

Investigation of Textile Fire Accident and Impact on Environment and Rapid Evacuation Plan in Ring Spinning Department: A Case Study

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Abstract

The textile industry is the leading manufacturing sector to enhance the economy of the country. The most causes of fireplace have several reasons that electricity, heating, human error, environmental atmosphere and failure of electrical components in the machine. The research objectives to investigate the reason of fire accident in the textile industries of Pakistan and Bangladesh, the environmental impact of fire and rapid evacuation plan in the textile spinning ring department during the fire emergency. For this purpose, the different approaches were used to collect data like research articles content and reference side. The expert systems level of investigation perception has been adopted. This elaborate the use of proficient judgment on the review of materials created by others to consider the magnitude of the fire problem, production of environmentally unfavorable products of burning, the effect of those products on the atmosphere, and whatever, without actually undertaking actual assessments of environmental impact. One emergency gate is not enough in the spinning department for rapid evacuation. There should be two emergency gates for rapid evacuation in spinning ring department.

Keywords: Fire accident; Textile industry; Environmental impact; Rapid evacuation plan; Ring department

Introduction

The textile industry is the leading manufacturing sector to enhance the economy of the country. Majority fire accidents have seen in the textile industry; which develops property losses and heavy lives [1]. The research objectives to investigate the reason of fire accident in a textile industries Pakistan and Bangladesh, the environmental impact of fire and rapid evacuation plan in the textile spinning mill especially ring department during the fire emergency. For this purpose, the

different approaches were used to collect data like research articles content and reference side.

According to the National Disaster Management Authority (NDMA) and Pakistan Engineering Council (PEC) that fire accidents directly causes the injuries and casualties. Moreover, fire incidents at industrial units, housing society, existing building and commercial building have taken 70% death. During the time 2015-2016, the massive and serious fires disaster occurred in most populated cities of Pakistan. The property, heavy loss of concrete buildings and a numerous number of human deaths by fire incidents [2]. Fires are harmful events with substantial prices for human life and property. The measurement of the quick and fire direct costs given a metric for accepting the economic and social impact of fire and for evaluating development in fire protection and prevention. Furthermore, the fire has a negative impact on the natural environment. The air contamination includes from the fire plume (whom sediment is expected to appropriately include water contamination and land), water contamination develops toxic products and other environmental pollutant releases and discharges from burned materials [3]. The timing of Evacuation has an important issue whereas numbering of fire mishap safety plan. The location of fire and passage of exit building need more consideration [4]. The man behavioral makes the positive role of evacuation timing to reach a safe place. The behavioral concept assists to organize evacuation decision model [5]. The part of the article has been concerned the safety material, essential safety system and safety level in the company. The intervention timing, emergency action plan and action implement in right situation have been contained in the remaining part of research [6].

Major Fire Accidents Pakistan and Bangladesh Textile Industry

Tazreen Fashions, Bangladesh

The textile fire accidents namely Tazreen Fashions blaze occurred fire accidents on 25 Nov 2012 at Dhaka, Bangladesh.

These incidents have taken more than 125 lives due to stumpage and fire. The people nearest the unlucky building industry were reported to the police station and firefighters department. They observed loud emotional utterance of workers; workers were also jumping from eight floors to protecting their life [7]. The fire started in a ground floor warehouse in which spinning yarn was stored. Within a short time, the fire spread to the whole 9th floor. Majority of the workers died in the 1st and 2nd floor due to improper evacuation plan, shortage of enough exit. When fire engulfed the whole building; workers had no way to escape out from the building. One of the official members of the investigation said in a telephonic interview that fire could have been caused by a spark from a cigarette and electrical fault as mention in **Figure 1** [8].



Figure 1 Firefighters tried to control a fire at a garment factory, Bangladesh, on Saturday (Source: Hasan Raza/ Associated Press).

Pakistan is a crucial country for export garments materials into America, Europe, German and Asian countries. The biggest city of Karachi, Pakistan is going to eminent due to fire accidents in textile garments industry.

Ali Enterprises, Baldia town, Karachi

The textile industry namely Ali enterprises, Baldia town, Karachi occurs the massive fire incident. The documents show that more than 300 workers had lost their lives due to suffocation and smoke. Furthermore, there was no way of escaping because the doors were closed and windows were covered with steel grill as shown in **Figure 2** [9].



Figure 2 Ali Enterprises factory (Source: Hasan Raza/ Associated Press).

Rajwani Garments, Karachi, Pakistan

The three-story building Rajwani garments Karachi fire erupted at about 2.36 PM. The fire started at Friday afternoon and could not be controlled till two days. The fire department was not properly equipment's and fire tenders. Only one snorkel was taking participation for extinguish the fire. The government of Sindh, Pakistan should see the critical condition of the fire department in Karachi. As shown in figures that poor fire-fighters equipment promotes economic losses. **Figure 3** shows the industry image before the fire, **Figure 4** shows the industry image during the fire and **Figure 5** shows the two day situation of industry image after the fire [10].



Figure 3 Before fire Rajwani garments, Karachi (Source: Rajwani Company website).



Figure 4 During fire Rajwani garments, Karachi (Source: Dunyanews.tv).



Figure 6 Eight storey commercial building named Rana Plaza, collapsed Bangladesh (Source: Wikipedia 24 April 2013).



Figure 5 After two day fire Rajwani garments (Source: Zeeshan, Reporter Geo News).

KBI Textile Mill, Karachi, Pakistan

December 7th, 2014, after the huge effort of 1 day, firefighter have succeeded to douse the blaze that started at KBI textile industry in SITE. Furthermore, thousands of workers had loosed their jobs. The industry building was fully collapsed and unable to perform any work. Moreover burning yarn, machine, cotton and yarn worth millions of rupees, the fire intense have covered all building as mention in **Figure 7** [12]. **Figure 8** shows the progression of steps conducted for Environmental Impact Assessment.



Figure 7 Goods worth millions of rupees were completely destroyed, while part of the building collapsed (Source: The Express Tribune).

Rana Building, Bangladesh

The Rana building is fully collapsed due to a fire accident as shown in the **Figure 6**. Furthermore, 1132 textile workers have lost their lives. Before the Rana Plaza collapse day, workers saw the huge cracks in the building but concern management did not take serious precautionary steps. After these incidents, the inquiry team has decided that Bangladesh government should give more concentration related about health and safety policy for the textile industries [11].



Figure 8 Progression of steps conducted for Environmental Impact Assessment (Source: Martin et al. [3]).

There are some important fire case studies and impact on the environment have discussed as shown in **Table 1**.

Table 1 List of fires important to the study of the environmental impact of fire (ISO, 2011).

Time	Place	Impact
1962-Present	Centralia, PA, USA	The town has the massive burning fire at a coal mine. The fire was greatly difficult and crucial to extinguish and hold, however, several endeavors had been made. The fire shows the negative impact in the greenhouse gas emission, vegetation die-off and air pollution [13,14].
1982, February	Yorkshire, UK	The biggest warehouse fired in the Yorkshire. The fire quickly grew up. The transport emergency cards (TREM) were provided to the fire department relating to fungicide, pesticide and insecticide. The fire department used water to extinguish the fire. The major pollution was widespread in the hand and local water [15,16].
1986, November	Basel, Switzerland	The fire Sandoz chemical warehouse activated the impact of fire on the environment. The eels in the Rhine were not consumable after the fire 10 years [17,18].
1987, May	Southern Russia and Northern China	The total 28,141 square mile (72,884 Square km) area were fully burnt. It was also called black Dragon fire. This forest ahead the Amur river, the china side 4687.5 Square mile) were also damaged [19].
1987, October	Nantes, France	Inorganic crops stored in a chemical warehouse. A decomposition of N-P-K goods made a reason of major blaze, producing a heavy harmful toxic plume that finally dissolved and spread over the ocean. Furthermore, 1500 family were displaced as protection. Eventually, an experimental evaluation of the plume harmful toxic proved the infectious toxicity of the emanation [20].
2018, 23rd July	California, USA	California possesses the redwood forest, Mojave desert, central valley farmland Sierra Nevada mountains and cliff-lined beaches. The massive fire recorded with (3318.422 Sq.km) has completely burned. In the north side, 1214.056 Sq.km) area of Mendocino complex have fully damaged. Mendocino fire has destroyed the rural area of the state. In addition to, car fire 1000 homes burned eight dead bodies found. Furthermore, Ferguson fire has burned the two famous national parks. Yosemite National Port and Sierra National Forest [21]
2011, 9th December	(AMRI Hospital Fire), India Kolkata	The massive disaster at a private hospital in Calcutta, India. The short circuit ignition has taken 89 lives and huge economic losses in the history. The illegal storage of flammable material became the reason for more fire [22].
1987, June	OHIO, USA	1.5 million barrel paint stored at Sherwin Williams point warehouse. Several aquifers were located near the warehouse. The pollution spread all over the aquifer location [23].

Case Study

The ring spinning department has the extreme ability of fire contaminants. The ring spinning section is very close to workers break room and cotton inspection laboratory. The speed of the ring machine is nearly 16000~17000 RPM which is the highest speed range all over the industry [24]. The ring machines continuously operate nearly 24 hours. The inadequacy electrical wires, devices and equipment are preserved in the ring section room. The long time and high rotation increase the heat level of any equipment's and material.

Mock fire drill

The practicing method of fire drill that how a building would be evacuated during the fire accident in the emergency circumstances. The purpose of this drill is to active the fire protection system in the workplace. Furthermore, workers and people easily evacuated to the safe region. The time is necessary to measure the evacuation that it happens within a tolerable period of time. The timing of alarm duration is a cause will support recognize the type of disaster situation at the workers place. The alarm duration may vary for every incident such as fire occurs and pressure release in any place, unexpectedly the boiler temperature increased. The technical fault makes the protection level failure during the emergency time. Therefore, the numerous accidents have taken the lives of people and workers due to unskilled evacuation training during the emergency condition. The safety trainer or

supervisor should manage the mock fire drill in all industry. The educational sectors, college, school and industries must follow the practices of fire mock drill. According to the factory act 1948 demonstrates that every industry should contact mock fire drill in the monthly or periodic time interval. The workers and people get awareness about the emergency condition during fire accident at the workplace.

Sample position of fire and emergency door

Figure 9 shows the sample position of fire and emergency door; the position of fire and worker running path, the location of emergency door placed as imaginary. The priority has given by workers to reach the normal and emergency door. The evacuation running paths are clearly noticed. There were 3 different way of the approach used to collect diverse time duration data. The study of Shanmuga et al. [25] shows that the duration of evacuation first trail was 67 second, second was 28 seconds while third was 85 seconds. Furthermore, researcher recommended the south side right corner for emergency door and second trail duration of evacuation time was very low which were not accepted by the researcher for evacuation process.

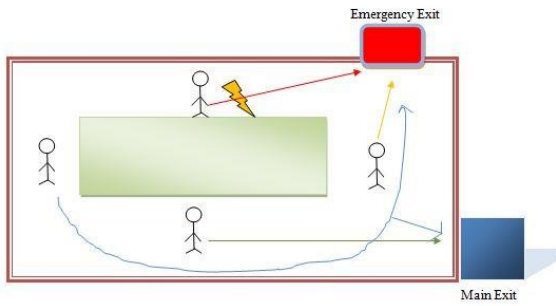


Figure 9 Sample position of fire and emergency door (Research of Shanmuga et al.) [25].

Trial-1

Workers	Illustration 1	
	Time (sec)	P-R
A	2	3
B	15	2
C	20	0
D	30	1

Trial-2

Workers	Illustration 1	
	Time (sec)	P-R
A	5	3
B	5	2
C	10	0
D	8	2

Trial-3

Workers	Illustration 1	
	Time (sec)	P-R
A	10	3
B	5	0
C	40	2
D	30	3

Figure 10 Three different trials to collect diverse time duration data [25].

According to my research, spinning ring department, due to high air pressure in the pipes. Within seconds the fire erupted and covered the whole department. During the emergency, only one emergency exit door is not enough to make proper evacuation in a short time. In first trial and third trial (time 67 and 85 seconds), both are too much time for evacuation process and may be chances loss of human life as in Figure 10.

Figure 11 shows that if fire engulfed North to South area then (A and B) section have no evacuation and emergency exit; where the workers will go, ultimately they will burn and lose their life. In section C and D, the workers can easily evacuate due to one emergency exit. According to this situation, the ring department should have two emergency exits for evacuation in a short time. R.F stands for ring frame.

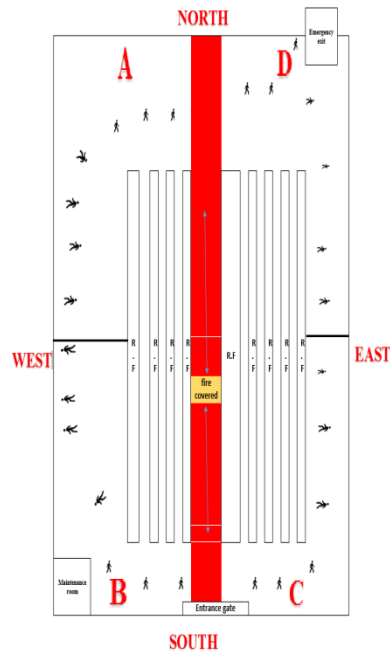


Figure 11 Ring spinning department with only one emergency exit [25].

The north side and south side covered with fire; no way to escape out. But in this figure two emergency exits has mentioned as shown in Figure 12. During this situation, A and B side peoples will easily evacuate, because there is one emergency gate. While in section C and D people will also easily evacuate. One emergency gate is not enough in the spinning department for rapid evacuation. There should be two emergency gate for rapid evacuation in spinning ring department.

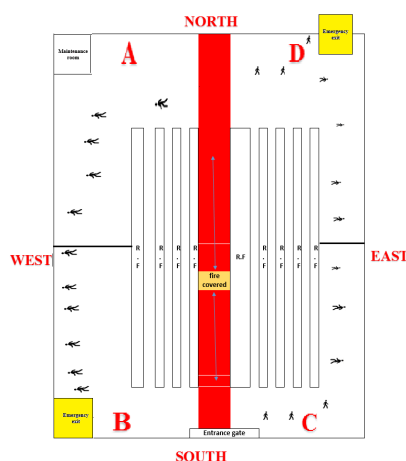


Figure 12 Ring spinning department with two emergency exits (Researcher study).

Conclusion

Majority fire accidents have seen in the textile industry of Pakistan and Bangladesh; which develops property losses and heavy lives. Fires are harmful events with substantial prices for human life and property. The measurement of the quick and fire direct costs given a metric for accepting the economic and social impact of fire and for evaluating development in fire protection and prevention. The technical fault makes the protection level failure during the emergency time. Therefore, the numerous accidents have taken the lives of people and workers due to unskilled evacuation training during the emergency condition. There is a need to make the proper infrastructure of fire safety in Pakistan and Bangladesh textile industry. The safety trainer or supervisor should manage the mock fire drill in all industry. One emergency gate is not enough in the spinning department for rapid evacuation. There should be two emergency gates for rapid evacuation in spinning ring department. The recommendation has been taken as an important point in the industry. This study will help industry management and government department.

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