JANUARY TO MARCH 2023

FIRE TECH

JOURNAL ON FIRE SAFETY BY

FSIF
FIRE SAFE INDIA FOUNDATION

NAFO
NATIONAL ASSOCIATION OF FIRE OFFICERS

HOSPITAL FIRES
A DEEP DIVE

Multiplexes Compliances: Challenges for Fire Safety

HAVE WE LEARNT FROM THE RECENT HOSPITAL FIRE INCIDENTS IN INDIA & ABROAD?

FIRE SAFE INDIA FOUNDATION

www.firesafeindia.org

CHAIRMAN

Shri M V Deshmukh
Chairman - FSIF
Former Director - Maharashtra Fire Service

VISION & MISSION

Fire Safe India Foundation is a not-for-profit advocacy group working to make India free from fire hazards. We aim to establish a fire-safety culture that is based on individual care, knowledge of techniques and available technologies for prevention and control of fire incidents.

The Organisation is built on a foundation of passion, strengthened by Knowledge, committed to creating awareness about Fire Prevention and Fire Protection.

To safeguard the quality of life for the Citizens through Fire prevention and protection, To sensitize authorities and public at large about the risks of Fire by harnessing Mass Media.

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It has been a long time indeed since the FIRE-TECH JOURNAL was last published.

Besides the COVID-19 restrictions, there were various other factors that led to the delay.

Of course, it isn't that fires respected the pandemic. In fact, the number of hospital fires went up significantly due to excess patients in the ICUs and the immense pressure on hospital infrastructure. It was a trying time for all of us, and especially firefighters.

I am happy to share that the Fire Safety Day/ Week observance that was affected by COVID-19 restrictions was on track this year.

> ***"We have given our move to digital a serious thought before deciding on reducing the print run."***

After a long hiatus, we are pleased to present a new edition of the magazine. We are focussing on hospital fires in this issue, a subject that needs our immediate attention.

With this issue, we are introducing a slight change in the format. We intend to use internet and the latest communication technology for FIRETECH. The publication will now be emailed to all the members and of course uploaded, as always, on our website www.nafoindia.org.

We have given our move to digital a serious thought before deciding on reducing the print run. Besides staying with the times, this decision of ours will help conserve paper and reduce printing and posting costs as well.

We request all our esteemed members to share their email address on firesafeindia.org. This will enable us to update our records and ensure quick communication with the members.

We look forward to your wholehearted support and suggestions.

I am pleased to welcome you to this new issue.

M V Deshmukh

NATIONAL ASSOCIATION OF FIRE OFFICERS
(REGISTRATION NO.: S-35438 OF 1999 UNDER SOCIETIES REGISTRATION ACT XXI OF 1860)
Office: 3rd Floor, Room 13, Tardeo Air Conditioned Market Building, Tardeo, Mumbai, 400034
Tel: 022 23534304 | Email: nafoindia98@gmail.com | Website: www.nafoindia.org

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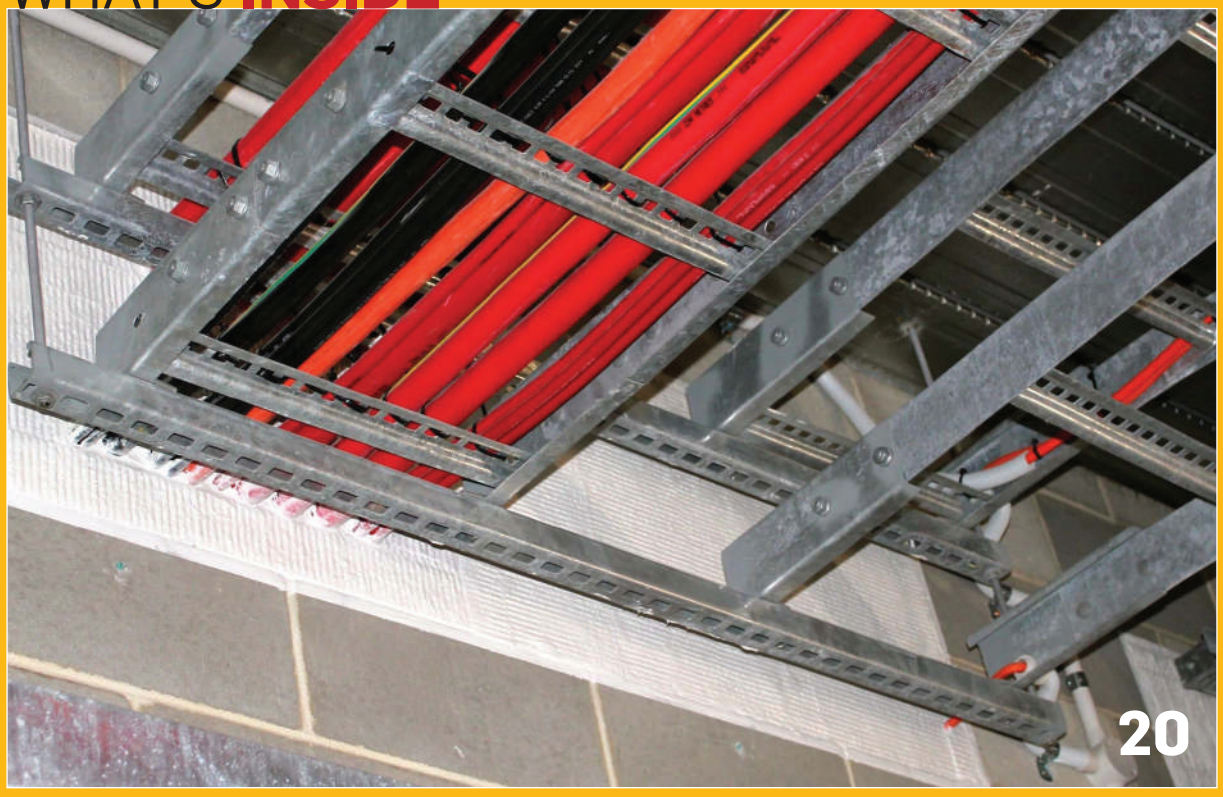


Editor - **Biprorshee Das**
203, 204, Sri Ram Apartments, A Wing, Ayodhya Nagari, Near Jari Mari Temple, Tisgaon, Kalyan (East) - 421306, Maharashtra.
Mobile: **98202 80232 |** Email: **biprorshee.das@gmail.com**

Design by - **JCN**

15-YEAR-OLD INNOVATOR BUILDS AI-POWERED APP FOR FIRE SAFETY

Anjali Raja K | Indiaai| Jan 27, 2023

Unlike any 15-year-old, Sainath Manikandan's thoughts revolve around the future of humanity, environmental protection, and sustainable development goals. This young champion is the recipient of numerous prestigious local and international titles, including Sony BBC Earth's Young Earth Champion 2022.

Sainath, who developed the AI Detection Security App, has taken an image-based approach. Developing the model included preparing the dataset and training and testing the model. The model could be deployed in the form of drones, cameras and CCTVs, which can be used for live surveillance purposes.

This task is similar to that of object detection. Once the model has learned the features, it can successfully

differentiate between fire and smoke.

Sainath developed the model during the Oxford internship. Only one per cent of the total students got the opportunity to take part in the internship.

EFFECTIVE FIRE FIGHTING

Monalisa Chaudhuri | Telegraph | Feb 25, 2023

The state fire and emergency services department has sent a notice to South City Garden — a housing complex off New Alipore in southwest Kolkata — accusing its management of non-compliance with fire safety norms.

The notice was sent following a fire in a ninth-floor flat of a 14-storey building in the complex.

The fire department's response has turned the focus on such alleged non-compliance across many residential housing complexes, where residents do not adhere to norms because of lack of funds and/ or awareness.

South City Garden, on BL Saha Road, has more than 700 apartments. Fire department sources said the complex lacked effective firefighting tools.

Ranveer Kumar, director-general, fire and emergency services, told The Telegraph on Friday there was "non-compliance" with the fire-fighting norms in the housing complex. "Adequate pressure was not maintained in the fire hydrant. According to the norms, we have sent a notice to the housing complex about the points of non-compliance," he said.

Non-compliance after the 30-day notice period ends attracts a police case under the West Bengal Fire Services Act, an official in the fire department said.

Senior officials in the fire department said the fire safety recommendations vary from one housing complex to another, depending on the floor plan, area, height and the distance between two staircases in a block.

NOTICES SOON TO BIZ UNITS OVER LACK OF FIRE SAFETY EQUIPMENT IN PATIALA

Tribune News Service | Feb 15, 2023

The Municipal Corporation will soon be issuing notices to commercial establishments regarding installation of fire safety equipment and availing of fire safety certification. Corporation officials said they have decided to issue notices to owners of commercial, educational and institutional buildings across the city.

The MC had been carrying out activities across the city to inform and educate residents about fire safety. The civic body had also sent notices to some building owners regarding the same.

Recently, the corporation had carried out a fire safety awareness programme at a private school in the city and trained students on handling fire incidents.

Officials at the fire wing of the Municipal Corporation said many government schools in Patiala lacked the requisite fire safety equipment.

BOMBAY HIGH COURT ASKS NAGPUR COLLECTOR TO ALLOT FUNDS FOR FIRE SAFETY EQUIPMENT AT IGMC

India Legal | Feb 25, 2023

The Bombay High Court has said that at least some portion of the money which is lying in the account of Collector, Nagpur can be directed to be made over to PWD (Electrical), Nagpur to immediately start work relating to installation of fire safety equipment at Indira Gandhi Medical College (IGMC), Nagpur.

The Nagpur Division Bench of Justice Sunil B. Shukre and Justice Vrushali V. Joshi heard a number of Public Interest Litigations (PILs) including a Suo Motu PIL related to the issue of medical condition during the Covid 19 Pandemic.

S.P. Bhandarkar, amicus curiae and Additional Government Pleader, submitted before the Court that a substantial amount of funds collected from and out of the CSR funds of various companies and corporations is lying in balance and therefore, a portion of it can be spent for taking forward the cause of the patients in Vidarbha region.

The Amicus Curiae further submitted that installation of fire safety mechanism at IGMC is pending since long and if the fire safety measures are taken immediately, it would serve the cause of the patients and also would amount to making compliance with various orders passed by this Court in the other connected matter.

The Additional Government Prosecutor submitted the Committee headed by Justice M.N. Gilani (retired) now requires approximately an amount of Rs 50,00,000 for making payment to the complainants /patients and a direction in this regard can also be issued to the Collector, Nagpur in whose account the money is lying.

Accordingly, the Bench directed District Collector, Nagpur to make over an amount of Rs 1 crore from and out of the amount lying the in the account of Collector, Nagpur which is a part of the direction issued by this Court in the present PIL, to Executive Engineer PWD (Electrical), Nagpur for the purpose of starting the work of installation of fire safety mechanism at IGMC and Hospital, Nagpur, which shall be done on or before the next date.

The High Court further directed District Collector, Nagpur to release and disburse the amounts to various patients/complainants as per the directions received by him from the Committee headed by Justice M.N. Gilani (retired) from time to time, which amount, in total shall not exceed the sum Rs 50,00,000. If this amount exceeds the sum of Rs 50,00,000, prior permission of this Court shall be taken.

The Amicus Curiae invited attention of the High Court to various directions issued by the Court on 30.06.2021. While issuing the directions, the Court had emphasized upon the need for being always in the state of preparedness to meet any kind of emergency, which may arise on account of resurgence of Covid-19 pandemic or any other similar situation. The Court had also noticed that the infrastructure and medical equipment available at Primary Health Centres, Rural Hospitals and District Hospitals were wanting in many respect.

Considering all these factors, this Court had initiated an exercise to ensure that medical facilities, infrastructure, medicines and all other requirements at Primary Health Centres, Rural Hospitals and District Hospitals were up to the mark and with that view in mind, the Court desired to have before it requisite information.

Accordingly, the authorities namely, Divisional Commissioner Nagpur, Divisional Commissioner Amravati, Civil Surgeons of all the districts in Vidarbha Region and District Health Officers of all the districts were directed to place on record the entire information, disclosing number of Primary Health Centres, Rural Hospitals and Districts Hospitals and other related information. These directions, as pointed out by learned amicus curiae, are yet to be complied with. The Court again directed the authorities to comply with these directions and place the requisite information before the Court on or before the next date.

The matter has been listed on 01.03.2023 for further hearing.

PILOTS SURVIVE BOEING 737 WATER BOMBER CRASH WHILE FIGHTING BUSHFIRE IN WESTERN AUSTRALIA

Natasha May | The Guardian | Feb 6, 2023

Two pilots battling a blaze on Western Australia's southern coast have managed to free themselves after their Boeing 737 firebomber aircraft crashed.

The national large air tanker crashed at 4.15pm on Monday afternoon while responding to a bushfire in the Fitzgerald River national park, Western Australia's Department of Fire and Emergency Services (Dfes) said.

The two pilots survived the crash with minor injuries and escaped the aircraft wreckage. They were retrieved by helicopter and conveyed to hospital.

Police received the report of the crash at about 4.40pm, a little over an hour after the aircraft had departed Busselton-Margaret River regional airport.

CAMP MOLLY HOPING TO TEACH TEEN GIRLS FIREFIGHTING SKILLS, PREPARE THEM FOR FUTURE CAREERS

Brilee Sears | Fort Erie The Post | Feb 24, 2023

Teen girls interested in firefighting are encouraged to apply for Camp Molly, coming to Niagara Region this spring.

"The motto of the camp is to empower, encourage, challenge, and change the way you see yourself. So we want to boost confidence and we want to provide the mentorship for females of that age in case they want to go into the fire service or emergency services," explained Tracey Fitzsimons with the Fort Erie Fire Department.

Throughout the May 11-14 camp, the girls will have the opportunity to learn a variety of skills, known as evolutions, necessary to enter firefighting as a career.

"It's firefighter survival, auto (extraction), fire dynamics, communications, forcible entry, there's a medical evolution, and fire prevention and education. So they'll get a chance to have a hands-on experience with each of the evolutions during their three days," added Fitzsimons.

The last day of camp includes a combat challenge, where the seven teams formed during the camp have the opportunity to compete against each other and prove their skills.

Camp Molly is named after the first female firefighter in North America, Molly Williams, an African-American enslaved person who lived in New York.

MONTREAL POLICE, FIRE DEPARTMENT AIMING TO RECRUIT MORE VISIBLE MINORITIES

Daniel J. Rowe | CTVNewsMontreal.ca | Feb 26, 2023

In honour of Black History Month, Montreal's fire and police departments held the fifth edition of their "Diversity in Uniform" career fair to recruit a greater number of minorities.

Fourteen public security organizations joined the Montreal police (SPVM) and Montreal fire department (SSIM) and set up kiosks at the event at a St-Michel community Centre.

"We are very conscious that we have a lack of diversity in our workforces and in all of our organizations," said the SSIM's equity, diversity, and inclusion advisor Anik St-Pierre. "We want people to know that we're open, and we want them to join us."

THE WORLDWIDE FIRE ALARM EQUIPMENT INDUSTRY IS PROJECTED TO REACH $7.2 BILLION BY 2030: HEIGHTENING AWARENESS OF SAFETY AND SECURITY DRIVE GROWTH

PRNewswire | Feb 13, 2023

The global market for Fire Alarm Equipment estimated at US$4.9 Billion in the year 2022, is projected to reach a revised size of US$7.2 Billion by 2030, growing at a CAGR of 5% over the analysis period 2022-2030.

Addressable Panels, one of the segments analysed in the report, is projected to record a 4.5% CAGR and reach US$2.1 Billion by the end of the analysis period.

Taking into account the ongoing post pandemic recovery, growth in the Notification Devices segment is readjusted to a revised 5.1% CAGR for the next 8-year period.

The U.S. Market is Estimated at $1.3 Billion, While China is Forecast to Grow at 8.2% CAGR

The Fire Alarm Equipment market in the U.S. is estimated at US$1.3 Billion in the year 2022. China, the world's second largest economy, is forecast to reach a projected market size of US$1.5 Billion by the year 2030 trailing a CAGR of 8.2% over the analysis period 2022 to 2030.

Among the other noteworthy geographic markets are Japan and Canada, each forecast to grow at 2.6% and 4.1% respectively over the 2022-2030 period. Within Europe, Germany is forecast to grow at approximately 3.2% CAGR. Led by countries such as Australia, India, and South Korea, the market in Asia-Pacific is forecast to reach US$978.9 Million by the year 2030.

FIRE SAFETY IN HOSPITAL BUILDINGS

KIRAN HATYAL
Asstt Director MFS.

DO WE EVER CHECK FOR FIRE SAFETY IN HOSPITALS BEFORE WE ADMIT SOMEONE OR WHEN VISITING FOR A CONSULTATION? IT IS UNLIKELY, AS ALREADY FACED WITH AN EMERGENCY, FIRE SAFETY IS THE LAST THING WE MIGHT HAVE IN MIND.

The next time you visit a hospital, be more aware. Ask the hospital administration if the fire safety guidelines mentioned below are being followed. If you are uncomfortable with the response, inform the local fire authorities and ask them to take action. You may just be doing a good deed that could save lives.

Private nursing homes are more dangerous than hospitals from the point of view of fire and life safety. This is because the nursing homes are often situated in mixed occupancy buildings or commercial buildings where other businesses are also run. It is very likely that concerns like fire safety are ignored while active and passive fire safety system recommendations given in NBC for institutional building are not complied due to various reasons.

Hospitals have many patients admitted in critical condition. Many of them might even have mobility issues while some might not be alert in case of an emergency. By ensuring fire safety in hospitals, we can prevent fire accidents.

Hospitals stock a lot of combustible materials like chemicals, cylinders, surgical equipment, etc. while some also have kitchens or canteens.

A fire accident may cause heavy casualties as a fire may become uncontrollable in a matter of minutes. Hospital management must ensure that hospitals are fire-safe at all times.

HAZARDS ASSOCIATED WITH HOSPITAL BUILDINGS

Institutional buildings with some high-risk areas with special problems relate to life risk of both ambulatory and non-ambulatory patients. It is, therefore, necessary to understand the types of hazards associated with such buildings.

With the rapid technological advancement in medical science, hospitals and nursing homes are now equipped with a wide array of new equipment such as Computerised Axial Topography scanners, Magnetic Resonance Imagers (MRI), lasers, Sophisticated Diagnostic Treatment Equipment, heaters, boilers, and flammable chemical hazards such as alcohols, solvents, acids, ethers, spirits, gas stores such as LPG cylinders, oxygen cylinders, and nitrous oxides, plants such as laundry and sterilisation plants, and AC plants and ducts, X-ray suits. Additionally, kitchen and canteen, general store, car park area, mattresses, bedding, furniture, oxygen cylinders, pipeline carrying oxygen or nitrous oxide in patients' rooms along with the sophisticated equipment increase the risk of fire in hospitals.

HAZARD ANALYSIS

Some of the major problems associated with institutional buildings during fire incidents in metropolitan cities other than patient's evacuation and rescue are:

- External firefighting and rescue operations
- Unreasonable evacuation time
- Difficult horizontal evacuation due to space constraints
- Simultaneous rescue and firefighting operations to be done mainly within the building
- Heat and smoke traps inside the building during a fire because of air conditioning
- Smoke venting problems and danger of flash over
- Large number of occupants with unpredictable human behaviour in case of fire
- Special care required for non-ambulant patients
- Special care required to keep escape routes clear from smoke and heat
- Hazards from increasing use of interior decoration and compartmentation with combustible materials
- Multi occupancy hazards, high fire loads
- Inadequate water supply
- Inadequate/unserviceable fire protection systems and equipment

LISTED BELOW ARE INCIDENTS THAT TELL US HOW RISKY HOSPITALS ARE WHEN IT COMES TO FIRE INCIDENTS. THESE ARE BUT A FEW INCIDENTS; THERE ALSO ARE MANY MINOR ONES IN NURSING HOMES AND HOSPITALS THAT ARE NOT RECORDED.

1. Dec 9, 2011: In a major fire accident at AMRI hospital in Kolkata, around 95 people lost their lives. During the incident, the hospital had around 160 patients, and many staff members.
2. Nov 24, 2012: A fire broke out in the children`s ward of state-run SSKM Hospital, West Bengal. Fortunately, there was no injury reported as some patients were shifted to safer wards.
3. Dec 18, 2012: A fire broke out in Goa`s premier government-run hospital. The incident affected the functioning of hospital but thankfully, there were no casualties.
4. Jan 13, 2013: Four infants were injured in the Prince Bijoy Memorial Hospital Bikaner hospital fire after a short circuit triggered it.
5. Aug 27, 2016: A massive fire in Murshidabad Medical College and Hospital in West Bengal killed three people while 50 children were injured.
6. Oct 17, 2016: IMS & SUM Hospital in Bhubaneswar saw one of the worst fire accidents. 22 lives were lost, and 120 people were injured.
7. Oct 17, 2017: In Rohini Super Specialty hospital in Hanamkonda, Telangana, a fire accident claimed the lives of two patients. Four people were injured. At the time of the incident, 199 patients were in the hospital.
8. Nov 4, 2017: During a fire at MY Hospital Indore, 47 newborn babies were in the hospital. Thankfully, there was no loss of life.
9. Dec 18, 2018: A massive fire swept through ESIC Kamgar Hospital at Marol in Andheri East. 8 people were killed while 176 people, including three firemen, were injured. Nearly 375 people, including patients and visitors, were in the five-floored hospital.
10. Jan 09, 2019: A massive fire broke out at an under-construction hospital in Nagpur. No injury was reported.
11. Feb 02, 2019: A fire broke out at Bhubaneswar's Apollo Hospital, Odisha. No casualties were reported.
12. May 13, 2019: In a fire that broke out at a children hospital in Ahmedabad, there were no casualties reported. A gas cylinder blast might have triggered the fire which gutted the fiber shed of the canteen.
13. Jan 09, 2020: A major fire broke out in the ESIC hospital in Noida, Uttar Pradesh. The blaze started in the basement of the hospital.
14. Aug 05, 2020: 8 people lost their lives in a massive fire that broke out at Shrey Hospital in Ahmedabad.
15. Jan 09, 2021: A massive fire broke out in the Sick Newborn Care Unit (SNCU) of a hospital in Bhandara district of Maharashtra. Among the total of 17 children, 10 died.
16. Mar 27, 2021: In a massive fire in Dreams Mall, Bhandup, Mumbai, 11 patients died while 78 were rescued.
17. Apr 4, 2021: More than 80 patients, including 62 persons infected with COVID-19, were rescued from a private hospital in Ujjain, Madhya Pradesh. Four patients sustained burn injuries.
18. Apr 9, 2021: Four lives were lost, and two people were left in a critical state in a fire that broke out in a 30-bed COVID hospital in Wadi, Nagpur.
19. Apr 18, 2021: Five COVID-19 patients died in a fire in a private hospital in Raipur, Chhattisgarh.
20. Apr 21, 2021: 24 Covid patients died due to shortage of oxygen in an oxygen supply tank leak in Nasik Municipal Hospital, Nasik. (should this incident be included in a list of hospital fires?)
21. April 23, 2021: 15 COVID-19 patients lost their lives in a fire in Vijay Vallabh Hospital in Virar, Mumbai.

Strict adherence to the National Building Code of India (NBC) and National Accreditation Board for Hospitals & Healthcare (NABH) Fire safety guidelines as well as strict implementation of the Fire Act is very important to prevent hospital and nursing home fires.

NABH FIRE SAFETY GUIDELINE

Few important points of NABH guidelines are mentioned below. These may differ for hospitals/ nursing home as per sub division type and height of the institutional building,

- Valid fire department No Objection Certificate
- Third-party fire safety Inspection Certificate
- Owner/Promoter/HOD letter of consent about updated fire safety
- Firefighting installation approval
- Easily accessible control room
- Control panel and PA equipment connected with detection system or manned fire alarm system
- Pumps and pump room
- Two separate pumps i.e. availability of electric and diesel pumps
- Provision of forced ventilation
- Arrangement of filling fire tenders
- Four-way fire inlets present in case of emergency
- Proper access for fire tender to fire tanks
- Regular fire drill and training
- Availability of yard hydrants
- Strategic locations of ring main and yard hydrants
- Two-way fire heads to charge the ring main
- Landing hydrant and hose reels
- Wet riser system installed
- Working first aid firefighting appliances
- First aid equipment cabinets
- Provision of escape routes (escape staircases)
- Sprinkler system
- Automatic smoke detectors/heat detectors
- Provision of fire alarm system and fire extinguishers
- Signages
- Sanctioned building/floor plan

NBC- 2016 – PART –IV – INSTITUTIONAL BUILDING

Hospitals and nursing homes have certain special features that are not identical to other categories of buildings. As per NBC- 2016 – Part –IV, hospital buildings are classified in Group “C” - Institutional Buildings as per occupancy-based classification.

These shall include any building or part thereof, which is used for purposes, such as medical or other treatment or care of persons suffering from physical or mental illness, disease or infirmity; care of infants, convalescents or aged persons, and for penal or correctional detention in which the liberty of the inmates is restricted. Institutional buildings ordinarily provide sleeping accommodation for the occupants. Buildings and structures under Group “C” shall be further subdivided in:

- Sub division -C-1 Hospitals and sanatoria subdivision
- Sub division - C-2 Custodial institutions subdivision
- Sub Division - C-3 Penal and mental institutions
- Subdivision C-1 Hospitals and sanatoria

This subdivision shall include any building or a group of buildings under single management, which is used for housing persons suffering from physical limitations because of health or age, and those incapable of self-preservation. For example, hospitals, infirmaries, sanatoria and nursing homes.

• SUBDIVISION C-2 CUSTODIAL INSTITUTIONS

This subdivision shall include any building or a group of buildings under single management, which is used for the custody and care of persons, such as children, convalescents and the aged who are incapable of self preservation. For example, homes for the aged and infirm, convalescent homes and orphanages.

• SUBDIVISION C-3 PENAL AND MENTAL INSTITUTIONS

This subdivision shall include any building or a group of buildings under single management, which is used for housing persons under restraint, or who are detained for penal or corrective purposes, in which the liberty of the inmates is restricted. For example, jails, prisons, mental hospitals, mental sanatoria and reformatories.

Considering fire risk and life safety, there is a height restriction of 45 metres in NBC – 2016 for institutional building; besides that, various fire and life safety guidelines are given in NBC – 2016

– Part IV, such as in Table 3, Occupant load for indoor patients' area is 15.00 sq. metre/person and outdoor patients' area is 10 sq. metre/person. Width per person for stairways is mentioned at 15 mm and level components and ramps is 13 mm (please check) in Table 4 Capacity Factor. Travel distance is mentioned at 30 metres (without sprinklers). Staircase width required is 2 metres and compartmentation area shall be 750 sq. metres for non-sprinkler building, but 1800 sq. metres if the building is provided with sprinkler system. Door width/corridor openings shall not be less than 2.0 metres in width of double swing double leaf type door. The dead end shall not be exceeding six metres. All exit passageway from hospital or infirmary sections shall be not less than 2.0 metres in width. Aisles, corridors, ramps, etc, through which patients are moved, shall have a minimum width of 2.4 metres throughout. Aisles, corridors, and ramps in other areas not intended for the housing, treatment, or use of inpatients shall be not less than 1.5 metres in width. Any sleeping accommodation or suite exceeding 100 sq. metres in area shall have at least two doorways leading to the exit access corridors. Also, suggested stretcher lift in a lift bank shall also act as fireman's lift meeting the requirements of Part 8 'Building Services, Section 5 Installation of Lifts, Escalators and Moving Walks, Subsection 5A Lifts' of the Code. The refuge area shall be provided immediately above 24 metres and thereafter at every 15 metres. It shall also meet all the requirements of life safety. NBC guideline also suggested for appointment of fire officer for institutional buildings taller than 15 metres.

Minimum Fire Safety Requirements are concerns everyone has to refer Table 7 of NBC- Part IV- 2016 where for Institutional building for sub division (C1 to C3) and considering height from Ground floor structure to 45 mts height different types of Fire Fighting systems are suggested. These have to comply and maintain referring various BIS standards by owner / occupant of the institutional building. (This part has to be rewritten/relooked. It is making little sense in its current form)

Extinguishers, hose reel, wet riser, down comer, yard hydrant, sprinkler system, fire alarm systems, smoke detection systems are minimum requirements for institutional buildings. Underground water tank, overhead water tank, and Main/Jockey/Booster Pumps capacities are different as per height of the building.

RESPONSIBILITIES OF HOSPITAL AUTHORITIES

Hospital Authorities must keep all fire safety system in place. Extinguishers, exit paths, sprinklers, hydrants, etc. have to be regularly checked and kept ready at all times. This ensures the building is always fire-safe. Hospital authorities must arrange fire drills for the staff who further must be trained to handle emergency situations. Periodical fire drills for the staff help them be better prepared for emergency situations. Evacuation becomes much easier when the staff is well-trained. The hospital premises should also have periodical fire safety audits that will help the hospital management to know if there are any potential fire hazards. The audit also suggests preventive measures if there is any risk identified.

The hospital authorities must establish a fire safety and evacuation plan and make sure that everyone working in the facility is aware of the procedures. Regular fire drills must be conducted to ensure all

workers know evacuation routes and what to do in case of a fire. All hospital staff must know about the location of manually operated fire alarm (push button fire alarm boxes), fire extinguishers, and hose reel on their respective floors, and the nearest exit from their work area, assembly point. They must also know how to fight fire with fire extinguishers/hose reel provided on the floor, keep the fire alarm point or fire extinguisher unobstructed, not damaged and in working order. In case of emergency, they must know how to turn off all medical gas supplies and electrical equip-

ment before vacating the site and evacuate the patients through the nearest safe exit. They must ensure all exit doors, evacuation routes and essential pathways are not blocked and are free of clutter. They also must recognise the need for immediate action in case of a fire to ensure patient safety and t know how to move patients quickly and safely. This can be achieved only by frequent practice and training.

FIRE PREVENTION BY HOSPITAL AUTHORITY

The best approach to fire safety is fire prevention. However, no facility is perfect, and no plan can prevent every possible cause of a fire. The following prevention tips can help to reduce the risk though:

- Hospital authority must prohibit smoking within the facility, especially among patients. Carelessness while smoking is a leading cause of fires in residential settings. If there's a designated smoking area, introduce large metal ashtrays that are designed to be tip-resistant. No one must be allowed to smoke near oxygen supplies or around electrical cords and electricity-powered tools and equipment.
- Authorities must routinely check electrical outlets and wires, and make sure electrical cords and plugs are in good condition with no damage, nicks, or frayed areas. Electrical cords should not run under rugs or carpets or overload electrical outlets or extension cords. Additionally, any appliances, tools, or pieces of equipment that generate sparks, smoke, or unusual odours must be replaced. Caution must be exercised in areas where fires are more likely to break, like kitchens, dining facilities, laundry rooms, and any other such areas.
- Hospital authorities must monitor kitchens activities especially while preparing meals making sure grease and other flammable materials don't accumulate on kitchen equipment. Also, flammable substances must be safely and securely stored. Alarms and fire suppression systems must be ensured are functional. Local requirements for placement and maintenance of fire alarms, smoke alarms, carbon monoxide detectors and fire suppression systems must be followed. Alarms and detectors must be serviced regularly and kept in working condition.
- Good housekeeping will reduce the chances of a fire. As it is likely that nursing homes generate a high quantity of combustible waste material, proper housekeeping also includes storing substances such as aerosol sprays, medical gases, and medications appropriately. Ideally, any flammable liquids and gases must be locked away in fire-resistant enclo-

sures. Authorities must try to reduce the quantity of dangerous substances to the smallest reasonable amount in nursing homes. When stacking linen, paper, packaging, and other materials, it must be done in an orderly fashion and stored such that they do not obstruct escape routes. Waste materials must be stored in suitable containers before they are removed from the premises; such waste must not be allowed to accumulate in open containers. Outdoor bins must be secured to prevent them from being moved closer to the building where they could catch fire.

PREVENTIVE MEASURES

- Good housekeeping in all areas, especially stores, kitchen, electrical installation, transformer house and waste disposals etc. must be maintained.
- No Smoking Zone must be strictly enforced.
- All electrical installations must be periodically checked and tested by competent electrical engineers, while all loose electrical wiring must be replaced immediately.
- Appropriate M.C.B. must be installed in the electrical installation as per Indian Electrical Rules.
- All old electrical wiring especially in the zone of insignificant and abundant area must be replaced with new ones.
- The basement, if any, must not be used as storeroom for material dumping, patient ward or for any other purpose that might cause fire/smoke.
- Lift shaft and stair lobby/landing shall be free from any obstacles/obstruction.
- Use of LPG gas cylinders shall be through gas bank, which shall be installed with separate place with barrier and precaution as per IS: 6044.
- Trained staff in dealing with the firefighting extinguisher/appliance/evacuation procedure shall be engaged.
- Firefighting drill and evacuation drill should be held on a regular basis.
- Building should be modular by making corridors horizontal and vertical exits from the origin of the fire place to a safe area easily, and also by incorporating fire and smoke check door in the lobby approaching stairways and elevators.
- One senior personnel preferably from administration may co-ordinate and look into all fire safety procedure.
- On-site emergency/evacuation plan shall have to be prepared and updated at regular intervals.
- Fire notice, fire order, exit sign, floor numbers must be displayed at conspicuous places.
- Proper arrangements must be made for checking, testing and maintenance of all fire protection and detection system to keep them in working condition at all times.
- Fire and electrical safety audit must be carried out at regular intervals.

PROTECTIVE MEASURES

- Water reservoir exclusively for firefighting shall be made available as prescribed in National Building Code (NBC) Part IV.
- Replenishment of the reservoir may be incorporated with deep tube well with auto facility.
- Fire Hydrant Ring main with Yard Hydrant & Wet Riser system with landing valve shall be installed as per NBC Part IV & IS: 3844.
- Hose box containing two 15-metre-long hose and one branch pipe with nozzle to be installed near each yard hydrant and landing valve.
- First-aid hose reel that is 40-metre-long to be provided near each landing valve tapped off from the wet riser.

- Sprinkler system to be provided for all the floors and other places/areas as applicable as per NBC Code.
- Firefighting extinguisher should be provided within the building as per IS: 2190 and person in the workstation must be trained to use the same in case of an emergency.
- Fire pumps such as main pump, jockey pump, booster pump etc. must be installed as suggested in NBC- 2016- Part IV- Table 7, and head of the pump must be such that 3.5 kg/cm2 pressure is available at the furthest/highest landing valve. Auto-start facility must be incorporated in the fire pump.
- A standby pump of equal capacity must be available on alternate sources of supply, preferably a diesel-operated one.
- Fire detection and alarm system for the entire building must be provided as per IS: 2185.
- Public address system with two-way communication System must be installed.
- Emergency power supply must be provided to the Illumination of means of escape route, fire alarm panel & P.A. console, fire pumps, fire lift, and borewell.
- General recommendations for the Electrical Installation -

Recommendations are made for different electrical installations (H.T. / L.T.) rectification/correction at Hospitals/Nursing Homes premises, in line with the “Central Electricity Authority (Safety) Regulations”, 2010 and relevant provisions of I.S. Code of practice.

EVACUATION / HORIZONTAL MOVEMENT OF PATIENTS

Life safety during a fire in hospitals relies on a “Defined in Place” principle. Horizontal exits or smoke barriers are required to sub-divide each storey of a hospital to provide an area of refuge on each floor. In case of emergency, the objective must be to keep the fire away from the patient rather than move the patient away from the fire.

Vertical evacuation of patients within a health care facility is difficult and time consuming. Therefore, horizontal movement of patients is important. Smoke barriers and smoke compartments are important for fire safety in health care facilities. This smoke barrier allows for horizontal evacuation of patients to an area of refuge on the same floor, and this horizontal exit must be provided with at least one fire and smoke check door with two hours fire barrier walls. It is always preferable that the refuge floor space has direct connectivity to the fire escape staircases/ramps for safe evacuation from the building. All required exits that serve as egress from hospitals or infirmary sections shall not be less than two metres clear in width including patient bedroom doors to permit transportation of patient on beds, litters or mattresses. The minimum width of corridors serving patients bedrooms in buildings shall be 2.4 metres.

COMPARTMENTATION

It is seen that smoke is the cause of most fire deaths, If proper protection against smoke if taken in hospital buildings, and if such buildings are sub-divided into separate smoke compartments, then the patient can be moved easily from one compartment to another, safely leave the building, or change floors.

SERVICE DUCTS/SHAFTS

a) Service ducts/shafts shall be enclosed by walls of two hours doors of one hour fire rating All such ducts/shafts shall be properly sealed, and fire stopped at all floor levels.

b) A vent opening at the top of the service shaft shall be provided having between on-forth and one half of the area of the shaft.

c) Fire, smoke, and other toxic products of combustion tend to spread vertically within a building. Special effort is required to prevent fire on one level from threatening the occupants in the upper floors. This is important in hospitals and nursing homes.

d) Dedicated A.H.U. shall be provided for individual floor with supply and return duct and, as far as possible, fire dumpers shall be provided in the supply and return ducts. In case of fire, the A.H.U. shall be tripped and fire damper shall be closed. Necessary interlocking with Fire Detection System shall be provided. Therefore, all shafts must be provided with fire rated enclosures of 1-hour fire resistance rating for vertical openings connecting not more than three floors. Opening to shaft should be limited and such openings must be protected.

Recommendation of minimum essential fire safety measures for institutional buildings

IMPORTANT MEASURES FOR LV/MV/HV INSTALLATION -

- To install Miniature Circuit Breaker (MCB) in all distribution circuits (main and branch) along with incomer MCB in the distribution board, so that all the circuits are controlled from one point of the said installation.
- Periodical checking and measurement of existing earth pit/grid resistance, earth to neutral voltage, and measurement of unbalance current in the system, and to take measures accordingly.
- Segregation of power cables from telephone line, cable line and other non-power line if any by erection of cable tray and laying dressing, clamping of cable, use of FRLS wire, separately with cable tag making, ferrule making for maintenance of the installation.
- Necessary gadgets to be fitted in each floor/room for fire alarm as well as tripping of the circuit breaker for isolation of supply of the installation.
- To measure current in each circuit; load of each circuit and sub-circuits, distribution board must conform relevant I.S. codes of practice.
- Marking of distribution boards (main & branch) and circuits accordingly for easy identification and maintenance of the circuit.
- Installation of lightning arrestor/lightning masts on

the building as per I.S. code of practice.

- To install modern starter and MCBs for air-conditioner control and other gadgets as per I.S. code of practice.
- To install dry type transformer by replacement of existing oil type transformers and preferably to replace all oil-type circuit breaker by Vacuum Circuit Breakers (V.C.B.)
- Arrangement of proper air circulation system for dry type transformers.
- To remove all sorts of storage materials causing hindrance for accessibility to the electrical control gadgets as well as exit in case of emergency. No material shall be stored in the substation rooms.
- Fire-retardant paint to be used in all rooms decorated by wooden panels.
- To fix responsibility to the personnel operating different electrical gadgets during or after office hours in view of safety, mode of operation and saving of energy.
- L.T. Distribution Panel (Main) of the Transformer should have proper rating Air Circuit Breakers (A.C.B.), at the incoming side (Main Incomer) and all outgoing feeders must have proper rating A.C.B./ M.C.C.B., with adequate protection system. Outgoing feeders L.T. cables should be of sufficient current rating in respect of Moulded Case Circuit Breaker (M.C.C.B./M.C.B.) connected with it. L.T. cables are preferred to run through the "Cable Duct" of the building. There should be floor wise/section wise distribution board in all floors with sub-circuit protection incoming and outgoing M.C.B./ M.C.C.B. of appropriate rating, as per connected/working load required. The installation in multi-storied building must be carried out and maintained such so as to prevent danger due to shock and fire hazards in accordance with the relevant I.S. code of practice. All ducts provided for power cable and other services shall be provided with "fire barrier" at each floor crossing. No other service pipe shall be taken along the duct provided for the power cable.
- Outdoor canopy/soundless type D.G. Sets as standby power supply must have proper interlocking system between generator supply and licensee supply.
- For the "Emergency Sections" of the hospital/ nursing home, "U.P.S. System" is preferred.
- Preparation of layout, single line diagram of the total HT installation and distribution diagram of all MV/LV installation after incorporation of above recommendation.
- All electric supply lines and apparatus shall be of appropriate rating and shall conform to the relevant I.S. codes of practice.
- All type of electrical installation work shall be carried out by government licensed electrical contractor in terms of Central Electricity Authority (CEA) (Safety) Regulation, 2010.
- Recommended for electrical safety officer in terms of safety regulation.
- List of electrical licensed persons to operate the HV/ MV Equipment to be displayed with names entered in the register in terms of safety regulation.

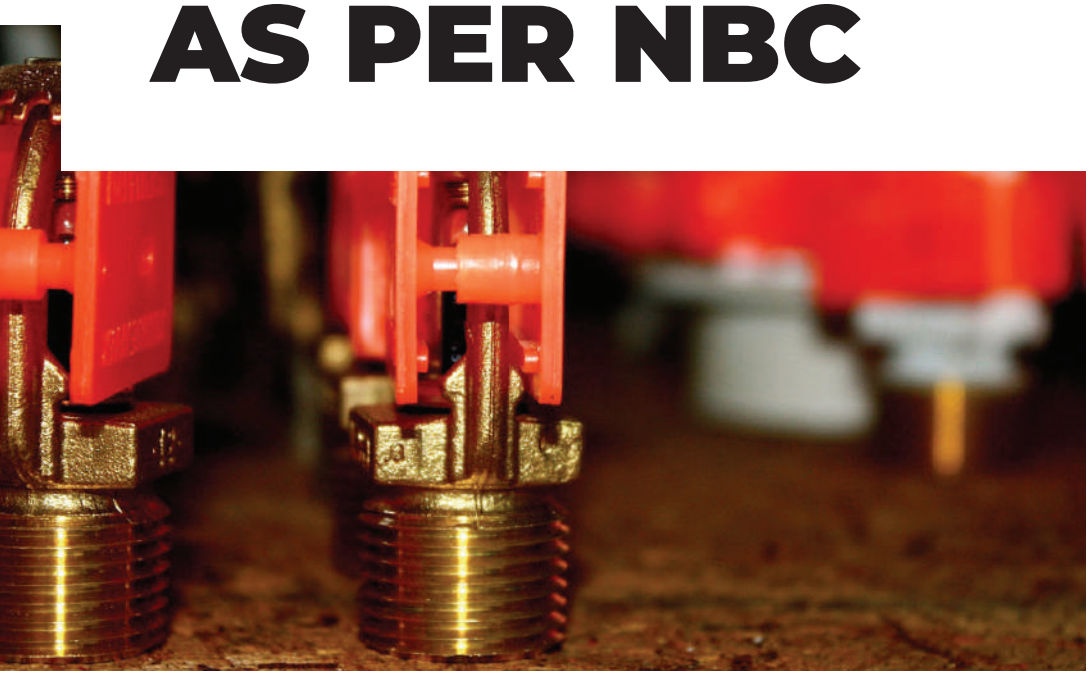
Fire safety measures have four parameters - means of access through approach roads, open spaces, means of escapes like external staircases, and Fire-fighting equipment. Provision of these is necessary from a safety perspective within hospital premises. An effective fire programme calls for an understanding of the hospital fire plan and the active participation of every employee at all times. Also, at least one well trained fire officer must be elected at every hospital. There is no better protection against fire than constant vigilant supervision to detect fire hazards, prompt action to eliminate in safe conditions and a high degree of preparedness to fight fire.

SYNOPSIS - Everyone must remember that every big fire starts from a small one. Therefore, nothing must be considered insignificant within hospital premises. Some hospitals lack trained staff to handle emergencies. Hence, frequent mock, as well as evacuation drills and training must be conducted in the hospital for staff. Panic and confusion are the greatest hazards during a fire and they can be countered only by sufficient preparedness.

If the hospital staff have adequate knowledge of basic firefighting and evacuation, and implement this in case of a fire incident, several lives can be saved. We must remember that the initial steps to protect hospitals against fires are prevention and suppression. Complete evacuation of patients must be avoided unless absolutely necessary.

If fire get beyond control, then safe evacuation or horizontal movement of patients must be carried out without delay.

PRODUCT COMPLIANCE & PASSIVE FIRE PROTECTION AS PER NBC



ABHISHEK CHHABRA
Market Development Manager, Thomas Bell-Wright International Consultants

USING BUILDING CODES OFTEN BECOME AS COMPLICATED AS CREATING THEM. A KEY REASON BEING THE SPREAD OCCUPANCY TYPES AND ENVIRONMENTAL CONDITIONS CLASH VERY OFTEN WITH JURISDICTIONS AND THEIR INTERPRETATION OF THE CLAUSES. WHILE THE COMPLIANCE TO 'DESIGN' AND INSPECTION OF 'WORKMANSHIP' CONTINUE TO GET DEBATED, ONE ASPECT OF 'CODE COMPLIANCE' IS NOW VERY EVOLVED GLOBALLY - 'COMPLIANCE OF MATERIALS'.

This article aims to introduce "Assurance Mechanisms" followed around the world with examples of Passive Fire protection. Products and materials that are used to create the infrastructure that 'architects' visualise and design, 'engineers' design and build, and 'Government and financial Institutions' fund. The promise of "compliance to the code" relies heavily on the assurance of the materials produced in factories and their ability to provide the same materials repeatably.

PASSIVE FIRE PROTECTION

If you imagine a fire incident like an electrical spark triggering a fire on a carpet or cigarette igniting a curtain, the immediate mental response is to try and extinguish it. And if you continue that storyline to imagine that the quick measures to extinguish the fire are not working out and the fire is spreading way too quickly, the ideal next move to strangle and contain it where it is and it does not spread out, close it in a box which suffocates the fire itself. These two responses have become the two basic means of fire protection: Active Fire Protection & Passive Fire Protection as described in Figure 1. The key implementation of what is described as passive fire protection is containment or compartmentation of fire. The same is also described as resistance to fire.

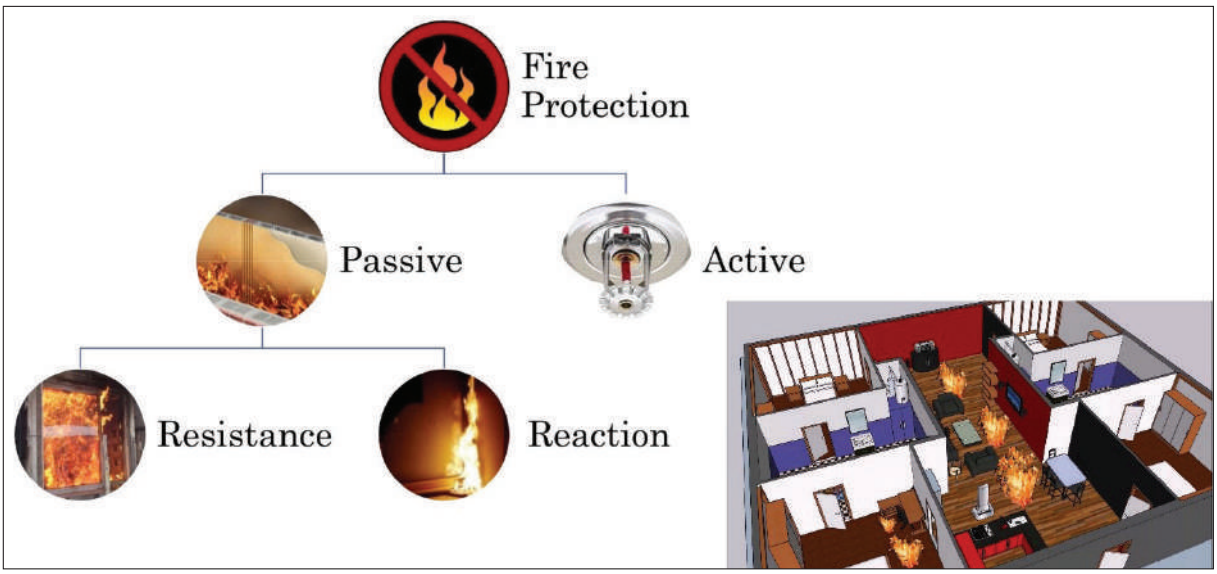


Figure 1 : Types of Fire Protection

Over decades, millions of man-hours have been spent in refining the implementation of both these approaches. New and innovative means have evolved to quantify the fire behaviour and the efficacy of the fire protection measures in dealing with such incidents, and how each one of them is able to prevent an incident turning into an accident.

While commerce can fund the evolution of newer solutions, there remains a lag in drafting of rules that define 'how' the fire protection should be 'designed' and 'implemented' in new infrastructure (Building Codes). Much more importantly: how to assure their functionality (assurance mechanisms).

ASSURANCE MECHANISMS

The assurance of the performance of any product is the primary promise for the commercial transaction. The supply chains of products and raw materials continue to become more complex and susceptible to global events. These events can disrupt availability of building materials leading to quick solutions of alternate suppliers. This could lead to dangerous outcomes if the performance is not as per requirements.

Governments and industries around the world have been evolving standard mechanisms over decades with more strict and stringent systems deployed for products that have higher risk to life. For example, the assurance mechanism in place for ensuring that an electrical switchboard will not create a short-circuit led fire is stringent in almost every country. Now whether an office chair or a piece of furniture will break while in use or the vegetables sold in the market might contain certain banned chemicals is not necessarily checked or assured in the same way. These vary across countries as are often driven by awareness among people and the risk it poses.

TEST REPORTS & CERTIFICATION

The word 'tested' is seen across many consumer-products and even industrial products; often this word drives some level of assurance. People relying on this should know that when a product gets tested, the sample often always knows that it will be tested. Hence a 'test' only demonstrates the 'capability' of making a product,

which can comply to a given test. Assurance requires not only a check of ability to produce repeatably and consistently, but also a mechanism to establish traceability. This is where 'Certification and Listing' as a mechanism is used as it has the potential to keep a check on how this repeatability and consistency can be delivered.

Figure 2 is from an ISO standard adopted in India by Bureau of Indian Standards and republished as an Indian Standard as well. ISO/IEC 17067 which is part of conformity assessment standards defines the 'Fundamentals of product certification and guidelines for product certification schemes. It is referenced in ISO/IEC 17065, which is also for conformity assessment and defines requirements for bodies certifying products, processes and services. While ISO 17065 is used by government and private certification bodies (Like BIS, UL or Thomas Bell-Wright) to design certification programmes; the Figure 2 from ISO 17067 gives an overview of how levels of stringency can be driven in certification programs depending on the level of assurance needed. More about this is covered after introducing Building Codes.

Table 1 — Building a product certification scheme

	Conformity assessment functions and activities[a] within product certification schemes	Types of product certification schemes[b]							
		1a	1b	2	3	4	5	6	*N*[c,d]
I	**Selection**, including planning and preparation activities, specification of requirements, e.g. normative documents, and sampling, as applicable	x	x	x	x	x	x	x	x
II	**Determination of characteristics**, as applicable, by: a) testing b) inspection c) design appraisal d) assessment of services or processes e) other determination activities, e.g. verification	x	x	x	x	x	x	x	x
III	**Review** Examining the evidence of conformity obtained during the determination stage to establish whether the specified requirements have been met	x	x	x	x	x	x	x	x
IV	**Decision on certification** Granting, maintaining, extending, reducing, suspending, withdrawing certification	x	x	x	x	x	x	x	x
V	**Attestation, licensing**								
	a) issuing a certificate of conformity or other statement of conformity (attestation)	x	x	x	x	x	x	x	x
	b) granting the right to use certificates or other statements of conformity	x	x	x	x	x	x	x	
	c) issuing a certificate of conformity for a batch of products		x						
	d) granting the right to use marks of conformity (licensing) is based on surveillance (VI) or certification of a batch.		x	x	x	x	x	x	
VI	**Surveillance**, as applicable (see 5.3.4 to 5.3.8), by:								
	a) testing or inspection of samples from the open market			x		x	x		
	b) testing or inspection of samples from the factory				x	x	x		
	c) assessment of the production, the delivery of the service or the operation of the process				x	x	x	x	
	d) management system audits combined with random tests or inspections						x	x	

[a] Where applicable, the activities can be coupled with initial audit and surveillance audit of the applicant's management system (an example is given in ISO/IEC Guide 53) or initial assessment of the production process. The order in which the assessments are performed may vary and will be defined within the scheme.

[b] An often used and well-tried model for a product certification scheme is described in ISO/IEC Guide 28; it is a product certification scheme corresponding to scheme type 5.

[c] A product certification scheme includes at least the activities I, II, III, IV and V a).

[d] The symbol *N* has been added to show an undefined number of possible other schemes, which can be based on different activities.

Figure 2 : Types of certification programs

BUILDING CODES AND COMPLIANCE

The aim of the National Building Code of India 2016 (NBC) is to provide guidance across various stages of conceptualization, planning, designing, constructing, maintaining and repairing the buildings. Keeping in mind substantial variations from region to region, the Code endeavours to meet the requirements of different regions of the country, both urban and rural, by taking into consideration factors such as climatic and environmental conditions, geographical terrain, etc.

Part 4 and Part 6 deal with two of the most critical aspects of any building infrastructure - Fire and Life Safety and Structural Safety. The infrastructure should not fall and should not catch fire causing harm to life.

The building code learns iteratively and progresses forward with each publication to assimilate learnings from accidents and new innovations. The code also uses published standards to quantify these guidelines and 'specify performance of building materials', which will bring about these design guidelines.

Example Case Study: Implementing Compliance to Fire Safety using passive fire protection

Passive Fire Protection is a key enabler of fire safety in buildings. Passive fire protection installations consist of all the building components, systems and assemblies that provide containment of fire and prevention from the passage of flames, deadly gases, and toxic smoke. These installations critical to fire and occupational safety are not just limited to fire doors and partitions but also include the penetrations, joints and other breaches in fire-resistive walls, floors and floor/ceiling assemblies.

The chapter 3 under the part 4 of the NBC details how buildings are classified under occupancy types, which is done based on how a fire accident will be differently perceived by a given building. The response preparedness of a school will differ from a mall or a hospital or a residential block and hence measures of Fire & Life safety are designed differently. Using 'Fire Zones' and 'Types of Construction', the code further details and guides the readers on the tools used to implement fire safety; more specifically, how containment and limiting of fire (Passive fire protection) is defined. Figure 3 reproduces the Table 1 of this section, which defines Fire Resistance Rating in hours. Simply put, for how long can the specific sub-unit of the infrastructure (like a floor or a room) contain the fire. The preparedness of the building type and location sets this time (published in the table) as a basis of evacuation time needed.

Table 1 Fire Resistance Ratings of Structural and Non-Structural Elements (minutes)
(*Clauses* 3.3.1 *and* 3.3.2)

Sl No.	Structural Element	Fire Resistance Ratings (min) for Type of Construction			
		Type 1	Type 2	Type 3	Type 4
(1)	(2)	(3)	(4)	(5)	(6)
i)	Exterior walls:				
	a) Fire separation less than 3.7 m:				
	1) Bearing	240	120	120	60
	2) Non-bearing	120	90	60	60
	b) Fire separation of 3.7 m or more but less than 9 m:				
	1) Bearing	240	120	120	60
	2) Non-bearing	90	60	60	60
	c) Fire separation of 9 m or more:				
	1) Bearing	240	120	120	60
	2) Non-bearing	60	60	60	60
ii)	Fire separation assemblies (like fire check doors)	120	120	120	120
iii)	Fire enclosures of exits	120	120	120	120
iv)	Shafts for services, lift hoistway and refuse chutes	120	120	120	120
v)	Vertical separation between adjacent tenant spaces	60	60	60	60
vi)	Dwelling unit separation:				
	a) Load bearing	120	120	60	60
	b) Non-load bearing	60	60	30	30
vii)	Interior bearing walls, bearing partitions, columns, beams, girders, trusses (other than roof trusses) and framing:				
	a) Supporting more than one floor	240	120	120	120
	b) Supporting one floor only	180	90	60	60
	c) Supporting a roof only	180	90	60	60
viii)	Walls supporting structural members	180	90	60	60
ix)	Floor construction	120	90	60	60
x)	Roof construction:				
	a) 5 m or less in height to lowest member	120	90	60	60
	b) More than 5 m but less than 6.7 m in height to lowest member	60	60	60	60
	c) 6.7 m or more in height to lowest member	0	0	0	0

NOTES

1 The above fire resistance rating shall be required to achieve the respective type of construction unless otherwise specified in the respective clauses for different applications/use.

2 In case of lift bank, the partition wall, if any, need not be of fire rating specified in this table.

Figure 3 : From the National Building Code of India

CONTAINMENT FOR ONE HOUR

Imagine you are in a low rise (8-storied) residential building sitting next a window working on your laptop in your home office. Your room consists of three walls, a large glazing (part of the curtain wall system); a door to the room, bathroom door, false ceiling to hold the lights and move utilities in and out of the room and two openings for the HVAC system. The adjacent house is the same. And then a fire breaks out in your adjacent house.

Now for the fire and smoke in the adjacent building to be contained for one full hour, it is required that at least the three walls, the door to the room, the penetrations across the false ceiling and the system sealing off the curtain wall system and the slab of the floor (through penetration firestop) can withstand and contain a fully developed fire (~1000 Degree centigrade). The responsibility of the contractor is not only to have a means to check the suppliers of fire doors, partition walls, through penetrations on the guarantee, but also assure that the installation and workmanship will last.

COMPLIANCE TO THE CODE: MEASUREMENT & ASSURANCE

Below is a list of test methods from the Annexure of Chapter 4 of the NBC.

- IS 3614-2: Fire Doors
- IS/ ISO 834-1: Fire-Resistance Tests Elements: General Requirements
- IS/ ISO 834-4: Fire-Resistance Tests Elements: Load Bearing Vertical Separating Elements
- IS/ ISO 834-5: Fire-Resistance Tests Elements: Load Bearing Horizontal Separating Elements
- IS/ ISO 834-6: Fire-Resistance Tests - Elements: Beams
- IS/ ISO 834-7: Fire-Resistance Tests - Elements: Columns
- IS/ ISO 834-8: Fire-Resistance Tests - Elements: Non-load Bearing Vertical Separating Elements
- IS/ ISO 834-9: Fire-Resistance Tests - Elements: Non-load Bearing Ceiling Elements

And below two have been indigenously published by professionals in India after the code was published.

- IS 16947: Fire resistance tests for doors with glass panes, openable glass windows and sliding glass doors
- IS 16945: Fire Resistance Test for Glass Walls

The goal is to assess the repeatability. So, any laboratory that is reproducing the conditions (fully developed fire with temperature and pressures) defined usually in these published test methods needs to be able to do it repeatedly. Accreditation bodies like United Kingdom Accreditation Services (UKAS) or National Accreditation Board for Testing and Calibration of India need specialist auditors who are experienced in understanding the nuances of the tests to help decision makers rely on results of accredited laboratories. Thomas Bell-Wright International in Dubai is currently the only laboratory in the whole world to be accredited by UKAS to all the 10 standards mentioned above.

When a (fire) test is being conducted, the sample which is installed by experts in the laboratory is aware that it must face a fire test. So, there is a need for documentation of how the sample to be tested is manufactured and how it is getting installed. An audit regime of manufacturing facility and installation inspection of the product at site closes the loop. A test report from a lab that may not have even established its repeatability cannot establish any assurance mechanism on the supply and installation of the product. And if the product is a fire door, or a partition assembly using boards or a sealant system that is responsible for creating a fire safe containment, such an assurance is critical and invaluable.

CERTIFICATION, LISTING & TRACEABILITY.

The type 5 system described in Figure 2 above is typical routine used by select International Certification Bodies to provide a high degree of assurance of promised properties of products. Let us see how the Certification Program of Thomas Bell-Wright International offers this assurance for fire doors.

A Fire Door manufacturer would want to certify two or four commonly used door designs as per IS 3614. The assembly of these sample doors is witnessed at the manufacturing location by a qualified auditor who marks these doors for traceability. Their manufacturing processes also get audited to demonstrate the ability of producing these doors repeatably. The marked doors are sent to the lab and the fire resistance tests are conducted as per ISO 3008 which is the referenced test method in IS 3614. Based on successful fire resistance tests, the certification body will list the name of this manufacturer along with their address, identification details of these door-sets along with the test method and the number of hours it was able to demonstrate the fire resistance.

A similar process is faced by the certification body themselves as they get audited every year. Certification body auditors are shadowed in their audit routines and complete documentation and processes get checked by experts from International Accreditation Bodies.

IMPLEMENTATION IN A BUILDING: FIRE DOORS

As the National Building Code guidelines define the design of the Fire Safety Plan, the design of a building would result in a list of total number of fire doors (a few hundred maybe) which are needed. Ranging from doors of fire exits, main doors etc. this list would have details of door designs, sizes etc. This 'Door Schedule' would be the procurement document and here is where the contractors can use the 'Certification & Listing" directory to look-up suppliers whose factories are audited regularly for manufacturing such fire doors.

Also, suppliers who submit their offers can send proof of compliance of their proposed doors that is verifiable on the certification directory (like www.tbwcert.com). This is where, many a times listed drawings may not match with the door schedule and the deviation in sizes or designs need a verification or evaluation by the certification body. Sometimes new fire test(s) is(are) needed as existing evidence is not enough to assure proposed designs will meet the ones in the door schedule.

FIRE DOOR LABELS

Not all certification bodies issue 'fire door labels' as a traceability mechanism. In fact, not all certification regimes need to create a certification traceability mechanism. But the ones who do offer these do it well and should be preferred as they offer better assurance. See figure 4 as an image of a sample fire door label.

One of the many ways this is implemented is as below. The manufacturer will maintain a record of each project/job which is covered under the certification body's assurance mechanism. So, the drawings of doors assembled and supplied get lined with specific serial numbers of fire doors that are issued. These are audited regularly to be within limits of what is testing and listed design, which is assured. The building owner, their contracted architect or consultant and any authority having the responsibility can easily look-up the listed drawings of the doors on the certification body's directory (see www.tbwcert.com as an example). The certification body is also obligated to dig out and share traceability data from audits if being queried by the authority or an inspection body.

Figure 4 : A typical Certification label with traceability information

CONCLUSION

Part 2 of NBC details several aspects of how enforcement mechanisms are suggested as a structure. The essence is being reproduced from section 13 of Part 2 of the code.

"13 RESPONSIBILITIES AND DUTIES OF THE OWNER

13.1 Neither the granting of the permit nor the approval of the drawings and specifications, nor inspections made by the Authority during erection of the building shall in any way relieve the owner of such building from full responsibility for carrying out the work in accordance with the requirements of the Code."

Every contract has a value and needs a level of assurance. In the construction industry in India where the NBC has been enacted and implemented, organisations and their representatives are responsible for the implementation of the compliance to the code in the building as per the laws. Using better assurance regimes frees them from the liabilities.

Abhishek is an engineer and a Post Graduate Diploma holder in Finance. He has been advocating the need for compliance with standards for improved safety and quality across industries for most of the last two decades. He has vast experience of promoting conformity assessment in several industries including Consumer Electronics, Industrial, Renewable and Building Products across geographies and jurisdictions. He has worked on several Standards and Codes development initiatives, specifically with Bureau of Indian Standards (BIS), ASTM, UAE Fire & Life Safety Code of Practice and Saudi Standards, Metrology and Quality Organization (SASO).

HAVE WE LEARNT FROM THE RECENT HOSPITAL FIRE INCIDENTS IN INDIA & ABROAD?

"DO WE FIGHT ONLY ILLNESSES AND NOT FIRE?"

DR RAKESH CHATURVEDI
Deputy General Mana4ger / Fire S Adani Ports & Special Economic Zone, Mundra

ALL CODE REFERENCES IN THIS ARTICLE ARE FROM THE MOST CURRENT EDITIONS OF NFPA. HOWEVER, THE CENTRES FOR MEDICARE & MEDICAID SERVICES (CMS) GUIDELINES FOR HEALTHCARE FACILITIES ARE STILL BASED ON THE 2012 EDITION OF NFPA 101. THE TWO PRIMARY CODES THAT OUTLINE REQUIREMENTS FOR HEALTHCARE OCCUPANCIES AND HOSPITAL FIRE SAFETY ARE NFPA 99: HEALTH CARE FACILITIES CODE AND NFPA 101: LIFE SAFETY CODE. THIS ARTICLE EXPLAINS HOW THESE DOCUMENTS DEFINE HEALTHCARE OCCUPANCIES WHILE PROVIDING AN OVERVIEW OF THE REQUIREMENTS THAT KEEP THESE FACILITIES SAFE.

Hospital fire safety is a serious issue to take note of. While COVID-19 brought the concern to the forefront, it existed well before. Firstly, we need to understand the fire incidents before and after the pandemic; we need to better cope with challenges for hospitals to meet the government fire safety requirements versus the commitment to save human lives with 100% utilisation of available resources.

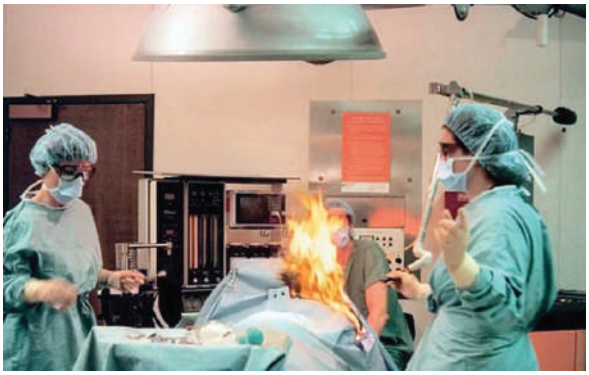
The pandemic has only added to the hazards like increased volume of flammable liquids (sanitisers), liquid oxygen gas, increased electrical load, stress on life-saving electrical equipment, HVAC/AC used in ICU and COVID patient wards (24x7 running of these critical equipment), large number of visitors along with patients in hospital, compartment of beds with highly combustible synthetic curtains for isolation of COVID-19 patients, regular sanitation of beds as well as the maintenance of sound hygiene conditions, a sudden increased demand of health workers by compromising quality, training of health care workers compromised, and high rate of change over of these health worker staff in every hospital.

The challenges faced by hospitals and health care workers and Management in COVID situation are immense. The probable causes of fire incidents are alcohol vapour rich environment, oxygen-rich atmosphere, overload or extensive use of 24x7 running of electrical equipment and HVAC/AC system, confined atmosphere of ICU to ensure no infection to patient, and insufficient air circulation. Apart from these critical factors, poor housekeeping, storage of unused combustible material in stores, high fire load due to the number of increased beds, combustible mattress with PVC covers, extensive use of plastic material equipment, combustible interiors, use of fuel like LPG/PNG for cooking and other purposes, provision of kitchen inside hospital, pantry at each floor for making tea, oxygen gas compressor, and huge storage of oxygen gas cylinders adjacent/inside building to hospital and smoking only add to the worries.

This has often led to major hospital fire incidents and claimed several lives. Let's focus on what went wrong in these hospitals' fire safety management systems, the minimum required infrastructure, the outcomes of past fire incident investigations, and recommendations to prevent similar incidents in the future.

Our memory is short. We tend to forget past incidents easily. All the recent fires could have been prevented by adopting proactive and practical approaches like daily fire safety inspection with checklists by hospital staff, random visits of respective fire officer having audit skills, immediate corrective actions. I will also document 100% mandatory training to health care staff including doctors too.

A 2013 study published in the Journal of Clinical Anaesthesia concluded that "Fire happens with alarming frequency and potentially devastating consequences in hospitals around the world." NFPA Journal summarised the study and global news reports that show how poor hospital fire safety leads to hundreds of deaths in Algeria, South Korea, Brazil, China, India, and Russia. Hospitals in the United States, however,



are much safer. Most of the fires occurred in Intensive Care Units mostly in air conditioners and other electrical equipment. The US fire departments respond to about 1,100 hospital fires annually, and the latest National Fire Protection Association (NFPA) data show that less than one death per year occurs in these fires. The reason for this exceptional safety record is the United States' strict adherence to and enforcement of building and fire codes and standards.

In the Indian hospital fire safety context, there is the National Building Code rev- 2016. Under this, buildings are classified as BIS 12433 if a hospital has less than 30 number beds.

The National Building Code- 2016 of India Guidelines is basically followed with different building bye laws of state to ensure fire prevention and life safety of hospital in India, and NABH standards to get certification of hospitals. Going through the fire incident analytics from Feb 2010 to Nov 2019, we see how 33 fire incidents claimed a total of 134 lives. Seven of the 33 incidents occurred in private hospitals while 26 in government hospitals.

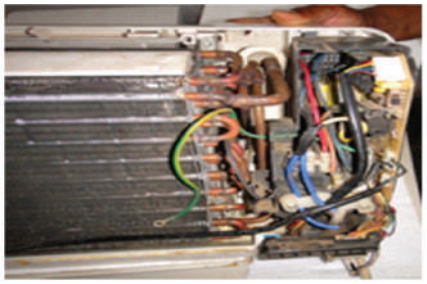


Fig. 6 Electrical component and wiring in a split air conditioner (AC) are potential fire sources.

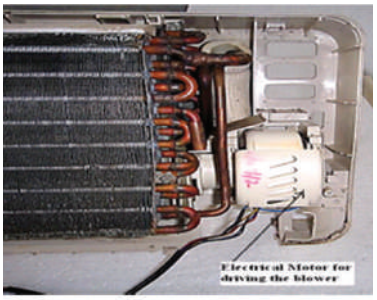
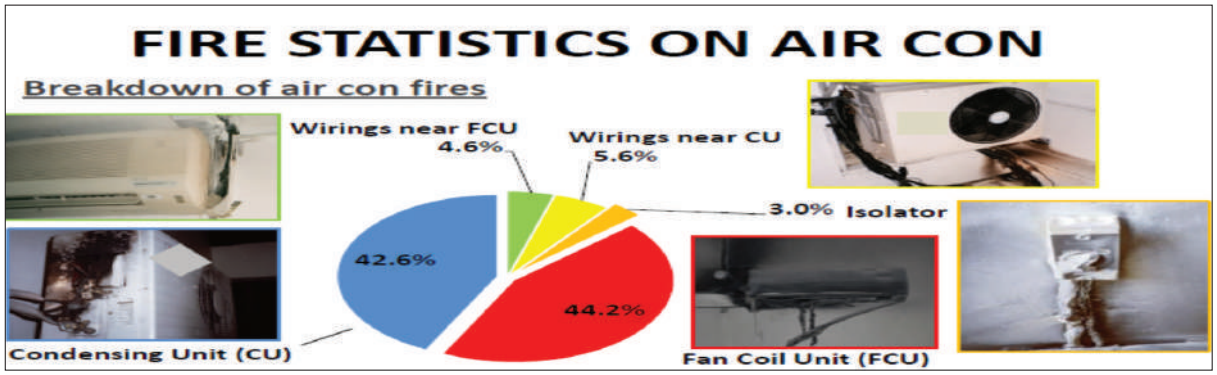


Fig. 5 Indoor unit containing the motor to drive the fan.

Fig. 15 Exposed heater coil is a potential source of fire: an unacceptable item in the intensive care unit.



FIRE INCIDENT ANALYSIS DONE IN HOSPITALS WORLDWIDE

The causes of fire mostly were electrical short circuit/overloading/overheating in AC or other electrical system. In the COVID-19 period, from March 2020 to April 2021, the number of hospital fire incidents in India were approximately 20 that claimed the lives of 96 (seven in Gujarat, eight in Maharashtra, two in Delhi, one each in Madhya Pradesh, Odisha, and Raipur). Globally, there was also a major hospital fire and explosion incident due to oxygen leakage that killed 82 patients in a COVID -19 hospital in Baghdad, Iraq.

Of a total of 29 case studies, 22 incidents occurred in Indian hospitals. Most of the incidents were related to electrical fire; 16 air-condition fire, two due to oxygen gas cylinder leakage and two by oxygen gas line leakage. Only one fire was a kitchen one caused by an LPG gas cylinder. The major reason of deaths in such fire incidents is not only due to burning of people by fire, but also due to inhalation of dense smoke and toxic carbon monoxide gas and other gases.

The few outcomes of the above study and my vast experience in fire incident investigation were:

1. It is hypothesised that oxygen (O2) enrichment of air, is primarily responsible for most of the fires, particularly in intensive care units, Indian hospitals need to make several changes in the arrangement of equipment and practice of handling O2 gas and electrical equipment, as well as create awareness among hospital staff, doctors, and administrators.
2. The use of huge volume of liquid oxygen gas to treat COVID -19 patients and highly flammable alcohol-based sanitisers, vapour trapping nearby by electrical equipment inside ICU rooms/OT and vapour trap inside HVAC ducts during re-circulation of air, and false celling further add to the risk.
3. Choosing wrong material of construction and rating of electrical wiring, and incompetent electrical engineers for execution of projects as well as engaging the same type of electrical engineers for due course repairs and maintenance for cost cutting measures is also responsible for fires.
4. The most common cause of fires was non-availability or failure to operate electrical safety devices like ELCB/MCCB/ROBO as per defined logic before short circuit, or overload or over heating due to improper selection of rating as per equipment (100 MA instead of 30MA). The temporary electrical connection might be one of the reasons of electrical fire.
5. The non-availability of electrical safety devices or no preventive inspection testing and maintenance of installed electrical safety device to ensure their trip mechanism to avoid any injury to humans and equipment damage and avoid fire incident or restrict the propagation of fire is another cause of fire.
6. Huge storage of flammable liquids and haphazardly storage of reactive chemical without confirming compatibility of chemical and gases leads to fire due to chemical chain reaction and spontaneous combustion. Storage of large quantity of edible oil for cooking purpose, high number of LPG gas cylinders inside or outside the kitchen and storage of other inflammable liquids diesel for DG

set and petroleum products must be avoided. We need to explore how we can reduce the quantity of these fuels as per weekly consumption to minimise fire load due to huge storage of fuels.

7. There are no early fire detection and alarm system in most of the hospitals, and if available, they are not in working condition. Early fire detection cum suppression system (water sprinklers/Aerosol based system/clean agent gas for critical ICU/ patience wards/IT server room/UPS/Battery/ Generator room) can be a game changer and loss of life and property can be avoided.
8. The material of construction of electrical equipment like air conditioners are being made with combustible plastic. This is one of the main causes of fire due to dripping of melted plastic liquid that fall on other combustible material leading to speedy flames propagation.
9. The lack of or improper smoke management system for immediate venting of deadly toxic CO gas is one of the chief reasons for fatalities and poor visibility due to dense smoke generation that lead to panic in building occupants. There is a critical concern that most of the hospital buildings did not pay attention to not putting in place passive fire protection system to restrict the spread of fire, minimised burning speed of combustibles materials, and no provision of compartmentation.
10. Climatic conditions are also contributing factors. For example, in the summer season, extensive use of electrical equipment and in winter, use of heating equipment often lead to fire incidents.
11. Last but not the least, arson is a reason too. Property owners often deliberately start a fire to claim insurance or escape from business.

Hospital fires are preventable, and level of escalation or mortality rate can be eliminated or reduced

A. Fire prevention, performance based robust building infrastructure: The hospital buildings shall have robust structure, in-built fire prevention, life safety, early fire detection and alert system, firefighting arrangements from planning, designing, construction as per occupancy defined in best practices worldwide for fire prevention and life safety and National Building Code-2016 and various state building bye laws.

1. Building management system must be integrated with early fire detection and alarm, occupants alert system, smoke management system, public announcement and fixed firefighting system, especially for critical and vulnerable areas like ICU/ patient wards/stores of flammable and combustible materials. There must be provision of sufficient numbers of emergency escape routes, as per occupancy load and associated fire risks, glow in dark signage for safe and speedy evacuation of building occupants. Floor-wise evacuation plan and building plan layout must be displayed at ground floor to guide emergency response team to understand location of critical patients, ICU room for speedy rescue, storage of hazardous area like storage of LPG gas/chemicals/flammable liquids/ radiation risk etc. with numbers of building occupants.
2. Mobile apps for Fire Safe Hospital must be directly connected to local fire brigade with one-touch button, as well as to hospital staff, admitted patients, their relatives, and nearby occupants for immediate alert of any untoward incident of hospital.
3. The control of fuels and ignition sources to prevent fire and restrict spread of fire and smoke by hazards elimination, substitution of risk, engineering control (activation of electrical equipment trips mechanism based on electrical faults), administrative control (permit to work system), early gas leak and smoke detection, and personnel protective equipment must be present. For example, LPG gas cylinder can be replaced by either PNG pipeline to minimise fire and explosion risk or can be eliminated by replacing with electric operated cooking devices. Identify the daily consumption of flammable liquids keep only stock for two or three days in the hospital. Keep the rest in a remote location with sufficient fire protection system.
4. There are three most important philosophies for fire prevention - control of fuels (combustible material, flammable liquids, flammable and explosive gas like LPG/PNG, other reactive chemicals and liquid oxygen gas, unsafe acts and conditions), control of ignition sources (open flames, electrical power, smoking, static current and lightening) and robust electrical wiring and trip mechanism and alternative escape routes for all patients.
5. Non-combustible or less combustible building construction material and interior decoration system must be used. Choose fire resistant plastic for air conditions and lifesaving equipment like ventilators to avoid dripping effects after overheating or fire to restrict the fire.
6. Innovations must be explored by introducing fire prevention system like hypoxic environment, which is mentioned in NBC-2016, especially in critical areas like ICU, patient wards, IT server/battery/ UPS rooms and other venerable areas.
7. Passive fire protection must be applied to minimised sense smoke generation in case of fire as well as compartmentation, smoke barriers, sealing of vertical electrical and utilities plumping shaft

with fire barriers, sealant and fire-retardant paint. The HVAC ducts and their support structure and opening must be two-hour fire resistant and opening one hour's fire rating.

8. Robust smoke management system like exhaust fans, HVAC ducts, smoke barriers and vent pipe at roof top for smoke venting in case of fire must be put in place.

B. Control of ignition sources:

1. Heated metallic parts due to friction act as ignition sources. Lubricating oil, grease, and insulation varnish, plastic and other polymers, dust particles, and metals such as aluminium, steel, and other, serve as fuel for fire.
2. To prevent fires, regular inspection and maintenance of these electrical equipment that are running 24x7 must be done. Alternative operation of equipment and thermography must be explored to identify hot spots.
3. Explore reorientation of patient beds by increasing four to five-metre distance between beds and electrical switches, and other equipment to avoid fly or fall of spark in the event of a short circuit or busting of capacitor of split AC due to overheating or dripping of plastics liquids from split AC on combustible materials. Decide on whether to go for central HVAC floor-wise system with auto trip mechanism in case of activated fire detectors.
4. Explore ways and means to minimise the level of electrical stress on electrical equipment to avoid overloading. Provide sufficient equipment that can be operated for 12 hours only or if there is constraint of resources, let them rest for two to three hours.

C. Control of fuels: (Electrical power, storage and use of combustible material and interiors decoration, liquid oxygen gas, flammable liquids and flammable and explosive gases like LPG/PNG).

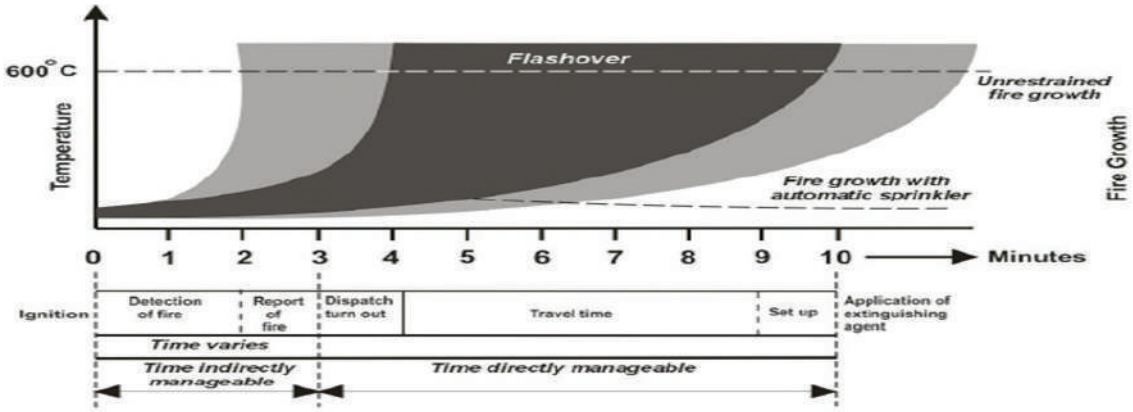
1. Layout of electrical wirings should be performed by professional electricians. The connections made by twisting wires and wrapping insulating tapes (use terminal block connectors instead), haphazard layout, disregard of the colour codes for electrical wires are problems caused by untrained staff and should be avoided to prevent fire.
2. To prevent electrical fire due to overheating, thermography must be done on a quarterly basis to identify hot spots inside electrical panels and cable joints and problems must be immediately rectified.
3. Regularly check heating, ventilation, and air-conditioning (HVAC) system and schedule preventive maintenance and auto trips interlock with fire detection and alarm system.
4. The outdoor unit of the split AC should not be located just above or very close to the O2 control room, as O2 may be released to cause fire in the outdoor unit.
5. The diesel generator (DG) set should not be located near the O2 control room, as unburnt fuel may form an explosive mixture with it.
6. No flammable and explosive gas line shall be allowed in underground or basement or below hospital buildings.
7. Synthetic curtains are used for patient beds and ICU. These need to be phased out with fire retardant fabrics. As immediate preventive action, such combustible curtains inside ICU/COVID-19 wards of hospital must be removed. Later, a phase-out plan can be drawn for fire retardant curtains.
8. A low-pressure alarm should be placed outside the oxygen control room and after each isolation valve to be used for isolating each hospital ward from the main oxygen supply in case of fire. At least one portable O2 monitor (0 - 80%) should be procured and used by each hospital/nursing home.
9. Oxygen enrichment of air inside a closed environment, which occurs due to leakage of O2 gas, is responsible for most hospital fires. Fire may be initiated in any equipment in the vicinity of oxygen-enriched air if there are ignition sources and easily ignitable material therein. To prevent such fires, reorientation or layout plan must be changed to avoid proximity of fuel and sources of ignition.
10. For power supply, dry transformer shall be installed with mineral oil and in case of oil-filled transformer, nitrogen injection gas suppression or water spray system shall be provided oil capacity of more than 2,000 litres or power generation capacity of 10MVA.
11. The air compressor room and vacuum room should not be located near the oxygen control room. Housing these rooms together in the same location as the oxygen control room is unacceptable.
12. Oxygen and N2O pipelines should not pass unnecessarily through a pathology laboratory. The number of joints in the O2 and N2O pipelines should be kept to a minimum and should be checked periodically for leakage.

13. Before installation, the oxygen pipeline should be thoroughly cleaned, acid-washed, and alkali-washed, rinsed with hot water, and dried so that it is free of dust and oil (and grease), which are primarily responsible for initiating fire in the oxygen control room and pipelines. The oxygen pipeline generates and accumulates dust from the system. Oxygen pipelines and regulator should be cleaned, and the non-metal parts replaced by competent professionals at least once every two years.
14. Substitution of material of construction for electrical equipment can be a game changer for prevention of fire as well escalation too. Some materials are more suitable than others in the oxygen- enriched environment. Polytetrafluoroethylene (PTFE; "Teflon"), copper, copper alloys (brass, bronze), nickel, nickel alloys, and thick stainless steel are safer materials. Most plastics, lubricating oil, soft solders, aluminium, carbon steel, and thin stainless steel are prone to fire in the oxygen-enriched environment. All aluminium components in the oxygen line should be replaced by brass, bronze, or copper. PTFE is the best material for a seal, but PTFE tape must not be soaked in lubricating oil. If burnt, PTFE produces toxic fumes.
15. Housekeeping and preventive inspection and maintenance are key for fire prevention. All kinds of rust, dust particles, and powders are potential sources of fire. Periodic maintenance of electrical units should include cleaning of potential heating spots (or points that are likely to spark) from dusts. This cleaning should be done specifically to prevent fire as fine dust is generally considered to be the biggest culprit in initiating fires (due to the availability of large surface area per unit mass and low bulk thermal conductivity).

D. Early detection of fire and alarm system & Fire protection system:

It is said the initial five minutes of any fire incident dictates the next five hours. There are two parts of any fire emergency management - one is time indirectly manageable and other one is time directly manageable. We need to decide whether ICU/COVID –19 or patient wards need to be protected with automatic water-based fire suppression system, which might control the fire in an early stage but on the other hand, the life of an ICU patient who is on life safety support system and is threatened by any malfunction and discharge of water sprinklers. The challenge will be after the exposure to water. In the event of these life-saving critical facilities as well as critical equipment like ventilators and other equipment malfunctioning, a backup plan must be in place to ensure critical patient life safety.

1. Aerosol-based fire detection cum suppression system in ICUs and patient wards, MRI machine, and other sophisticated machinery must be installed. Early detection of fire as well as suppression must be done where installation of water sprinklers system in old, fixed firefighting systems is difficult. Technically, it will not only save critical lifesaving equipment in case of malfunction of water sprinklers, but will reduce the life threat to critical patients, who are surviving on this critical equipment that will stop working after water spray sprinklers are activated.
2. Any commercial kitchen and cooking facilities in a medical facility must be protected with a hood and fire suppression system, which requires semi-annual inspections, testing, and maintenance. Additionally, the filters and exhaust ductwork that make up the hood system require regular cleaning—the frequency of which is based on the amount of grease that is used in the cooking process.
3. Vehicle parking inside hospital area and smokers are also high potential fire risk. There must be enough portable fire extinguishers for small parking, and for underground parking, fire detection and alarm system with water sprinklers as per



NBC 2016 guidelines must be installed. It is always better to avoid underground parking.

E. Fire safety audits, capacity building of health-care staff & evacuation drill and mock drill:

1. Strict compliance of fire safety by law enforcement agency by setting examples for defaulters.
2. To ensure life safety of hospital staff, patients and visitors, there shall be a system to issue Life Passport with information about risk of hospital, emergency contact numbers, dos and don'ts of hospital, floor-wise evacuation plan as well as display on LED screen at strategic location in three languages - English, Hindi, and local language.
3. One initiative that will be a boon for fire prevention is an online platform open to all visitors and healthcare staff to upload unsafe acts and conditions of hospital that might lead to any fire incidents.
4. Roles and responsibilities of every hospital staff and monthly muster must be prepared and posted on each floor with defined floor-wise wardens (Fire, first aider, and rescue), incident commander and deputy incident commander, frequent wet drill with all credible emergency of hospital including ICU/Patient wards.
5. Internal fire safety audit and third-party fire safety audit for systems, gas identification and bridging the system gaps must be done. Tracking of previous audit recommendations compliances also must be ensured.

The presence of mind and fire prevention and emergency response awareness to occupants in case of fire and smoke logged room or building can save lives. We are committed to the fight against COVID-19; but we need to be equally committed to prevent fires as well.

HOSPITAL FIRES: A BURNING ISSUE

HOSPITALS IN INDIA (AT LEAST IN THE METROS) ARE STRINGENTLY CHECKED AND FIRE RISK ASSESSMENT AUDITS DONE REGULARLY. YET, AS MANY AS 93 PEOPLE, MOST OF THEM COVID-19 PATIENTS, DIED IN 24 INCIDENTS OF FIRE IN HOSPITALS IN INDIA DURING THE PANDEMIC.

by
Fire Safe India Team

11 of the 24 fires were major fires while the rest were minor ones. More than half of these fires occurred in March and April, when rising COVID-19 cases snowballed into a second wave. Of 59 deaths from hospital fires around the time, 33 deaths were reported from Maharashtra in six fire incidents and Gujarat (21) in three fire incidents.

Fire experts blamed an "over-stressed" hospital system unable to bear the rising patient load for the frequent fire incidents.

THE AIR CONDITIONING ISSUE

"Hospitals increased beds, equipment and staff to admit more COVID patients, but it is not possible to immediately expand the electrical wiring system. Medical equipment or wires carrying current beyond their capacity can overheat. That is what is happening in many hospitals. We don't need just a fire audit, we also need an electrical audit," said Rajendra Uchake, Chief Fire Officer in Nagpur.

In 13 of the 24 cases, the fire began in an ICU. "These hospital ICUs did not function up to 100% capacity before the pandemic. The ventilator, equipment, air conditioners were working 24 x 7 later. It puts a lot of pressure on the entire system," said Santosh Warick, Director, Maharashtra Fire Services. He added that air conditioners ideally must run for 15-16 hours and then need a cooling period. A back-up AC is necessary, which is absent in small hospitals, he said.

In a fire in Vijay Vallabh Hospital in Virar outside Mumbai, which killed 15, and in Ayush Hospital, Surat, which killed three, the air conditioning was the

> IF TEMPERATURE RISE TO 78°C, SPRINKLER AUTOMATICALLY STARTS DISPENSING 35 LITRES PER MINUTE. THEY CAN BECOME FIRST FORM OF RESPONSE,"
>
> **Pratap Karguppikar**
> Former Mumbai CFO

culprit. In both cases, the AC had functioned for 24 hours. Uchake said instead of a cassette or window AC, air handling units (AHU) must be installed in ICUs to circulate air as they are better workhorses.

Air handling units take air from the atmosphere, "recondition" it — cooling or heating as required — and circulate it within a building or a section of the building through ducts.

THE PROBLEM INTENSIFIES

In Safdarjung Hospital, Delhi, a fire mishap in March was due to an overheated ventilator machine.

In Gujarat, fire officials have noted that ICUs lack cross-ventilation. This is the case with all ICUs as they are sealed for the purpose of keeping them sterile. In addition, due to COVID, there has been an increase of inflammable material in hospitals – sanitiser spills and vapour, higher oxygen content in the air, and PPE kits, which are made of synthetic material.

According to a fire official, highly inflammable material spread fire quickly leaving very little time for a response.

K K Bishnoi, director, Gujarat Fire Services, said the response time of fire brigade in Welfare Hospital (Bharuch) was seven minutes. "But a high oxygen percentage and sanitiser fumes in the ICU led to a rapid propagation flash fire. To further reduce response time, we plan training of staff in hospitals, deputation of more fire officials in major COVID hospitals. Regular auditing/inspection with adequate and necessary corrective measures from time to time would help in making the hospitals fire resilient".

As per the national and international Standards, ICUs need to be protected with proper sprinkler or water mist systems, which are also endorsed by all the senior fire professionals.

In the case of the fire in Rajkot's Uday Shivanand Hospital and in Bharuch's Welfare Hospital, the preliminary observation by fire department was that the fire began in an ICU which did not have any ventilation.

Former Mumbai CFO Pratap Karguppikar said hospitals must install sprinklers.

"If temperature rise to 78°C, sprinkler automatically starts dispensing 35 litres per minute. They can become first form of response," he said.

THE MAKESHIFT HOSPITAL CHALLENGE

Makeshift hospitals, jumbo centres for COVID patients present their own set of challenges. These are made of highly inflammable materials, and sprinklers or fire alarms are difficult to install. Only fire extinguishers can be provided.

Suresh Kakani, Additional Municipal Commissioner, said that to prevent a massive mishap, they had placed a fire engine next to the Mulund, Dahisar and BKC jumbo centres to reduce the response time to seconds.

List of fire Incidents reported

MAY 1: Fire in laboratory of Mazumdar Shaw Hospital, Bengaluru: no death

APRIL 28: Prime Criticare Hospital, Thane: 4 deaths (not Covid patients)

APRIL 25: Ayush Hospital, Surat: 3 deaths

APRIL 23: Vijay Vallabh Hospital, Virar: 15 deaths

APRIL 18: Rajdhani Super-Specialty Hospital, Raipur: 5 deaths

APRIL 10: Fire in Well Treat hospital, Nagpur: 4 deaths (non-Covid)

APRIL 6: Fire in Nashik's Chandwad Covid care centre in a private building: no deaths

APRIL 4: Fire in Dahisar jumbo centre: no deaths

APRIL 4: Patidar Hospital, Ujjain: no deaths

MARCH 31: Safdarjung Hospital, Delhi: no deaths

MARCH 28: LPS Institute of Cardiology, Kanpur: no deaths

MARCH 17: Shree Vijay Vallabh Sarvajanik Hospital, Vadodara: no deaths

JANUARY 9: Civil General Hospital, Bhandara: 10 deaths

JANUARY 6: Government General Hospital, Guntur: no deaths

DECEMBER 9, 2020: Little Flower Hospital, Ahmedabad: no deaths

SEPTEMBER 28: Chhatrapati Pramila Raje Hospital, Kolhapur: no deaths

NOVEMBER 27, 2020: Uday Shivanand Hospital, Rajkot: 6 deaths

SEPTEMBER 21, 2020: Sadguru Hospital, Cuttack, : no deaths

SEPTEMBER 8,2020: SSG Municipal Hospital, Vadodara: no deaths

AUGUST 25, 2020: Guru Gobind Singh Hospital, Jamnagar: no deaths

AUGUST 9, 2020: Swarna Palace hotel converted into isolation facility, Vijaywada: 10 deaths

MULTIPLEXES COMPLIANCES

CHALLENGES FOR FIRE SAFETY

ON AUGUST 6, 2018, A FIRE BROKE OUT IN THE PRIYA CINEMA HALL, IN SOUTH KOLKATA, DURING THE LATE-NIGHT SHOW. NO INJURIES WERE REPORTED BUT THE SMOKE CREATED PANIC. THE FIRE DEPARTMENT HELPED RESCUE THE OWNER'S FAMILY OF FOUR MEMBERS FROM THEIR RESIDENCE. DARK SMOKE COMPELLED FIRE FIGHTERS TO DON BREATHING SETS AND TO BREAK GLASS PANES FOR VENTILATION.

SUBHASH RANE
Retired Fire Officer, Mumbai Fire Brigade/ MIDC

It brought back memories of June 13, 1997 - the Uphaar Cinema tragedy in New Delhi, one of the worst ever, when the transformer fire and thick smoke created panic.103 people were injured, and 58 lost their lives in the resultant stampede as people tried to escape.

Many points were highlighted in the inquiry that followed: in addition to violation of safety codes viz; non-operational PA system, no emergency foot and exit lights, blocked gangways and exits, unauthorized use of premises, no periodic maintenance of the transformer, no fire extinguishers, haphazard electrical cables, and no isolation device.

THE RISE OF MALLS

Uphaar Cinema was a stand-alone property. The situation now has changed. Today, most of the cinema houses have been converted into multiplexes. The new ones are coming up in malls. This poses a big challenge for regulatory authorities for fire safety, and speedy evacuation.

In 2001, there were just three Malls all over India, which increased to 570 in 2013. It is expected that this has doubled in the last five years. The mall concept has been changing from need-driven to leisure time entertainment.

The multiplex industry has around 2,200 screens which was expected to cross over 3,000 screens by 2019. The largest multiplex 16-screen megaplex Mayajaal is in Chennai, and the first Maris theater, inaugurated in 1980 with five screens was also in Trichy, Tamil-Nadu.

Indian cinema chains INOX, PVR, Carnival Cinemas, SPI Cinemas, Cinepolis, Que sera sera miniplex, and Big Cinemas are expanding as India looks good to become the world's largest film viewing industry.

Every month some big banner movie is exhibited with a houseful board. At a time thousands of viewers are present in the multiplex and this number is peaks during weekends. Just ponder for a while !!! have you ever thought about your safety when you go for movie? People visit mall to watch movie, to do window shopping, enjoy food but are totally unaware about their safety. Most of the time panic situation results into stampede and people get injured or lose their lives during such incidents

MANY A TIME ONLY SAFETY OF AUDITORIUMS AND ACTIVE FIRE SYSTEM IS FOCUSED ON BY AUTHORITIES & FIRE PRONE AREAS SUCH AS PROJECTOR ROOMS, STORES, ADMIN OFFICES, ETC. AND PASSIVE SYSTEM REMAINS UNATTENDED.

It is imperative that every patron makes himself aware of the exit ways, corridors, staircases etc. Once one enters the premises one must know that one has to avoid elevators and escalators in case of emergency evacuation.

Cinema Theater Industry now become multiplex industry so some changes are needed in various rules, regulations & in old standards. Such as.....

- As per NBC part IV and IS 4878 Rows of seats opening to an aisle at one end shall have not more than 7 seats, but Cinema regulations Maharashtra says no seat shall be more than 10 seats away from gangway.
- As per Cinema rules and regulations and IS 4878 staircase, corridor width should be 1.5 mts but multiplex comes under Assembly type occupancy where it should be 2 mts as per NBC.
- As per Cinema Rules and Regulations extinguishers has to refill every year, but IS 2190 says pressurized extinguishers has to be refill in two years and Co2 and DCP cartridge type extinguishers has to refill after 5 years and Now as per IS 15683 new good extinguishers are available in market.
- As per cinema rules and regulations Projector room shall not have direct access with auditorium but now as with advance technology cinemas exhibit through server and projectors are of suspended type inside auditorium. Use of Film concept has vanished, so there is need to separate projector room.
- Still few states cinema rules and regulations state that there should be minimum three sides entry/exits to cinema theater which is not possible in multiplex concept where auditoriums are attached to each other .
- AHUs, smoke Extract system & integration with detection system are very important issues for multiplex industry, which concept needs to be updated.
- Still Cinema rules and regulations and IS 4878 are not updated where sand buckets, extinguishers, stirrup pumps and cisterns etc. suggested as fire safety. Provision of Hydrant & Hose reel in auditorium is the present requirement.
- As per NBC sprinklers have to be provided in auditoriums. Multiplexes installed side wall or ceiling type sprinklers. Considering Fire Load & huge Auditorium space and height of ceiling, it just seems to be compliance of rules -regulations but Its debatable issue for its effectiveness,
- As per NBC all exits has to be so arranged, that they may be reached without passing through another occupied unit, but in most of the mall exits are passing through food court or some occupied areas.
- At many places Occupancy of multiplex and staircase requirement will not comply as per NBC and exit formula, as multiplex is constructed afterward so need a guideline to Multiplex and mall industry while seeking approval.
- Sloping space below back side auditorium is misuse by multiplexes for which specific guidelines are needed in cinema rules & regulations. Cinema rule and regulations has specific provision for Admin area, Eng. Area, store room, AHU room, Lobby area ventilation etc to minimize fire risk of Multiplex industry.
- There is no provision in any Rules & Regulations for deputing trained staff for operation/ maintenance of fire fighting system and due to that fire fighting is minimal till arrival of fire department personnel.

Floor plans are prominently displayed on screens & in Lobby area. Emergency exits are tagged with conspicuous signages to assist speedy evacuation. In addition Manual call points are located so every one can be alerted in case of an emergency

The Mall and Multiplex have their Standard Operating Procedures and Emergency Response Teams . Staff is also trained by periodic Fire safety training & mock drills.

Multiplex management always give first priority for speedy Evacuation and maintains Passive fire protection systems, such as adequate size exits, corridors, Lobby area, Aisles, Staircases with proper signages. etc. Also Active fire fighting system is maintained such as portable fire extinguishers, hose reel, hydrants, sprinklers etc.

In addition to that to ensure adequate ventilation, Smoke detection systems have been integrated with smoke extraction and AHUs . Despite all this Fire safety gets affected sometimes due to Constructional constraints of the structure, negligence of staff, poor maintenance of fire safety equipment by Mall authorities, Differences in rules & codes, Different guidelines by regulatory authorities, wrong interpretation of codes & rules, as well as lethargy of authorities in revising Rules & Regulations.

While constructing any mall or multiplex due diligence should be taken to abide-by with the things which are mandated by law, but in reality most of the time fire safety systems are found to be in bad shape due to poor maintenance. Only provision of fire safety will not serve the purpose; the Staff has to has to understand the concept of passive fire protection and has to learn operation of the fire equipment.

Multiplex Managements & Government Licensing Authorities need to refer Table-7 of NBC 2016 - part IV for active fire fighting system, IS 2190 for Extinguishers, IS 2189 Fire Detection and Alarm system, IS 3844 for Hydrants and hose reels, IS 15105 for Sprinkler system, & Cinema rules and IS 4878 for cinema rules and regulations along with each state Cinema rules and regulations for Fire safety.

Government Authorities suggest sometime remedial actions during annual inspection for deficiencies but due to poor response from mall / multiplexes safety gets hampered.

Many a time only safety of auditoriums and active fire system is focused on by authorities & fire prone areas such as projector rooms, stores, admin offices, etc. and passive system remains unattended.

Now Regulatory Authorities need to check feasibility of separate fire protection systems such as water mist system for fire safety arrangement for multiplexes considering heavy fire load and huge occupancy to make themselves self compliant for their Fire safety.

Most of the time violation of fire safety norms is one of the major cause of fire accidents. To avoid violations, corrupt practices, wrong interpretations there is a need to review Cinema rules and regulations by referring various codes, acts, rules and regulations along with NBC guideline . It is imperative to issue completely fresh guideline for Multiplex industry considering Life safety as first priority of this Industry.

Cooking Safety

Cooking brings family and friends together, provides an outlet for creativity and can be relaxing. But did you know that cooking fires are the number one cause of home fires and home injuries? By following a few safety tips you can prevent these fires.

"COOK WITH CAUTION"

- Be on alert! If you are sleepy or have consumed alcohol don't use the stove or stovetop.
- Stay in the kitchen while you are frying, boiling, grilling, or broiling food. If you leave the kitchen for even a short period of time, turn off the stove.
- If you are simmering, baking, or roasting food, check it regularly, remain in the home while food is cooking, and use a timer to remind you that you are cooking.
- Keep anything that can catch fire — oven mitts, wooden utensils, food packaging, towels or curtains — away from your stovetop.

If you have a small (grease) cooking fire and decide to fight the fire...

- On the stovetop, smother the flames by sliding a lid over the pan and turning off the burner. Leave the pan covered until it is completely cooled.
- For an oven fire, turn off the heat and keep the door closed.

If you have any doubt about fighting a small fire...

- Just get out! When you leave, close the door behind you to help contain the fire.
- Call 9-1-1 or the local emergency number from outside the home.

Cooking and Kids

Have a "kid-free zone" of at least 3 feet (1 metre) around the stove and areas where hot food or drink is prepared or carried.

FACTS

- The leading cause of fires in the kitchen is unattended cooking.
- Most cooking fires in the home involve the kitchen stove.

NATIONAL FIRE PROTECTION ASSOCIATION
The leading information and knowledge resource on fire, electrical and related hazards

Your Logo

nfpa.org/education

FIRE SAFE INDIA FOUNDATION

VISION

Fire Safe Living

Fire Safe India Foundation, a not for profit advocacy group built on a foundation of passion, strengthened by Knowledge, committed to creating awareness about Fire Prevention and Fire Protection Pan India; continuously strive and advocate a Fire safe environment and Life Safety.

MISSION

- To safeguard the quality of life for the Citizens through Fire prevention and protection
- To sensitize authorities and public at large about the risks of Fire by harnessing Mass Media
- To advocate compliance of Fire safety & Building codes and measures for fire safe occupancy of public and private premises through Social and judicial activism
- To create mass awareness through education, holding Seminars, Exhibitions, Fire Drills, etc.
- To award/reward acts of Courage and rescue by Firefighters and general public during Fire incidents

3rd Floor, Room 13, Tardeo Air Conditioned Market Building,
Tardeo, Mumbai, 400034
Tel: 022 23534304 | Email: executiveofficer@firesafeindia.org
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