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A COMPARATIVE ANALYSIS OF FIRE SAFETY PREPAREDNESS AND DISASTER REDUCTION AMONG DOMESTIC AIRPORTS IN NIGERIA.

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ABSTRACT

This research analysed fire safety preparedness and disaster reduction among domestic airports in Nigeria. The objectives of the study were to: Analyse availability of fire service units and investigate the availability of water Hydrant Facilities and the effect on fire disaster preparedness at Nigerian Domestic Airports. The study adopted a cross-sectional design using the survey method. The population of the study involves 21 domestic Airports operating in Nigeria with 462 heads of internal departments, 105 safety officers of safety services, and 2 additional employees from each internal department i.e., 924 operating in the 21 domestic airports total (1,491) as statistically reported by the Federal Airports Authority of Nigeria (2019). Out of 21 domestic airports in Nigeria, 8 airports were randomly selected. The study sample size of 400 was obtained using the Taro Yamane formula. The instrument for data collection was a questionnaire. Data collected were analysed using both descriptive and inferential statistics. The null hypotheses were tested at a 0.05 level of significance, using ANOVA. Findings showed that there is no significant difference in the perceptions of respondents on the availability of fire service units and water hydrant facilities at Nigerian Domestic Airports (P =. 307, & .737 > 0.05). Recommendations were made as follows: airport administrators and the government urgently need to upgrade facilities to meet up with modern disaster demands in the airports, stakeholders have to establish a Terms of Reference, have regular meetings, and use a common Operational Airport Information System.

Keywords; Fire, Safety, Domestic Airports, Disaster Reduction, Preparedness

1. Introduction

The air transport industry has played an increasingly important role during the last quarter of the 21st century as a facilitator of overall economic activity and a critical element in certain economic sectors. Air transport is one of the safest forms of travel. Commercial air transport operations involve the transportation of passengers, cargo, and mail for remuneration or hire (EASA, 2014). Air travel today is undoubtedly safer than it has been at any time in the past five decades. Notwithstanding the importance of passengers carried, air transport has become a necessity to ensure the efficient and cost-effective movement of goods and services. Even though flying is one of the safest forms of transportation, headline-grabbing disasters still occur at frequent intervals and Africa has been labeled as one of the most aviation disaster-prone regions in the world (Kwiatkowski, 2016).

On another level, there is also an increasing interest in aircraft manufacturers, carriers, and other actors in the aviation industry for large-size airplanes and the number of flights in many airports is on

the increase. According to Ayres (2009), this makes airports to be extremely busy and even congested with an increasingly large number of people being at the airport at any one time, yet there is no meaningful expansion and modernization of facilities.

The potential impact of airport-related disasters involving these large numbers of people continues to increase. In the event of a disaster, the impact is often phenomenal. These disasters may arise from many causes ranging from mechanical problems to even human-related factors such as fire, terrorism with the latter having the greatest frequency. Not only do disasters occur frequently around the world, but it would seem that their incidence and intensity have been increasing in recent years (UN/ISDR, 2008).

Worldwide, fire disasters cause injuries, numerous deaths, and extensive damages to homes and businesses (World Fire Statistics Bulletin, 2016). Such fires may be caused by natural forces/processes known as natural disasters or by human actions such as negligence or errors commonly referred to as 'anthropogenic disasters. According to USAID (2012), fire destruction, as with most other natural disasters, is usually aggravated by anthropogenic activities; thus, the fire hazards which are part of nature often turn into disasters due to human actions or inactions.

Despite advances in knowledge and technology, vulnerability to and risks to fire disasters have been rising in both developed and developing countries. Risks and vulnerability to fire disasters have resulted from changes in people's lives socially, economically, culturally, politically and environmental contexts partly due to development as well as lack of development processes. However, according to Hemond & Robert (2012), sometimes man faces risks from such disasters because of a lack of awareness of hazards in his environment. Aspects leading to fire destruction are present almost everywhere ranging from wildfires caused by lighting or dropping of cigarettes outside on flammable surfaces, industrial accidents to earthquakes which have been known to cause damage to gas leaks leading to explosions and fires (Wisner et al, 2015).

Fire destruction can also come from acts of arson and terrorism such as the September (2011) terrorist attack in the United States of America in which terrorists crashed planes into the world Trade Centre causing a jet fuel explosion that set the twin towers on fire. Recent examples of fire as a natural disaster (out-of-control wildfires) that caused death and destruction have been witnessed in Australia in 2009, in Russia in 2010, and virtually every year through different southern and western states of the United States and Mediterranean Europe. However, among the developed countries, the USA has had a bigger share of fire disaster destruction. Owing to the nature of airport operations, airport terminal buildings are generally atrium designed. As such buildings are large and spacious; any fire outbreak can spread rapidly. This, coupled with the high number of passengers commuting through the airport daily, places airport buildings in the high fire load category. This study, therefore, aimed to compare and analyse fire safety preparedness and disaster reduction among domestic airports in Nigeria.

2 Aim and Objectives of Study

The study aimed was to compare and analyse fire safety preparedness and disaster reduction among Domestic Airports in Nigeria.

Objectives are to:

1. Analyse availability of fire service units at Nigerian Domestic Airports
2. Investigate the availability of water Hydrant Facilities and the effect on fire disaster preparedness at Nigerian Domestic Airports.

3 The Study Area

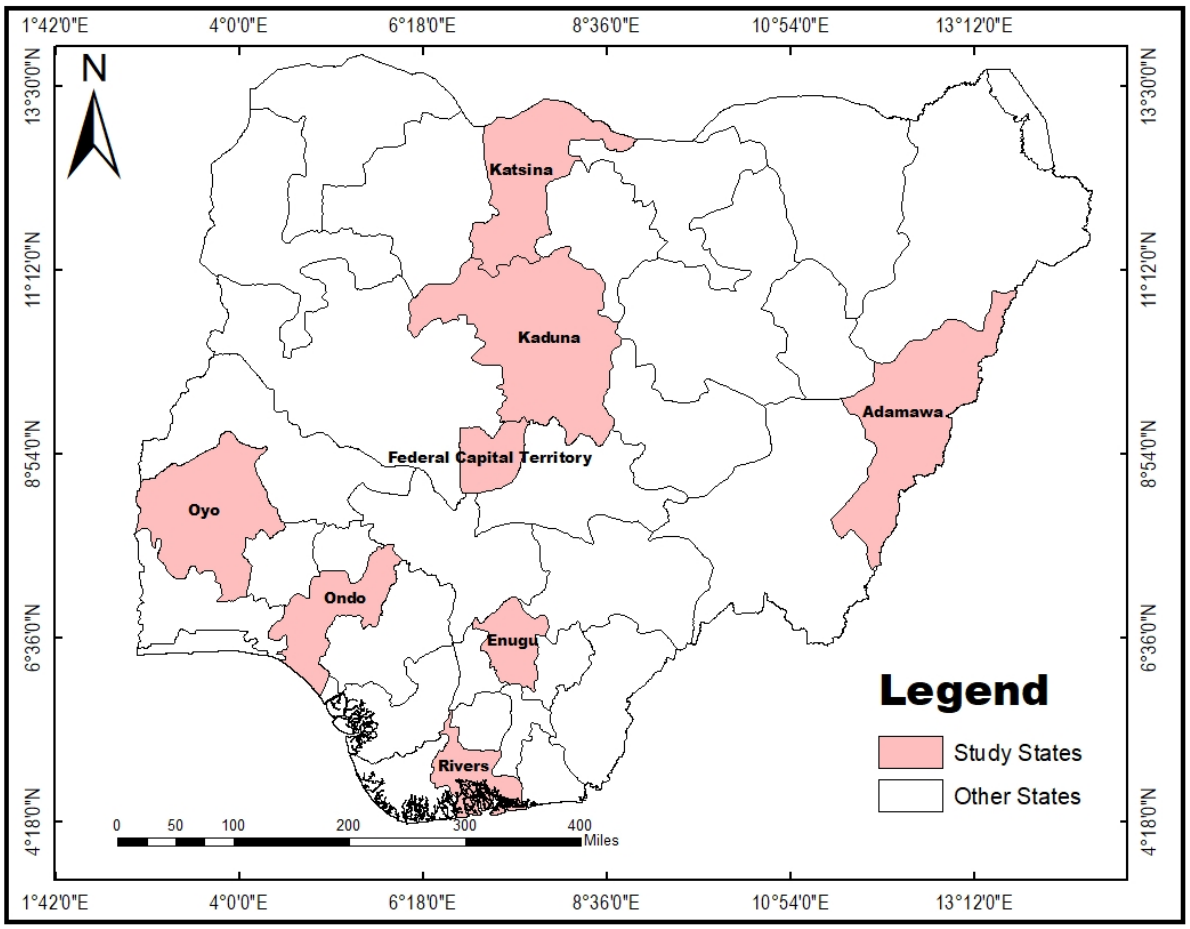

Figure 1: Nigeria Showing the study States

The study area is the Federal Republic of Nigeria. However, the overall sub-regional, regional and continental effort will be a focus of the study. Nigeria is located in the West Africa sub-region. It is bounded in the north by the Niger Republic, south by the Atlantic Ocean, east by Cameroon and Chad, and west by the Benin Republic. She is the most populous country in Africa. Concerning the National population commission (NPC, 2006), Nigeria accounted for more than 140 million and by August 2019 estimated to be about 197-200 million. Nigeria is located within the longitude 3^0E and

15^0E and latitude 4^0N and 14^0N of the equator (Afolayan et al., 2014). Figure 1 shows the Map of Nigeria showing Showing the study States.

4 Materials and Methodology

The study adopted the cross-sectional design. The descriptive design was based on a cross-sectional sampling of the opinions of individuals on a comparative analysis of fire safety preparedness and disaster reduction among domestic airports in Nigeria.

The population for this study consists of all the 21 domestic Airports operating in Nigeria with 462 heads of internal departments, 105 safety officers of safety services, and 2 additional employees from each internal department i.e., 924 operating in the 21 domestic airports total (1,491) as statistically reported by the Federal Airports Authority of Nigeria (2019). Out of 21 domestic airports in Nigeria, 15 airports (71.4%) were randomly selected. The study sample size was calculated using the Taro Yamane formula. In this formula, sample size can be calculated at 3%, 5%, 7% and 10% precision (e) levels. The confidence level used is 95% with a degree of variability (p) equivalent to 0.05.

$$n = \frac{N}{\left(1 + N\left(e^2\right)\right)}$$

Where:

n-signifies the sample size

N-signifies the population under study

e-signifies the margin error = 0.05

$$n = \frac{1491}{\left(1 + 1491(0.0025)\right)}$$

$$n = \frac{1491}{4.7275} \approx 400$$

The instrument adopted for data collection for this study was a structured questionnaire, face to face interview with respondents.

Questionnaires were selected and set according to the objectives of the study and it is preferred as it is easy to interpret, saves time, and provides uniformity as per information collected. Key Informant Interview (KII) were conducted using a checklist to collect information from key stakeholders such as heads of internal departments and safety officers. This is because both techniques are simple and effective for collecting information and also minimizes researcher biases in assessing the impact of the study. For the qualitative data, the information was collected through interviews with different individuals as well as from focus group discussions with selected staff members. Quantitative data was coded and entered into the computer for analysis using the Statistical Package for Social Sciences

(SPSS). Descriptive statistics such as percentages, means, and standard deviation were used to analyse the data generated in line with the research questions while hypotheses were tested using, Analysis of variance (ANOVA).

5 Result and Discussion

5.1 Availability of fire service units at Nigerian Domestic Airports

This section presents analysis and interprets data to answer the five research questions posited for the study. The results are presented in tables according to the research questions.

Table 1 Availability of fire service units at Nigerian Domestic Airports

Fire Service Units	Airport	Respondents Per Airport		
		Available	Not Available	Total
State fire service	Yola Airport=50	50(100.0%)		50
	Kaduna Airport=50	50(100.0%)		50
	Akure Airport=50	50(100.0%)		50
	Katsina Airport=50	50(100.0%)		50
	Port Harcourt Airport=50	50(100.0%)		50
	Enugu Airport=50	50(100.0%)		50
	Abuja Airport=50	50(100.0%)		50
	Ibadan Airport=50	50(100.0%)		50
Airport rescue firefighting service	Yola Airport=50	50(100.0%)		50
	Kaduna Airport=50	50(100.0%)		50
	Akure Airport=50	50(100.0%)		50
	Katsina Airport=50	50(100.0%)		50
	Port Harcourt Airport=50	50(100.0%)		50
	Enugu Airport=50	50(100.0%)		50
	Abuja Airport=50	50(100.0%)		50
	Ibadan Airport=50	50(100.0%)		50
Fire brigade service	Yola Airport=50	50(100.0%)		50
	Kaduna Airport=50	50(100.0%)		50
	Akure Airport=50	50(100.0%)		50
	Katsina Airport=50	50(100.0%)		50
	Port Harcourt Airport=50	50(100.0%)		50
	Enugu Airport=50	50(100.0%)		50
	Abuja Airport=50	50(100.0%)		50
	Ibadan Airport=50	50(100.0%)		50
Corporate fire service	Yola Airport=50	50(100.0%)		50
	Kaduna Airport=50	50(100.0%)		50
	Akure Airport=50	50(100.0%)		50
	Katsina Airport=50	50(100.0%)		50
	Port Harcourt Airport=50	50(100.0%)		50
	Enugu Airport=50	50(100.0%)		50
	Abuja Airport=50	50(100.0%)		50
	Ibadan Airport=50	50(100.0%)		50
Red Cross/Red crescent	Yola Airport=50		50(100.0%)	50
	Kaduna Airport=50		50(100.0%)	50
	Akure Airport=50		50(100.0%)	50
	Katsina Airport=50		50(100.0%)	50
	Port Harcourt Airport=50		50(100.0%)	50

	Enugu Airport=50		50(100.0%)	50
	Abuja Airport=50		50(100.0%)	50
	Ibadan Airport=50		50(100.0%)	50
NEMA	Yola Airport=50		50(100.0%)	50
	Kaduna Airport=50		50(100.0%)	50
	Akure Airport=50		50(100.0%)	50
	Katsina Airport=50		50(100.0%)	50
	Port Harcourt Airport=50		50(100.0%)	50
	Enugu Airport=50		50(100.0%)	50
	Abuja Airport=50	50(100.0%)		50
	Ibadan Airport=50		50(100.0%)	50
Civil defense	Yola Airport=50	50(100.0%)		50
	Kaduna Airport=50	50(100.0%)		50
	Akure Airport=50	50(100.0%)		50
	Katsina Airport=50	50(100.0%)		50
	Port Harcourt Airport=50	50(100.0%)		50
	Enugu Airport=50	50(100.0%)		50
	Abuja Airport=50	50(100.0%)		50
	Ibadan Airport=50	50(100.0%)		50
Community-based organizations	Yola Airport=50	50(100.0%)		50
	Kaduna Airport=50	50(100.0%)		50
	Akure Airport=50	50(100.0%)		50
	Katsina Airport=50	50(100.0%)		50
	Port Harcourt Airport=50	50(100.0%)		50
	Enugu Airport=50	50(100.0%)		50
	Abuja Airport=50	50(100.0%)		50
	Ibadan Airport=50	50(100.0%)		50
International agencies	Yola Airport=50		50(100.0%)	50
	Kaduna Airport=50		50(100.0%)	50
	Akure Airport=50		50(100.0%)	50
	Katsina Airport=50		50(100.0%)	50
	Port Harcourt Airport=50		50(100.0%)	50
	Enugu Airport=50		50(100.0%)	50
	Abuja Airport=50		50(100.0%)	50
	Ibadan Airport=50		50(100.0%)	50

Source: Researchers' Fieldwork, 2021

Responses from Table 1 indicate that most of the Nigerian Domestic Airports (100.0%) had State fire service available in their respective Airports. All the sampled Nigerian Domestic Airports reported the availability of the Airport rescue firefighting service.

Respondents of the eight sampled Nigerian Domestic Airports revealed the availability of Fire brigade service and corporate fire service in their airports respectively. Furthermore, Respondents reported nonavailability of Red Cross/Red Crescent, International agencies, and NEMA. However, only Abuja Airport had the representative of NEMA.

In addition, All the sampled Nigerian Domestic airports have both Civil Défense and Community-based organizations representative in their respective Airports.

This is an indication that there is the availability of fire service units at Nigerian Domestic Airports such as State fire service, Airport rescue firefighting service, Fire brigade service, corporate fire service, Civil Défense, and Community-based organizations.

Table 2 Availability of water Hydrant Facilities

Item	Respondents Per Airport	Available	Not Available	Total
Single Hydrant Valve	Yola Airport=50	42(84.0%)	8(16.0%)	50
	Kaduna Airport=50	50(100%)		50
	Akure Airport=50	50(100%)		50
	Katsina Airport=50	39(78.0%)	11(22.0%)	50
	Port Harcourt Airport=50	48(96.0%)	2(4.0%)	50
	Enugu Airport=50	50(100%)		50
	Abuja Airport=50	46(92.0%)	4(8.0%)	50
	Ibadan Airport=50	50(100%)		50
Double Hydrant Valves	Yola Airport=50	50(100%)		50
	Kaduna Airport=50	50(100%)		50
	Akure Airport=50	50(100%)		50
	Katsina Airport=50	41(82.0%)	9(18.0%)	50
	Port Harcourt Airport=50	50(100%)		50
	Enugu Airport=50	50(100%)		50
	Abuja Airport=50	50(100%)		50
	Ibadan Airport=50	50(100%)		50
Pendant Sprinklers	Yola Airport=50	44(88.0%)	6(12.0%)	50
	Kaduna Airport=50	36(72.0%)	14(28.0%)	50
	Akure Airport=50	5(10.0%)	45(90.0%)	50
	Katsina Airport=50	37(74.0%)	13(26.0%)	50
	Port Harcourt Airport=50	32(64.0%)	18(36.0%)	50
	Enugu Airport=50	22(44.0%)	28(56.0%)	50
	Abuja Airport=50	47(94.0%)	3(6.0%)	50
	Ibadan Airport=50	50(100%)		50
Sidewall Sprinklers	Yola Airport=50		50(100%)	50
	Kaduna Airport=50	6(12.0%)	44(88.0%)	50
	Akure Airport=50		50(100%)	50
	Katsina Airport=50	11(22.0%)	39(78.0%)	50
	Port Harcourt Airport=50	28(56.0%)	22(44.0%)	50
	Enugu Airport=50	2(4.0%)	48(96.0%)	50
	Abuja Airport=50	17(34.0%)	33(66.0%)	50
	Ibadan Airport=50	23(46.0%)	27(54.0%)	50
Foam Sprinkler	Yola Airport=50	38(76.0%)	12(24.0%)	50
	Kaduna Airport=50	50(100%)		50
	Akure Airport=50	40(80.0%)	10(20.0%)	50
	Katsina Airport=50	31(62.0%)	19(38.0%)	50
	Port Harcourt Airport=50	50(100%)		50
	Enugu Airport=50	44(88.0%)	6(12.0%)	50
	Abuja Airport=50	50(100%)		50
	Ibadan Airport=50	50(100%)		50
Hose Reels with Drum	Yola Airport=50	50(100%)		50
	Kaduna Airport=50	50(100%)		50
	Akure Airport=50	50(100%)		50
	Katsina Airport=50	50(100%)		50
	Port Harcourt Airport=50	50(100%)		50

	Enugu Airport=50	50(100%)		50
	Abuja Airport=50	50(100%)		50
	Ibadan Airport=50	50(100%)		50
High Velocity Water Spray Nozzle	Yola Airport=50	12(24.0%)	38(76.0%)	50
	Kaduna Airport=50	43(86.0%)	7(14.0%)	50
	Akure Airport=50	11(22.0%)	39(78.0%)	50
	Katsina Airport=50	7(14.0%)	43(86.0%)	50
	Port Harcourt Airport=50	18(36.0%)	32(64.0%)	50
	Enugu Airport=50	21(42.0%)	29(58.0%)	50
	Abuja Airport=50	47(94.0%)	3(6.0%)	50
	Ibadan Airport=50	33(66.0%)	17(34.0%)	50

Source: Researchers' Fieldwork, 2021

Table 2 indicated percentage level of Availability of water Hydrant Facilities in the studied airports which reveals as follows; Single Hydrant Valve was 84.0% available and 16.0% not available for Yola, Kaduna 100% available, Akure 100% available, Katsina 78.0% available and 22.0% not available, Port Harcourt 96.0% available and 4.0% not available, Enugu 100%, Abuja 92.0% available and 8.0% not available and Ibadan 100% available. Double Hydrant Valves have 100% available for Yola, Kaduna 100% available, Akure 100% available, Katsina 82.0% available and 18.0% not available, Port Harcourt 100% available, Enugu 100% available, Abuja 100% available and Ibadan 100% available. Pendant Sprinklers had 88.0% available and 12.0% not available for Yola, Kaduna 72.0% available and 28.0% not available, Akure 10.0% available and 90.0% not available, Katsina 74.0% available and 26.0% not available, Port Harcourt 64.0% available and 36.0% not available, Enugu 44.0% available and 56.0% not available, Abuja 94.0% available and 6.0% not available and Ibadan 100% available. Sidewall Sprinklers has Yola 100% not available, Kaduna 12.0% available and 88.0% not available, Akure 100% not available, Katsina 22.0% available and 78.0% not available, Port Harcourt 56.0% available and 44.0% not available, Enugu 4.0% available and 96.0% not available, Abuja 34.0% available and 66.0% not available and Ibadan 46.0% available and 54.0% not available. Foam Sprinkler has 76.0% available and 24.0% not available for Yola, Kaduna 100% available, Akure 80.0% available and 20.0% not available, Katsina 62.0% available and 38.0% not available, Port Harcourt 100% available, Enugu 88.0% available and 12.0% not available, Abuja 100% available and Ibadan 100% available. Hose Reels with Drum has 100% available for Yola, Kaduna, Akure, Katsina, Port Harcourt, Enugu, Abuja and Ibadan respectively.

High Velocity Water Spray Nozzle has Yola 12.0% available and 76.0% not available, Kaduna 86.0% available and 14.0% not available, Akure 22.0% available and 78.0% not available, Katsina 14.0% available and 86.0% not available, Port Harcourt 36.0% available and 64.0% not available, Enugu 42.0% available and 58.0% not available, Abuja 94.0% available and 6.0% not available and Ibadan 66.0% available and 34.0% not available.

Hypotheses Testing

The Analysis of variance (ANOVA) tool was used to test the hypotheses about the views of the respondents at a 0.05 level of significance. The results are presented in Tables 3 to 4.

Hypothesis 1: There is no statistically significant difference in the availability of fire service units at Nigerian Domestic Airports

Table 3 Summary of Analysis of Variance (ANOVA) on the availability of fire service units at Nigerian Domestic Airports

ANOVA

Status	**Sum of Square**	**Df**	**Mean Square**	**F**	**Prob.**	**Remark**
Between Groups	123.571	7	41.191	1.202	.307	H0 retained
Within groups	12896.576	392	34.302			
Total	12896.900	399				

Analysis on table 4.8 shows the f-ratio value (1.202) at 7 df 399 and the level of 0.05. The probability level of significance P (.307) is greater than 0.05. This means that there is no significant difference in the perceptions of respondents on the availability of fire service units at Nigerian Domestic Airports. Therefore, the null hypothesis is retained.

Hypothesis 2: There is no statistically significant difference in the Water Hydrant Facilities at Nigerian Domestic Airports

Table 4 Summary of Analysis of Variance (ANOVA) on the availability of Water Hydrant Facilities at Nigerian Domestic Airports

ANOVA

Status	**Sum of Square**	**Df**	**Mean Square**	**F**	**Prob.**	**Remark**
Between Groups	59.359	7	19.786	.423	.737	H0 retained
Within groups	17582.798	392	46.763			
Total	17642.158	399				

Table 4.9 present the f-value (.423) at 7 df 399 and at the level 0.05. The probability level of significance P(.737) is greater than 0.05. This means that there is no significant difference in the availability of Water Hydrant Facilities at Nigerian Domestic Airports. Therefore, the null hypothesis is retained.

6 Conclusion and Recommendation

In summary, the results presented and discussed above clearly outline the many challenges in disaster preparedness at Nigerian Domestic Airports. From the respondents, it is evident that Nigerian

Domestic Airports are still not prepared to handle any major airport disaster due to a lack of proper disaster preparedness policy awareness and training. Even though the airport has mechanisms in place to coordinate any major operation with the external community, measures have not been taken to incorporate the adjacent community in disaster preparedness awareness.

In light of the findings of the study, the researcher recommends that:

Airport administrators and government urgently need to upgrade facilities to meet up with modern disaster demands in the airports. While the airport managers on their part should try to maintain and manage properly the fire service units available;

2. To that end, stakeholders have to establish Terms of Reference, have regular meetings, and use a common Operational Airport Information System. All participating organizations could be connected to this system and capture information about air and ground incidents into a common database. This information exchange, the regular meetings, and common objectives provide the necessary premises for the early identification of disaster preparedness bottlenecks, the design of achievable corrective measures, and their effective implementation;

3. Air accidents frequently occur near, rather than at airports. Therefore, integrating the activities of local and airport emergency services becomes a major issue for planning. However, this requirement does not encompass planning for potential accidents outside the airport limits. Furthermore, recent experience of major disasters has highlighted the importance of planning to manage the traumatic aftermath of major disasters for survivors, relatives, and operational personnel. Recent US regulations place requirements on airlines to draw up plans and commit resources to deal effectively with the traumatic aftermath of aviation disasters (Federal Family Assistance Plan for Aviation Disasters).

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