindustan Times)*

8.3 LESSONS LEARNT

The Surat Fire of 2019 was a completely man-made disaster which was avoidable had the preventive measures been taken. There are certain key issues or downfalls that contributed to the disaster having such an impact.

i) **Illegal construction and structural irregularities**: The Surat Urban Development Authority (SUDA) had sanctioned the plan for a residential society at the location in 2001. However, a shopping centre was illegally constructed at the site in 2007. The structure was however legalised after paying the impact fees in 2013 post the formulation of building regularisation rules in 2012. This legalised the second floor. The third floor, however, was built illegally (Parmar, 2019) the top floor, which had a huge dome-like structure, was allegedly illegally constructed. It has to be noted the building was not maintained as per the CGDCR rule of the Government of Gujarat. The building also did not hold a valid Building Use Certificate (BUC).

> **"Lot of smoke accumulated on the top floor where there were AC compressors and tyres which too caught fire. There was no escape route available for the students who got trapped on the top floors. The fire was doused in one hour. There were no safety equipment installed in the building."**
>
> *—Fire Official (India Today)*

ii) **Enforcement of fire safety norms**: Surat is pitched to be the fastest growing city of the world by GDP by 2035 (www.businessinsider.com, 2019), however fire safety norms are flouted with ease. As per initial investigations, no audit or certificate has been issued in the area within the required provisions under the Gujarat Fire Prevention and Life Safety Measures Act, 2013. It is also to be noted that the structure, being inherently illegal has been supplied electricity connection by the authorities. The overload in the connection had led to the short circuit and thereby the incident. This is a case of institutional failure.

The authorities did not properly implement the Fire and Life Safety Measures and the building did not obtained a No Objection Certificate

(NOC) from the Fire Department. According to initial investigations, the building had only a single point for entry and exit to the top floors. One of the two staircases was blocked and not in operation. The number of exits must be planned for each floor considering the probable number of occupants and travel distance. The building did not have a fire exit and even lacked passive fire protection, which would have prevented the spreading of fire and smoke from ground floor to top (Ranjan, 2019). The ceiling height of the top floors were only 5 feet (nearly 1.5 metres), whereas it should be minimum of 2.5 metres according to the National Building Code (NBC) of 2005. Due to less height of the floors and the absence of smoke extracting system resulted in excessive suffocation due to smoke during the fire outbreak. To add to the grave of the situation, the owners of the Takshashila Arcade did not install any fire safety equipment in the complex.

iii) **Use of combustible and flammable materials as interiors and furniture**: The use of combustible materials like wood proved fatal in case of a fire outbreak. The operational staircase in the building was made of wood and had engulfed in fire, preventing the students from using it (Ranjan, 2019). The materials used for interior coatings and internal walls of the buildings were highly flammable spreading the fire very quickly. Fire load for the structure should have been calculated and checked regularly. Electrical audits and thermographic assessments should have been done for the structure. The use of flammable materials as makeshift seating arrangements further worsened the situation (Ranjan, 2019).

iv) **Inadequacy of equipment in the Fire Services**: The fire services, though located within 2 km from the Takshashila Complex, reached the spot after 45 minutes of the outbreak in the complex due to the traffic and congestion in the surrounding roads. The fire tenders that eventually reached the spot did not have ladders tall enough to reach the top floor that could have potentially saved some lives. The students had to jump from the third and top floors since the fire-fighters could not reach them. Those who were afraid to jump lost their lives to the blaze. Another major downfall was that the Fire Services were not equipped with jump nets, which would have saved the lives of those who jumped from the building.

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major downfall was that the Fire Services were not equipped with fire jump nets, which would have saved the lives of those who jumped from the building.

v) **Enforcement of laws and norms**: It was clearly the responsibility of the Surat Municipal Corporation to remove the illegal construction under the BMPC Act, 1949 Chapter VI. However, the operations in the building were still allowed to continue. No audit was conducted for the buildings though it is compulsory for all the high-rise buildings and industrial complexes to carry out a third-party audit every two years (Ranjan, 2019).

"Around 10 students on fourth and third floor jumped off to the ground to save themselves from fire and smoke."

—Fire Official (India Today)

"We have given one-week time to these coaching centres to upgrade themselves with requisite fire-fighting equipment."

—Jagdish Mehra, Fire Safety Officer, Nainital District (Times of India)

8.4 IMPLICATIONS ON POLICY & PRACTICE

Following the incident, the State Authorities ordered to shut all coaching and tuition centres until a proper audit of fire systems were carried out in all cities and districts. The Municipal Commissioner suspended two senior officials of the fire department for negligence. Surat Municipal Corporation identified around 3,000-3,500 buildings across its jurisdiction with no fire equipment installed and issued notices or sealed them as a knee-jerk reaction to the fire (ANI, 2019). Another 9,962 buildings were scrutinised in the following week of the fire incident under the state-wide drive of Gujarat and as reported to the Indian Express, 9,395 of them were found to be in violating the safety norms. Mukesh Puri, the Principal Secretary of Urban Development of Gujarat, has directed the civic authorities and government to inspect all buildings where there is movement of large people or vulnerable facilities like schools, hospitals, nursing homes, commercial complexes, etc. (Saiyed & Mohanty, 2019).

The civic authorities of the National Capital and various other States started conducting fire audits and inspection in the commercial buildings in wake of the Surat Fire Tragedy. The incident had led to the Delhi Fire Service planning to conduct audits in coaching centres operating from the high-rise buildings of the National Capital and to shutdown immediately any facility that is found violating the fire-safety norms (Scroll, 2019). Nainital District Administration conducted inspections in high-rise coaching centres across six sub-divisions of Kumaon Division. 35 coaching centres in Haldwani, the 'coaching hub' of Uttarakhand, were consequently issued the notice for violations of fire safety

norms (Upadhyay, 2019). The Fire Department of Delhi, meanwhile, had also issued notices to several guesthouses (Scroll, 2019).

8.5 CONCLUSION

The Surat Fire was one of the three major fire incidents that occurred within a period of six months in 2019 (Anaj Mandi and Arpit Hotel Fire in Delhi, being the other two). The incident is clearly a man-made disaster and an example of wilful negligence. Notwithstanding the inquiries proving the building not to have adequate safety measures, the authorities did not take a measure to prevent them from running further.

After a similar incident had taken place in a coaching centre at Vesu area that killed 2 persons, several tuition centres were sealed and notices were given to over 230 for non-adherence to safety norms. Gujarat Education Minister had promised a policy framework that makes it mandatory for coaching centres to obtain required permissions before they began operations. This, however, has not seen the light of the day. The present fire safety norms and regulations also need to be revisited and should be made more comprehensive.

LESSONS LEARNT AND THE WAY FORWARD

India witnesses one of the highest number of deaths due to fire hazards, their number increasing year by year. The nation has witnessed 300 percent increase of fire outbreaks, i.e. an increase from 179 to 716 cases, in commercial buildings between the years 2014 and 2015. In the year of 2015, 20 Indian cities have recorded 81 percent of deaths due to building fires. In 2018, 3.1% of all accidental deaths were caused by fires. Most of the urban fires in our country are triggered by human-induced factors. Slums in cities are a major source of fire in India. Most of the Indian cities suffer from slum fires, especially in the hot dry summer months.

The lack of planning and poor implementation of norms in urban areas is a major reason behind increasing fire risks as it leads to formation of informal settlements and over densification. As per Census 2011, 17.4 percent of urban households live in slums and informal settlements. 65 percent of the slums of the country are concentrated in major cities like Mumbai, Delhi, Chennai, Hyderabad, Kolkata, Bengaluru, Nagpur, Pune, Indore and Bhopal. These informal settlements, excluded from the purview of building byelaws and planning regulations, are developed without any consideration to fire safety. With increasing urban slum population, this has become a matter of concern.

The other factors that further increases the risks to fire outbreaks are:

- **Response time**: Fire and emergency services, across the country, though trained to respond at the earliest, suffer from restricted access, encroachments and traffic congestion. This often causes a delay in response, leading to loss of life and assets. The delay in response to fire outbreaks by the authorities is a major issue as the inability to rescue within the golden hour increases the casualties. The norms of the Standing Fire Advisory Council (SFAC) stipulate response time between 3-7 minutes based on the risk category and one fire station per 10 sq km in urban areas and per 50 sq km in rural areas (NDRF & CD, 2012).

- **Enforcement of building byelaws, planning and zoning norms**: The improper enforcement of laws and regulations by the civic authorities is at the root of numerous fire outbreaks in India. Regular monitoring and inspection are very rare in most of the towns and cities. The structures are often found to be installed with non-functional fire-fighting systems thus increasing the risks. The lack of monitoring and improper enforcement also leads to issues of unauthorised constructions and structural

irregularities. The fire incidents like Dabwali Tragedy and Meerut Trade Fair Fire reveals the need for strict compliance of the codes of practice for temporary structures like pandals, festival tents, etc.

- **Apathy and information**: The casual attitude and negligence of people due to lack of awareness is also at the root of frequent fire outbreaks in our country. The residents are little bothered about their safety and are often found to be violating the fire safety norms and regulations. Issues like obstruction of exits, storage of highly flammable materials, etc. also arises due to the casual attitude of people.
- **Individual load management**: The use of faulty equipment leading to fire outbreaks is another major concern in the Indian towns and cities. The users, especially in commercial complexes, also tend to put excess loading than the permissible limit often leading to transformer fires. The Uphaar Cinema tragedy was such an instance.
- **Lack of infrastructure**: There also have been several complaints regarding the inefficiency of the fire rescue team due to the lack of proper infrastructure. For example, in the case of Stephen Court Fire and Carlton Tower Fire, residents were unable to escape because the height of the ladders could not reach the upper floors and safety nets available with the rescue team were insufficient. According to the report of the Standing Fire Advisory Council (SFAC) under the MHA, India is currently facing deficiency in infrastructure facilities: 97.54 percent in terms of fire stations, 80.04 percent in terms of fire vehicles and 96.28 percent in terms of fire personnel.
- **Enforcement of building byelaws, planning and zoning norms**: Improper enforcement of laws and regulations by the civic authorities is at the root of numerous fire outbreaks in India. Regular monitoring and inspection are very rare in most of the towns and cities. The structures are often found to be installed with non-functional firefighting systems increasing the risks. The lack of monitoring and improper enforcement also leads to issues of unauthorised constructions and structural irregularities. The fire incidents like Dabwali Tragedy and Meerut Trade Fire reveals the need of fire safety guidelines for temporary structures like pandals, marriage tents, etc. Use of flammable cladding and insulation materials should also be monitored. Fire safety plans and blueprints can also be drafted in consultation with the Fire Department and Municipal Corporation. The fire blueprint plan of Bangalore can be an exemplary for this.

9.1 WAY FORWARD

The present scenario demands a paradigm shift from firefighting to fire prevention by ensuring the involvement of all stakeholders. It is thus imperative

to learn the lessons from the previous incidents and reduce the risks of urban fire by addressing the underlying cause. The lessons learnt from the case studies would acts as a guiding light for building and shaping the fire safety norms and regulations of the country. The following are some of the action strategies for building fire resilience in urban areas:

➢ **Strengthening guidelines and policy framework:**

- Strict adherence to available norms of electrical load management for new constructions. Encouraging use of low voltage lights in place of incandescent lights.
- Guidelines for existing old structures w.r.t fire prevention needs to be formulated.
- Guidelines should also declare the permissible amount of flammable materials that can be used for any structure without creating fire risks.

➢ **Enforcement of fire safety norms and regulations:**

- Proper evaluation and scrutiny before the sanction and renewal of the permits, licenses, approvals, NOCs, etc.
- Strict scheduling for renewal of licenses and permits.
- Regular monitoring and inspection by the authorities for checking the functionality of the installed fire-fighting equipment.
- Accountability of the officials renewing and sanctioning the licenses and permits needs to be ensured.

➢ **Upgradation of fire-fighting equipment and infrastructure:**

- The local fire departments need to upgrade the fire-fighting equipment and infrastructure according to the NDMA Guideline on Scaling, Type of Equipment, and Training of Fire Services.
- Procurement of suitable size of vehicles for accessing narrow lanes is necessary.
- Pre-Planning of emergency routes.
- Integration of real-time traffic monitoring devices to minimise the response time.
- Mobile applications for reporting fire incidents to authorities can also be adopted.

- **Mainstreaming of fire risks mitigation and management in urban planning and development:** Incorporation of assessment of vulnerabilities and risks to fire at all levels. The fire safety provisions are available at building level design, but no specific fire norms at area level are present in the urban and regional planning guidelines.

- **Building community resilience:** The communities being the first responder play an indispensable role in case of a fire outbreak. The strengthening capacity of individuals and communities is thus very pertinent. The following are some of the suggested ways to build community resilience.

  - **Stakeholder participation:** Consultation of all the stakeholders while developing an emergency management plan for any structure or settlement. This will put forward the issues faced by each stakeholder. The involvement of the stakeholders in decision making also create a sense of accountability to the individuals and communities.

  - **Creating awareness among the public:** Conduction of sensitization and awareness programmes for the urban residents and other stakeholders regarding the prevalent urban fire risks. The awareness of the risks and vulnerabilities will bring a state of urgency among all the stakeholders and inculcate the culture of prevention and mitigation.

  - **Better Preparedness:** Evacuation and safety mock drills needs to be arranged for residents the high-rise, commercial complexes, institutions like schools and hospital, offices, etc.

To reduce the urban fire risks in the surroundings, the above measures need to be implemented to bridge the identified gaps. Though our governments and fire departments have done a lot of improvement in the fire-fighting system, progress in prevention, mitigation and monitoring is highly required. Fire Risk Management is a process-oriented coordinated action, which calls for the co-operation among the departments of urban development, traffic management and fire officials.

EPILOGUE: LESSONS LEARNT?

As the lessons from various fire disasters across the nation were being consolidated, a devastating fire in Delhi, the National Capital made disconcerting news and shocked everyone. On December 8, 2019, a fire in a factory building in the Anaj Mandi area claimed 45 lives, with more than 50 people seriously injured.

Delhi has a strong historical significance. It has witnessed succession of several empires and kingdoms and was captured, ransacked and rebuilt several times especially during the medieval period. It has several pockets and markets which are densely populated, congested with narrow streets and poor infrastructure making them vulnerable to fire outbreaks. The national capital like any other metro cities in India is extremely vulnerable to urban fires because of these pockets. A number of fire incidents occurred in the city over the years, of which the Uphaar Fire Tragedy in 1997 was the deadliest. The fire outbreaks at Lal Kuan, Bawana and Karol Bagh are also some of the other major tragedies. A number of fire incidents occurred in 2019 itself, of which the Hotel Arpit fire in Karol Bagh in February and the Anaj Mandi Fire in December were most devastating.

Figure 10.1: Map of Delhi showing Anaj Mandi

Source: (Delhi Unlimited)

The Anaj Mandi neighbourhood in Rani Jhansi Road in North Delhi is a congested commercial area dotted with small factories and workshops. This area consists of several factories and small manufacturing units operating from old, cramped quarters and in blatant disregard for the fire safety and municipal norms. Several fire outbreaks are reported on a regular basis. The recent outbreak that occurred on 8th December, 2019 in a building where factories were working

illegally was a massive one. It was even declared as the second deadliest fire outbreak in the city since the Uphaar Tragedy (Nigam, Pandey & Gothi, 2019).

10.1 ANAJ MANDI FIRE

10.1.1 Description of the Event

The Anaj Mandi neighbourhood in North Delhi witnessed a massive fire, from an illegal factory building, early morning around 5 am on 8th December 2019. The factory was operating in a four-storey cramped building in the neighbourhood (Nigam, Pandey & Gothi, 2019). According to reports, roughly 70 workers were sleeping inside the factory when the fire broke out at the second floor of the building (India Today Webdesk, 2019) (Nigam, Pandey & Gothi, 2019). Most of the labourers were migrants from other states like Uttar Pradesh and Bihar who stay in the factory itself.

Figure 10.2: Fire Outbreak at Anaj Mandi, North Delhi

Source: (Nigam, Pandey & Gothi, 2019)

The building was stored with a lot of combustible materials and of the two staircases in the building, one was blocked by these goods (Nigam, Pandey & Gothi, 2019). Those awakened by the fire also could not escape because of the

> **"At 5 am, I heard screams from the nearby building. I rushed to the terrace and found that a fire broke out on the third and second floor of the building. Six to seven men were standing near the windows, begging to be saved. As the window cannot be opened, they were trapped inside."**
>
> *—Md. Rashid, a neighbour (India Today)*

blocked exits. The building was reported to have no ventilation. The cause of the outbreak is suspected to be a short-circuit in the building (News 18, 2019).

10.1.2 Impact/Loss

This fire killed around 45 people mostly the labourers working in the factory (India Today Webdesk, 2019). Though the Delhi Fire Service (DFS) and the authorities rushed to the spot for rescue immediately after the reporting, many of the victims were already dead due to excessive

> **"This is the second biggest fire in Delhi's history."**
>
> *—Chief Fire Officer, Atul Garg (India Today)*

smoke inhalation. The fire has also been reported to have injured around 16-20 people (India Today Webdesk, 2019).

10.1.3 Response and Relief

Figure 10.3: Fire Personnel at Rescue and Relief Operation

Source: (Nigam, Pandey & Gothi, 2019)

Figure 10.4: DFS fire engine at the site of fire outbreak

Source: (Nigam, et al 2019)

The fire department and the authorities rushed to the spot immediately. It took nearly four hours to douse the flame by a team of 150 fire-fighters, while 50 fire engines were involved in the operation (Nigam, Pandey & Gothi,

2019). The narrow lanes in the neighbourhood acted a typical hindrance for the fire personnel causing delay in the response. The locked iron gate at the top floor of the building was another hindrance faced by the rescue team. The fire personnel had to break the gate to rescue the victims. The victims were rushed to the nearby hospitals where several have been declared dead due to inhalation of smoke.

Figure 10.5: Ambulances carrying the victims to Hospitals

Source: (Nigam, Pandey & Gothi, 2019)

Figure 10.6: Distressed family and relatives of the victims near Hospitals

Source: (Nigam, Pandey & Gothi, 2019)

10.1.4 Aftermath

The Delhi Chief Minister Arvind Kejriwal announced a Rs. 10 lakhs compensation for the families of the dead and Rs. 1 lakh to each of those injured (Nigam, Pandey & Gothi, 2019). The Delhi Government initiated a magisterial inquiry into the matter and sought for a detailed report within seven days (India Today Webdesk, 2019). The Hon'ble Prime Minister of India also announced ex-gratia of Rs. 2 lakhs for the family of the deceased and compensation of Rs. 50,000 each for the seriously injured victims in the incident. The Union Home Minister Amit Shah also issued instructions to the authorities to provide all the assistance to the victims on an urgent basis (Nigam, Pandey & Gothi, 2019).

The owners of the plot have been booked under Section 304-A (causing death due to negligence) and Section 285 (negligent conduct with respect to fire or combustible matter) of the Indian Penal Code (IPC). The owner of the building has been arrested by the police.

The materials such as the cardboard boxes and mirror frames on the second floor were completely gutted. The burnt remnants of clothes, bags and sewing machines were found on the second and the third floor. The fire outbreak gutted a major portion of the inventories of these factories. The economic impact on the factory owners and employees of this outbreak would be huge. The shutting down of the factories after the fire outbreak left the workers without shelter and devoid of their personal belongings in the harsh winter.

10.1.5 Factors Responsible

The devastating fire incident at the Anaj Mandi in Delhi, shows the negligence and apathy of the authorities. The police investigation after the incident has revealed the following factors that have contributed to the outbreak:

i) **Violation of Rule and Regulations**: The building comprises of five floors, each having four to five rooms. There was a plastic toy manufacturing unit on the ground floor, a cardboard manufacturing unit at the first floor; and a garment workshop, (jacket factory and a printing press) at second floor. All the factories in the building were operating illegally. Permit was not given to these units to operate any kind of factories in the residential area. The Fire Department was also informed that one of the houses caught fire and accordingly only four fire engines were sent to the spot which also delayed appropriate response. No fire NOC was obtained for this building.

ii) **Negligence to Fire Safety Norms**: One of the two staircases in the building was completely blocked by the goods. The factory building was stacked with lots of combustible goods which should not have been stored. The fire got easily ignited due to the presence of the combustible

materials. Majority of the workers used to stay overnight in the building. The building did not have any fire-fighting equipment, safety gears, fire alarms, etc. There was no emergency escape route as well.

iii) **Building and Planning Irregularities**: The building only has one exit which opened into a narrow lane. With the high occupancy of building, the exit was not adequate. There was no ventilation in the building. The grilled windows of the buildings were permanently sealed trapping the victims during the outbreak.

The access road to the building was extremely narrow as only one vehicle could enter and come back at the same time. The fire tenders could not reach the building on time because of the narrow lanes. The ambulance also could not enter these lanes.

iv) **Enforcement of Laws and Norms**: This tragedy shows lack of enforcement of fire safety norms by the authorities. No action has been taken against the owner for violating the bye-laws and the norms. The incident has also revealed the need of redevelopment of the congested and over-dense pockets of the cities. The Redevelopment Plan of Special areas prepared by the North Delhi Municipal Corporation (NDMC) as per mandate of Master Plan of Delhi 2021 is still pending (Hindustan Times, 2019). This also shows the apathy of the authorities to enforce norms and regulations. This incident also points to the lapses that were allowed to continue with impunity. The problems of the areas have been repeatedly identified yet the authorities were not diligent in taking any action.

10.2 DID WE LEARN LESSONS FROM THE PAST?

The fire at Anaj Mandi has brought back the memories of some of the past tragedies that have been witnessed in the city. This section details out three such tragedies and probe the policy implications after these disasters.

10.2.1 Lal Kuan Tragedy

The massive fire blaze in a transport company godown storing chemical containers at Lal Kuan's Gali Mir Jumla in the Walled City on 31st May, 1999 killed 57 people (Shrangi, 2019). The godown now houses a wholesale kitchen appliances shop. The reasons behind the fire at Lal Kuan was similar to those of the Anaj Mandi fire. Most

> **"At times we don't have enough to eat. My elder son died. The younger son has burn injuries on his back and hand and makes little money by working at a garment store. He is on and off work because in the summers, the heat irritates his burns. The remaining amount can help us live better."**
>
> *—Kamala Devi, who had lost her elder son and younger son sustained 40% burns (Hindustan Times)*

of the residential buildings in the neighbourhood have been illegally changed to commercial use over the years. These building are usually stocked with piles of hardware, steel, pipes and plastic, leaving no space for movement during emergencies. The neighbourhood, even after 20 years of the outbreak, still has not got any fire station (Shrangi, 2019). A resident of the neighbourhood, Mohammad Nafis, complained to the Hindustan Times that he has been repeatedly writing to the Delhi Government demanding a fire station within the neighbourhood. The DFS has claimed that fire station could not be built in the neighbourhood due to non-availability of suitable land. The land which was proposed for the fire station already houses a three-storey CISF (Central Industrial Security Force) unit of DMRC (Delhi Metro Rail Corporation Limited) and hence, a fire tender is stationed temporarily in this area during festivals (Shrangi, 2019). The families of the victims, as reported by the Hindustan Times, are yet to receive the half of compensation amount. The penalty levied by the court on the chemical traders are yet to be collected and distributed among the families of the deceased (Shrangi, 2019).

Figure 10.7: Map of Delhi showing the location of Lal Kuan

Source: (Delhi Unlimited)

10.2.2 Bawana Tragedy

The city witnessed a fire outbreak in the F-83 building in Bawana Industrial area Sector-5 on 20th January, 2018. 18 workers inside got trapped and asphyxiated to death as the door of the building was locked from outside (Lama, 2019). The building was used as a godown to store firecrackers before the outbreak. At present, the building is sealed and is abandoned (Lama, 2019). The industrial area is still very prone to fire outbreak but the poor workers has little choice but risking their lives. Most

> **"We sleep in the same room. This helps us save money. After finishing work every evening, we shift the machines and raw materials to one corner and sleep there."**
>
> *—Raju Chaudhury, a Factory Worker (Hindustan Times)*

of the migrants are from the states of Bihar, Uttar Pradesh, Madhya Pradesh and Chhattisgarh and often lives in the factories itself to save the accommodation cost. Though cooking is not permitted in the premise, workers often prepare their own meals in the factories. The fire department officials reported that 15-20 calls every month are received in summers from the industrial area. No measures have been taken by the authorities to reduce the fire threats in the Industrial Area of Bawana.

Figure 10.8: Map of Delhi showing the location of Bawana Industrial Area

Source: (Delhi Unlimited)

Figure 10.9: Map of Delhi showing the location of Karol Bagh

Source: (Delhi Unlimited)

10.2.3 Karol Bagh Tragedy

The pre-dawn blaze on 12th February, 2019 at Hotel Arpit Palace in Karol Bagh killed 17 people (Pillai, 2019). The government agencies after the outbreak have step up the fire safety regulations in the area. As an aftermath of the

disaster, over 100 guest houses were sealed in Karol Bagh and Paharganj area for violation of safety norms (Pillai, 2019). The Delhi Government has also prohibited kitchens or cooking activity in any form on rooftops or basements, storage of inflammable materials or temporary roofing in terraces. The guest houses and lodges were also instructed to mandatorily install exhaust fans to

> **"All the focus is on small guest houses. But what about the state of the entire market? The fire occurred in a guest house so all the focus is on these establishments. We need a comprehensive fire safety plan for the market."**
>
> *—Balan Mani, President, Karol Bagh's Delhi Hotel and Restaurant Owner Association (Hindustan Times)*

ensure ventilation in case of a fire and set up fully automatically pressure pumps, which would sprinkle water as soon as smoke is detected. In addition, they were also instructed by the authorities to install fire proof doors. A sub-committee has also been constituted with members from Delhi Police, DFS, government and fire experts to review the safety measures in the guest house and eateries of the Karol Bagh area (Pillai, 2019). Though the neighbourhood still has dangling wires outside buildings and cramped passageways, the measures taken by the government have led to better enforcement of safety norms. The reception desk of most of the guest houses at present are reported to have fire safety pamphlets and the hallways are equipped with fire extinguishers. Smoke and carbon monoxide detectors have also been installed in some of the guest houses. The residents express their grievance saying that agencies are only focusing on the hotels and guest houses, whereas the need of the hour is to make the entire market safe. There should be a comprehensive fire safety plan for Karol Bagh market.

10.3 QUESTIONS REMAIN...

The apathy of the authorities in taking any action has clearly indicated that little has been learnt from the previous fire outbreaks. No measures have been taken in many areas like Lal Kuan and Bawana even after hazardous outbreaks. All factors that caused the fire incident at Anaj Mandi have been previously identified. The owner not caring to get fire clearance from the authorities again points out on the need of awareness of the fire safety among common people. Building community resilience would also have been helpful in avoiding this disaster. Compliance of the building bye-laws and planning norms could have easily avoided such a deadly incident and saved many. What we have to ponder here is the state of preparedness we have in terms of fire safety and how seriously the safety norms are being taken.

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