FIRE SAFETY AWARENESS MONTH CAMPAIGN - EXPERT PERSPECTIVE

FIRE SAFETY AT HOSPITALS

RAJASEKHARAN R. NAIR
Director, Safety and Health Information Bureau

Email
rajan.shib@gmail.com
ceo@shib.co.in

1.0 Introduction :

Fire has enormous potential for destruction. It creates havoc – loss of lives and damage to precious property. A fire can occur at any time at any place. Fire in any hospital has potential to cause harm to its occupant patients, staff and visitors – and severe damage to property.

Fire in a hospital building, in particular, high-rise buildings is more complex and the salvaging operations becomes more difficult and sometimes even resulting in many deaths and property loss. Even though hospitals follow several safety measures and standards, there is always a boundless chance for a new accident to happen because hospital environment is charged with compound inherent risks.

To mitigate a fire, the first step we should take is to identify the potential fire risks. Fire risks in hospital buildings varies from hospital to hospital. It mainly depends upon the nature of activities / specialisation carried out in the hospital and the size of the hospital

This article will focus on the status, case histories of the fire accidents and the various measures to be adopted to mitigate the potential fires in Indian hospitals.

2.0 Categorisation of Hospitals :

Hospitals in India are categorised as per the norms of The **Clinical Establishments (Registration and Regulation) Act, 2010.** The **Clinical Establishments (CE) Act** is an Act of the Parliament of India. It seeks to regulate all clinical establishments in India. The CE Act requires all clinical establishments in India to register themselves and provides a set of standard treatment guidelines for common diseases and conditions.

2.1 Category as per CE Act :

As per the CE Act, all the hospitals in India are categorised into four levels depending upon the activities / services carried out, which are given below:

Level I :

Hospitals under this category provides Primary Healthcare Services by qualified doctors that include General Medicine, Paediatrics, First Aid, Obstetrics & Gynaecology and Outpatient Services. However, it does not carry out any surgical activities.

Level II :

Hospitals under this category may include all the services provided at Level-I above plus have facility for Surgery and Anaesthesia. Secondary Healthcare Services can be provided through a Registered Medical Practitioner under the supervision and with the support of Specialists. It will have other support systems required for these services like Pharmacy, Laboratory, Diagnostic Facility, etc.

Level III :

Hospitals under this category may include all the services provided at Level I and II, plus Multispecialty Clinical Care with distinct departments, General Dentistry and Intensive Care Units. Tertiary Healthcare Services can be provided through Specialists. It will have other support systems required for these services like Pharmacy, Laboratory, and Imaging Facility.

Level IV :

Hospitals under this category will include all services at Level III. However, it will have the distinction of being a teaching / training institution. It will have Multi Super Specialities. Tertiary Healthcare Services are provided through Specialists. It will have other support systems required for these services. It shall also include the requirements of Medical Council of India / other registered bodies.

Further, the number of beds availability in the hospital is also considered for deciding the category of hospitals. The four levels considered are:

i) Less than 30 beds,
ii) From 31 to 250 beds,
iii) From 251 to 1000 beds and
iv) More than 1000 beds.

2.2 Category as per NBC :

Ensuring life safety is the most essential aspect of all building codes. The 2016 edition of the **National Building Code (NBC)** of India, is representing the present state of knowledge on various aspects of building construction and fire safety in India. Many of the code provisions has been incorporated by various State Governments and Local Bodies in their own Building Regulations.

The Maharashtra Fire Prevention and Life Safety Measures Rules 2009, framed under the **Maharashtra Fire**

Prevention and Life Safety Measures Act 2006, is an example to this. In a way the NBC 2016 is a comprehensive building code and is regarded as a national instrument providing guidelines for regulating the building construction activities across the country. The Part 3, Part 4 and Part 5 of the **NBC 2016** are more appropriate to fire safety.

Hospitals and Nursing Homes have certain special features which are not identical to other categories of buildings. As far as fire safety is concerned, the hospitals in India come under **Institutional Buildings (C)** and are divided into two main groups viz .:

1) Hospitals, Sanatoria and Nursing Homes and
2) Custodial and Penal & Mental. Both these groups are further subdivided into various categories and the details of which are given in **Table 01 and Table 02** respectively. It may be seen from the Table 01 & 02 that the height of the hospital building is an important parameter in deciding the category of hospitals. However, the above categories do not consider the activities / services rendered by the hospitals.

TABLE 01 HOSPITALS, SANATORIA AND NURSING HOMES		
1)	Less than 15 Meters in Height with Plot Area up to 1000 Sq. M.	
	i)	Up to Ground Plus One Storey, with No Beds
	ii)	Up to Ground Plus One Storey, with Beds
	iii)	Up to Ground Plus Two or More Storeys, with No Beds
	iv)	Up to Ground Plus Two or More Storeys, with Beds
2)	Less than 15 Meters in Height with Plot Area more than 1000 Sq. M.	
3)	15 Meters and above but not exceeding 24 Meters in Height	
4)	24 Meters and above but not exceeding 45 Meters in Height	

TABLE 02 CUSTODIAL AND PENAL & MENTAL		
1)	Less than 10 Meters in Height	
	i)	Up to 300 Persons
	ii)	More than 300 Persons
2)	10 Meters and above but not exceeding 15 Meters in Height	
3)	15 Meters and above but not exceeding 24 Meters in Height	
4)	24 Meters and above but not exceeding 30 Meters in Height	

3.0 NABH Accreditation :

The standard and quality of the hospital is judged in India by the accreditation rank allotted by the **National Accreditation Board for Hospitals & Healthcare Providers (NABH).**

NABH is a constituent board of **Quality Council of India (QCI),** set up to establish and operate accreditation programme for healthcare organizations. The board is structured to cater the needs of the consumers and to set benchmarks for progress of health industry. NABH is functioning at par with global benchmarks.

NABH is offering accreditation programs for Hospitals, Small Health Care Organizations / Nursing Homes, Blood Banks and Transfusion Services, Oral Substitution Therapy (OST) Centres and Primary and Secondary Health Centres.

As large number of hospitals face challenges and difficulties in implementing all the accreditation standards, NABH has developed Pre-accreditation Entry Level Certification standards, in consultation with various stakeholders in the country, as a stepping stone for enhancing the quality of patient care and safety.

Once Pre-accreditation Entry Level Certification is achieved, the health care organisations can then prepare and move to the next stage – Progressive Level and finally to Full Accreditation status. This methodology provides a step-by-step staged approach, which is practical for the health care organisations. The applicant hospital must have conducted self-assessment against NABH Pre-accreditation Entry Level standards after implementing it for at least 3 months before submission of application and must ensure that it complies with the standards

It may be reminded here that the fire safety management is an important parameter to be complied by the Healthcare Organisations for obtaining NABH accreditation. The scope of fire safety management of any organisation can be stretched to any extent, but it can be limited to its objectives.

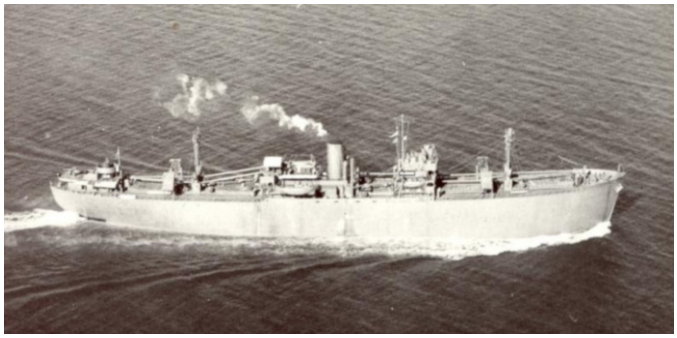
4 .0 Past Fire Incidents :

One must admit that the fires are caused almost entirely by people, either through their actions, which may be accidental or deliberate and malicious or through their failure to make appropriate precautions such as, for example, the regular inspections, maintenance and repair of defective equipment. Accidental fires occur frequently and can be controlled often, but may at times result in loss of life and property.

India has a long history of fires. Although the fire and explosion at Victoria Dock, Bombay, on 14th April, 1944, was not a hospital fire, it has become an inalienable part of its history, wherein, more than 800 persons died.

While battling this devastating fire, 61 firemen sacrificed their lives. As a mark of respect to these firemen, 14th April is observed as Martyr's Day and from 14th to 21st April of every year is observed as the Fire Service Week.

As the fire and explosion at Victoria Dock had occurred prior to our Independence, many of the present generation readers might not be aware of it and some information on the incident might enlighten them. The fire and explosion at Victoria Dock, Bombay, originated in a ship, named SS Fort Stikine **(See Fig 01),** which was carrying a mixed cargo of cotton bales, chemicals, gold bars, around 1,400 tons of explosives (ammunition like shells, torpedoes, mines, signal rockets, 238 tons of highly sensitive A' explosives). On the day of the incident, there were two explosions. Both the explosions were powerful enough to be recorded by seismographs at the Colaba Observatory in the city. Sensors recorded that the earth trembled at Shimla, a city located at a distance of over 1700 km. The intensity of the explosion was such that it destroyed not only the ship SS Fort Stikine but also 12 other ships including three Royal Indian Navy ships. Few other ships and small vessels were heavily or partially damaged. Due to the impact of the explosion, debris were thrown about 2000 feet (600 metres) high and fell on several civilian populations causing death and injuries to several hundred. The blast also sent a shower of gold in gots over Bombay. The gold bricks each weighing 25 Kgs also injured several persons. Some gold bricks fell into the sea and other areas. To the surprise of many, gold bricks crashed through roofs and fell in their homes. The shower of burning material set fire to slums in the area. Around two square miles were set ablaze in an 800 marc around the ship. Burning cotton bales fell from the sky on docked ships, on the dock yard, and on slum areas outside the harbour. The sound of explosions was heard as far as 80 km away. Some of the most developed and economically important parts of Bombay were wiped out because of the blast and resulting fire.



SS Fort Stikine at the deep seas before it exploded in the Victoria Dock, Bombay.

The selected fire incidents that occurred in major hospitals in India from 2010 to 2021 were compiled and presented below. During this period 61 incidents were reported, which are divided into 2 groups. The group 1 provides the details of 35 fire incidents reported during the period 2010 – 2019.

The group 2 provides the details of 26 fire incidents reported during the years 2020 and 2021, and this period can be regarded as COVID-19 pandemic era in which spurt of fire incidents were noticed.

Before proceeding to the details of the fire incidents reported from 2010 to 2021, let us remember the gruesome fire incident that occurred on 6th August, 2001, at Moideen Badusha Mental Home in Erwadi Village in Tamil Nadu **(See Fig 02),** where 28 inmates of a faith-based mental asylum died in the fire. The inmates were unable to escape as they were bound by chains to trees and beds. The origins of the fire are unknown, but once it spread, there was little hope of saving most of the 45 inmates, who were chained to their beds in the ramshackle shelter in which they slept, though such shackling was against the Indian law. Some in mates whose shackles were not as tight escaped, and five people were hospitalized for severe burns. The bodies of the dead were not identifiable.

Burnt bodies of the inmates at the Moideen Badusha Mental Home in Erwadi Village in Tamil Nadu.

4.1 Fires from 2010 to 2019 :

The authentic statistics relating to fire incidents in hospitals in India are not readily available. However, one has to rely on the information reported in various online and print media. Based on the media reports, a brief description of 13 fire incidents out of the 35 reported in India are compiled and presented below:

1) On 09th December, 2011, a major fire occurred at AMRI Hospital in Kolkata's Dhakuria **(See Fig 03)** at about 3.30 am, which claimed the death of 94 people, out of which 90 of them were patients. It also left hundreds injured. The most of the deaths occurred due to asphyxiation. The fire might have been caused by a short circuit in the basement. The spread of the fire was aided by flammable material, stored illegally in the basement, and spread to the upper floors through air-conditioner ducts. It was reported that every door and window was locked and there was no room for ventilation. There were 160 patients at the time of the incident of which around 50 were in the ICU. Six board members of the AMRI hospital in Kolkata were arrested for culpable homicide on

20th December, 2011. On 30th December 2013, the hospital unit was reopened partially, which it became fully operational by 5th July 2014.

Rescue work undergoing at AMRI Hospital, Kolkata.

2) On 07th September, 2012, a fire broke out in the Intensive Care Unit of KM Memorial Hospital at Bokaro in Jharkhand. Eleven out of 14 patients admitted in the ICU were rescued, while three patients died of burns. The fire was doused after an hour. A short-circuit in the air-conditioner, which was installed in the ICU, caused the fire.

3) On 13th January, 2013, a fire broke out at PBM hospital, Bikaner, Rajasthan. Electric wires connecting the Air-conditioning unit in the ICU could not carry the load due to which the fire occurred. Three infants were injured and damaged the property in the ICU.

4) On 29th November, 2015, a fire broke out at Sardar Vallabhai Patel Postgraduate Institute of Paediatrics Hospital (Shishu Bhavan) in Cuttack, Odisha. The fire occurred in the Neonatal Intensive Care Unit (NICU), which were caused due to the short-circuit in the Electrical Warmer. The fire gutted machines worth Rs. 11 Lakhs and left one child severely injured.

5) On 27th August, 2016, a fire broke out at West Bengal's Murshidabad Medical College Hospital, Berhampore. Three persons including a three-year-old child died and seven others were injured in the incident. About 50 others sustained injuries in the incident. The fire spread from the AC of a VIP cabin on the first floor.

On 17th October, 2016, a major fire broke out at the Institute of Medical Sciences and SUM Hospital (IMS and SUM Hospital), which is the Medical College and Hospital of Siksha 'O' Anusandhan, Bhubaneshwar **(See Fig 04),** which claimed 22 lives and 120 injured. The blaze was suspected to have been triggered by a short circuit in the dialysis ward on the first floor of the Hospital which spread to the nearby Intensive Care Unit (ICU). The deaths occurred due to suffocation as the smoke spread in most of the wards, soon after the fire. Most of the victims, who were on Oxygen support died. The most shocking aspect of the incident was that the security personnel prevented dying patients from fleeing the premises, reportedly citing protocol, even pushing them back into the burning building, because they had not received orders from the Top Management to release the patients.

Injured being rescued from the IMS and SUM Hospital, Bhubaneshwar.

7) On 07th December, 2018, a major fire broke out at ESIC Kamgar Hospital, Marol, Andheri, Mumbai **(See Fig 05).** Eleven persons died and over 176 were injured in this fire accident. A total of 147 people, including patients and visitors, were rescued after the fire broke out. The injured were shifted to nearby hospitals such as Cooper Hospital, Seven Hills Hospital, Holy Spirit Hospital, etc. Fire officials said the blaze started prima facie from the ground floor, where some rubber ducts were stored and spread upwards. Seven fire tenders and five jumbo water tankers were pressed into service to control the flames and the rescue operation continued till late evening. Some of the people trapped in the building jumped off the upper floors to save themselves and sustained injuries.

Fire fighters conduct rescue operations at ESIC Kamgar Hospital, Marol, Mumbai.

8) On 09th January, 2019, a massive fire broke out at an under-construction hospital at Kingswar Road in Nagpur **(See Fig 06).** The fire reportedly broke out due to a short circuit in the building, where construction work was currently going on. As the 10-storeyed hospital building was made of glass, fire fighters reportedly found it difficult to douse the fire. Ten fire-tenders were present at the spot and the blaze has been brought under control. Army Jawans aided in the fire-fighting operations. Seven people were injured in the fire, out of which 2 were said to be in a critical condition.

Massive fire on Under Construction Hospital in Nagpur, Maharashtra.

9) On 07th February, 2019, a major fire broke out at Metro Hospital and Heart Institute, Sector–12, in Noida **(See Fig 07).** The fire occurred at the Second Floor ICU of the of the Hospital which was caused due to a short-circuit of the water heater inside the recovery area. Thick smoke was billowing out of the building as staffers tried to evacuate the patients. Many people were trying to jump out of windows. People were standing on ledges in balconies as rescuers tried to reach them by breaking window panes. A few others were seen slithering down the building using ropes. All the patients were successfully rescued and evacuated to the Hospital's Sector–11 branch.

A man is being rescued at Metro Hospital in Noida, U.P.

10) On 10th April, 2019, a minor fire broke out in the plastic surgery ward of the Lok Nayak Jai Prakash Narayan Hospital in Central Delhi. Fire department officials said the blaze erupted due to a short circuit in the air conditioner. Seven fire tenders were rushed to the spot. No causalities have been reported.

11) On 10th May, 2019, a major fire broke out at 3.00 am in a medical store situated on the ground floor of the state-run SMS Hospital premises which spread fast to the first floor. The hospital administration shifted 135 patients to another ward. Twelve fire tenders doused the fire in four hours. The fire apparently broke out due to short circuit. The fire officer said no loss of life was reported.

12) On 17th August, 2019, a massive fire broke out at the All India Institute of Medical Sciences (AIIMS), New Delhi. The fire on the first and second floor were started due to a short circuit. Soon the fire spread up to the fifth floor as a result of an AC compressor that blew up, which forced the management to shift the patients of general ward to another ward. A total of 34 fire tenders reached the spot and were involved in dousing the flames. National Disaster Relief Force (NDRF) teams were also rushed to the spot and aided the fire fighting operations. AIIMS officials said that there was no loss of life and injuries in the incident.

13) On 22nd October, 2019, a fire broke out in the Neonatal Intensive Care Unit (NICU) on the fourth floor of the Shine Children's hospital, Hyderabad, Telangana in the early hours of the day. Six infants, who were in incubators, sustained burn injuries. One of the infants died, while the others were shifted to a nearby hospital for treatment. Fire Department personnel, who rushed to douse the flames, broke open glass panes to rescue the children from the NICU. Police suspect short circuit to be the cause of the fire.

It may be reminded here that apart from the 13 incidents explained above, 22 minor fire incidents were also reported from various Hospitals in India such as

1) Park Super Specialty Hospital, Hyderabad;
2) Surana Sethia Hospital, Mumbai;
3) Acharya Harihar Regional Cancer Centre, Cuttack;
4) SCB Medical College, Cuttack;
5) Safdarjung Hospital, New Delhi;
6) Trauma Center, King George Medical University, Lucknow;
7) Apollo Hospital, Jubilee Hills, Hyderabad;
8) Chittaranjan National Cancer Institute, Kolkata;
9) Calcutta School of Tropical Medicine, Kolkata;
10) Calcutta Medical College & Hospital, Kolkata;
11) Geetanand Hospital, Alwar:
12) ESIC Hospital, Noida;
13) Chhattisgarh Institute of Medical Sciences, Bilaspur;
14) ApolloHospital, Bhubaneswar;
15) SCB Medical college And Hospital, Cuttack;
16) North Bengal Medical College and Hospital, Siliguri,
17) KEM hospital, Mumbai and
18) Medi Point Hospital, Pune

Multiple fire incidents had occurred in

1) SCB Medical College, Cuttack;
2) Calcutta Medical College & Hospital, Kolkata;
3) Safdarjung Hospital, New Delhi and

Sardar Vallabhai Patel Postgraduate Institute of Paediatrics Hospital, Cuttack, which suffered huge losses due to fire incidents that destroyed equipment infrastructure and medicines worth millions of rupees.

Although all these institutions had functional fire fighting systems, the staffs were unaware of the fire policy and were poorly trained in handling fire-fighting systems. It may be added here that the most common cause of fire was due to electrical short circuit with air conditioners being the most common source.

4.2 Fires during 2020 & 2021 :

During the period 2020 and 2021 (17 months) there were 26 fire incidents reported in Indian Hospitals. Out of the 26 fire incidents reported, 9 incidents occurred in 2020 and 17 occurred in 2021. It may be noted here that this period belongs to COVID-19 pandemic era and most of the hospitals in India were catered to treat COVID-19 patients. In the absence of an authentic statistics on fire incidents, the data regarding the fire incidents for this period are also compiled from the information reported in various online and print media. Based on these media reports, a brief description of selected 16 fire incidents (minor and major) are given below:

1) On 9th August, 2020, a massive fire engulfed the COVID-19 isolation facility created at the Swarna Palace Hotel, Vijayawada, Andhra Pradesh **(See Fig. 08).** The fire initially started on the ground and first floor. When fire spread thick smoke filled the rooms. The exact cause of the fire was not known yet. However, it resulted in the death of 11 COVID-19 patients and injury to 22 patients.

Rescuers and others stand outside Hotel Swarna Palace, Vijayawada, A.P.

2) On 15th August, 2020, a major fire broke out in the ICU ward of Shrey Hospital, Ahmedabad, Gujarat, resulting the death of 8 COVID-19 patients **(See Fig. 09).** Due to this fire, 41 patients were shifted to nearby hospitals. The cause of the fire was attributed to electrical short-circuit.

Charred remains of the ICU at Shrey Hospital in Ahmedabad, Gujarat.

3) On 8thSeptember, 2020, a minor fire broke out at the ICU ward of SSG Municipal Hospital, Vadodara, Gujarat. At the time of accident there were 272 COVID-19 patients in the hospital for treatment. The fire broke out in one of the ICU wards on the first floor of the Covid-19 isolation building. The blaze was caused by a short-circuit in the wiring of one of the ventilators in the ICU. No death was reported in the fire. However, the authorities were forced to evacuate 39 patients.

4) On 21st September, 2020, a major fire broke out in the ICU on the fourth floor of Sadguru Hospital, Cuttack, Odisha, which was converted into a dedicated COVID-19 hospital. No death was reported in this fire. However, about 100 patients were rescued. Though the exact cause of fire is yet to be ascertained, it seems an electrical short-circuit in the ICU was the trigger.

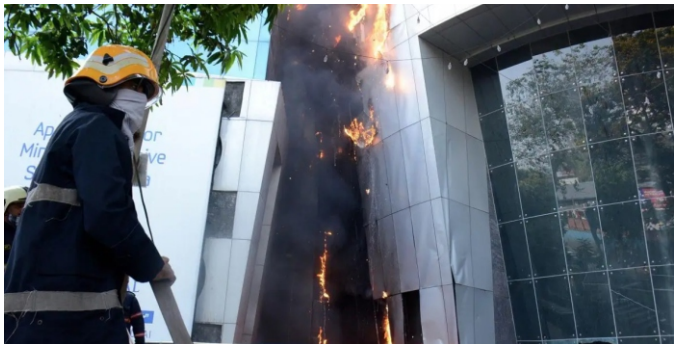
5) On 27th November, 2020, a massive fire broke out at the ICU ward of Uday Shivanand Hospital, Rajkot, Rajasthan, which resulted in the death of 6 COVID-19 patients **(See Fig. 10).** A short-circuit in one of the ventilators is suspected to have triggered the fire, which spread so fast that the Mavdi Fire Brigade, which is barely 300 meters from the hospital, could not save their lives. There were four staff in the ward, including a doctor, but they could not use the fire extinguishers, despite being trained to, because the blaze spread so rapidly.

Charred remains of the ICU at Uday Shivanand Hospital in Rajkot, Gujarat.

6) On 9th January, 2021, a massive fire broke out at Civil General Hospital, Bhandara, Maharashtra, in which 10 newborn babies died **(See Fig. 11).** Seven other infants who were admitted in the unit were however rescued. The cause of the fire was attributed to electrical shortcircuit.

Massive fire broke out at Civil General Hospital, Bhandara, Maharashtra.

7) On 25th March, 2021, a major fire broke out at Dreams mall, Bhandup, Maharashtra and quickly spread to Sunrise Hospital, a dedicated COVID facility, which is located on the third floor of the mall **(See Fig. 12).** At the time of the incident there were over 80 COVID patients taking treatment in the hospital. The fire resulted in the death of 10 patients. The fire brigade evacuated 44 patients and they were shifted to nearby hospitals. The fire originated at shop number 140 on the upper ground of the mall, which was caused due to a defective electric circuit. The mall's passages were used for storage of combustible materials, which enhanced the spread of fire. It was also found that the fixed fire fighting system of the mall was not in a working condition. At present, the Dreams Mall and the Sunrise Hospital are closed and the municipal administration has decided not to allow the Hospital to reopen in the near future.



Fire fighting operations at Dreams Mall (Sunrise Hospital) in Mumbai.

8) On 31st March, 2021, Safdarjung Hospital, New Delhi, witnessed a minor fire in the Medical ICU which is located on the first floor **(See Fig. 13).** Fortunately, no one injured or died in the fire. However, about 50 patients in the ward were shifted to various hospitals in New Delhi. Nine fire tenders were rushed to the spot with over 40 fire fighters. A short-circuit in the ventilator triggered the fire.

Remains of the Medical ICU at Safdarjung Hospital, New Delhi.

9) On 4th April, 2021, a major fire occurred at the COVID-19 ward of Patidar Hospital, Ujjain, Madhya Pradesh **(See Fig. 14).** Though no death was reported, about 80 patients were rescued from the hospital. The fire broke out due to a short-circuit in the power board of the ICU which is located at the first floor.

Patients try to jump from the burning floors of the Patidar Hospital, Ujjain, M.P.

10) On 4th April, 2021, a major fire engulfed the camp of COVID-19 Care Centre at Dahisar, Maharashtra. Fire brigade officials said that after hangar F, the fire spread to hangar G. Though no death was reported, about 50 COVID-19 patients were rescued. The fire was caused due to an electrical short-circuit.

11) On 10th April, 2021, a major fire broke out in the COVID-19 ward of Well Treat Hospital, Nagpur, Maharashtra, in which 4 COVID-19 patients died **(See Fig. 15).** The fire was caused due to electrical short-circuit in an Air Conditioner Unit.

Charred remains of the hospital beds at Well Treat Hospital, Nagpur.

12) On 18th April, 2021, a massive fire occurred in the COVID-19 ward of Rajdhani Speciality Hospital, Raipur, Chhattisgarh, which had taken the life of 5 COVID-19 patients **(See Fig. 16).** Out of the 5 patients died, one was charred to death and 4 others died due to suffocation. A team of the police and fire fighting personnel rushed to the spot and 29 patients were evacuated from the hospital. According to officials, the fire was caused by a short-circuit in one of the fans and eventually spread to the Covid-19 ward.

Charred remains of the COVID-19 ward of Rajdhani Speciality Hospital, Raipur, Rajasthan.

13) On 23rd April, 2021, a massive fire occurred in the ICU ward of Vijay Vallabh Hospital, Virar, Maharashtra, which resulted in the death of 13 COVID-19 patients **(See Fig. 17).** There were 17 patients in the ICU for Covid-19 treatment when the fire took place. A blast in the Air Conditioner Unit, resulted in the fire.

Remains of the ICU ward of Vijay Vallabh Hospital, Virar, Maharashtra.

14) On 25th April, 2021, a major fire occurred in the ICU ward of Ayush Hospital, Surat, Gujarat, which resulted in the death of 4 patients **(See Fig. 18).** At the time of fire there were 15 patients in the ICU. Out of the 15 patients, 4 were in the ventilator. All the 15 patients were shifted to nearby hospitals and 4 patients died while shifting. The cause of the fire was electrical short-circuit which happened due to a blast in the Air Conditioner Unit.

Remains of the ICU of Ayush Hospital, Surat.

15) On 28th April, 2021, a major fire occurred in Prime Criti care Hospital, Thane, Maharashtra, in which 4 patients died **(See Fig. 19).** At least 20 patients were undergoing treatment in the hospital when the blaze was triggered. The officials got into action to shift the patients to nearby hospitals, however, four patients succumbed while in transit. An electrical short-circuit occurred in the meter room initiated the fire.

A major fire occurred in Prime Criticare Hospital, Thane.

16) On 1stMay, 2021, a massive fire broke out in the ICU of Patel Welfare Hospital in Bharuch, Gujarat, in which 16 COVID-19 patients and 2 nurses were killed **(See Fig. 20).** At the time of fire, there were 57 Covid-19 patients in the hospital, including 23 in the general ward and 12 each in two ICUs. Forty-one patients were shifted to various hospitals in Bharuch and nearby towns. The fire was so intense that the ICU ward was almost burnt to the ground. All the equipment inside, including the ventilators and the fridge used to store the medicines and also the beds, were turned to ashes. The exact cause of the fire is yet to be ascertained. However, the fire department officials suspect a leak in an oxygen cylinder may have led to the fire.

Remains of the ICU of The Patel Welfare Hospital in Bharuch.

It may be added here that apart from the 16 incidents explained above, 10 minor fire incidents were also reported from various Hospitals in India such as

1) Guru Gobind Singh Hospital, Jamnagar;
2) Sardar Vallabhai Patel Hospital,Pune;
3) Chhatrapati Pramila Raje Hospital, Kolhapur;
4) Little Flower Hospital, Ahmedabad;
5) Government General Hospital, Guntur;
6) Shree Vijay Vallabh Sarvajanik Hospital, Vadodara;
7) LPS Institute of Cardiology, Kanpur;
8) Chandwad Covid Care Centre, Nashik;
9) Mazumdar Shaw Hospital, Bangalore and
10) Vikaspuri COVID Hospital, New Delhi.

It may be noted here that 5 fire incidents in 2020 and 11 fire incidents in 2021 were reviewed above. It may also be noted here that 7 fire incidents had occurred in April 2021 itself. It may be further noted that out of the 16 fire incidents reviewed above, 14 fire incidents had occurred due to electric short-circuit. A lack of cross-ventilation has also been noted, especially in the case of ICUs which require a sterile environment. Moreover, COVID-19 is leading to the presence of more inflammable material in the hospitals – including sanitiser vapour and spills, more oxygen content, as well as synthetic material-made PPE kits, etc. These aid in quicker spread of fire and leave lesser response time. Another phenomenon noticed was that the ICUs were operating at full capacity, which resulted in the use of ACs, Ventilators and Equipment being run throughout the day and night.

It may be further reminded that the ACs need a cooling period after running for 15 to 16 hours. In the absence of such cooling time, ACs were more vulnerable to fires and explosions. The above situations might have led to more fire incidents during this short period.

5.0 Fire Prevention Requirements :

The basic minimum requirements needed to prevent potential fires and the measures necessary to protect the life of inmates in the event of a fire in any occupancy including the hospitals are more over the same. However, the measures necessary to protect the life of inmates in the hospitals should be more stringent because the inmates are mostly disabled in one way or other, and their rescue becomes more difficult and require advance planning.

The fire prevention and fire protection measures which are to be adopted in various categories of structures are laid down in Chapter 4 of NBC 2016. The list of fire protection items to be installed in hospitals are given in Table 7 (Part 4 of NBC 2016). In addition to the above list, many other parameters also need to be considered while adopting fire safety in hospitals. Some of the important fire safety measures to be incorporated in hospital buildings are summarized below :

5.1 Fire Water Tanks :

The minimum fire water requirements of hospitals vary from hospital to hospital. They are met from the underground storage tanks (capacity ranging from 75,000 L to 2,00,000 L) and the terrace tanks (capacity ranging from 5,000 L to 20,000 L). The readers are advised to refer Table 7 (Part 4 of NBC 2016) for more details.

5.2 Fire Hydrant System :

Fire hydrant system plays a vital role in mitigating fires in hospitals. The minimum requirements for a fire hydrant system for various categories of hospitals are dealt in Table 7 (Part 4 of NBC 2016).

Generally, the fire hydrant system, consists of

i) one electric motor driven fire pump,
ii) one jockey pump, and
iii) one diesel engine driven fire pump. One booster pump is also used when the height of the building is more than 15 M. These pumps are installed in the pump room for pumping water from the underground water tank. These pumps should have a minimum pressure of 3.5 Kg / Sq.CM at the remotest location.

The common outlets of the fire pump delivery system shall cater to

i) internal hydrants in each floor and on roof,
ii) external hydrants and
iii) first aid hose reels on each floor. At the top of each wet riser an air vessel assembly with air relief valve, a drain valve and a pressure gauge, shall be provided to take care of pressure surges and also for letting out entrapped air in the system. Water supply header and main pipe up to the hydrant valve/landing valve shall be kept pressurised to the jockey pump, which shall start automatically on receiving the impulse from the pressures witch, in case of any pressure drop in the header. It shall stop at a pre-set pressure as soon as pressure builds up in the header. It is advised that the switches for the pumps in the control panel are always kept in Auto mode.

It may be noted here that all the items used for hydrant system should meet the specifications of Bureau of India Standards and they should be functional at all times.

5.3 Other Items :

In addition to above, the hospitals are to be provided with Sprinkler System, Smoke Detector System, Fire Alarm System, First-Aid Fire Extinguishers, etc. It may be noted here that all the items used for the above systems should meet the specifications of Bureau of India Standards and they should be functional at all times.

5.4 Setback Area :

Setback area of a hospital building is very much important for the point of view of fire safety. As per the NBC 2016, for any hospital above 17 meters to 30 meters in height, the setback area around the hospital building should be minimum 7 meters width on all the four sides and 9 meters width on all the bends, for the safe passage of fire fighting vehicles, in the event of afire. However, it was observed, that many of the hospitals were neglecting this important provision, probably due to paucity of space or due to the ignorance of the importance of setback area, which hampers the fire-fighting operations. It was also observed that this was one of the main reasons for not getting Fire NOC for many hospitals.

6.0 Life Safety Requirements :

The Part 4 Clause 6.3.2 of NBC 2016 deals with Life Safety. However, due to limitations of space, the details about the provisions of Life Safety requirements are not dealt here and the readers are advised to refer to Part 4 Clause 6.3.2 of the National Building Code 2016.

7.0 Fire Safety Audit :

Fire Safety Audit is an important tool to access the effectiveness of fire prevention and fire protection procedures adopted in an Institution. As per the Annexure E-7 of NBC 2016, the audit adopts a standard procedure and follows certain norms, such as

a) Fire and life safety audit shall be carried out for all buildings having a height of more than 15m.

b) Such audits shall preferably be conducted by a third-party auditor having requisite experience in

fire and life safety inspections.

c) Frequency of such audits shall be once in two years. At present there is no specific standards available exclusively for determining fire safety in hospitals. Of course, there is an Indian Standard (IS 14489 : 2018), which gives a general frame for conducting safety audit / assessment in various organisations. As it is not specific, it has to be modified to suit the needs of various hospitals.

7.1 CAHO's Role :

Consortium of Accredited Healthcare Organizations (CAHO) plays an important role in reinforcing the idea that accreditation / certification is the beginning of quality improvement in healthcare organisations.

Fire safety audit being one of the important parameters of NABH accreditation, CAHO has taken the help of a group of fire safety experts in the country in preparing a 'Standard Fire Safety Audit Checklist', which could be used as a tool for conducting a fire safety audit / assessment in hospitals. Incidentally, the Author of this article was one amongst the fire safety experts who had prepared this checklist. The checklist is very exhaustive but can be pruned to the needs of a specific hospital. This checklist is being successfully used in conducting fire safety audits in a number of leading hospitals in India. Incidentally, CAHO had drawn a list of Empanelled Fire Safety Auditors who can carry out Fire Safety Audits in any hospitals in India.

8.0 How to Prevent Hospital Fires :

It may be borne in mind that the potential risk of a fire can be reduced only when the buildings and structures are designed, constructed, equipped, maintained and operated so as to save the life and property of its occupants. Thus, any structure should be erected / constructed only after meeting the basic infrastructure needed to protect them from fires and explosions and even to withstand natural calamities like earthquake, cyclone, lightening, etc.

Hospitals being most sensitive to various hazards and accidents, fire safety needs to be implemented according to the norms of the National Building Code and other Safety Standards and Guidelines issued by various agencies.

All Healthcare Facilities should obtain Fire NOC from the concerned fire department and renewed periodically. Similarly, all Hospital Buildings should secure Occupation Certificate (OC) from the concerned authority and renewed periodically.

Model Building Bye laws on Fire Protection and Fire Safety requirements, issued in November 2004 by the Town and Country Planning Organisation of Ministry of Urban Development, Government of India, can serve as a good guide for those seeking information on various aspects of fire protection and life safety in buildings.

National Disaster Management Guidelines on Hospital Safety issued by National Disaster Management Authority (NDMA) also serve as a very good guide for those seeking requirements for a reasonable degree of safety from fire emergencies in hospitals.

A fire accident is always very precarious in a hospital. If the accident happens nearby Intensive Care Unit, patients inside the ICU may not be aware of the fire and could not respond properly to call for help. As most of the patients cannot move out by themselves, the evacuating techniques are typically diverse. Thus, an evacuation plan and competent persons in evacuation techniques should be available to meet the situation.

The design of the hospital buildings plays a significant role in the evacuation. Properly designed hospital building can help in avoiding various hazards, which may turn into disasters. Corridors, External Staircases, Refuge Areas, Shafts, Ducts and Basements should be constructed and maintained as per the NBC 2016 guidelines. Combustible materials should not be stored in Corridors and Basements of the hospitals.

Lifts, Meter Rooms and Pump Rooms should be maintained as per the safety norms. Overloading of electrical connections should be avoided. Periodical Electrical Audit shall be carried out in the Hospital Buildings.

Bio-Medical wastes such as Syringes, Needles, Napkins, Used Cottons, etc. should be disposed off as per the norms laid by the Bio-Medical Wastes (Management and Handling) Rules, 2016 framed under the Environment (Protection) Act, 1986 Every hospital, especially those in high rise building should prepare an Onsite Emergency Plan and conduct periodic Mock Drills.

Emergency Escape Routes and other Signages should be displayed. Emergency Escape Routes and Exits should be always kept free of any obstacles.

Fire extinguishing equipment should be easily approachable, readily usable and maintained properly in regular intervals. Hospitals equipped with Automatic Fire Fighting System always have a good chance of escaping damage. Hence, Automatic Sprinkler and Alarm Systems shall be installed with an alternative source of power supply. A Public Address System in the hospital shall be installed and fully functional to inform everyone about the emergency disasters.

Sufficient quantities of PPE Kits, Gloves, Face Masks, Face shields, etc. should be available in the hospital.

Third Party Fire and Life Safety Audit shall be carried out once in 2 years.

Create awareness on Fire Safety amongst Hospital Staff, Doctors and Administrators. Above all, the Hospital Management has a prime responsibility towards safety of patients and visitors by implementing control measures to fire accidents.

9.0 Conclusion :

- Hospitals in India are registered and regulated as per the norms of the Clinical Establishments (Registration & Regulations) Act, 2010.
- The National Building Code (NBC) of India, is representing the present state of knowledge on various aspects of building construction and fire safety in India.
- The fire prevention and fire protection measures need to be adopted for various categories of hospitals which are laid down in Table 7, Part 4 of NBC 2016.
- The standard and the quality of the hospital is judged in India by the accreditation rank allotted by NABH. Fire Safety Audit is one of the important parameters considered for NABH accreditation.
- CAHO plays an important role in reinforcing the idea that accreditation is the beginning of quality improvement in healthcare organisations. CAHO Empanelled Fire Safety Auditors can carry out Third Party Fire Safety Audit in any Hospitals in India.
- Fire incidents are common in hospitals. The AMRI Hospital fire in Kolkata, which claimed the life of 94 persons in2011, is still in the mind of many, even after a decade.
- During the COVID-19 pandemic era, there were spurt of fire incidents in Indian Hospitals. During this period 26 fire incidents were reported.
- Electrical short-circuit is one of the main causes of fires in Indian hospitals.
- The emergency evacuation procedures are paramount importance to all healthcare organisations especially those organisations who functions at high rise buildings.
- Many healthcare organisations in the country fail to comply with the existing regulations / norms regarding the fire safety in hospitals. In order to mitigate the potential fires, all healthcare organisations in India should comply with all the norms relating to fire and life safety.

References :

1) https://economictimes.indiatimes.com/news/politics-and-nation/vijayawada-massive-fire-at-covid-19-care-facility/rescue-operation/slideshow/77443428.cms Fig 08
2) https://indianexpress.com/article/cities/ahmedabad/bharuch-hospital-fire-that-killed-18-senior-fire-official-suspended-pending-inquiry-says-govt-to-hc-7338692/ Fig 20
3) https://indianexpress.com/article/cities/delhi/safdarjung-hospital-fire-7252366/ Fig 13
4) https://indianexpress.com/article/cities/mumbai/bhandara-hospital-fire-civil-surgeon-among-4-officials-suspended-transferred-contracts-of-three-terminated-7156578/ Fig 11
5) https://indianexpress.com/article/explained/behind-frequent-hospital-fires-covid-patients-death-toll-7302274/
6) https://mumbaimirror.indiatimes.com/mumbai/other/thane-fire-breaks-out-at-mumbra-prime-criticare-hospital-3-dead/articleshow/82284086.cmsFig 19
7) https://rememberingerwadi.wordpress.com/tag/mental-hospital/ Fig 02
8) https://www.benjidog.co.uk/MiscShips/Fort%20Stikine.html Fig 01
9) https://www.business-standard.com/article/current-affairs/five-die-in-chhattisgarh-coronavirus-hospital-fire-probe-ordered-121041800487_1.html Fig 16
10) https://www.dnaindia.com/india/report-mumbai-death-toll-in-esic-kamgar-hospital-fire-rises-to-10-2698304 Fig 05
11) https://www.dnaindia.com/india/report-noida-hospital-fire-at-least-35-patients-rescued-shifted-to-local-hospital-situation-now-under-control-2717205 Fig 07
12) https://www.india.com/maharashtra/mumbai-fire-bhandup-west-sunrise-hospital-covid19-hospital-dreams-mall-4536441/ Fig 12
13) https://www.indiatoday.in/cities/ahmedabad/story/fire-breaks-out-at-icu-of-covid-hospital-in-gujarat-s-rajkot-claiming-5-lives-1744466-2020-11-27 Fig 10
14) https://www.indiatoday.in/cities/mumbai/story/fire-vijay-vallabh-hospital-virar-maharashtra-covid-patients-1794076-2021-04-23 Fig 17
15) https://www.indiatoday.in/india/story/all-you-need-to-know-about-sum-hospital-fire-347137-2016-10-18 Fig 04
16) https://www.indiatoday.in/india/story/massive-fire-breaks-out-in-nagpur-under-construction-hopital-building-1427093-2019-01-09 Fig 06
17) https://www.nationnext.com/nagpur-fire-at-well-treat-hospital-in-wadi-claims-four-lives Fig 15
https://www.ndtv.com/india-news/4-covid-patients-die-after-fire-breaks-out-at-surats-ayush-hospital-2422225 Fig 18
18) https://www.newindianexpress.com/nation/2021/apr/04/80-including-62-covidpatients-rescued-from-burning-hospital-in-mps-ujjain-2285678.html Fig 14
19) https://www.rediff.com/news/slide-show/slide-show-1-healthcare-is-nothing-but-a-lucrative-business-in-bengal/20111212.htm#3 Fig 03
20) https://zeenews.india.com/india/8-die-as-massive-fire-breaks-out-at-shrey-hospital-in-gujarats-ahmedabad-2300899.html Fig 09
21)Model Building Bye-laws – Town & Country Planning Organisation, Ministry of Urban Development, Government of India, November 2004.
22)Nair, R.R. – Electrical Hazards, Industrial Safety Review, October 2012.
23)Nair, R.R. – Evacuation System for High-Rise Buildings, Industrial Safety Review, July 2013.
24)Nair, R.R. – Fire Prevention and Protection, Industrial Safety Review, June 2012.
25)Nair, R.R. – Fire Safety – Indian Scenario, Industrial Safety Chronicle, January-March 2018.
26)Nair, R.R. – Fire Safety Audit: The need of hour, Industrial Safety Review, July 2012.
27)Nair, R.R. – Fire Safety Audits carried out in various hospitals in India.
28)Nair, R.R. – High Rise Building Emergency Evacuation, Life Safety Today and Tomorrow, December 2015.
29)Nair, R.R. – Major Fires: Have we learnt from the past? Industrial Safety Review, May 2016.
30)Nair, R.R. – Safety in High Rise Buildings, Industrial Safety Review, November 2011.
31)Nair, R.R. – SAFETYCON – 2014 http://www.youtube.com/watch?v=fCecj7hOT40
32)Nair, R.R. – Why Fire Safety, Industrial Safety Review, November 2015.

33)Nair, R.R. – Workshops on Fire Safety conducted out at various Five Star Hotels pan India.
34)Nair, R.R. and Alappad, V.R. – Fire and Life Safety in Hospitals, Industrial Safety Review, October 2019
35)Nair, R.R. and Joshi, D.K. – Safety Audit (CEP Publications) Bangalore, All India Council for Technical Education, 2001.
36)National Building Code of India, 2016 ed – Bureau of Indian Standards, New Delhi.
37)National Disaster Management Guidelines – Hospital Safety, National Disaster Management Authority, Government of India, February 2016.
38)Patharla, S.S.R., Pyreddy, S.R., Panthagani, S.N. – A study on reported fire incidents in major hospitals of India, Published by International Journal of Community Medicine and Public Health, October 2020.
39)Safety and Fire Protection Handbook, 2nd Edition, – Edited by R. Veeraraghavan. Safe Technology, Mumbai, 2009.
40)Shastri, A.B., Raghav, Y.S., Sahadev, R. and Yadav, B.P. – Analysis of Fire Protection Facilities in Hospital Buildings: Advances in Fire and Process Safety, Published by Springer, 2018.

*****