SAFETY IN HEALTH CARE FACILITIES

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Abstract:

This paper is meant to outline the important components of safety in buildings, particularly in health care facilities and their effect on occupants of the building and the properties. Fire safety, is the most important of all factors in the planning and design of health care facilities as many of the occupants (patients) may not be able to evacuate or relocate themselves because of their conditions. If evacuation is possible this requires assistance and safe location. Some recommendations for the design and construction of health care facilities form part of the fire safety codes and standards.

INTRODUCTION

Safety is one of the most important elements in the planning, design and construction of any building. Buildings not satisfying basic requirements and fire safety codes will not be licensed to be built nor operated as they would constitute a hazard and risk to the occupants and the public. Fire safety requirements in healthcare facilities should be strictly applied without any relaxation. As such facilities are required to operate 24 hours a day and seven days a week. Elements affecting safety to be considered during the design and planning stages are site location, structural elements, electrical power, communication, signal systems and security. These elements in-turn are constituted by finishing materials, fire alarm and fighting systems, electrical distribution system and gases installation, sufficiency of water supply, drainage system, nuclear medicine and radiation and medical waste. (1,2)

1.0 SITE LOCATION:

The site for the health care facility has to be easily and safely accessed from the road and catchment areas. This access allows patients and visitors to reach the building on foot, by car or public transport. The site's area has to be big enough to allow for further expansion and car parking for staff and visitors. It should also have easy connection to water supply, drainage, electricity and communication. The site should not be exposed to flooding, landslides or any hazard resulting from qualities of soil and pollution sources or undue noise, smoke, or disposable plants. It should comply with all local authority's ordinance.

The site should have an alternative access routes leading to the health care facilities, and a dedicated route for ambulance and emergency department. Deliveries and staff should be through separate entrances. Directional signage should be at visible locations and readable even in darkness.

2.0 STRUCTURE OF THE BUILDINGS:

Most of health care facilities in the Sudan are either built with reinforced concrete or load bearing brick wall, with light roof structures and in most cases as single floor buildings. Recently many new hospitals buildings were built as multi stories, but in such case more precautions and firefighting facilities have to be provided.

The structural design should meet international codes, standards and equipment for safe building. (3)

The building should be safely designed to carry its own weight and all superimposed dead loads. Wind tunnel studies and seismic loading should be considered at the design stage.

The diagnostic imaging equipment requires special design consideration because of the weight and the necessary radiation protection. This weight should be transmitted through strong safe foundation to the supporting ground without exceeding the soil's allowable load bearing capacity.

The structural design should be sufficiently detailed to show the interaction of the non-structural elements with the main structure and resilient to various natural phenomena and behaviour in response to different hazards and dangers.

Normally health care buildings are designed to last many years. Increasing the life time of the building requires the use of durable, strong materials and proper supervision, execution and maintenance programs.

The structure has to be fire rated for high increase in temperature either due to direct flames or surrounding temperatures caused by neighbouring fires. This high temperature may cause the collapse of the building due to the reduction of the compressive strength of the concrete and yield stress of steel. It is important to stipulate the fire rating requirements of the building elements which are based on type of occupancy, structural system, finishing materials, building height and surface area as required by the code.

The fire escape stairs must be fire-resistant structure and designed as an independent fire section, separated from the different floors by 60 minutes' fire resistant structure and have a direct exit to the open air.

3.0 FIRE SAFETY

The main objective of fire safety is not only to put the occupant of the building or the public against the risk in the eventuality of a fire hazard, but also protect the building and contents and prevents the spread of fire to neighbouring buildings.

The fire risk is not only a result of flames and high temperatures but also from the toxic smoke and gases produced by combustion processes. Smoke dampers are required to stop the spread the smoke and the gases through the air conditioning ducts. During a fire, the oxygen in the space is consumed by the combustion process and the level of available oxygen will decrease significantly if there is a restriction in the air flow, at the same time the proportion of carbon dioxide and monoxide in the air will increase leading to an unsafe environment for the occupants.

All the safety codes emphasize the importance of the fire protection and ultimate evacuation of patients from the immediate fire areas to safe areas, especially those who cannot relocate themselves during emergency, including those in the surgical suites, ICU, CCU and haemodialysis units.

The fire codes with three aspects of safety problems;

3.1 Fire Prevention:

To reduce the risk for fire starting, enough precautions have to be made to prevent ignition resulting from equipment and devices using or producing energy and from storage of flammable chemicals. This could be achieved by using the right device or equipment with proper wiring and increasing awareness of the building occupants and the users

3.2 Fire Protection:

The building structure is the first line of defence against spread of fire. The structure has to provide resistance to high temperature due to fires and direct flames, which may cause burning down of the building or collapse due to the reduction of the compressive strength of concrete and yield stress of steel. Fire codes determine requirement of buildings based on type of occupancy, structure, height and materials.

Fire detection provides early warning especially in closed areas or in areas where occupants require maximum escape time. The detection system is linked to the alarm system and to the control system which operates pre-planned emergency procedures such as automatically closing some doors in the event of a fire preventing spread of fire or smoke to other areas and operating sprinkler systems and notification of civil defence department (fire department). The alarm system should automatically control air conditioning and ventilation systems, bringing elevators to the ground level and all other systems necessary to make the building safer for the occupants.

Flammable gases can be ignited by static electric charge. The method to minimize the build up of static charge is to develop and use it. This includes high impedance conductive floors, conductive footwear, clothing etc. The use of isolated power in operating suites reduces electrical shocks and eliminates explosion risk resulting from flammable gases (compressed oxygen) and inhaled anaesthetic agents.

3.3 Fire suppression:

Fire suppression or fire extinguishing systems include:

3.3.1 Fire alarm detection and extinguishing system should be interconnected automatically with suppression system.

3.3.2 Heat and Smoke detection system should be installed in corridors and patient's rooms.

3.3.3 The provision of fire storage water tank connected to the main city water supply for automatic and manual filling, connection for filling the fire engine at the street level and the dry hydrant. The fire water has to be of a quality that will not have any adverse effect on the piping system and to its components.

3.3.4 A complete electric fire pump connected to the main and emergency power supply The fire pump has to be arranged in parallel with the electric pump as the primary fire pump.

3.3.5 A complete automatic wet stand pipe system equipped with fire department hose valve.

3.3.6 A complete automatic wet pipe sprinkler protection throughout the entire building for automatic control of fire with the exception of the electric and computer rooms where gas or powder is used.

3.3.7 A rapid activation of special designed system is required to control the spread of fire into other corridor.

4.0 ELECTRICAL SAFETY

Electrical safety is one of the most important aspects of the design of electrical systems in health care facilities because of the high occupancy density and the critical conditions of some patients. The constantly running of the large number of equipment, not only monitoring patients, but keeping a lot of people alive, in many health care facilities the staff operating the system tends to have limited technical experience an d hence insufficient electrical training.

With the increasing size and complexity of healthcare facilities they become more dependants on safe, adequate and reliable electrical systems. New types of medical equipment are coming into the market everyday utilising microprocessors or computers. Many of these products are sensitive and require reliable power sources. Invasive medical procedures such as cardiac catheterization have become routine in hospital, and such procedures make electrical safety very important. Other areas which are potentially hazardous are: psychiatric patients' rooms, general medical critical care units, recovery areas, laboratories, operating rooms and wet areas.

Electrical safety in operating and maintenance may be achieved through appropriate design of distribution systems, appropriate grounding system and selection of equipment with regard to enclosures, key-interlocking, circuit breakers and fuse interrupting capacity and fault detectors. The electrical system should be clear of the structure and all components must be identified. Many problems arise as a result of careless and improper installations and making the necessary efforts to follow the codes. (7)

The emergency power supply is extremely essential in case of normal power. The emergency power should automatically connect within seconds and switching devices supplying the required load. Sometimes more than one back -up system is available is available in case of power failure in form backup generators and batteries. These generators usually go on for several 'levels' to make sure that in a worst case scenario, patients will be protected at all costs.

Emergency lights with back up should be available for use between the period of the interruption of the power supply and the start up of the emergency generator. this is essential to light up certain areas like the stairs, the hallways, the operating rooms, ICU.

The emergency power is also essential for life saving machines, for surgical suites, obstetrical delivery suites, the ICU, CCU and laboratory. It is also essential in the patients' floors receptacles, life safety lighting, egress signs, alarm systems and communication systems. It is also required for selected elevator service.

The emergency power supply has to be checked regularly to ensure that the supply of electric load is automatically connected within seconds to the emergency system loads and to the switching devices supplying the equipment system load.

Various codes and standards provide rules and regulations as minimum safeguards of life and property. The system's designer needs to study and implement what is relevant in the codes according to his best judgment.

5.0 COMMUNICATION AND SIGNAL SYSTEM;

Communication and signal system in health care facility represents the backbone of all services. It makes the operation of the facility efficient, timely and safe.

The health care communication and signal systems consist of three basic elements which should be planned for in advance:

5.1. The equipments which include the telephone, speakers, nurse- call buttons, and doctor register stations, radio pagers, two way radios etc.
It should also include movements of supplies, traffic flows, the number of inpatients and out-patients handled each day, number of emergencies, surgical procedures, coronary care provided etc.

5.2. Communication systems which require a large quantity of on-site central communication equipment must be properly related within the facility.

5.3. Net-work of communication parts which is required to connect the devices and the communication equipment.

The system should meet the requirements and it should be capable of expanding and updating to meet the future development in the technology of communication and signals. The development in technology provides opportunities for more information and a wide range of available functions.

The codes require connection of electric power in health care facilities to all communication and signalling systems, covering all life safety items within the health care building, which include telephones, fire alarm systems, medical gases, compressed gas, operation of major equipment and communication systems used for instructing occupants during emergencies. It also covers the nurse call and nurse assist systems, code blue.

Clocks in health care facilities are necessary to provide accurate reliable time for medical procedures and efficient, safe operation of the facility. They are also useful for legal records. Clock should be well distributed in waiting areas, lobbies surgical suites, offices, lounges etc

6.0 SECURTY SYSTEM:

Security is an important component of safety. It provides safety protection for staff, patients and the public from any criminal act. The electrical and electronic devices are needed for monitoring, security detection are there to supplement the physical staff monitoring for any intrusion into the premises especially within the restricted areas such as the laboratory, the pharmacy, the medical records, the storage, the neonatal, ward, the operation suites…. etc. It also reduces the risk of theft and loss of instruments and equipment.

Security devices can be grouped as follow:

6.1 Security sensors: They can be simple as in door switches or installed in the building to provide network location of people and equipment and the presence of staff entering or leaving patients' rooms. They are integrated with the life saving and nurse call systems in many different forms i.e.: laser beam, photoelectric beam, pressure mats, audio, infra red body heat, different type of switches and many others.

6.2 Close circuit television (CCTV): It is another way to monitor and record the movement of staff, patients and visitors in and outside the building. It's also used as patients' educational media and for entertainment.

6.3 Hospital safety manual programme policy can be developed by the hospital and also the procedures to be followed which addresses ways to meet safety standards.

6.4 Intrusion detectors: It is another system to detect intruders in restricted and high risk areas, and in areas containing high value medical equipment.

7.0 DESIGN CONSIDERATION;

7.1 Buildings are normally designed for safety against fire, for the occupants and property and facilitating the rescue of the occupants, while protecting the surrounding areas form the spread of fire.

7.2 The structure should be appropriate for the building function and location and environment and natural hazard.

7.3 In the design of the health care facilities special consideration should be taken because most patients cannot evacuate or relocate themselves.

7.4 The designer must be well acquainted with the requirements of fire codes and any standards at the conception design stage of health care facilities. The appropriate location of external and internal fire walls and doors which should be well studied and specified.

7.5 The designer must consider the minimum distance between surrounding buildings.

7.6 The designer should study the appropriate location of the external and internal fire walls and doors and avoid using combustible materials which could produce toxic smoke and gases.

7.7 The plans should be properly divided into compartments and sections to control fire and smoke from spreading into the building and provide a safe area for relocating the occupants.

7.8 The design should minimize the use of combustible materials in the internal finishing and cladding. Doors and partitions should be fire rated according to their positions.

7.9 The design should assure the safest possible electrical installation. This include proper terminal panels, overload protection, proper grounding provision, proper conductor sizes and equipment locations.

7.10 Health care facilities require minimum widths of corridors, alternative route exits and proper location of vents and windows for smoke control and exhaustion. The design should provide emergency lighting, panic lighting, emergency escape route and exits, fire-safe stairways and fire fighting equipment.

7.11 Safety issues include the preserve of signage, including the location of escape routes, exits and firefighting equipment. This is to prevent confusion and panic during emergency.

7.12 Communication us vital to success of all efforts to coordinate and inform and direct patients, staff and visitors.

8.0 RECOMMENDATIONS

8.1. Safety in building starts with the selection of the site with regard to the topography and traffic and the quality of the structural design of the building.

8.2. Fire is the most threatening to life and property. In healthcare facilities high percentages of patients are not ambulant, in weak conditions, may have some cardiopulmonary deficiency or are undergoing surgery of some other invasive procedures. In these buildings it is particularly important to apply fire codes in the design and provide all factors to minimize any damages or loss of lives,

8.3 The hospital safety directors hand book is another document which identifies the role of the director and the procedures for assessing risks and providing strategies to mitigate these risks.

8.4. It is most important to educate and train all hospital staff expected to take part in emergency response in fire prevention and fire fighting and proper evacuation and saving lives during emergencies.

8.5. Occupants' awareness is another factor in reducing the risk of starting and spreading fires and how to reduce damage and save lives.

8.6 Drills have to be performed regularly to check the firefighting systems and the response of the staff in dealing with and managing any risks.

8.6 Communication is vital to the success of all coordination efforts in case of emergency.

8.7 Drills have to be conducted regularly to check the fire fighting systems and the response of the health care facility staff in dealing with and managing any risks.

8.8 Fire alarm system and smoke detectors are important immediate response to fire.

8.9 The paper does not go into all details and listing of all procedures and devices for life and property safety. A hospital safety manual is expected to cover all the requirements of fire codes.

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