ASSESSMENT OF FIRE SAFETY MANAGEMENT PRACTICES IN SELECTED HIGH RISE BUILDINGS IN ABUJA

ABSTRACT

Fire causes huge losses every year, typically measured by property loss, human deaths and injuries. The heights of buildings increases the risk of fire disaster for several reasons among which includes: the process of evacuations becomes very difficult and time consuming; the difficulty of fire fighters to access the upper floors in a high-rise building and the conveyance of firefighting devices especially heavy equipment to upper floors. The study is aimed at assessing fire safety management practices in high rise buildings. The population of the study was drawn from six high-rise buildings in Abuja. Purposive sampling technique was used for the selection of high-rise buildings, while simple random technique was employed for the selection of respondents for questionnaire administration and interview which included occupants and users of the buildings. The study revealed the following: Fire Alarm, Portable Fire Extinguishers, Sprinkler System and Smoke Detectors ranked first, second and third respectively with regards the availability of fire safety equipment in the high-rise buildings under study. Whereas, Fire Exits, Smoke Detectors and Portable Fire Extinguishers ranked first, second and third respectively in terms of functionality of the fire safety equipment in the high-rise buildings; majority of the respondents revealed that they have never attended fire safety trainings which could imply that majority of the respondents could not handle fire safety equipment and also incapable of discerning the required action to take in the event of fire incidents; with regards to the different factors affecting the integration of fire safety equipment in high-rise buildings, size of building ranked first, type of building ranked second and type of occupant/complexity of building ranked third. Based on the findings, recommendations were proffered amongst which include: The functionality of installed basic fire safety equipment should be ensured. Also, regular maintenance of these equipment should be carried out to guarantee the safety of lives and properties in fire situations; Fire safety unit and personnel should be established in high-rise buildings. Occupants and users of these high-rise buildings should be educated and trained in fire life safety practices with regular evacuation drills conducted among others should also be practiced; A preparedness plan should be designed for each building based on its unique features; Qualified professionals should be solely involved in the design and construction of high-rise buildings and also the installation of fire safety equipment.

1.0 Introduction

Fires can occur anywhere, at any time in buildings, automobiles, and outdoors. Fires that affect our homes are often the most tragic and the most preventable. The annual fire outbreaks in Federal Capital Territory Abuja, was put at about 444 with resultant deaths of approximately 194 persons (Federal Fire Service, 2013). The financial loss due to fire incidence runs to about 50billion Naira (Federal Fire Service, 2013). Fire outbreaks are also predominant in developed

countries. In the United States for instance, every year over 75% of all civilian fatalities occur as a result of fires in residential buildings. Between 2007 and 2009, civilian fire casualties in residential buildings accounted for 81% of all fire fatalities (Topical Fire Report Series, 2011). Fire causes huge losses every year, typically measured by property loss, human deaths and injuries.

High-Rise-Building maybe defined as any structure with an occupied floor situated more than 22.7 metres above the lowest level of fire department vehicle access (Prashant, 2007). Much earlier observation by the American National Standard Institute (2004) shows that these buildings are generally considered as one that is taller than the maximum height which people are willing to walk up; it thus requires mechanical vertical transportation. High-rise buildings became possible with the invention of the elevator (lift) and cheaper, more abundant building materials. High-rise structures pose particular design challenges for structural and geotechnical engineers, particularly if situated in a seismically active region or if the underlying soils have geotechnical risk factors such as high compressibility or bay mud. They also pose serious challenges to fire fighters during emergencies.

According to the Federal Service Department (2013), most of these fire incidents are caused by electrical sparks or domestic gas explosions. In Kano State, the state fire service reportedly noted that fire outbreaks took 1,017 lives between January and December 2009 (Federal Fire Service, 2013). In 2011, 368 fire outbreaks reportedly occurred in the Federal Capital Territory, Abuja, resulting in 262 deaths. Between January and June 2012, about 209 fire outbreaks were reportedly recorded in the same FCT, Abuja of these incidents, which claimed 12 lives and over N2billion worth of property, 43 were said to have been caused by gas, 13 by electrical equipment, nine by electrical sparks and four by accidents/arson. The financial loss due to fire

incidences runs over N50 billion (Federal Fire Service, 2013). This is not to count the destruction of sometimes irreplaceable valuable documents.

Climate, building stock characteristics, and human factors importantly influence fire rates. While structural factors of buildings have an effect on the incidence of fire, of equal or greater importance today is how humans use and maintain those buildings (Federal Emergency Management Agency, 2003). Tan and Hiew (2004) emphasized how all parties, comprising of landlords, tenants, occupants, cleaners and security, maintenance and operations personnel are equally responsible for the safety and security in any high-rise building. In this regard, fire safety management has become an integral aspect in the daily operations of high-rise buildings. The height of the building may make evacuations very time consuming, if not impossible in time of an emergency. Fire creates serious threat to life and property in high-rise buildings. First, it is not easy for fire fighters to access the upper floors in a high-rise building; for instance, most fire truck ladder rarely extends beyond the eight floors. Therefore, to extinguish fire beyond this point, fire fighters have to on occasion climb dozens of flights of stairs, dragging fire hoses and other heavy equipment with them. Second, the huge population of people in high-rise buildings makes it difficult to rapidly and safely conduct evacuation of people. Since elevators are not safe for usage as means of exit during a fire, this forces large number of people to descend an already crowded stairway. This is an overwhelming challenge even under the best of conditions, but the risks increases with smoke darkness, noise and confusion of fire in a high-rise, specifically for people attempting to get away from an upper floor. As such, this research attempts to identify and assess fire safety management practices that influences fire safety of high-rise building users and subsequently, identify methods to improve fire safety of high-rise building users (Black, 2002).

Similarly, Bryan (2004) stated that fires are rare occurrences; everyone working in a high-rise building must be ready to act quickly in the event of an occurrence. This is due to the fact that in a fire emergency, the first three to four minutes are crucial. The timely handling of a fire emergency, according to sound procedures established well before the incident ever occurs, can prevent the emergency from becoming a catastrophe.

2.0 Fire Safety in High-Rise Buildings

The rapid growth of urban population globally, specifically the development of mega cities and the increase in incidences of non-accidental fires has prompted careful consideration of fire 'safety' in populated urban centres. Among the incidences of non-accidental fires captured globally included the terrorist attack fires in the World Trade Centre on 11 September, 2001 in USA (Chow, 2001a), Arson fires in a bank, in universities in Beijing (Chow, 1995) and underground railway arson fires in South Korea and Russia (Chow, 2001a). Fundamentally, fire safety codes of buildings deal with accidental fires. But with the terrorist attack of World Trade Centre and several other arson incidences, non-accidental fire should be considered because with so many political and social conflicts, the probability of having terrorist attacks and arson fires is quite getting higher than usual (Chow, 2001a; Chow, 2001b).

Modern architectural features, such as the utilization of numerous glass wares for constructions, might constitute extra problems. Cracking and falling down of glass panels as a result of explosion or failure of the fittings for putting in place the glass panels would provide greater air intake rate to support combustion and eventually cause greater heat emission that could result in severe damages (Fire Services Department, 1998). Amongst the fire safety challenges of high-rise buildings are: accessibility of firemen and delivery of equipment for rescuing people and combating of fires are upward through lifts or staircases; direct rescuing through ground

applications from the exterior of buildings is impossible; basic routes of escape for occupants are downward by lifts or staircases; direct application of water by fire fighting jets from the outside the building is impracticable or much stalled and fire fighting techniques (application of water, fire ventilation amongst others) are usually applied from the interior of buildings (Chow, 2001a).

2.1 Comparison of Fire Safety of High-Rise Buildings and Low-Rise Buildings

Considering fire life safety, high-rise buildings are different from low-rise buildings in many unique ways. For instance, the existence of several floors one on top of the other with a large number of people and business properties concentrated in a single location translates to a greater potential fuel load for any fire that could take place in the building. In addition, the possibility of a huge uncontrolled fire ascending in a high-rise is an ever-present risk as a result of its vertical nature. Also, the concentration of people in a single location at the same time translates to a higher possibility of injuries or death taking place in greater proportion (Craighead, 1995). Furthermore, there is delay in attending to occupants or victims located on higher floors due to the time required by response team to get to upper floors when compared with the same situation in a low-rise building or on the ground floor. There is also the challenge of evacuating occupants in high-rise buildings at the same time through the utilization of stairways or elevators.

Another major distinction lies in the restriction of accessibility by fire fighters from both the interior and exterior of a high-rise building. Internally, there is restriction of accessibility to the utilization of elevators and stairways which can be approached through the building lobby or lower levels such as basements.

Lastly, almost certainly the major distinction is stack effect which takes place in high-rise buildings. According to Boyce (1991), high-rise buildings most times possess natural forces impacting the movement of smoke and fire which are usually insignificant in low-rise buildings. Stack effect and the impact of winds could be very important in high-rise buildings. Stack effect which is as a result of differences in temperature between two areas in the same building, creates a differential pressure that creates the movement of natural air within a building. In high-rise buildings, stack effect becomes greater with increase in height of buildings. Several high-rise buildings have considerable stack effect with the potential of transmitting large volumes of smoke and heat unmanaged through buildings.

3.0 Methodology

In this study, any building of five or more storeys (floors) was assumed as a high-rise building due to its geographical location. Six high-rise buildings in Abuja which comprise Sheraton Hotel, NICON Insurance building, Radio House, Bank of Industry, Federal Secretariat Complex building Phase II and Unity House all in Abuja were examined. In addition to this, data were sought from professionals such as Architects, Builders, Mechanical and Electrical Engineers in the built environment based in Abuja and Fire Service Headquarters Abuja.

4.0 Results and discussion

4.1 Analysis of Questionnaire Survey

Table 1: Age Group of Respondents

Age group	Frequency	Percentage	Valid Percentage	Cumulative Percentage
21 - 30	43	19.11	19.1	19.1
31 – 40	80	35.56	35.6	54.7
41 – 50	70	31.11	31.1	85.8
Above 50	32	14.22	14.2	100
Total	225	100	100	

Majority of the respondents fall within the range of 31 – 40 years representing 35.55%, 31.11% represents those that are between the ages of 41 – 50, 19.11% are within the ages of 21 - 30 and 14.22% above 50years, while, no respondent was below 21years. This distribution is an indication of an active working population made up of youths within the ages of 21 years and 50 years. Respondents who are above 50 years of age, who could likewise be categorised as aged people are the most likely and vulnerable victims of fires, due to their reduced agility.

Table 2: Educational Status of Respondents

Educational Status	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Secondary education	11	4.89	4.9	4.9
Non-formal education	32	14.22	14.2	19.1
Tertiary education	182	80.89	81.0	100.1
Total	225	100	100	100.0

From Table 2, majority of the respondents representing 80.89% have gone through tertiary institutions, 19.1% of the respondents have Non-formal education, 4.89% have Secondary education. The educational level of respondents determines to a large extent the ability to understand, embrace and apply fire safety strategies and management practices. It also guarantees the ability to read and understand instructions on buildings and fire safety equipment for the reduction and mitigation of fire risk.

Table 3: Type of Building

Number of Floors	Frequency	Percentage	Valid Percentage	Cumulative Percentage
5 – 10	37	16.44	16.4	16.4
11 – 15	177	78.67	78.7	95.1
16 – 20	11	4.89	4.9	100.0
Total	225	100	100	-

Majority of the respondents work in buildings of 11 – 15 floors representing 78.67%, 16.44% of the respondents work in buildings with 5 – 10 floors while, 4.89% work in buildings with 16 – 20 floors. The more floors a building possess translates to more risk and fire hazard in the event of fire outbreak.

Table 4: Type of Office Accommodation

Number of Users in Building	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Single User	59	26.22	26.2	26.2
2 – 3 Users	32	14.22	14.2	40.4
General Office	129	57.35	57.4	97.8
Others	5	2.22	2.2	100.0
Total	225	100	100	

Majority of the respondents uses general office representing 57.35%, 26.22% of the respondents work in single user buildings, 14.22% work in 2 – 3 users' buildings and 2.22% in other types such as hotel. With the general office users representing the majority, it implies a higher risk of fire due to the high population of users with diverse backgrounds, degree of negligence and ignorance of fire risk in high-rise buildings.

Table 5: Building Usage

How often building is used	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Daily	187	83.11	83.1	83.1
Weekly	27	12.00	12.0	95.1
Fortnightly	11	4.89	4.9	100.0
Total	225	100	100	

Table 5 revealed that majority of the respondents (83.11%) make use of high-rise buildings on a daily basis, 12% of the respondents use the high-rise building weekly, with 4.89% fortnightly.

The frequency of building usage implies the magnitude of exposure to fire risk, of which majority are exposed daily to the risk of high-rise building fire.

Table 6: Fire Risk in High-Rise Building

Potential Fire Risk	Frequency	Percentage	Valid Percentage
Smoking	188	83.56	83.6
Electrical faults	187	83.11	83.1
Arson	32	14.22	14.2
Cooking	54	24.00	24.0
Renovations	129	57.33	57.3
Storage of highly flammable materials	214	95.11	95.1

Table 6 revealed that majority of the respondents representing 95.11%, 83.56%, 83.11% and 57.33% are of the opinion that Storage of highly flammable materials, smoking, electrical faults, and renovations respectively constitute risk of fire in high-rise buildings. Whereas, 24% and 14.22% of the respondents are of the opinion that cooking and arson respectively constitute risk of fire, implying that 76% and 85.78% are of the opinion that cooking and arson respectively do not constitute risk of fire.

Table 7: Witnessed Fire in High-Rise Building

Witnessed any Fire in High-Rise Building?	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Yes	114	50.67	50.7	50.7
No	111	49.33	49.3	100.0
Total	225	100		

Majority of the respondents have witnessed fire incidence in high-rise building representing 50.67% while, 49.33% have not witnessed fire in high-rise building (See Table 4.9).

Table 8: Extent of Damage in Fire Incidence in High-Rise Building

Rating of the Extent of Damage due to Building Fire Experienced in High-Rise Building?	N	Sum	Mean	Rank
Injury	224	576	2.57	1st
Destruction of Property	224	450	2.01	2nd
Structural Defect	224	439	1.96	3rd
Permanent Deformity	224	439	1.96	3rd
Collapse of Structure	224	395	1.76	5th
Loss of Reputation	224	395	1.76	5th
Death	224	247	1.10	7th

The mean score of respondents with regards the level of damage as a result of the impact of fire occurrence revealed that, Injury ranked first, Destruction of Property ranked second, Structural Defect and Permanent Deformity both ranked third, Collapse of Structure ranked fifth and Death ranked seventh which also according to the frequency of occurrence.

Table 9: Availability of Active Fire Safety Equipment in High-Rise Building

Availability of Active Fire Safety Equipment in High-Rise Building?	N	Sum	Mean	Rank
Fire Alarm	225	659	2.93	1st
Portable Fire Extinguisher	225	654	2.91	2nd
Smoke Detector	225	643	2.86	3rd
Sprinkler System	225	643	2.86	3rd
Sprinkler System	225	643	2.86	3rd
Fire Hose Reel	224	632	2.82	5th
First Aid Box	224	632	2.82	5th
Fire Exits	223	627	2.81	6th
Fire Safety Signs	224	621	2.77	7th
Emergency Lighting System	223	595	2.67	8th
Fire Hydrant	224	584	2.61	9th
Dry Riser	223	520	2.33	10th
Fire Blanket	224	461	2.06	11th
Wet Riser	221	391	1.77	12th
Foam Extinguisher	224	396	1.77	12th
Fire Bucket	224	375	1.67	14th
Fusible Link Door	223	359	1.61	15th
Heat Detector	223	354	1.59	16th

Flame Detector	223	354	1.59	16th
Halon Gas System	223	354	1.59	16th
Fire Gas Mask	224	332	1.48	19th

Table 9 revealed that Fire Alarm, Portable Fire Extinguishers and Sprinkler System/Smoke Detectors ranked 1st, second and third respectively with regards availability of fire safety equipment in the high-rise buildings under study. Fire Hose Reel, First Aid Box, Fire Exists and Fire Safety Signs are ranked fifth, sixth and seventh respectively. This implies that fire safety equipment ranked first to seventh are the equipment mostly available in the high-rise buildings investigated. Whereas, Emergency Lighting System, Fire Hydrant, Dry Riser, Fire Blankets, Wet Riser, Foam Extinguishers, Fire Bucket, Fusible Link Door, Heat Detector, Flame Detector, Halon Gas System and Fire Gas Mask are ranked eighth, ninth, tenth, eleventh, twelfth, fourteenth, fifteenth, sixteenth and nineteenth respectively. The implication of this is that fire safety equipment ranked eighth to nineteenth are the equipment mostly not available in the high-rise buildings investigated. Some of the fire safety devices available in the selected high-rise buildings are shown in Appendix B.

Table 10: Functionality of Active Fire Safety Equipment in High-Rise Building

Functionality of Active Fire Safety Equipment in High-Rise Building?	**N**	**Sum**	**Mean**	**Rank**
Fire Exits	220	670	3.05	1st
Smoke Detector	220	664	3.02	2nd
Portable Fire Extinguisher	220	659	3.00	3rd
Fire Alarm	220	654	2.97	4th
Sprinkler System	220	654	2.97	4th
Emergency Lighting System	188	557	2.96	6th
First Aid Box	214	616	2.88	7th
Fire Safety Signs	220	632	2.87	8th
Fire Hose Reel	220	621	2.82	9th
Fire Hydrant	220	595	2.71	10th
Dry Riser	220	514	2.34	11th
Fire Blankets	220	493	2.24	12th

Fire Bucket	209	445	2.13	13th
Foam Extinguishers	214	434	2.03	14th
Halon Gas System	193	343	1.78	15th
Fusible Link Door	198	321	1.62	16th
Flame Detector	193	305	1.58	17th
Wet Riser	220	343	1.56	18th
Heat Detector	193	300	1.55	19th
Fire Gas Mask	204	300	1.47	20th

Table 10 revealed that Fire Exits, Smoke Detectors and Portable Fire Extinguishers ranked first, second and third respectively in terms of functionality of the fire safety equipment in the high-rise buildings under study which implies the most functional fire safety apparatus in the buildings, with a mean score of 3.02. Whereas, Fire Alarm/Sprinkler System, Emergency Lighting System, First Aid Box, Fire Safety Signs, Fire Hose Reel, Fire Hydrant, Dry Riser, Fire Blankets, Fire Bucket, Foam Extinguishers, Halon Gas System, Fusible Link Door, Flame Detector, Wet Riser, Heat Detector and Fire Gas Mask ranked fourth, sixth, seventh, eighth, ninth, tenth, eleventh, twelfth, thirteenth, fourteenth, fifteenth, sixteenth, seventeenth, eighteenth, nineteenth and twentieth respectively. The implication of this is that apart from Fire Exits, Smoke Detectors and Portable Fire Extinguishers, the other fire safety equipment mostly do not function effectively in the buildings investigated.

Table 11: Attendance of Fire Safety Training

Attendance of Fire Safety Training?	**Frequency**	**Percentage**	**Valid Percentage**	**Cumulative Percentage**
Frequently	16	7.11	7.1	7.1
Often	27	12.00	12.0	19.1
Rarely	43	19.11	19.1	38.2
Never	134	59.56	59.6	97.8
Missing system	5	2.22	2.2	100
Total	225	100	100	

Majority of the respondents revealed that they have never attended fire safety trainings. This implies that majority of the respondents could not handle fire safety equipment and be able discern the required action to take in fire incidents, though 7.11% of the respondents frequently attend training. 19.11% rarely attend training and 12.0% often attend trainings.

Table 12: Frequency of Receiving Training on Evacuation Procedure

Training on Evacuation Procedure?	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Frequently	17	7.56	7.6	7.6
Often	19	8.44	8.4	16.0
Rarely	59	26.22	26.2	42.2
Never	128	56.89	56.9	99.1
Missing system	2	0.89	0.9	100
Total	225	100	100	

Table 12 revealed that majority of the respondents (56.89%), have never received trainings on evacuation procedures. While, 26.22% rarely receive training on evacuation procedure, 8.44% often receive trainings and 7.56% frequently receive training on evacuation procedure. This implies that, majority of the respondents could be of assistance in terms of evacuation, whenever the need arises to a certain degree.

Table 13: Knowledge of Current Fire Emergency Phone Numbers

Current Fire Emergency Phone Numbers?	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Yes	16	7.11	7.1	7.1
No	209	92.89	92.9	100
Total	225	100	100	

From Table 13 it was discovered that majority of the respondents (92.9%) do not have the current fire emergency phone numbers. This implies that in the event of fire disaster, most of

the occupants and users of the buildings would not be able to seek for assistance in combating the incident.

Table 14: Level of Acceptance of Fire Safety Strategies

How Often Are The Following Fire Safety Strategies Observed?	N	Sum	Mean	Rank
Conducting inspection of electrical installations.	225	1039	4.62	1st
Taking renovation work precautions and inspections.	225	1034	4.60	2nd
Implementing good housekeeping practices.	225	1029	4.57	3rd
Provide clear signage indicating exit routes and location of fire safety equipment.	225	1023	4.55	4th
Education and training of high-rise building users in fire life safety.	225	1023	4.55	4th
Conducting inspection, operation and maintenance of fire safety equipment.	225	1018	4.52	6th
Implementing fire safety procedures and evacuation drills.	225	1002	4.45	7th
Adhering to Standard Codes.	225	959	4.26	8th
Implementing pest control program.	225	954	4.24	9th
Provision of fire safety plan.	225	938	4.17	10th

Table 14 revealed that conducting inspection of electrical installations, taking renovation work precautions and inspections and implementing good housekeeping practices ranked first, second and third respectively. Provision of clear signage indicating exit routes and location of fire safety equipment and Education and training of high-rise building users in fire life safety; Conducting inspection, operation and maintenance of fire safety equipment; Implementing fire safety procedures and evacuation drills; Adhering to Standard Codes; Implementing pest control program and Provision of fire safety plan ranked fourth, sixth, seventh, eighth, ninth, and tenth respectively. The implication of the above is that conducting inspection of electrical

installations, taking renovation work precautions and inspections and implementing good housekeeping practices are the fire safety strategies with the highest degree of acceptance based on the respondents. Also, provision of fire safety plan which ranked tenth is an indication of the lack of awareness amongst respondents of the relevance of fire safety plans. The following strategies were suggested by respondents towards ensuring fire safety in high-rise: Provision and servicing of fire safety equipment, Conducting inspection, operation and maintenance of fire safety equipment, Continuous training and education of users of high-rise buildings and the establishment of safety department manned by professional to ensure compliance with safety rules, regulations and procedures.

Table 15: Degree of Influence of Factors that Hinder the Integration of Fire Safety Equipment in High-Rise Buildings

Degree of Influence of the Following Factors in Hindering the Integration of Fire Safety Equipment	N	Sum	Mean	Rank
Initial Cost	18	86	4.78	1st
Fraudulent Practices	18	84	4.67	2nd
Maintenance Cost	18	83	4.61	3rd
Limited Regulation of the Sector	16	69	4.31	4th
Limited Knowledge of Professionals	18	75	4.17	5th
Attitudes of End Users	18	74	4.11	6th
Government Policy	18	71	3.94	7th
Ignorance of Client	18	66	3.67	8th
Carelessness of Design Team	18	66	3.67	8th

Table 15 revealed that amongst the factors listed that hinders the integration of fire safety equipment, Initial cost ranked first, fraudulent Practices ranked second and Maintenance Cost ranked third. The factor with the least influence was discovered to be Ignorance of Client and Carelessness of Design Team. The implication of the result is that the three most influential factors have to do with money.

4.2 Analysis of Physical Observation

The researcher was able to visit the six selected buildings in Abuja to ascertain available and functional fire safety equipment.

Table 16: Frequency of Availability and Functionality of Fire Safety Equipment in High-Rise Buildings

Fire Safety Equipment	Availability (%)	Functionality (%)	Remark
Smoke Detector	100	100	Available and Functional in all the Buildings
Heat Detector	16.7	16.7	Available and Functional in a Single Building
Flame Detector	16.7	16.7	Available and Functional in a Single Building
Fire Alarm	100	100	Available and Functional in all the Buildings
Sprinkler System	100	83.3	Available and Functional in five of the Buildings
Portable Fire Extinguishers	100	100	Available and Functional in all the Buildings
Halon Gas System	0	0	Absent in all the Buildings
Fusible Link Door	0	0	Absent in all the Buildings
Fire Exits	100	100	Available and functional in all the Buildings
Emergency Lighting System	83.3	83.3	Available and Functional in five of the Building
Fire Hose Reel	100	100	Available and Functional in all the Buildings
Dry Riser	100	100	Available and Functional in all the Buildings
Wet Riser	33.3	33.3	Available and Functional in two of the Buildings
Fire Hydrant	100	83.3	Available in all but Functional in five of the Buildings
Fire Safety Signs	83.3	83.3	Available and Functional in five of the Buildings
Fire Bucket	66.7	66.7	Available and Functional in four of the Buildings
Fire Gas Mask	16.7	16.7	Available and Functional in a Single Building
First Aid Box	100	100	Available and Functional in all the Buildings
Fire Blankets	33.3	33.3	Available and Functional in two of the Buildings

Table 16 revealed that Smoke Detector, Fire Alarm, Portable Fire Extinguishers, Sprinkler System, Fire Exists, Fire Hose Reel, Fire Hydrant, First Aid Box and Dry Riser are available in all the high-rise buildings investigated. Fusible Link Door and Halon Gas System are absent in all the buildings. Also, it revealed that Smoke Detector, Fire Alarm, Portable Fire Extinguishers, Fire Exists, Fire Hose Reel, First Aid Box and Dry Riser are functional in all the high-rise buildings investigated which could be attributed to the status of Abuja as a modern city. Sprinkler System, Fire Hydrant, Emergency Lighting System and Fire Safety Signs are functional in five of the six high-rise buildings under study. Also, in all these buildings there are inadequate signs, directions and information on fire safety equipment. The fire Exits available in all the buildings are securely locked which is an indication of lack of use, likewise the fire glass of the Alarm System are unbroken due to the fact that they have never been used. These securely locked fire exits could constitute the risk of been trapped in emergency situations despite their location on every floor.

5.0 Conclusion

Periodical inspection of the functionality of fire safety equipment in these buildings are not carried out, trainings on operations of fire safety equipment and regular evacuation drills for occupants and building users are not in place. The different factors affecting the integration of fire safety equipment in high-rise buildings which are size of building, type of building, type of occupant, complexity of building, purpose of building, client's brief and financial capability of client, with size of building ranked as first. Also, the factors hindering the integration of fire safety equipment identified are initial cost, fraudulent practices, cost of maintenance, and ignorance of client and carelessness of design team with initial cost ranked as first.

Education and training of high-rise building users in fire life safety, taking renovation work precautions and inspections, conducting inspection of electrical installations, conducting inspection, operation and maintenance of fire safety equipment, implementing fire safety procedures and evacuation drills are the accepted fire safety strategies with education and training of high-rise building users in fire life safety ranked first.

The need to improve fire safety management practices in high-rise buildings in Abuja is very important. Based on the findings of this study, the following recommendations are proffered which should be collectively considered by all stakeholders in the built environment:

1. Actions and items that constitute risk of fire such as storage of highly flammable materials, smoking amongst others should be strictly discouraged and restricted in every high-rise building especially those used by a large number of people.

2. Integration of basic fire safety equipment in every high-rise building should be enforced effectively, right from the stages of approval of design, construction and post-construction. The functionality of this basic fire safety equipment should be ensured. Also, regular maintenance of this equipment should be carried out to guarantee the safety of lives and properties in fire situations.

3. Fire safety unit and personnel should be established in high-rise buildings. Occupants and users of these high-rise buildings should be educated and trained in fire life safety practices with regular evacuation drills conducted. Other fire safety strategies such as conducting inspection of electrical installations, taking renovation work precautions and inspections, implementation of pest control programme, implementation of good housekeeping practices, provision of clear signage indicating exit routes and location of fire safety equipment,

conducting inspection, operation and maintenance of fire safety equipment, implementing fire safety procedures and evacuation drills, adherence to standard codes and provision of fire safety plan should also be practiced.

4. A preparedness plan should be designed for each building based on its unique features. This would help in curbing or minimizing the impact of fire disaster and getting occupants ready to face the situation whenever there is a fire incident.

5. Qualified professionals should be solely involved in the design and construction of high-rise buildings and also the installation of fire safety equipment.

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