



Assessment and Evaluation of Fire Safety Standards a Case Study of Mallam Aminu Kano International Airport

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ABSTRACT

Airport operations are associated with various hazards among which fire outbreak is the most dangerous, cautions need to be taken in order to save lives and properties, and such can only be achieved by providing adequate, and sufficient maintenance exercise, in this study a survey of the fire safety department of the Mallam Aminu Kano International Airport, Kano airport was carried out, a questionnaires were administered to the rescue and firefighting personnel, and results of the survey were analyzed and discuss critically. Its shows that 62% of the respondents were not satisfied with the existing safety plans which indicate that plans were not provided as required by the standards. Based on the findings, it was conclude, that the airport has no fire safety management and contingency plans that meet up with the current standard, thus hindering seamless operation, and pose a threat to safety and wellbeing of the airport users.

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INTRODUCTION

Assessment of safety procedure requires understanding interactions between the various components and parties involved. The process of this research has three distinct phases, the first is the literature studying process, which enabled the complete understanding of the domain, while the second is field research through interactions with key personnel and the third is distribution of questionnaire for the complete analysis of safety situations in an organization. Safety is the state in which the risk of harm to persons or of property damage is reduced to, and maintained at or below an acceptable level through a continuing process of hazard identification and risk management (ICAO, SMM, 2006). According to Landry and Ingola (2011), "airlines and

ground handlers require operational and safety training of all staff to support aircraft servicing, including use of ground service equipment (GSE) such as belt loaders, tugs, transporters, unit load devices, baggage carts, pallet loaders, and portable ground power units.

According to U.S. Government Accountability Office (2007). However, despite the mandatory training, the presence of a large number of people operating various equipment in a relatively constrained area, often under considerable time pressure, creates an environment in which fire out breaks, injuries and fatalities, as well as aircraft and equipment damage, can occur. The aviation industry is one of the key sectors that ensure economic, industrial and social development in Nigeria. There are several international and



local airports spread across the country and Mallam Aminu Kano International (MAKIA) happens to be one of the oldest among them. MAKIA is one of the airports under the control of Federal Airports Authority of Nigeria (FAAN), operating in accordance with international civil aviation organization ICAO annex 14 standard regulations (MAKIA, ESR, 2007). The fire safety department in MAKIA is regarded as very important department due to the hazards associated with day to day running activities of the airport. In large organization where hazards occurrence are likely, it's important to delegate responsibilities, for this reason MAKIA operates a fully-fledged fire safety department internationally named as; Aerodrome Rescue and Fire Fighting Services (ARFFS).

This research involves assessment and evaluation of fire safety standards in MAKIA, just like other business organization aims at being productive, cost effective and profit making and maximize on their service outputs. It thus becomes mandatory for MAKIA to put in a safe and healthy work policy in order to remain in business.

LITERATURE REVIEW

Chow (2013) Approached working out fire safety strategy for large airport terminals in the far east, In the study it was found out that most airport terminals in large cities in the Asia-Oceania regions are very busy, well-formulated fire safety strategies are needed to tackle the potentially high fire risk. Serious consequences may result due to disruption of flights. In addition, a small fire occurred near the departure area of the Canton Airport, despite no casualties, minimal damage and a 12-hour disruption of air traffic was observed, the fire raised two concerns on fire safety provisions in new airport terminals; Many big halls in airport terminals in dense cities of the Asia-Oceania regions are not fully covered by fire

suppression systems or smoke exhaust systems and Occupational health and safety of firemen.

Fire safety in crowded large halls not fully protected by fire suppression or smoke exhaust systems should be reviewed. It should also be noted that the firefighting equipment and facilities in smaller cities are not adequate as in the more developed and richer cities (Chow, 2012). Adequate fire safety must be provided in those large airport terminals (Chow, 2015, 1997, 2013).

Moreover, many assumptions made in designing fire safety provisions for airport terminals were based on research conducted years ago. Such assumptions might not hold now and should be reviewed with reference to long-term research (Bresston, 1995 and Beeper, 1998).

New challenges have emerged such as the ever-increasing passenger loadings, larger quantities of luggage that result in higher fire load densities, larger volume of air traffic and more frequent flight suspensions due to adverse weather conditions, earthquakes and even volcanic eruptions. Only up-to-date fire engineering tools and justified design data, such as the estimated heat release rates should be used in working out new design and upgrading fire safety provisions (Hong Kong International Airport Tenant Design Guideline, Appendix A Sample Fire Engineering Report, 2011). Fire safety research with more systematic experimental studies should be carried out to justify the design data for fire safety provisions used years ago. The Canton airport fire should be taken as a reference to address new challenges so as to enhance and upgrade the fire safety provisions (Meacham B, 2013).

Firefighting and rescue may be impeded by inadequate fire safety provisions. Even worse, the safety and health of firemen may be endangered. For example, without appropriate fire service



installations, it took several hours for the firemen to locate the burning source in the airport fire in Hong Kong in 1998 (Tin Tin Daily News, Hong Kong, 1998). Obviously, new airport terminals must be designed properly and assessed rigorously on fire safety provisions in order to meet the new challenges such as the higher passenger loadings, higher fire load densities and larger traffic volumes.

Fire safety provisions in existing airport terminals are difficult to be upgraded. If the authorities insist on doing so, serious criticisms may arise from different sectors. Fire safety provisions are upgraded usually only after a disastrous incident had happened. For example, after the tragic Garley Building fire in 1996 which claimed 37 lives, much tighter fire safety control was implemented in old high-rise buildings in Hong Kong. An immediate viable action that the authorities can take is to implement tighter fire safety management (South China Morning Post, Hong Kong, 1996). Lu, Wetmore, and Smith (2005) analyzed 189 accident and incident reports between 1999 and 2004 and identified ground crew operations as the second leading factor of accidents. According to the researchers, the factors leading to ground crew error were identified as: Poor situational awareness (air stair/ jet bridge/ vehicle operations). Ineffective communication (tug/truck/belt loader driver– pilots–wing walkers), Lack of supervision/quality assurance, Ramp agent's ignorance of safety criteria, Physical fatigue, and Personal health and medication. He concluded that good fire safety awareness program has to be an integral part of operations and following considerations must be borne in mind; Establishment of safety records and accurate accident records, the complexity of oil operations, which will determine the practicability and acceptability of proposed

codes of practices, and Establishment of appropriate safety inspections procedure and personnel training programs.

RESEARCH METHODOLOGY

Assessment of safety procedure requires understanding interactions between the various components and parties involved. The process of this research has two distinct approaches; the first is the literature studying process which enabled the complete understanding of the domain while the latter is field research through interactions with key personnel.

This project research employed multidisciplinary methods and generally involved desktop studies, field survey, consultations of key personnel to ascertain the fire safety provisions in accordance with the standard requirements, and also administration of questionnaires to the fire safety staff of MAKIA. The personnel consulted are from, The head of ARRF department, Duty watch officers/Head of shifts and Watch room/Control room officers

The data collected for this research was obtained from the respondents of the questionnaire (shown in Appendix one) administered and field survey of the fire safety station with ARFF personnel, observation of equipment's was conducted throughout the survey. Questionnaire was used to obtain information from the ARFF staff; the questionnaire contained a total of 44 questions.

The data obtained were analyzed descriptively and presented in tables, pie chart and bar chart. Each question item in the questionnaire was analyzed. The values were obtained by using the method below



$$Z_1 = \frac{X_1}{X_2} \times 100\%$$

$$Z_2 = \frac{Y_2}{X_2} \times 100\%$$

Z_1 = Percentage in favor (yes)

Z_2 = Percentage against (no)

X_1 = Response in favor (ye)

X_2 = Total number of questionnaires

Y_1 = Question item and responses obtained

Y_2 = Response against (no)

Therefore, each item and response obtained is given by;

$$\text{Percentage in favor (yes)} = \frac{\text{Response in favor (yes)}}{\text{Total number of questionnaires}} \times 100\%$$

$$\text{Percentage against (no)} = \frac{\text{Response against (no)}}{\text{Total number of questionnaires}} \times 100\%$$

RESULTS

A total of one hundred and nine (109) questionnaires were distributed to the staff of rescue and firefighting department, they were answered by the fire men, unit heads and the head of the department, one hundred questionnaires were returned completed while five were not properly completed and four were not

returned. A total of 91.7% of the questionnaires were analyzed.

Gender Analysis

The tables 2 shows that, 92 out of 100 respondents were males, representing 92%, while only 8 out of 100 were female, representing 8 %.(Source: questionnaire administered)

Table 1: Gender analysis of the respondents (Question B – 1)

Response	Number of respondent	Percentage (%)
Male	92	92%
Female	8	8%
Total	100	100%

Marital Status Analysis

The figure 1 shows that, 12 out of 100 respondents were single, representing

12% and 84% were married, while 4% did not respond to this particular questions item. (Source: Questionnaire Administered)

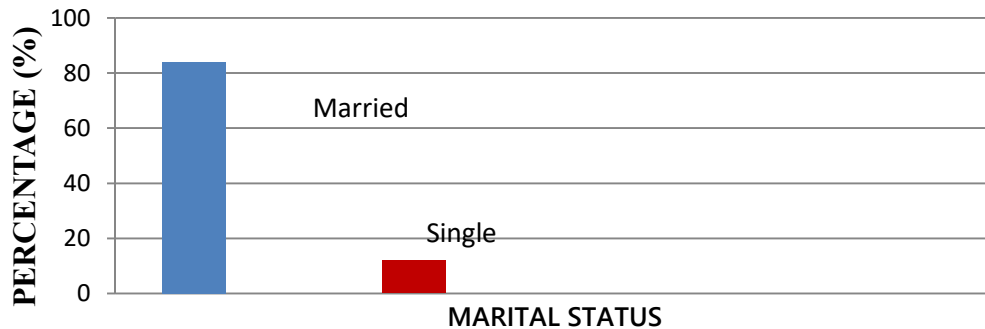


Figure 1: A bar chart representing the marital status analysis

Analysis on the functional fire safety plans, inspection, monitoring, and implementation in MAKIA

Figure 2 shows the opinion of the respondents on the effective provision and implementation of airport emergency plans in MAKIA its shows that, 21% and 6% of the respondents were satisfied as against 52% and 10% that were dissatisfied and 11% that were undecided. This indicates that either the RFF personnel were not aware of the existing airport emergency plan, or the plan has not been provided as required by the standard, that ‘ A system for locating and reaching each accident site in minimum time with adequate rescue, firefighting and medical equipment should be employed at each airport’(ICAO, ASM, DOC. 9137).

On the opinion of the provision and implementation and effectiveness of safety management system in MAKIA, 20% of the respondents were satisfied, 10% were strongly satisfied, 50% were dissatisfied, 10% were strongly dissatisfied, and the rest of 10% were undecided. This shows that 50% and 10% of the respondents were dissatisfied as against the 20% and 10% that were satisfied. This means that the majority of the respondents was on the opinion that there was no provision of an effective safety management system in MAKIA as required by the ICAO’s standards and recommended

practices (SARPs). That, ‘In accordance with the provision of ICAO, SMS, DOC. 9859, annexes 6, 11, and 14, States shall require that individual operators, maintenance organizations, Air Traffic Service providers and certified aerodrome operators implements Safety Management System accepted by the state’. Such SMS shall: Identify safety hazards, Ensure that remedial actions necessary to mitigate the risk/hazards are implemented and Provide for continuous monitoring and regular assessments of the safety level achieved.

Also 50% and 35% of the respondents was satisfied and strongly satisfied respectively on the opinion that there exist an effective record of accidents and incidents in MAKIA as against the 15% that were undecided. This is ‘In accordance with Annex 13, states report to ICAO information on all aircraft accidents that involve aircraft of a maximum certified take off mass of over 2250 kg. ICAO also gathers information on aircraft incidents (involving aircraft 5700kg)

This indicates that an average of 30.3% and 17% responses on the functional fire safety plans, inspection, monitoring and implementation in MAKIA were in favor of the investigation, while 34% and 6.7% of the respondents were against the investigation and 12% were undecided(Source: questionnaire administered).

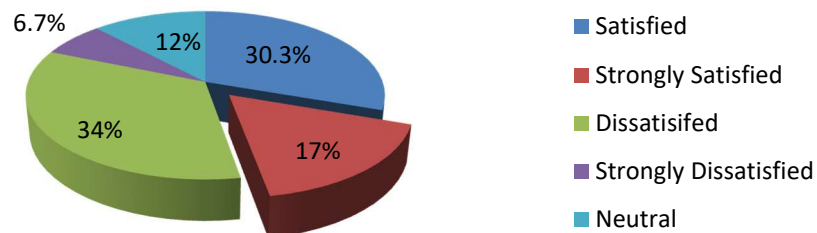


Figure 2: A pie chart representing an investigation on functional fire safety plans

Analysis of Safety Consciousness of the Airport

The respondents were asked to assess the fire safety consciousness of MAKIA. The figure 3 shows that 64 out of 100 respondents representing 64% claimed

that the safety consciousness of the airport was on the high side, 32 or 32% of the respondents said it was moderate. And 4 or 4% of the respondents said it was low. This indicates that fire safety consciousness in MAKIA in on the high side.

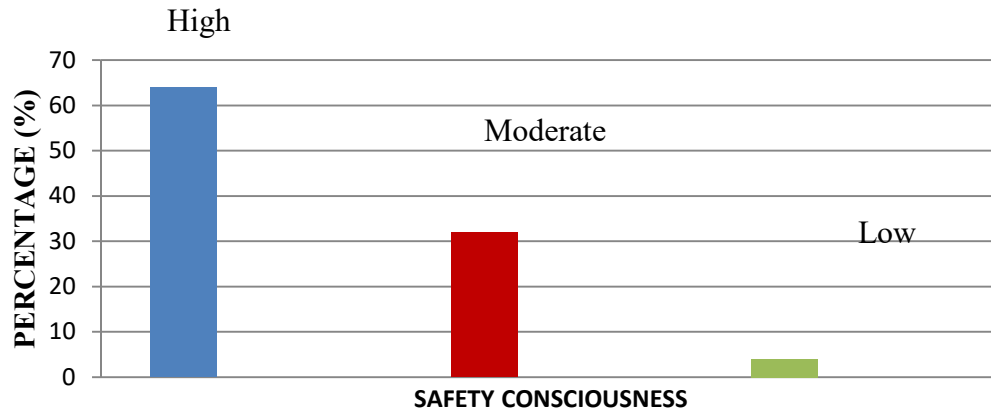


Figure 3: A bar chart representing an investigation on safety consciousness of the airport

Analysis on Average Working Hours of Each Firefighter per Day

Figure 4 shows that 16 out 100 respondents representing 16% claimed that they worked 8 hours per day, 76% of the respondents said that they worked 6 hours per day, while 8% of the respondents did

not answer this particular question. This indicates that the statutory limits of weekly working hours of 40 hours per week or less has been maintained as established by the international labor organization (ILO). (Source: ILO Occupational safety and health convention, DOC. 155, 2002).

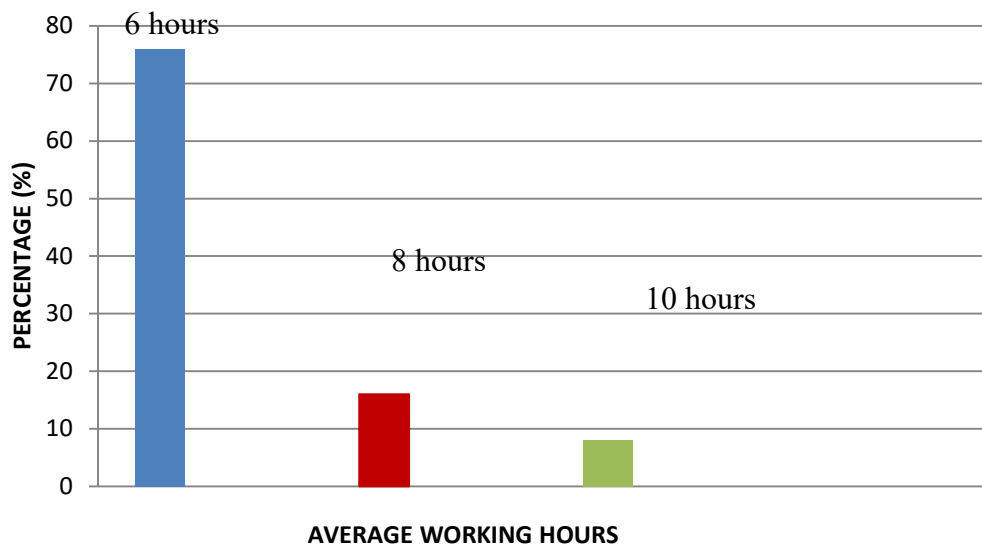


Figure 4: A bar chart representing average working hours

Analysis of the Work Force of Fire Safety Department at MAKIA

Figure 5 shows that 12 out of 100 respondents representing 12% claimed that the work force of fire safety department at MAKIA is between 50 to 100 workers, 8% of the respondents claimed that the work force of fire safety department is between 150 to 200 workers while 80% of the

respondents said that the work force of fire safety department is between 100 to 150 workers. This indicates that the minimum staffing level of fire safety department in MAKIA as category 9 airport is within acceptable level of at least 120 firemen as established by ICAO standards. (Source: DOC. 9137, ASM, 2015).

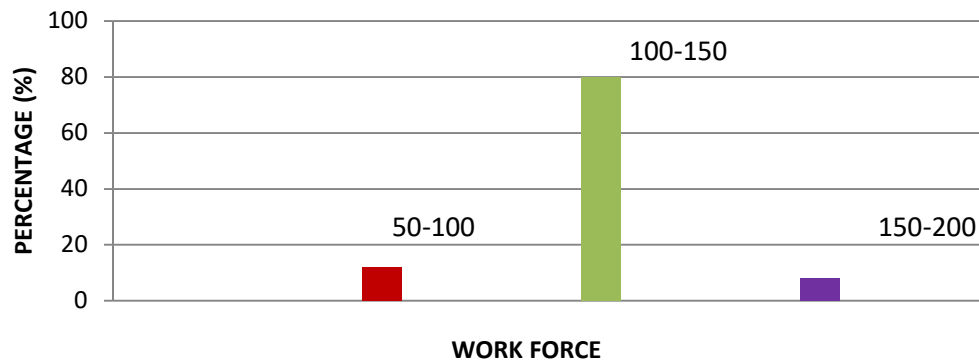


Figure 5: A bar chart representing the work force of fire safety department

Analysis on Response Time

Figure 6 shows that, 35% of the respondents were satisfied and 65% were strongly satisfied on the opinion that, there has been an effective coordination on communication between fire stations and air traffic control tower as required by the standard for the achievement of response time. That 'A discrete communication system should be provided linking the fire station with the control tower, any other fire station on the airport and the RFF vehicles'.(DOC. 9137, ASM, 2015)

standards. That 'The operational objective of the RFF service should be to achieve response times of two minutes and not exceeding three minutes to the end of each runway, as well as to any other part of the movement area, in optimum condition of visibility and surface conditions'.(DOC. 9137, ASM, 2015)

Also 35% and 65% of the respondents were satisfied and strongly satisfied respectively on the opinion that there has been a provision for regular and accurate timed response test. This gives the total average response of 35% and 65% in favor of the investigation on effectiveness of response time. This indicates that in MAKIA every arrangement has been put in place for the achievement of minimum response time as required by the ICAO

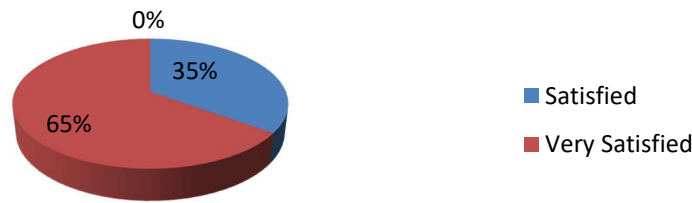


Figure 6: A pie chart representing investigation on response time

Analysis on the Provision of Satellite Fire Station in MAKIA

Results shows that 68% of the respondents were in favor while 32% were against the investigation. This revealed that there has been a provision of satellite fire station as required by the standard. That, 'Satellite fire station should be provided whenever the response time cannot be achieved from a single fire station'. (DOC, 2015)

Analysis on Training

Table 7A above shows that 64% of the respondents said that there has been an existing new operator training program. 63% said that there has been a regular refresher training programs for experienced firemen. 80% of the respondents said that there has been a routine training program on fire hazard awareness for general employee in MAKIA. This indicates that an average response of 72.5% respondents was made in favor of this investigation on training, while 27.5% of the response was made against the investigation

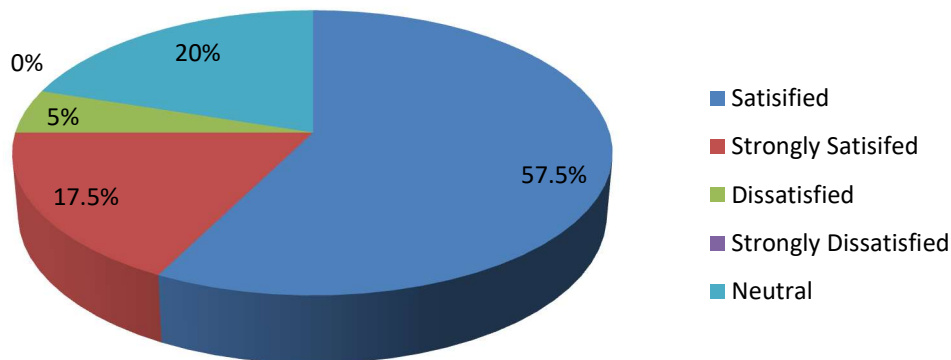


Figure 7A: A pie chart representing investigation on training

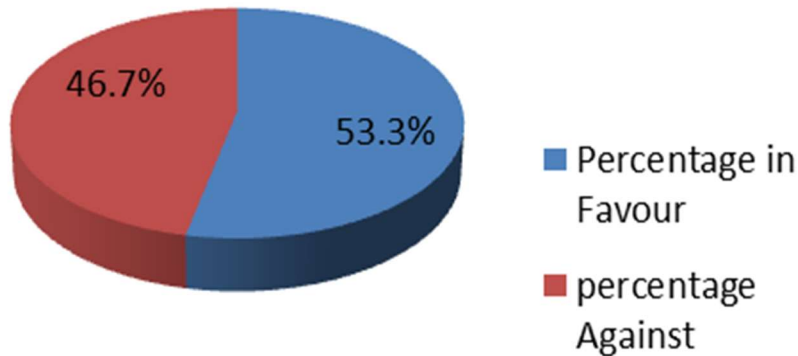


Figure 7B: A pie chart representing investigation on training

Analysis on RFF Training

Figure 7B above shows that 84% of the respondents claimed that the RFF personnel in MAKIA were not properly trained and 16% said that the RFF personnel were properly trained. 88% of the respondents said that all RFF personnel were participating in live fire drills while 12% were against the investigation. 56% of the respondents said that all the RFF personnel undergone emergency medical care training while 44% were against the investigation. This indicates that an average response of 53.3% was made in favor of the investigation on training, while 46.7% of the response was made against the investigation.

Analysis of the Investigation on Firefighting Equipment's

Figure 8A above shows that 60% of the respondents were satisfied, 30% strongly satisfied and 10% were undecided on the opinion that all RFF vehicles were properly maintained and in good operational condition. 55% and 30% of the respondents were satisfied and strongly satisfied respectively, while 15% were undecided on the opinion that all RFF personnel were properly equipped. 65%

and 20% were satisfied and strongly satisfied respectively while 15% were undecided on the opinion that a suitable, efficient and serviceable fire warning and evacuation equipment were provided in the airport. Also 55% and 30% of the respondents were satisfied and strongly satisfied respectively while 15% were undecided on the opinion that there was provision of suitable, efficient and serviceable fire extinguishing equipment's. This indicates that the average 58.75% of the respondents were well satisfied, and 22.4% were against. Each fire fighter will be provided with a personal issue of protective clothing and respiratory equipment to enable him/her to perform his/her duty in effective manner.

Figure 8B above shows that 76% of the respondents said there has been a provision of suitable and sufficient personal protective equipment while 24% believes otherwise. Also 90% of the respondents said that all RFF personnel were provided with serviceable self-contained breathing apparatus during rescue operation in a breathless environment. This indicates that the average 83% of the respondents were in favor of this investigation and 17% were against this investigation. Each fire fighter

will be provided with a personal issue of protective clothing and respiratory equipment to enable him/her to perform his/her duty in effective manner as required by the standard. That 'It is essential that all personnel operating at an aircraft fire be

provided with protecting clothing which will ensure the wearer is able to perform the assigned duties. This clothing should be provided, maintained and readily available for instant use'. (DOC. 9137, ASM, 2015)

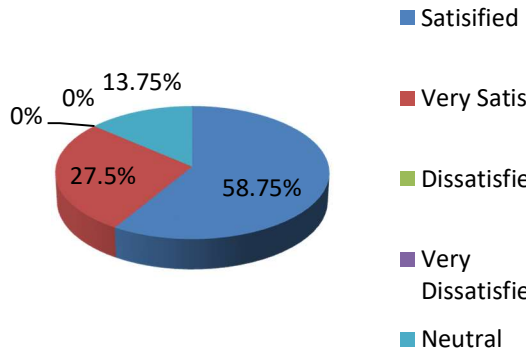


Figure 8A: A pie chart representing investigation on firefighting equipment

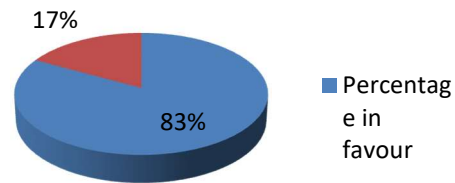


Figure 8B: A pie chart representing investigation on firefighting equipment

Analysis of the Investigation on Communication and Alerting System

Figure 9A above shows that the average percentage 43.3% and 45% of the respondents were satisfied and strongly satisfied respectively while 11.7% were undecided on the opinion that there were sufficient provision of suitable communication and alerting equipment and all these equipment were in good operational condition. And according to the responses, the provision of communication linkage between the fire station, air traffic control tower and the ARFF vehicles was found to be very effective as required by the standard.

Table 9B above also shows that averages of 92% of the respondents were in

favor of the investigation while 8% were against the investigation. This indicates that there was effective provision of audible alarm system to alert the auxiliary staff and other supporting agencies on or off the airport in the case of an emergency. Provision of effective and serviceable communication facilities in the RFF vehicles. This shows that there is effective communication system as required by ICAO standards. That the efficiency of RFF service is significantly dependent on the reliability and effectiveness of its communication and alarm system. In addition, the successful conduct of the total firefighting and related rescue operation will be facilitated by the system for alerting and mobilizing other participating emergency support personnel.

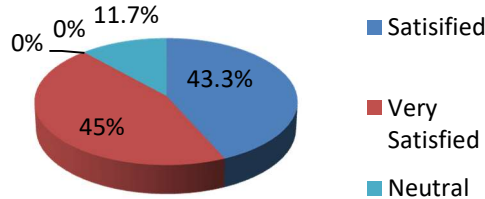


Figure 9A: A pie chart representing investigation on communication and alerting system

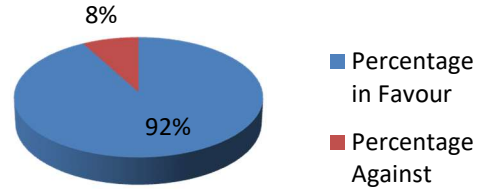


Figure 9B: A pie chart representing investigation on communication and alerting system

Analysis of the Investigation on the Provision of Ambulance and Medical Services

Figure 10A and 10B shows that 100% of the respondents said that there is provision of ambulance for RFF operations. 25% and 10% were satisfied and strongly satisfied as against 25% and 20% that were dissatisfied on the opinion that there is provision of fully equipped first aid room. This indicates that the provision of first aid facilities is poor. 92% of the respondents said that there is provision of medical clinic in the airport vicinity. 92% of the respondents also said that there is provision of medical and physical fitness equipment

as required by the standard. That, 'During protracted rescue operations, the ability of RFF personnel to perform strenuous activities over an extended period of time influences the overall operational effectiveness, Therefore, firefighters must be aerobically fit to withstand the rigorous of a variety of operations. Clearly, physical fitness training requirements should be designed to be commensurate with the equivalent fitness intensity generated in the performance of RFF operations, which include the use of breathing apparatus, hand-lines, ladders, heavy equipment and other associated rescue operations such as casualty handling'. (DOC. 9137, ASM, 2015)

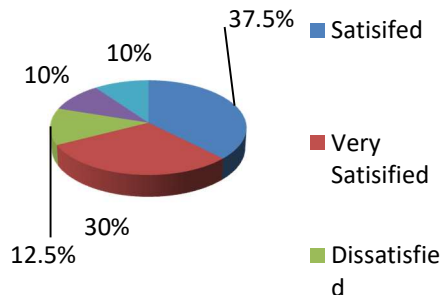


Figure 10A: A pie chart representing investigation on provision of ambulance and medical services

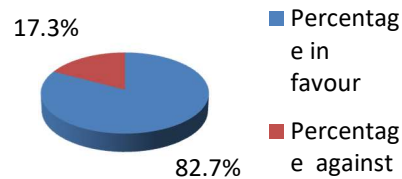


Figure 10B: A pie chart representing investigation on provision of ambulance and medical services



CONCLUSION

It is safe at this stage to draw conclusion having carried out a survey on the assessment and evaluation of fire safety standards on Mallam Aminu Kano International Airport (MAKIA) In accordance with the professional regulatory standards nationally (NCAA) and internationally (ICAO). In the course of this research, questionnaire was administered to the RFF personnel; descriptive survey result obtained was analyzed and presented using tables, pie charts and bar charts. Major fire safety concerns have been identified. The challenges faced by the Recue and Firefighting personal includes; Inadequate staffs, Inadequate training, Ineffective implementation of safety management system, Ineffective implementation of airport emergency plans and Inadequate first aid facilities. Some fire fighters have limited skills and knowledge as they have not had an opportunity to participate in training programs to enhance their knowledge and skills for fire prevention and firefighting. Appropriate mitigation measures and recommendations have been considered for application in order to ensure a sustainable airport operation.

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