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Risk level of firefighters' activities in DKI Jakarta province: a study of occupational safety and health

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Abstract
Fire disasters pose risks to the community but also to firefighters. In dealing with a fire disaster, officers sometimes have to be faced with events that are detrimental to them. The purpose of this study is to carry out a hazard risk assessment and provide suggestions for controlling the hazards faced by firefighters. The research method used is qualitative with a descriptive study design approach, through in-depth interviews and direct observation. The results of the study indicate that there are potential hazards faced by firefighters starting from preparation activities, going to the location of the fire incident to returning to the post. The amount of risk faced is dominated by medium risk, for high risk it occurs during the extinguishing process, and for low risk only when officials receive news of a fire disaster. For risk reduction efforts, the forms of control that can be implemented can be in the form of engineering engineering, administrative controls, and Personal Protective Equipment.
Keywords: fire disaster; firefighters; OSH; risk assessment; risk control

1. Introduction

Jakarta as one of the most densely populated cities in Indonesia faces a high risk of news. In 2020, fire was recorded as one of the most frequent types of disasters (BPBD, 2020). Disaster risk can be referred to as a non-natural disaster which due to the burning fire has an uncontrollable or uncontrolled nature and results in material losses and casualties (BNPB, 2016; Ramli, 2010). There are six categories of fire hazards to firefighters when carrying out their duties in big city areas, namely biological, chemical, ergonomic, physical, safety and psychological hazards (Canadian Centre for Occupational Health and Safety (CCOHS), 2023). Data from the International Labor Organization, 2015 explains that more than 2.3 million men and women die every year due to work-related accidents and diseases. Additionally, more than 313 million workers have been seriously injured on the job, causing permanent or temporary disability.

There were 5,043 fire cases in the DKI Jakarta Province in 2020, 1,505 large fire cases and the remaining small fire cases, judging from the number affected and the coverage of the affected areas. In handling the fire disasters that occurred, South Jakarta became the area that experienced the most frequent fire disasters, with as many as 397 cases. Followed by East Jakarta with 349 cases. As for rescue cases, the most rescue cases were also in the South Jakarta area, namely 1,098 cases, followed by the East Jakarta area with 1,013 cases (BNPB, 2020). Therefore, these data show an increase in fire incidents in DKI Jakarta. The high number of fire incidents can increase the intensity of firefighting work, therefore the profession of a firefighter is a high risk and dangerous profession.

Firefighters have a fairly high risk potential, where one of their duties is to put out fires and have to save people in an emergency (Penny et al., 2022) Hazards that have a high enough potential for firefighters such as the danger of falling from a ladder, slipping when

preparing a fire car, being hit by another colleague while being prepared in a rush, getting tangled in the water hose when preparing the hose to the scene of a fire, hot temperature of the fire at the location, electric shock, fire smoke which can be detrimental to health, and also cardiovascular and musculoskeletal disease (Cheng et al., 2022; Ras et al., 2022)

Firefighters do not have a special place to carry out their duties, so firefighters must be ready to work remotely (Kanyama et al., 2023). In 2020 DKI Jakarta Province fire and rescue officers there were 76 DKI Jakarta fire and rescue officers who had work accidents as a result of injuries. In addition to injuries, there was one DKI Jakarta fire and rescue officer who died while on duty to put out a fire in one of the North Jakarta Warehouses (Disgulkarmat DKI Jakarta Province, 2022). Firefighters need to prepare all the equipment properly in order to save themselves and victims (Muir et al., 2017). Preparation for response and prevention are also important aspects of their work (Gywne et al., 2017). Therefore firefighters in a fairly heavy job and uncertain situations require the use of special and mandatory personal protective equipment (Murphy et al.,2022).

Sometimes there are obstacles in handling them, such as locations that are difficult to reach, the availability of human resources (HR) for firefighters who are on standby and sometimes equipment that is incomplete. In addition, there were work accidents while on duty which resulted in injuries and even fatalities. The high risk of danger to firefighters when carrying out their duties requires K3 risk management to identify hazards and evaluate firefighters. Therefore the purpose of this research is to carry out a hazard risk assessment and provide suggestions for controlling the hazards faced by firefighters. The research results are expected to provide an overview regarding worker safety in dealing with fire disasters.

2. Methods

The location of the research was carried out at the DKI Jakarta Provincial Fire and Rescue Service which is located on Jl. Kyai Haji Zainul Arifin No 71, RT 10 RW 10, Duri Pulo Village, Gambir District, Central Jakarta City. The research process was carried out for five months, starting from February - June 2022. Data processing was carried out by comparing the results of the interviews that were obtained with the HIRADC form, which is a process of identifying and evaluating hazards and minimizing potential hazards in the work environment. After that, it was analyzed (AS/NZS 4360 guidelines, 2004).

This research was conducted using a qualitative method where a descriptive study design approach, through in-depth interviews and direct observation, especially on firefighters. There were six research informants namely the Head of the Fire Department, the Head of Operations, the Head of the Fire Section, the Platoon Commander, the Team Commander, and the Fire Unit. The selection of informants was based on several aspects such as having responsibility for officer safety, formulating training, responsibility for the team, and being directly involved in the fire incident.

3. Results and Discussion

The DKI Jakarta Fire and Rescue Service has 246 units of pump cars or water tank cars, 18 units of ladders, 12 units of foam, 12 units of fire rescue cars, 12 units of ambulances, 2 units of fire boats and 137 units of rubber boats, 858 units of water hydrants , the number of fire po service sub-offices is 5 units, namely West, East, North, South and Central Jakarta. There are 91 sub-district level fire stations and the sub-district sector has 26 fire departments, so a total of 122 posts or sectors. Firefighters' activities are carried out from 07.30 AM – 07.30 PM, with various types of activities such as morning assembly, preparedness, physical training , skills training, reporting, and implementation of pickets. In Figure 1, the flow of activities carried out by officers when obtaining fire information is explained.

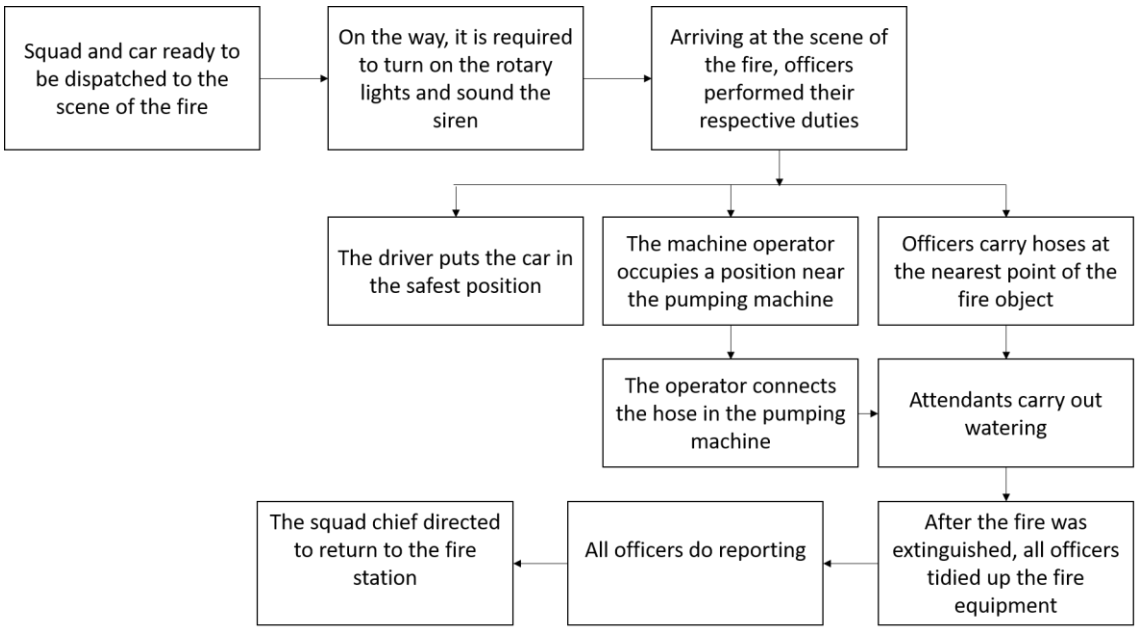

Figure 1. The flow of officers' activities when receiving news of a fire

For risk assessment and control, the results of in-depth interviews and direct observation found the types of hazards and sources of danger found in firefighters (Ahmad, et al. 2016). The following table describes the types of hazards and their sources.

Table 1. Types of Hazards and Sources of Hazard in Firefighters

No	Type of Hazard	Source of Hazard
1	Health Hazard	Residual results of fire Electricity Smoke Poison gas B3 waste Mired Pinched
2	Bahaya Keselamatan	Explosion tube/fire Burning building Combustion products Height

From the observations made, there were 11 sources of danger. There were 7 sources of health hazards and 4 sources of safety hazards. officer The results of the observations are then entered into the HIRADC form sheet to then carry out a risk assessment and will formulate recommendations for its control. In addition, according to the results of interviews and observations, it was found that potential hazards faced by firefighters started from preparatory activities, going to the location of the fire incident to returning to the post following the results in Table 2.

Table 2. Potential Hazards for Firefighters

No	Activites	Potential Hazard
1	Departure preparation	Fall from a ladder or fire extinguisher when receiving an emergency call to extinguish a fire Collided with another officer due to rush Slipped

No	Activites	Potential Hazard
3	Depart to Location	Fell from the car due to high speed and officer sitting on the tank Traffic accident Trees and power lines that cross the road endanger the officers sitting on the car
4	Preparing Tools at the Fire Location	Twisted water hose Crowds of residents can interfere with the extinguishing process
5	Blackout Process	Hot air temperature at the location of the fire Electric Shock Burnt Out of water in fire truck tank Hit by a sharp object resulting from a fire Exposed to rubble of burning material At a height using a height tool Tripped, slipped, fell Shortness of breath due to lack of oxygen (smoke)
6	Back to Departure	Traffic accident Fatigue

From the results of the study, it was found that routine activities were carried out by firefighters who were in accordance with the SOP and non-routine activities such as during a fire incident. There are 15 routine activities carried out by firefighters and 9 non-routine activities. Two types of hazards were found, namely health hazards and safety hazards where 11 sources of danger were found from the 2 types of hazards. From the results of in-depth interviews and direct observations, 19 potential hazards were found in firefighters. From the activities and sources of the hazard, a risk assessment will be carried out in order to produce or formulate controls for the hazard risk.

Based on the results of observations made at the DKI Jakarta Province Fire and Rescue Service, there is a source of danger in work activities. Work activities in firefighters are divided into two, namely routine and non-routine work activities. In activities when carrying out fire fighting duties there are 1 low risk, 17 medium risks and 4 high risks. The magnitude of the risk resulting from the source of danger and the activities of firefighters.

Tabel 3. Results of risk assessment when carrying out blackouts based on HIRADC

No	Work Activity	Hazard	Impact	Risk Amount
1	Receive fire news	Ergonomics	Sick	4
2	Travel to Location	Traffic accident	Hit, Injured	12
		Work on moving Vehicles (Height)	Fallen	12
3	Preparation of hose distribution to hotspots (on location)	Water Hose Leak	Wounded	6
		Folded Water hose	Fallen	6
4	Open access paths for officers	Crowd of people on site	Be long and someone hurt	5
5	Blackout process	Electricity	Electrocution by direct contact	12
			Electrocuted through the medium of water	10

No	Work Activity	Hazard	Impact	Risk Amount
		Fire Smoke	Smoke inhalation	20
		Burnt Building	Crushed by rubble	15
		Trapped	Burnt	8
		B3 waste	Damage to the respiratory and digestive systems	15
		Temperature	Burnt	8
		Residual Fire	Pierced, mired	9
		Poison gas	Out of breath	8
		Nail	Wounded	5
		Chemical material	Fire/explosion	15
		Coal	Burnt	10
6	Cooling Process	Residual Burnt material	The remaining combustion products that look extinguished can have heat that can cause burns	8
7	Equipment and supplies packaging	Fatigue	Fall, faint	6
8	Travel Back to post or sector	Travel Back to post or sector	Hit, Injured	12
		Work on moving Vehicles (Height)	Fallen	12

Recommendations for risk control based on the results of hazard identification and risk analysis are explained as follows:

1. Receiving fire news, forms of risk control that can be carried out, namely the use of supporting equipment in order to minimize diseases caused by non-ergonomics and must be written in SOPs, and training regarding proper and correct sitting positions. This recommendation is in line with a study by Bui et al. (2017).
2. Travel to the location, for risk control in the form of training for drivers, asking for the nearest police escort, and using a safety rope attached to the truck
3. Open access lanes for officers, risk control can be carried out by asking for escort from the police
4. Preparation of hose distribution to hotspots (on location), it is recommended to make a daily record after checking, then checking before leaving for the TKP, and filling is done under supervision
5. The extinguishing process, risk control that can be carried out, namely assistance by the team commander to supervise members who may be electrocuted, and identification of areas to see potential stagnant water and locations where spraying is not permitted
6. Cooling process, it is recommended to use a heat detector or heat gun
7. Packaging of equipment and supplies, it is recommended to supervise the team
8. Traveling back to the post or sector, a form of risk control can be carried out by training drivers, asking for the nearest police escort, and using a safety rope attached to the truck

Overall, the form of risk control that can be controlled is by engineering engineering, administrative control, and personal protective equipment. This is because the majority of

hazards that occur in the work activities of the DKI Jakarta Fire and Rescue Service have sources of danger that are impossible to eliminate or replace.

4. Conclusions

The DKI Jakarta Fire and Rescue Service has 24 work activities, specifically for activities during a fire, namely 8 activities. The hazards contained in the work activities of firefighters at the DKI Jakarta Fire and Rescue Service consist of health hazards and safety hazards and there are 11 sources of danger and 19 potential hazards for firefighters. The majority of disaster risks faced based on HIRADC calculations are moderate types of risk, however for low risks there is only 1 activity, namely at the beginning before handling a fire disaster. Therefore, it is very important to pay attention to the level of risk faced by officers. There are several risk control recommendations that can be carried out to improve the work safety of DKI Jakarta Fire and Rescue officers with types of engineering engineering, administrative control, and Personal Protective Equipment.

This research is still limited in that data collection is carried out through observation and interviews, where there are several work activities that cannot be predicted when they occur and cannot be observed directly. Therefore, in subsequent studies, it can further deepen the activities that have the potential to be a risk faced by Fire and Rescue personnel. In addition, analytical methods can also be developed using quantitative methods, so that the level of risk can be more clearly quantified.

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Conflicts of Interest

The authors declare no conflict of interest.

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