

# **Study of Existing Safety Signs in Three Selected Thermal Power Plants Situated in Sylhet Division, Bangladesh**

**Mohammad Iqbal<sup>1</sup>, Md. Abdul Aziz<sup>1</sup>, A. T. M. Sayeed Istiaque<sup>1</sup>**

<sup>1</sup>Department of Industrial and Production Engineering

Shahjalal University of Science and Technology

Sylhet-3114, Bangladesh

iqbalm\_ipe@yahoo.com, aziz.sustipe16@gmail.com, sayeedistiaque@gmail.com

## **Abstract**

Use of safety signs is one of the ways for controlling hazards in the work environment. Safety signs are used to increase human awareness, prevent unwanted situations of the employees and visitors in workplace. Safety signs are used to effectively control workplace hazards. Correct usage of safety signs is vital, in order to prevent injury and save lives as well as properties. This study tried to find the existing workplace safety signs in three selected thermal power plants namely Sylhet 150 MW Combined Cycle Power Plant, Fenchuganj 90 MW Combined Cycle Power Plant and Bibiyana South 400 MW Combined Cycle Power Plant. The research concluded that out of the 15 signs, "no smoking" and "high voltage" signs had the highest use at necessary places of posting safety signs. However, some of the standard safety signs were not used in the studied thermal power plants. Results show that overall safety sign usage within the studied thermal power plants was satisfactory for Bibiyana South 400 MW Combined Cycle Power Plant. But the other two thermal power plants namely Sylhet 150 MW Power Plant and Fenchuganj 90 MW Power Plant require to implement suggested safety signs at hazardous areas for a better safety culture.

## **Keywords**

Safety Signs, Thermal power plant, Cognitive Ergonomics, OHSAS

## **1. Introduction**

Safety is one of the prime concerns worldwide. Nowadays, Bangladesh Government is realizing the importance of occupational health and safety in the workplaces and industries. The government is emphasizing much on this matter. Accidents and injuries related to work are a major occupational health problem in most of the industrialized countries. Worldwide, there are around 340 million occupational accidents and 160 million victims of work-related illnesses annually. The ILO updates these estimates at intervals, and the updates indicate an increase of accidents and ill health [1]. Accident and ill-health record of the thermal power plants compares poorly to that of other economic sectors such as manufacturing, construction and railway. Safety assessment and safety management in thermal power plants are necessary to ensure workers safety as well as the safety of the facility. The reasons for the use of safety signs in industries are (i) To draw attention to health and safety hazards. (ii) To point out hazards that may not be obvious. (iii) To provide general information and directions. (iv) To remind employees where personal protective equipment must be worn. (v) To show where emergency equipment is located. (vi) To indicate where certain actions are prohibited. (vii) To improve the working procedures and working conditions. (viii) To develop safety awareness. (ix) To minimize the loss due to accidents. (x) To save the employers from injuries, accidents. (xi) To prevent dangerous move or work in restricted areas. (xii) To prevent unnecessary access to the restricted areas and (xiii) To minimize the possibility of hazards.

What will happen without safety signs in Industries: A power plant is an industrial facility that generates electric power. In thermal power plant mechanical power is generated by a heat engine that transforms thermal energy often from combustion of a fuel, into rotational energy. This generation of electricity involves a wide range of hazards and emergencies and potential threats. In order to prevent and/or mitigate those workplace hazards and emergencies, proper usage of many safety signs is very important.

Consequence of not using safety signs in industries: An absence of safety example if a "Slippery floor" safety sign is not used; people might not be aware of it and many of them might slip and fall causing them injuries. If an "Emergency fire exit" sign is not used, people might not know where a fire exit is during a fire accident and might try to escape from the fire by jumping from a several stories high and this might even cause death. If traffic signs were not used, there have been much more road accidents and traffic jam. If "No smoking" sign is not used in gas stations, people might not be aware of it and thus huge accident may pose many potential threats. Without having those safety signs, people would not know and would not prepare themselves for any danger

that they might face which can even hurt them. If there are no safety signs, there would definitely be chaos in every factory and industries all over the world.

## 2. Literature Review of Previous Works

This section deals with the previous research works related to the proposed research work. Literature review means studying the existing studies relevant to proposed study. It is essential to make manifest the relevance of the resource of the mass of knowledge and to conduct the research work successfully. A literature review was conducted in this study by assessing different articles about safety signs related issues and topics. BetyWeiler, Heather Zeppel, Rob Saunders and Pascal Scherrer in their research paper titled “A review of safety signage for Queensland Parks and Wildlife Service: report 1: literature review” tested comprehension and effectiveness of warning signs and symbols in Queensland parks and wildlife service in 2015 [2]. Four researchers namely Amirhossein Davoudian Talab, Mohsen Meshkani, AmirabbasMofidi, and Mahdi Mollakazemiha in their paper namely “Evaluation of the perception of workplace safety signs and effective factors” carried out a study in 2012 on 166 factory workers in 4 factories at the Khoramdasht to evaluate the perception of workplace safety signs and effective factors [3]. In another paper titled “Comprehension of workplace safety signs: A case study in Shiraz industrial park” four authors Zamanian Z, Afshin A, Davoudiantalab AH, Hashemi H tried to show that there is a significant difference in comprehensions of tested safety signs. For full comprehension of safety signs, it is necessary to train the employees or add supplementary texts to the symbols in some cases [4]. Amir Hossein, Davoudian Talab, and Gholam Reza Azari in their paper titled “Safety Signs Perception and Adoption with the ISO and ANSI Standard” tried to survey about the perception of safety signs and adoption with ISO and ANSI standards in October, 2017 [8].

### 2.1 Research gap

The above section discussed the previous research works done so far in the field of safety signs related to this paper. Issues related to safety signs has become major concern all over the world. A lot of research works have been carried out by many authors regarding safety signs. But very few researches have been conducted in Bangladesh.

Table 1: Summary of Studies on safety signs.

Sources	Objectives	Methodology
BetyWeiler, Heather Zeppel, Rob Saunders and Pascal Scherrer (2015)	To comprehend the effectiveness of warning signs and symbols in Queensland parks and wildlife service.	Empirical/Case Study
Amirhossein Davoudian Talab, Mohsen Meshkani, AmirabbasMofidi, and Mahdi Mollakazemiha (2012)	To evaluation the perception of workplace safety signs and effective factors.	Empirical/Case Study
Zamanian Z, Afshin A, Davoudiantalab AH, Hashemi H (2018)	To assess the comprehension of workplace safety signs in Shiraz industrial park.	Empirical/Case Study
Amir Hossein, Davoudian Talab, and Gholam Reza Azari (2017)	Surveying perception of safety signs and adoption with ISO and ANSI standards.	Empirical/Case Study

Different researchers worked on safety signs in many workplaces. However, there has been a lack of study of only safety signs in in thermal power plants worldwide. Research work on existing safety signs in thermal power plants has not yet been conducted in Sylhet city. So, this work will be the first one regarding safety signs in thermal power plants in Sylhet city, Bangladesh.

### 3. Objectives

The objectives of this study are:

- i. To study the existing safety signs in three selected thermal power plants situated in Sylhet, Bangladesh.
- ii. To compare the existing safety signs of the three selected thermal power plants.

### 4. Methodology

#### 4.1 Questionnaire Development

Action plan shown in figure 4.1 describes logical and sequential progress involved in this study.

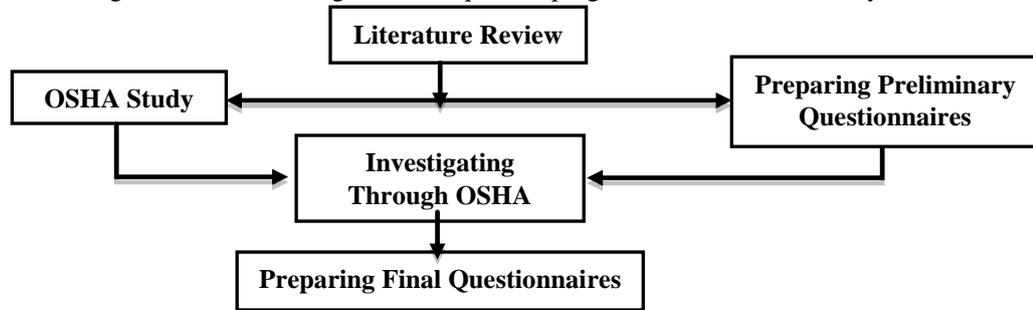


Figure 4.1: Process of Questionnaire Development.

Questionnaire is called the list of a research or survey questions asked to respondents and designed to extract specific information. It serves four basic purposes: to (1) collect the appropriate data, (2) make data comparable and amenable to analysis, (3) minimize bias in formulating and asking questions, and (4) to make questions engaging and varied. This study has been mainly conducted with the help of a questionnaire containing 15 safety signs selected based on the OSHA (Occupational Safety and Health Administration) standard. Five types of safety signs were included in the questionnaire like danger signs, warning signs, caution signs, notice signs, and safety instruction signs [5]. Initially 20 safety signs were selected. However, 15 safety signs were usable for this study based on safety experts' opinions. A field study was carried out in different sections of the three selected thermal power plants to visually check the presence or absence of those safety signs.

Table 4.1: Standard safety signs generally used in thermal power plants [5].

Safety Sign	Place of Application
	Name: DANGER. HIGH VOLTAGE. Place: High Voltage Area
	Name: DANGER. HOT STEAM PIPES. Place: Places, where hot steam pipes pass through.
	Name: MOBILE PHONE PROHIBITED. Place: Workplaces at a height.
	Name: SPEED LIMIT. Place: At necessary places by the roadside inside the plant area.
	Name: STOP SMOKING. Place: Workplaces.
	Name: CAUTION! WEAR PROTECTIVE EQUIPMENT. Place: Different workplaces, where PPE is necessary.
	Name: Unauthorized Vehicles NOT PERMITTED. Place: At the entrance of workplaces, where necessary.
	Name: DANGER. SULFURIC ACID. Place: Workplaces or storage of Sulfuric acid.
	Name: FIRST AID. Place: Storage of First Aid.
	Name: WARNING! DO NOT WALK UNDER HANGING LOAD. Place: Workplaces under heavy loads.

	Name: SLIPPERY WHEN WET. Place: At slippery places.		Name: NO ENTRY. Place: Control room and other restricted areas.
	Name: DANGER. ELECTRIC SHOCK HAZARD. Place: Electrical circuits and boards.		Name: FOOT PROTECTION IS MUST. Place: At hazardous working areas.
	Name: FIRE EXTINGUISHER. Place: At different departments.		

## 5. Analysis

The primary importance of displaying Safety Signs is to prevent injury and ensure staff and visitors are well aware of the possible dangers and hazards ahead in certain situations and/or environments. Without signs, many employees would lack the necessary direction in times of crisis, and employers might find themselves in significant legal difficulties if any accidents were to arise as a result.

The following table 5.1 shows the existing safety signs used in the three selected thermal power plants namely Sylhet 150 MW Combined Cycle Power Plant, Fenchuganj 90 MW Combined Cycle Power Plant and Bibiyana South 400 MW Combined Cycle Power Plant in Sylhet division, Bangladesh.

Table 5.1: Condition of existing safety signs as in the three selected thermal power plants [5].

Safety Sign	Place of Application	Existing Practice			Cost
		Fenchuganj 90 MW Power Plant	Sylhet 150 MW Power Plant	Bibiyana South 400 MW Power Plant	
	Name: DANGER. HIGH VOLTAGE. Place: High Voltage Area	Yes	Yes	Yes	
	Name: DANGER. HOT STEAM PIPES. Place: Places, where hot steam pipes pass through.	Yes	No	Yes	50x5=250 Taka
	Name: MOBILE PHONE PROHIBITED. Place: Workplaces at a height.	No	No	Yes	40x3=120 Taka
	Name: SPEED LIMIT. Place: At necessary places by the roadside inside the plant area.	No	No	Yes	50x3=150 Taka
	Name: STOP SMOKING. Place: Workplaces.	Yes	Yes	Yes	
	Name: CAUTION! WEAR PROTECTIVE EQUIPMENT. Place: Different workplaces, where PPE is necessary.	Yes	Yes	No	50x2=100 Taka

	Name: Unauthorized Vehicles NOT PERMITTED. Place: At the entrance of workplaces, where necessary.	No	No	Yes	40x3=120 Taka
	Name: DANGER. SULFURIC ACID. Place: Workplaces or storage of Sulfuric acid.	No	No	Yes	50x2=100 Taka
	Name: FIRST AID. Place: Storage of First Aid.	Yes	Yes	No	40x3=120 Taka
	Name: WARNING! DO NOT WALK UNDER HANGING LOAD. Place: Workplaces under hanging loads.	No	Yes	Yes	50x3=150 Taka
	Name: SLIPPERY WHEN WET. Place: At slippery places.	Yes	No	Yes	50x2=100 Taka
	Name: DANGER. ELECTRIC SHOCK HAZARD. Place: Electrical circuits and boards.	Yes	Yes	Yes	
	Name: FIRE EXTINGUISHER. Place: At different departments.	Yes	No	Yes	50x3=150 Taka
	Name: NO ENTRY. Place: Control room and other restricted areas.	No	Yes	Yes	40x3=120 Taka
	Name: FOOT PROTECTION IS MUST. Place: At hazardous working areas.	Yes	Yes	Yes	

Table 5.1 compares the existing safety signs scenarios of the three selected thermal power plants. From the table 5.1, it is seen that, Bibiyana South 400 MW Combined Cycle Power Plant, Bibiyana, Habiganj uses maximum number of safety signs as required to warn the workers and other staffs about various potential hazards. The safety condition of Sylhet 150 MW Power Plant is comparatively better than that of Fenchuganj 90 MW Combined Cycle Power Plant, Fenchuganj, Sylhet.

## 6. Findings

Fenchuganj 90 MW Combined Cycle Power Plant, Fenchuganj, Sylhet practice 9 safety signs, Sylhet 150 MW Combined Cycle Power Plant, Kumargaon, Sylhet practice 8 safety signs and Bibiyana South 400 MW Combined Cycle Power Plant, Bibiyana, Habiganj practice 13 safety signs out of 15 safety signs. Out of the 15 safety signs all the three thermal power plants practice four safety signs namely “High voltage”, “Smoking is prohibited”, “Electrical shock hazard” and “Foot protection must be worn”. While other safety signs are missing in some plants. Bibiyana South 400 MW Combined Cycle Power Plant, Bibiyana, Habiganj practice 13 safety signs out of 15 safety signs. This is the highest among the three thermal power plants. Fenchuganj 90 MW Combined Cycle Power Plant, Fenchuganj, Sylhet and Sylhet 150 MW Combined Cycle Power Plant,

Kumargaon, Sylhet practice very few safety signs to warn the workers and other personnel about any potential hazard.

## 7. Conclusion

To ensure the proper functioning of an industry, safety signs must be used. It doesn't prevent danger from occurring. But it provides message for workers and visitors so that they will not do something that will cause them danger or cause any accident that may take away the lives of the workers of the factories. Signs also provide information that may be used in times of emergency like the first aid box sign or the fire extinguisher sign. If fire extinguisher signs are not used, if there is fire in the workplace, valuable time might be wasted to search the fire extinguisher and more damage might be wasted to search the fire extinguisher and more damage might be done by that time [2].

This study has tried to compare the existing safety signs in three selected thermal power plants namely Sylhet 150 MW Combined Cycle Thermal Power Plant, Kumargaon, Sylhet, Fenchuganj 90 MW Combined Cycle Thermal Power Plant, Fenchuganj, Sylhet and Bibiyana South 400 MW Combined Cycle Thermal Power Plant, Habiganj, Sylhet. In order to establish such a good safety culture in the workplace in thermal power plants practice of safety signs is very important. This study discussed the existing safety signs practice in those three selected thermal power plants with a view to improving the OH&S situation in the organizations. The study showed that Bibiyana south 400 MW thermal power plant practice 80% of the standard safety signs.

## References

- ilo.org. (2019). World Statistic [online] Available at: [https://www.ilo.org/moscow/areas-of-work/occupational-safety-and-health/WCMS\\_249278/lang--en/index](https://www.ilo.org/moscow/areas-of-work/occupational-safety-and-health/WCMS_249278/lang--en/index).  
<http://www.ehow.com/about/5137081-safety-signs-meanings.html>
- Scherrer, Pascal & Weiler, Betty & Zeppel, Heather & Saunders, Rob. (2015). A review of safety signage for Queensland Parks and Wildlife Service - Report 1: LITERATURE REVIEW. 10.13140/RG.2.1.2103.9840.
- Mofidi, Amir. (2013). Evaluation of the Perception of Workplace Safety Signs and Effective Factors. *International Journal of Occupational Hygiene*.  
<https://www.creativesafetysupply.com/qa/safety-signs/types-of-workplace-signs>
- Zamanian, Zahra & Afshin, A & Davoudiantalab, AH & Hashemi, Hassan. (2013). Comprehension of workplace safety signs: A case study in Shiraz industrial park. *Journal of Occupational Health and Epidemiology*. 2. 37-43. 10.18869/acadpub.johe.2.1.2.37.  
<https://www.creativesafetysupply.com/signs/safety-signs/>
- Davoudian Talab A H, Azari G R. Safety Signs Perception and Adoption with the ISO and ANSI Standards, *Jundishapur J Health Sci*. 2017 ; 9(4):e12911

## Biographies

**Professor Dr. Mohammad Iqbal** is currently serving as a Professor at Shahjalal University of Science and Technology (SUST) under the Department of Industrial and Production. He is the founder lecturer of Department of Industrial and Production, SUST. He served as the Head of the dept. for 13 years. Dr. Iqbal was the Dean of School of Applied Science and Technology for two years. He was the Head of Petroleum and Mineral Engineering Dept. Shahjalal University of Science and Technology (SUST), Sylhet, Bangladesh for one year. He has 28 years of industrial, research and teaching experiences along with the working scopes in a development organization. He was a member, Peer Review Committee on Engineering & Applied Science, Ministry of Science, Information and Communication, Republic of Bangladesh Government for the selection and peer review of different research projects for the financial year June 2006-July 2007. He has more than 80 National and International publications in Conference proceedings. He is a member of Institution of Engineers, Bangladesh. He is a member secretary of IEB Sylhet Centre, Sylhet, Bangladesh. Dr. Mohammad Iqbal is the Conference Chair of IEOM society of Bangladesh.

**Md Abdul Azizis** a B.Sc. student of the Department of Industrial and Production Engineering in Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh. His research interests include supply chain, operations research, reliability, scheduling, manufacturing, and lean.

**A.T.M Sayeed Istiaqueis** a B.Sc. student of the Department of Industrial and Production Engineering in Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh. His research interests include product designing, simulation, manufacturing, scheduling, and lean.