

Planning And Installation of Water Spray System in The Underground for The Fire Hazard Prevention in PC. GKBI Production Unit



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ABSTRACT: Fire is a serious risk that can cause great losses, both moral and material. This study evaluates fire prevention and control at PC. GKBI Medari, which recently experienced a major fire due to lack of fire detection. Using the AS/NZS 4360: 2004 method, nine hazards with high, medium, and low risks were found. In the underground area of the cambric factory, there are deficiencies in the existing fire extinguishing system, especially in dealing with invisible fires. Hot and dirty air is sucked and channelled through PVC ducts to the air filter, but this system is not effective in extinguishing fires. This study recommends the installation of water spray at several underground points to improve fire protection.

KEYWORDS: fire protection, hazard, water spray

I. INTRODUCTION

Industrial development in various sectors is expected to provide benefits for the nation's progress. Existing industries can be divided into large, medium and small industries. Industrial development aims are to increase employment opportunities, improve the quality of development, and improve the welfare of society. However, efforts to implement and prevent the risk of danger occurring in the workplace are often inadequate, one of which is the risk of accidents. One of the dangers that can occur in the workplace is fire. According to Tarwaka (2012), fires can occur at any time and anywhere, because of many opportunities that can trigger them. Many accidents are currently occurring, including fires in several large and small industrial companies. Various factors could be the cause of this incident. It is not only companies that experience losses, but workers also experience damage and loss. This creates a big problem that must be overcome by preventing and controlling the sources that can cause this problem.

Several fires have hit factories both domestically and abroad, including a fire at a furniture factory in northern Egypt in 2015 that killed at least 25 workers (Islam Pos, 2015). Furthermore, a fire that occurred at PT Mandom Indonesia Tbk in the Jakarta area in 2015 killed six people and injured 52 other workers (Islam Pos, 2015). A similar incident also happened to a factory in PC.GKBI is a textile factory located in Sleman, Yogyakarta. This incident occurred on 16 May 2023, according to the data obtained there were no fatalities, but six employees suffered respiratory problems and were referred to Sleman Regional Hospital (Sutriyanta, 2023). It is suspected that the fire originated from an electrical short circuit on a machine in the factory. The fire was first noticed from the ACL JC4 machine by the operator. The operator then reported the incident to the head of maintenance (Sutriyanta, 2023).

Although some factories have implemented fire prevention and suppression systems, fires can still occur. Poorly monitored sources of fire hazards allow this to happen. With the issuance of the Regulation of the Minister of Manpower of the Republic of Indonesia No. 186 of 1999 on Fire Fighting Units in the Workplace, Regulation of the Minister of Manpower and Transmigration No. 4 of 1980 on Requirements for the Installation and Maintenance of Light Fire Extinguishers, and Regulation of the Minister of Manpower No. 2 of 1983 on the Installation of Automated Fire Alarms, shows that fire is a very important issue to be addressed. PC.GKBI Indonesia is a textile factory. Located at Jalan Magelang Km 14 Sebayu Medari, Sleman, Yogyakarta, Indonesia.

During the production process, the use of materials and equipment can easily cause fires and explosions. Continuous operation of the machine can also create a fire hazard. In the production room, textile machines in their operations generate heat and dirt in the form of flying waste or dirt that flies around. The waste is flammable and must be removed to fresh air. The process is like that, the hot and dirty air in the production room is sucked in by the return motor through the PVC air duct which is placed under the

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machine, centrally going into the underground (bottom of the floor). Then it will be pulled into the rotary air filter and thrown out. So, there is a lot of dirt on this route which, if there is a fire, is difficult to extinguish. Therefore, fire prevention and extinguishing to minimize the risk of fire and explosion is very necessary. In the production room, special installations need to be made to protect against fire. For example, making water installations from iron pipes with diameters of 3" and 4".

Fire prevention and control facilities such as light fire extinguishers (APAR), hydrants, sprinklers, and fire alarms are available, APAR is provided in every room of the company. Two fire extinguishers and fire alarms are installed in the security room. Fire extinguishers are also available in every production area of the company. Fire extinguishers are used to control small fires and with fire alarm detection in each production area of the company.

Electrical short circuits can also occur and cause sparks and small fires. Continuous use of machines for 24 hours is also one of the factors causing fire problems in the company. A hot engine exposed to flammable materials will cause smoke and sparks.

This prevention and control is by maximizing the performance and function of fire prevention and control facilities. If it is functioning optimally, then the occupational health and safety of workers can be fulfilled and implemented. Based on the description above, the author is interested in analyzing the availability of fire prevention and control facilities as an effort to reduce losses due to fires in PC.GKBI, Indonesia.

The purpose of this case study is to find answers to the problems formulated to find out how to prevent and control fires that have been implemented at PC.GKBI Medari, because some time ago there was a fire at the cambric factory which allegedly no one knew about the fire and it caused a large fire.

II. METHOD

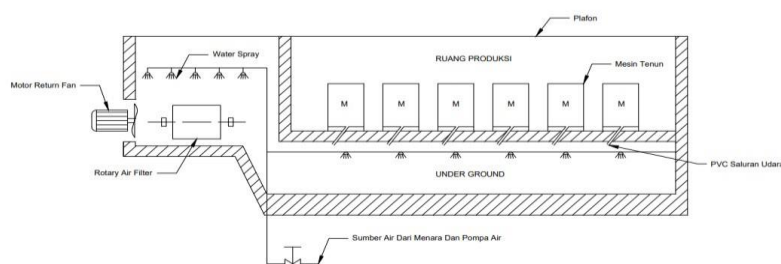
The research method is a structured and systematic work step to solve the problems found in this research. These stages include literature study and field study of research objects, formulation of research problems, literature study, finding out research objectives, collecting and processing data, and making conclusions and suggestions. In addition, risk assessment analysis was carried out using the AS/NZS 4360: 2004 method.

III. RESEARCH RESULT The Implementation of Planning and Installation of Water Spray System in the Underground for Fire Hazard Management in PC.GK Production Unit 1. Planning

A textile industry will generate hot air, especially in parts of the production room where there are operating machines and cause dirt in the form of flying waste or dirt that flies and pollutes the air in the production room. The nature of the dirt itself is very flammable so it must be removed indoors and replaced with fresh air so that air circulation runs smoothly. Therefore, it is necessary to create and install a security system against fire hazards.

This project is an update of the previous system, where hot and dirty air in the production room is sucked in by the return fan motor through PVC air ducts which are placed at the bottom of the machine in the production room. The dirty air that is sucked in is channeled and concentrated into the underground (hallway under the production floor) to the rotary air filter to be thrown out of the room. There is a drawback to this system, namely that when a fire occurs underground, the fire is difficult to extinguish.

Therefore, it is necessary to plan the manufacture and installation of water spray underground at several points according to the number of PVC air ducts. The first thing to do in planning is determine the materials that will be used, the materials that will be used are iron pipes with diameters of 3 and 4 inches. The second is making a water spray channel installation plan in the form of a drawing of the system to be created.



Picture 1 Production Room of PC.GKBI

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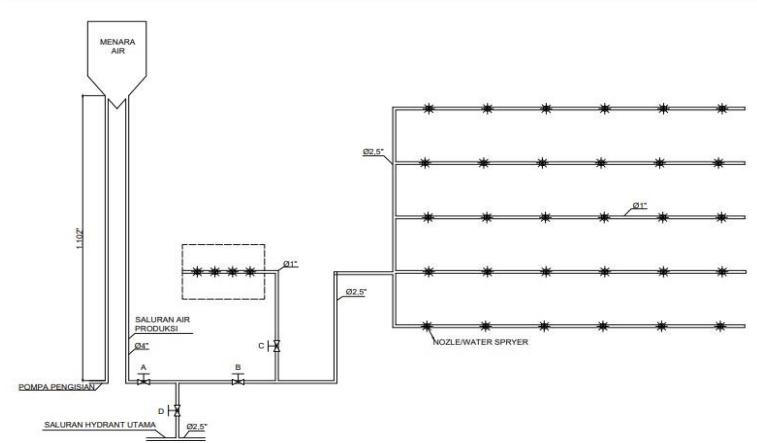


Figure 1. Manual Working System

2. Organizing

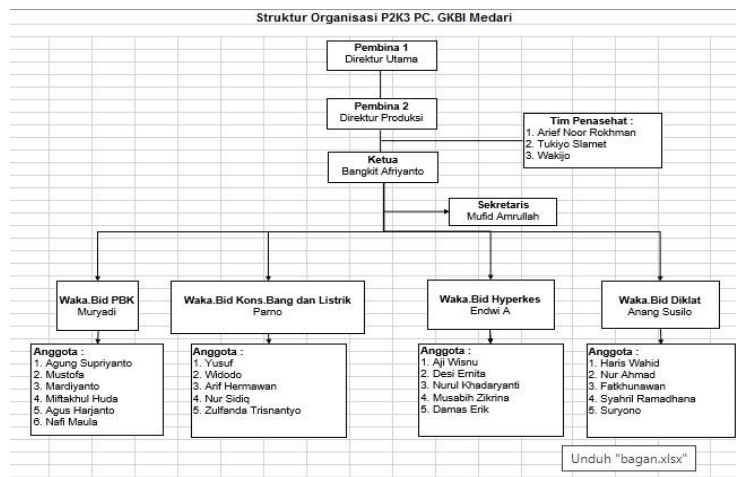


Figure 2. Organizing

3. Actuating

After determining the materials and making installation drawings, the next step is the process of making a water spray system in the hallway under the production floor. In this system the working mechanism is manual, when smoke and the smell of fire are detected in the underground passage by the five senses, the first thing to do is open the water spray flow valve manually.



Figure 3. Water Installation' on the Divider to Each Unit



Figure 4. Water Tower' for Production and Hydrant



Figure 5. Hydrant Pump



Figure 6. Water Spray Installation' in Underground

4. Controlling

Fire risk control in production rooms includes several key aspects. First, identify the type of fire extinguisher used, such as a light fire extinguisher (APAR), portable fire extinguisher, sprinkler system, smoke detection system, and fire alarm system. Regular maintenance is an important step to ensure all equipment is in good condition; this includes periodically checking expiration dates, pressure and physical integrity as well as ensuring tools come with clear labels and usage guidelines. Employee training is crucial, so they can use fire extinguishers correctly, follow evacuation procedures, and take other emergency actions. Regular inspection of the fire suppression system is also necessary to ensure optimal function, with repair or replacement if problems are discovered. Placement of fire extinguishers must be in a location that is easily accessible and visible, without being obstructed by objects. In an emergency, immediately activate the fire alarm, call the fire service, and use extinguishers with caution if safe. If a fire cannot be controlled, the top priority is employee evacuation by following established procedures. After a fire incident or drill, conduct an evaluation to improve the response and update the contingency plan according to changes in production conditions or technology. Controlling fire extinguishers in the production room is a crucial step in maintaining safety and reducing the risk of fire.

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Outcomes and Impacts of Planning and Installation of Water Spray Systems In Underground for Overcoming Fire Hazards in PC.GKBI Production Unit

This project aims to improve the fire extinguishing system in the factory by focusing on several key aspects. First, updating the fire extinguishing system includes identifying critical areas, such as production rooms, that require additional protection, in particular through the installation of a water spray system in the hallway under the production floor. Second, the effectiveness analysis aims to evaluate the extent to which the installation of underground equipment has succeeded in preventing and overcoming fires, including comparing the level of damage before and after the implementation of the new system. Third, policy recommendations will be developed to provide advice to companies, governments or regulatory bodies on how to improve safety and fire protection standards in similar factories. Fourth, risk identification from case studies will help identify specific risks associated with a particular type of factory or industry and provide suggestions for mitigating them. At this risk assessment stage, the level of risk can be determined in terms of the chance of a work accident occurring (probability) and the severity of the hazard (severity). The probability measurement parameter used in this case study is how often activities occur which include unsafe acts and unsafe conditions which could have the potential to become work accidents/fires. The impact of potential hazards discovered in the previous stage is then analyzed using a risk matrix table to obtain a risk rating for each hazard by considering its probability and severity.

Table 1. Risk Assessment

No.	Hazard Identification	Risk	Rating Risk (Scale)		Risk Rating
			Probability	Severity	
1.	Burnt capacitor in lighting lamp TL AJL Line 3 RS 190	Fire and smoke in lighting area and Mablo	Often (4)	Weight (4)	Hight
2.	Tyng cable short circuit / chafing cable peeling off at Loom 2 Machine Number 31 N	Fire / burning warp in the weaving beam and fabric in the machine	Moderate (3)	Moderate (3)	Moderate
3.	A short circuit in Box Panel Loom II	Fire in machine number 8 H	Moderate (3)	Moderate (3)	Moderate
4.	Cable chipped due to friction with side lever cup	Fire in machine number 3 S Loom III	Moderate (3)	Moderate (3)	Moderate
5.	The cable peeled off due to friction with the belt protector	Fire in Loom II Engine number 4 H	Moderate (3)	Moderate (3)	Moderate
No.	Hazard Identification	Risk	Rating Risk (Scale)		Risk Rating
			Probability	Severity	
6.	Friction between pulley and machine body due to bearing failure	Fire in pallet machine set 15	Moderate (3)	Moderate (3)	Moderate
7.	Friction between axle and jack lever due to nonoptimal lubrication, worn bearings, dirty	Fire in Engine H 3 AJL	Moderate (3)	Moderate (3)	Moderate
8.	Cable chafing in the cable terminal box area behind the engine motor	Fire at machine 32 H Loom II	Moderate (3)	Moderate (3)	Moderate
9.	Loose picking parts fell on a running machine causing sparks	Fire on Machine number 8H Loom II	Rare (2)	Low (2)	Low

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This project includes several important outcomes to improve the fire extinguishing system systems in the factory. First, comprehensive fire data collection and analysis will be carried out to plan further prevention measures and track safety trends. This data will help in understanding fire patterns and determining areas for improvement. Second, this project aims to increase awareness among factory personnel about the importance of fire safety, including evacuation procedures and the use of fire extinguishing systems. Effective training and communication will be key in ensuring that all employees understand their responsibilities in emergencies. Third, the project will assist in the development or updating of emergency plans appropriate to the case study findings, including evacuation procedures, emergency communications, and actions to be taken during a fire. This plan will ensure that the factory has a clear and coordinated strategy to deal with fire situations effectively.

The planning and installation of water spray system in underground for fire hazard management in the PC.GKBI Production Unit has the following impacts:

1. Fire Risk Reduction

Implementation of an effective fire management system can significantly reduce the risk of fire in a textile factory. This can involve the use of modern fire-fighting equipment, reliable fire-detection systems, and strict safety procedures.

2. Improved Employee Safety

The most important impact is the improvement of employee safety. With a good system in place, employees will be better prepared for emergencies and quicker to take appropriate action in the event of a fire.

3. Asset Protection

An effective fire management system can help protect plant assets, such as machinery, equipment, raw materials, and finished products, from fire damage. This can save the cost of repairing or replacing damaged assets.

4. Improved Company Reputation

Companies that demonstrate a commitment to employee safety and asset protection have a better reputation in the industry and with consumers. This can help retain and attract customers and investors.

5. Regulatory Compliance

The project can ensure that the plant complies with all applicable regulations and safety standards. This can save the company from legal sanctions and fines that may be imposed if they violate safety regulations.

6. More Efficient Emergency Investigation and Response

A good fire management system can speed up the process of investigation and emergency response in a fire situation. This can reduce losses and risks that may arise.

7. Improved Operational Efficiency

A well-integrated fire management system can also improve operational efficiency. This can include faster incident reporting, early warnings that enable faster intervention, and faster restoration of operations after a fire incident.

8. Less Downtime

In some cases, the project can reduce plant downtime due to fire. This can save time and money spent on full recovery from the incident.

9. Improved Crisis Readiness:

Factories that have a good fire management system are also better prepared for other crises, such as natural disasters or other security incidents.

10. Decreased Insurance Costs

A company with a robust fire management system may get lower insurance premiums as it is considered a lower risk. In addition, the obstacles and challenges in the planning and installation of the underground water spray system for fire hazard prevention in the PC.GKBI Production Unit includes:

1.Constraints: Not having adequate planning for fire pipe maintenance. Pipes that are not maintained can experience corrosion or other damage over time. This damage can lead to water leakage or even structural damage to the pipes.

2.Countermeasures: Create a scheduled maintenance plan and ensure all staff are trained in the use of fire equipment. Then, conduct regular visual inspections and checks of the pipe wall thickness. Damaged or corroded pipes should be replaced immediately. Painting pipes to prevent corrosion can also be a preventive measure.

IV. CONCLUSIONS

Based on the explanation that has been explained, the conclusions are as follows:

1. A new system has been found related to fire prevention that occurs in the underground area of the production machine section at PC GKBI. The system used is the installation of pipes under the ground with iron pipes with a diameter of 3 and 4 inches.

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With this system, it can prevent fires, because if a hot engine or spark is detected, it can immediately turn on this installation and water will automatically flow and extinguish the fire without having to have workers enter the underground area.

2. GKBI Medari Cambric Factory using AS/NZS 4360: 2004 has hazard factors that have a high rating, from the identification of hazards carried out in unsafe conditions and unsafe acts, 9 (nine) hazards were found, namely cables on machines that were peeling off, damaged capacitors on TL lamps, and friction between machine parts that caused sparks that had the potential for fire, of the 9 (nine) hazards there were 11.1% conditions and or activities that had a high risk (High), 77.7% conditions or activities that had moderate risk, 11.1% conditions and or activities that had a low risk. The implementation of an underground water spray system for fire suppression in the PC.GKBI Production Unit significantly reduces fire risk, increases employee safety, protects assets, and improves the company's reputation, as well as ensuring regulatory compliance. Pipeline maintenance constraints were overcome with a scheduled maintenance plan and staff training, as well as inspection and replacement of damaged pipework.

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