

Risk Factors Identification of Fire Incidents in 2017-2018

Identifikasi Faktor Risiko Kejadian Kebakaran pada Tahun 2017-2018

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ABSTRACT

Introduction: The massive development of the industrial sector leads to an increase in the risk of fire incidents. A company is obligated to prevent, reduce, and extinguish fire incidents by providing training and facilitating supporting tools to avoid fire incidents in the workplace. PT. ARPS is a Surabaya-based manufacturing company that produces plastic packaging and has a potential danger of medium to high levels. By applying the case study design, as an observational study, this study aims to identify the factors that influence and trigger the fire incidents at PT. ARPS during 2017-2018. **Methods:** The population of this study is the workers of the Assembly Decoration 1 (AD1) and the Blow Molding (DM) production areas. The collected data are analyzed and presented descriptively through tables and narration. **Results:** The data show that the first fire incident occurred on 10 February 2017 to the KK6 machine in the AD1 area, followed by the second incident that occurred on 18 March 2018 to the VK4 machine in the BM area, and the third incident (30 March 2018) to the KKS6 machine in the AD1 area. **Conclusion:** It can be stated that the three fire incidents at PT. ARPS that occurred from 2017 until March 2018 are caused by unsafe actions that are the negligence of the human resources, and unsafe conditions, which comprise the unstable machines. Other factors, such as supervision, maintenance, work instruction, and managerial, are identified as the upholding factors to the fire incidents at PT ARPS.

Keywords: factor identification, fire incident, unsafe action, unsafe condition

ABSTRAK

Pendahuluan: Meningkatnya perkembangan sektor industri membawa dampak meningkatnya risiko bahaya kebakaran. Perusahaan wajib untuk mencegah, mengurangi dan memadamkan kebakaran dengan cara memberikan pelatihan dan memfasilitasi alat penunjang untuk penanggulangan bencana kebakaran di tempat kerja. PT ARPS merupakan perusahaan yang bergerak dibidang manufaktur yang memproduksi kemasan plastik yang beroperasi di Surabaya dan memiliki tingkat potensi bahaya menengah ke atas. Tujuan penelitian ini adalah mengidentifikasi faktor yang mempengaruhi kejadian kebakaran di PT. ARPS di tahun 2017 hingga 2018. **Metode:** Penelitian ini merupakan penelitian observasional dengan rancangan case study karena kejadian kebakaran telah terjadi, kemudian dicari penyebabnya atau faktor yang mempengaruhi. Populasi pada penelitian ini adalah pekerja yang terlibat saat produksi di area Assembly Decoration 1 (AD1) dan di area Blow Molding (BM). Data dianalisis secara deskriptif dengan menggunakan tabel dan narasi. **Hasil:** Kejadian kebakaran pertama terjadi pada tanggal 10 Februari 2017 di area Assembly Decoration 1 (AD1) pada mesin KK6. Kejadian kebakaran kedua terjadi pada 18 Maret 2018 di area kerja Blow Molding (BM) mesin VK4 dan pada 30 Maret 2018 di area kerja Assembly Decoration 1 (AD 1) mesin KKS 6. **Simpulan:** Terdapat tiga kejadian kebakaran di PT ARPS selama tahun 2017 hingga bulan Maret 2018 dengan faktor penyebab terjadinya kebakaran yaitu unsafe action akibat kelalaian sumber daya manusia saat melakukan proses produksi dan unsafe condition akibat kondisi mesin yang tidak stabil. Selain faktor tersebut, terdapat faktor pengawasan, maintenance, intruksi kerja maupun manajerial yang menjadi faktor pendukung terjadinya kebakaran di PT ARPS.

Kata kunci: identifikasi faktor, kebakaran, unsafe action, unsafe condition

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INTRODUCTION

The industrial sector grows more rapidly in this technological era, proven by the invention of production machines and new raw materials to produce new products. The development of technology, however, also brings more significant impacts if there is an error in the usage, such as material loss, and a fatal incident, death.

Occupational Safety and Health (hereafter, OSH) is a program that is made to prevent occupational accidents, blasting, fire, or occupational illnesses. According to Hadiguna (2009), occupational accidents, blasting, fire, and occupational illnesses are commonly caused by the unsafe and improper implementation of the OSH requirements.

The government has released Law of Republic Indonesia (1970) on Occupational Safety to protect the workers or other human resources in the workplace. Law of Republic Indonesia (1970) Chapter III article 3 on Occupational Safety stated that one condition of occupational safety is to prevent, decrease the possibility, and extinguish the fire.

According to the National Fire Protection Association (2010), a fire incident is an oxidation event that involves three elements, namely flammable materials, oxygen, and a heat energy source that can cause harm or loss. Fire can be caused by several factors, such as general factors (human factors) and technical factors (Ramli, 2010).

The data of the International Labour Organization (2018) shows that in 2012, there were 426 death cases due to fire in the industrial sector. From a total of 426, 67.8% of the victims were from garment factories, 14.6% from oil refinery plants, 8.7% from firework factories, and the other 8.9% were from different industries. In the same year, on 25 August 2012, ILO recorded that the fires that occurred in the oil and gas industry took place in the Venezuelan oil refinery company, which caused 48 deaths and 151 other injuries.

The most prominent case of fire in the industrial sector, as recorded by International Labour Organization (2018), occurred in 1911 in New York, which resulted in 146 deaths. In 1988, 167 workers were dead due to the fire at the oil rig of Piper Alpha North Sea, England. Five years later, in 1993, a massive blast occurred in a toy factory in Nakhon Pathom, Thailand, which caused 188 death of the workers. The most recent case, in addition, occurred

in 2012, which caused 289 deaths of the workers at a garment factory.

In developing countries, most workers are involved in dangerous sectors, for example, mining, oil and gas, and chemical materials (ILO, 2013). Those sectors are believed having immense risks of a fire incident, which also explains that fire is a hazard to the workplace that needs to be taken seriously.

Surabaya Fire Department (2016) has recorded that in 2016, 21 of 154 reported cases were the fire in the industrial buildings, with a total damaged area of 17,872 m². It is further discovered that the most significant cause of the incidents was the open fire (matches, stoves, candles, insect repellents, and oils) and caused five deaths and 50 injuries. Besides, the material loss was estimated for IDR 29,985,500,000.

The occurrence of fire as an occupational accident is considered high, which results in massive losses for the company, including the discontinuation of production and work termination (Dewi, 2012). For that reason, fire as an occupational accident requires special attention and treatment to prevent and reduce its likelihood.

However, it is still common to find actions or conditions that may trigger the fire in the workplace, given every industry owns a processing section that uses flammable materials.

PT. ARPS is a manufacturing company that produces plastic packaging which operates in Surabaya. Furthermore, the company is also known for having moderate to high hazard level since its production processes require the use of flammable materials, for example, plastic base materials. Besides the material itself, the production processes are likely to cause a fire.

As recorded by the company, the fire incidents at PT ARPS occurred three times during January 2017 until March 2018, two of which were reported as middle fire, and the other one was a small fire. One of the middle fire incidents occurred on 10 February 2017, at the KK6 machine in the area of Assembly Decoration 1 (AD1). Given the fire was considered middle fire, special extinguishing was necessary.

In 2018, the company recorded two fire incidents, which was twice as much the previous year. The first incident occurred on 18 March 2018 at the VK4 machine in the area of Blow Molding (BM). The incident was considered middle fire, given the height of the fire was more than 50 cm.

Twelve days later, on 30 March 2018, the second incident happened at the KKS 6 machine in the area of AD1. Different from the two previous incidents, this incident was considered a small fire. However, this accident took place in the same area and the same machine as the accident occurred on 10 February 2017; thus, it can be said that the same accident reoccurred after one year.

The fire incidents brought severe impacts on the productivity of the company. One of the effects was work restrictions due to the damaged machines, namely the rubber dais and grounded machines. Even though no serious injuries nor death was reported, the loss for the company in the form of obstruction of the production process and material failure was enough to change the work rhythm of the company.

The three fire incidents that have been recorded by PT. ARPS make the company to pay close attention to fire as an occupational accident. The company has realized that many factors have caused and can lead to another fire in the company. This study, therefore, aims to identify the factors that cause or influence the fire incidents at PT. ARPS from 2017 until 2018.

METHODS

This study is a descriptive case study since it aims to discover the factors causing the occurred incidents. This study was carried out at PT. ARPS, which is located in the industrial area of Surabaya. The data was collected from March to April 2018 by conducting an interview and observation of the workers who witnessed or are familiar with the incidents.

The population of this study is the workers of the areas in which the incidents took place: Assembly Decoration 1 (AD1) and Blow Molding (BM) areas. The sample of this study consists of 4 people, including two people from the AD1 area, one person from the BM area, and one safety inspector. The purposive sampling technique was chosen to determine the sample, with the criteria of being involved in the incidents.

RESULTS

Fire Incidents at PT. ARPS

The first fire incident happened on the KKS 6 machine in the Assembly Decoration 1 (AD1) area

on 10 February 2017 during the shift change (shift 1 to shift 2) at 13:30 WIB. As affirmed by one of the respondents who work as a supervisor in the area, the fire came from the stamping process when the machine operator operated the product 4008 with the temperature parameter of 340° Celsius. After 30 of operation, the rubber dais was stuck and could not spin.

Due to the heat from the heater that reached 300° Celsius with the machine stopped, the fire arose from the rubber dais and quickly burned the KKS 6 machine. By referring to the respondent, the stuck engine might be caused by the dry bearing. The condition of the machine after the fire can be seen in Figure 1.



Figure 1. The KKS 6 Machine after the Fire in the Assembly Decoration 1 (AD1) Area



Figure 2. The VK4 Machine after the Fire in the Blow Molding (BM) Area

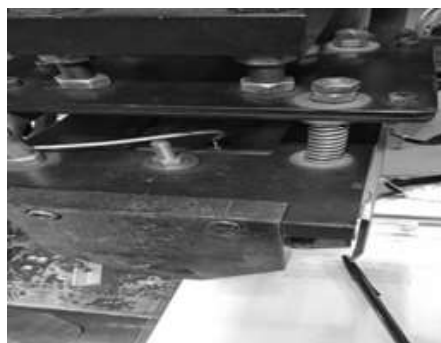


Figure 3. The KKS 6 Machine after the Fire in the Assembly Decoration 1 (AD1) Area.

Table 1. The Potential Fire Hazard at PT. ARPS in 2018

| Production Area | Work Process | Potential Fire Hazard | Combustion Triangle Element |
|-------------------|-------------------|---|-----------------------------|
| MPC | Mixing | Mixing machine operation | Heat |
| | | Flammable hazardous and toxic waste | Fuel |
| | | Scattered materials | Fuel |
| | | Oil and water drop in the work area | Fuel |
| | | Stripped wire and exposed to water drops | Heat |
| IMM | Injection Molding | Flammable liquid usage | Fuel |
| | | Flammable oil and hazardous and toxic waste packaging | Fuel |
| | | Flammable plastic products | Fuel |
| | | Plastic seed cumulation | Fuel |
| | | Hot cutting machine | Heat |
| EBM | Blow Molding | Oil drops in the work area | Fuel |
| | | Flammable hazardous and toxic waste packaging | Fuel |
| | | Cable connection and water drops | Heat |
| | | Plastic-made and flammable products in the work area | Fuel |
| | | Chemical material usage | Fuel |
| AD 1 | Stamping | Heater usage | Heat |
| | | Flammable hazardous and toxic waste packaging | Fuel |
| | | Electricity with high voltage danger | Heat |
| Printing Workshop | Printing | Plastic boxes and products in the work area | Fuel |
| | | The heat from the printing machine | Heat |
| Assembly Workshop | Assembly | The closed and hot assembly system | Heat |
| | | Plastic-made and flammable products | Fuel |

The second fire incident took place in the Blow Molding (BM) area at the VK4 machine on 18 March 2018 at 18:30 WIB. According to the respondent, the incident began when the "as deplashing" nut was released and did not touch the switch censor. Thus, the mold was in the campling condition in the upper position. Figure 2 displayed the state of the machine after the fire.

The third incident reoccurred at the same machine and area as the first incident; the KKS 6 machine in the Assembly Decoration 1 (AD1) area on 30 March 2018. However, different from the first incident, this incident happened during shift three at 02:30 WIB when the initial setting was carried out. The incident, as affirmed by the respondent, occurred after the technician finished the maintenance with the electrical short circuit in the heating element. When trying to set up the machine, its temperature suddenly reached 500° Celsius in the heater that resulted in a small fire. Figure 3 showed the condition of the machine after the fire.

The Cause of Fire at PT. ARPS

The first incident that happened in the KKS 6 machine was caused by the negligence of human resources or also known as unsafe action. The company has determined a safe procedure has there a check at the beginning of each shift. The technician, however, did not lubricate the machine that was stuck during the process and caused sparks.

The second fire incident took place in the Blow Molding (BM) area at the VK4 machine and was caused by both unsafe conditions and unsafe action. When the incident occurred, the on-duty operators were not on the location; one was taking a break, and the other one was absent. Thus, in the beginning, no one was aware of the broken machine that led to the fire.

Another unsafe action caused the third fire at the KKS 6 machine in the Assembly Decoration 1 (AD1) area. The incident happened when a worker carried out the maintenance of the machine. However, the temperature drastically arose to 500°

Celsius and triggered the sparks on the rubber dais of the KKS 6 machine.

The Potential Fire Hazard at PT. ARPS

From Table 1, it can be perceived that the potential fire hazard in the workplace can be caused by several factors, including the work process itself and the machine, tools, and materials usage. Human errors, such as unsafe action and unsafe conditions, besides, can also be another trigger of the fire incident.

DISCUSSION

The Fire Incidents at PT. ARPS

As a manufacturing company that produces plastic packaging, PT ARPS has a high risk of fire incidents to happen. From 2017 until March 2018, from three recorded accidents, two of which are considered middle fire. All three incidents resulted in the obstruction and restriction of the work process, given the machines were damaged. Even though the work process did not run as smoothly, the workers were still expected to be present at work. Therefore, it can also be stated that the incidents were considered small.

In the first incident that happened in the KKS 6 machine at the Assembly Decoration 1 (AD1), unsafe actions were said as the primary cause. In other words, the workers did not carry out the work by the Standard Operating Procedure (SOP). Notably, the workers did not thoroughly check the dais that they did not aware of if it should be lubricated to be able to spin.

The second incident, the fire in the VK4 machine at the Blow Molding (BM) area, was a result of both the human error and the machine error. First, the two on-duty operators left the machine unsupervised when they were supposed to supervise it. Second, the engine was broken in the beginning; thus, when it was operated, it produced sparks that caused the fire.

The third incident occurred at the same location as the first one did; the Assembly Decoration 1 (AD1) area, which was caused by an unsafe condition (unsafe machine). It was reported that when carrying out the maintenance, the worker noticed that the machine temperature was unstable and drastically arose to 500° Celsius that later initiated fire.

According to Bird and Germain, as cited in Ekasari (2017), occupational accidents can be caused by many occurrences. The direct triggers to cause occupational accidents are unsafe actions and unsafe conditions. The next level of the trigger is the underlying cause, which comprises the personal factor and job factor. Moreover, the highest level of a trigger or the main factor is the lack of control.

Other than that, occupational accidents can also be caused by contact with the hazard source, for example, the unstable condition of a machine or hazardous work activities.

It has been stated that there were three fire incidents at PT. ARPS from 2017 until March 2018. Based on the interview carried out with the respondents, unsafe action happened due to the negligence of the workers in carrying out the SOP, which requires the workers to thoroughly check the completeness, appropriateness, and condition of every machine before use. Hence, because of the negligence of the on-duty workers, the engine was left unlubricated that it became too dry to perform its job and triggered a middle fire.

Moreover, the incident that happened in March 2018 was also caused by unsafe action: the negligence to supervise the machine. It was later explained that the first operator was taking a praying break, while the other was having a lunch break. Additionally, both operators admitted that there was a miscommunication between them. Besides, the broken machine also caused the incident, which might be caused by the lack of maintenance.

Aside from the unsafe action, the unsafe condition also roles as a trigger of the fire incident at PT. ARPS. For instance, the hazardous condition triggered the fire in March 2018, where the machine temperature suddenly arose when the maintenance was being carried out. Although the fire was considered a small fire, the impacts could still be felt by the company, especially when the production process became obstructed and delayed that the financial issue started to arise.

Supervision

The supervision in the production area is carried out by a supervisor in every section. Moreover, the monitoring is done in the beginning and at the end of each shift. Aside from the lack of supervision that resulted in fire incidents, overall, the control at PT. ARPS is considered excellent. However, had the supervision performed better, the fire incidents could be handled that it would not cause a fire.

Tool Maintenance

The maintenance carried out by PT. ARPS includes preserving, managing, and repairing production tools. The non-feasible tools, if still used during the production process, can cause occupational accidents, including fire, for instance, the machines in the Assembly Decoration 1 (AD1) and Blow Molding (BM) areas.

There are several types of maintenance carried out by the company, such as lifetime maintenance, lubrication, wire rope, and reparation. The fire happened at the machines in both the AD1 and BM areas are proofs that the maintenance at PT. ARPS is not well-performed. It is noticed that the production process that should be temporarily stopped during the maintenance was still carried out. Thus, the temperature rose and resulted in a fire. Besides maintenance, supervision also plays a significant role in the production activity. Had the supervision well-carried out, the fire could have been avoided. Furthermore, the workers, both when doing the production process and when performing the maintenance, should follow the SOP as given by the company to minimize the risk of fire.

Work Instruction

It is noticed that the work instruction to operate every machine and tool in the work area of PT. ARPS is clear. The work instruction, moreover, is always delivered during the safety induction in addition to the SOP. In other words, in carrying out every production activity, every worker should pay attention to the SOP and the instruction given. Although the supervision of the SOP is well-executed, fire incidents still occurred due to the negligence and disobedience of the workers in carrying out the production process.

Management

According to the Fayol (2012) that there are five management functions: planning, organizing, directing, controlling, and evaluating. By referring to these five functions, the unsafe condition, such as the damaged machine is due to the lack of planning and controlling. The controls referred to in the function comprises all endeavors, such as the provision of competent human resources and the machines, carried out by the company to achieve its goals. Also, the authorized party should be more firm in controlling the production process if the machine is in need to be repaired or is under maintenance,

as what happened with the KKS 6 machine in the Assembly Decoration 1 (AD1) area. The likelihood of the fire could have been reduced had the plan and control well-carried out.

CONCLUSION

Out of the three fire incidents occurred at PT. ARPS from 2017 until March 2018, two of which are considered middle fire, while the other one is a small fire. Furthermore, there are two main factors discovered to cause the fire, for instance, unsafe action and unsafe conditions. The dangerous action comprises the negligence of human resources (the operators, supervisors, and the manager). The hazardous condition, on the other hand, is the unstable condition of the machine and tool used during the production process.

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