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Evaluation of the implementation an active fire protection system in production unit PT. Wijaya Karya Beton Tbk. Pasuruan

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Abstract

PT Wijaya Karya Beton Tbk. Pasuruan is a manufacturing company engaged in the ready-mix concrete industry. One of the potential unpredictable hazards during the concrete production process is fire. Fire is an unwanted ignition that is difficult to control, as it can result in losses of property, loss of life, and the interruption of the production process. Therefore, the objective of this research is to evaluate the compliance of the active fire protection system as a preventive and mitigating measure against the fire hazard at PT Wijaya Karya Beton Tbk. Pasuruan. The research is observational and uses a descriptive method. The research findings indicate that the level of compliance with the implementation of the active fire protection system at PT Wijaya Karya Beton Tbk. Pasuruan averages 83.33%. The evaluation of the implementation of fire extinguishers according to NFPA 10 is categorized as good (91%), the evaluation of hydrant implementation according to SNI 03-1745-2000 and Minister of Public Works Regulation No. 26/PRT/M/2008 is categorized as good (90%), and the evaluation of the implementation of fire alarms according to NFPA 72 is categorized as sufficient (68%). In conclusion, the compliance of the active protection system at PT Wijaya Karya Beton Tbk. Pasuruan is considered to be in the good category.

Keywords: Active Fire Protection System; Fire extinguisher; Hydrant; Fire Alarm

1. Introduction

In carrying out its production activities, a company needs to implement Occupational Health and Safety (OHS) measures. The implementation of OHS in the production unit aims to protect and ensure the safety of every worker and other individuals in the workplace, guarantee the safety and efficiency of every production material for workers, and enhance the well-being of employees. [9]. One way to improve the welfare of workers is by ensuring safety conditions, including efforts to prevent accidents and fires.

Fires can occur anywhere, whether in residential areas, public places, forested areas, or within an industrial setting. The numerous industries utilizing fuel and electricity in their production activities pose a potential risk of fire [10]. Fires in industries can result in the loss of property, assets, and lives. The occurrence of a fire can disrupt the operational continuity of a company, leading to significant financial losses [4]. Additionally, the company may lose qualified Human Resources (HR) due to such incidents. The compensation efforts provided to the families of the victims also incur substantial costs, further increasing the company's overall losses significantly.

The data on fires in Indonesia, based on information compiled by the National Disaster Management Agency (BNPB) over the last five years from 2018 to 2023, indicates a total of 1,841 fire incidents [1]. According to the National Fire Extinguisher Report, the number of fire incidents in Indonesia in 2021 alone reached 17,768 cases across the country. The most common cause of these incidents was attributed to electrical overloads and poor cable quality, accounting for approximately 5,274 cases or around 45% [5]. Companies are considered vulnerable to fire incidents due to technical

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factors such as exceeding the electrical capacity during the production process [11]. Furthermore, based on data from the Indonesian Central Statistics Agency in 2022, there were 8 fire incidents in East Java, where 2 of them occurred in the industrial sector [1]. It is noted that the victims of these fire incidents totaled 66,109, with injuries reported, but no recorded fatalities.

PT Wijaya Karya Beton Tbk. Pasuruan, a concrete product manufacturing plant, is engaged in the concrete industry. The company produces various concrete products, both precast and non-precast, including pile foundations, Corrugated Concrete Sheet Pile (CCSP), and electrical poles. PT Wijaya Karya Beton Tbk. Pasuruan operates on a made-to-order production system. When orders are received from customers, new products are manufactured. The company consists of five sections, namely planning and evaluation, finance and human resources, engineering and quality, equipment, and production units [8].

In the production unit, there are 6 lines, each dedicated to a different type of concrete production. Lines I, II, V, and V1 produce concrete using a rotating/molding method, while lines III and IV produce concrete using a non-rotating/precast method. Based on observations and interviews with the HSE (Health, Safety, and Environment) department of PT Wijaya Karya Beton Tbk. Pasuruan, the production unit is identified to have a higher risk of fire hazards compared to other units. The potential fire hazards arise when the production process involves large and high-voltage machinery. Poor wiring systems can lead to short circuits, resulting in sparks and potential fire outbreaks. Additionally, the use of various chemicals in the production process, such as diesel fuel, LPG gas, oxygen, and printing oil, increases the risk of fire incidents.

During production, workers are fully involved physically in the concrete manufacturing process. Therefore, workers are the most vulnerable individuals to fire incidents in the production area. The primary technical factor to prevent fire incidents is the provision of an adequate active fire protection system. Fire protection facilities such as lightweight fire extinguishers, hydrants, and fire alarms can provide optimal fire protection [12]. This is because an active fire protection system helps prevent the occurrence of small fires, can operate automatically, supports the safety of occupants during evacuation, and can quickly detect the onset of a fire [2]. Therefore, the author is interested in discussing the evaluation of the implementation of the active fire protection system in the production unit of PT Wijaya Karya Beton Tbk. Pasuruan.

2. Material and methods

This research was conducted at the production unit of PT Wijaya Karya Beton Tbk. Pasuruan. The research method used was descriptive research with an observational approach. Data were obtained through direct field observations using checklists based on standards outlined in SNI-03-1745-2000, Minister of Public Works Regulation No. 26/PRT/M/2008, NFPA 72, and NFPA 10. The research focused on the evaluation of the active fire protection system, including Fire extinguishers, Hydrants, and Fire alarms. The instruments used in this research were observation sheets related to the active fire protection system, evaluating Fire extinguishers according to NFPA 10 criteria, Hydrants according to SNI 03-1745-2000 and Minister of Public Works Regulation No. 26/PRT/M/2008 criteria, and Fire alarms according to NFPA 72. Additionally, a mobile phone camera was utilized to document the research activities. The assessment of the suitability of the active fire protection system implementation was classified into three categories: 0 = Not Suitable, 1 = Adequate, and 2 = Suitable.

The results of the research will undergo data processing to ensure that the obtained interpretations are easily understandable. The assessment results of the active fire protection system will be calculated to find the total score by summing up all checklist items according to the fulfilled scores. Meanwhile, data analysis will be conducted after the data processing process is completed. In this research, data analysis will be performed by calculating the percentage of each indicator of the active fire protection system, including fire extinguishers, hydrants, and fire alarms. The calculation of the fulfillment value for each indicator of the active fire protection system is done as follows:

$$X = \frac{Total\ Score}{Maximum\ Score} \times 100\%$$

Explanation:

X = The percentage of compliance results for the installation criteria of each type of active fire protection system, including fire extinguishers, hydrants, and fire alarms.

After obtaining the percentage of compliance results for the installation criteria of each type of active fire protection

system, the resulting percentage (X) can be categorized into 4 categories, including:

Table 1 Classification of the Active Fire Protection System Implementation Level

Value	Category	Description
>80% - 100%	Good	If all components of the active fire protection system can function perfectly and adhere to the standards used as a reference for assessment.
60% - 80%	Satisfactory	If the majority of components in the active fire protection system can function well, but there are some other components that do not function perfectly or do not adhere to the standards used as a reference for assessment.
<60%	Poor	If the majority of components in the active fire protection system are not functioning or their performance falls below the standards set as a reference for assessment.
0%	Non-existent	If the components of the active fire protection system have no conformity whatsoever with the standards used as a reference for assessment.

Source: Research and Development Center of the Indonesian National Police, 2005

3. Results and discussion

3.1. Evaluation of The Fire Extinguishers Suitability in the Production Unit of PT Wijaya Karya Beton Tbk. Pasuruan

PT Wijaya Karya Beton Tbk. Pasuruan has implemented fire prevention measures in accordance with the Decree of the Minister of Manpower of the Republic of Indonesia No. 186 of 1999 concerning Fire Prevention Units. One of the firefighting efforts that have been undertaken is the provision of adequate active fire protection equipment, including fire extinguishers, hydrants, and fire alarms. Based on observations and interviews with the company's HSE department, PT Wijaya Karya Beton Tbk. Pasuruan has 24 fire extinguishers distributed throughout the production area of the Concrete Product Plant (PPB) 1 Kejapanan. The type of fire extinguisher used is Dry Chemical Powder with a weight of 6 kg each.

The observations conducted regarding the suitability of fire extinguishers at PT Wijaya Karya Beton Tbk. Pasuruan cover general requirements, fire extinguisher selection, installation, placement, as well as inspection and maintenance, and all have been well met. The measurements were carried out using a checklist method in accordance with the National Fire Protection Association (NFPA 10) standards. The checklist fulfillment was created based on on-site observations, interviews with the HSE department, and a review of company documents.

Table 2. The Suitability Results of Fire Extinguishers at PT Wijaya Karya Beton Tbk. Pasuruan

No	Regulations	Recommended Rules	Compliance Level Scores			Description
			0	1	2	
1.	NFPA 10	The fire extinguishers used are appropriate in terms of type and fire classification, and are always in good condition and ready for use			√	The fire extinguishers available at PT Wijaya Karya Beton Tbk. Pasuruan have been identified for use according to potential fire types, namely Class B, C, and D
2.	NFPA 10	There is a seal that should be in good condition, and the cylinder cap must be securely fitted			√	The seal on the fire extinguisher is still in good condition and locked (the wire is not broken), and the installed cylinder cap is also secure
3.	NFPA 10	The fire extinguisher must be placed conspicuously, easily accessible, and positioned along			√	The fire extinguisher is positioned along the main production process route, making it easily accessible and equipped

No	Regulations	Recommended Rules	Compliance Level Scores			Description
			0	1	2	
		the normal crossing paths, including exit routes				with a FIRE EXTINGUISHER indicator for visibility
4.	NFPA 10	The fire extinguisher, weighing not more than 18.14 kg, should be installed at a height not exceeding 1.53 m above the floor			√	All fire extinguishers weigh 6 kg and are placed no more than 1 meter above the floor
5.	NFPA 10	Fire extinguishers weighing more than 18.14 kg should be installed no more than 1.07 m above the floor			√	All fire extinguishers weigh 6 kg and are placed no more than 1 meter above the floor
6.	NFPA 10	The fire extinguisher located outside the building and installed inside a cabinet box should not be locked		√		Out of the 24 fire extinguishers located outside the building, 8 of them are installed without using a cabinet box
7.	NFPA 10	Fire extinguishers must always be maintained in a fully charged condition and ready for operation			√	Inspections of fire extinguishers are conducted once a month, and repairs are carried out if any issues are identified
8.	NFPA 10	Fire extinguishers must be stored in designated locations			√	There is a layout for the placement of fire extinguishers, and each fire extinguisher is equipped with identification (fire extinguisher number)
9.	NFPA 10	There are labels, identification cards, stencils, or indicators affixed as information containing the product name and contents of the fire extinguisher			√	The label attached to the fire extinguisher cylinder contains information about the fire extinguisher supplier, owner, type of fire extinguisher, and the date for the refill schedule
10.	NFPA 10	There is 1 fire extinguisher for every 200 m2 and is located within a distance of less than 200 m from all positions on a single floor	√			All fire extinguishers within one floor are spaced more than 200 m apart. The placement of fire extinguishers is adjusted only to areas with potential fire hazards
11.	NFPA 10	The fire extinguisher cylinder and hose are resistant to high pressure and are in a non-leaking condition			√	All available fire extinguishers are not in a leaking condition
12.	NFPA 10	Fire extinguishers should not be exposed to temperatures exceeding the temperatures recorded in the table			√	The fire extinguisher should not be exposed to extreme temperatures exceeding the limits recorded in the table
13.	NFPA 10	There are signs or symbols indicating the placement of fire extinguishers			√	Every installation of a fire extinguisher is accompanied by symbols indicating the location of the fire extinguisher to make it easy to find during emergencies
14.	NFPA 10	There are operating instructions for the fire extinguisher placed in front of it, and they must be clearly visible			√	There is a location marker placed directly above the fire extinguisher, colored red, and has clear writing to ensure that the fire extinguisher is easily visible

No	Regulations	Recommended Rules	Compliance Level Scores			Description
			0	1	2	
15.	NFPA 10	There must be instructions available regarding the installation, usage, inspection, and maintenance of the fire extinguisher			√	There are operating instructions on all fire extinguishers, including how to break the seal, check the fire extinguisher, the distance for use from the ignition point, and the correct position when using the fire extinguisher
16.	NFPA 10	Personnel conducting inspections must keep documentation of the results of all inspected fire extinguishers, including findings that require repairs			√	All documentation of monthly fire extinguisher inspections is included in the monthly inspection report, and if there are findings, a special note will be created for discussion in the HSE meeting
17.	NFPA 10	During inspections, the month, year, and initials of the personnel conducting the inspection must be recorded			√	The fire extinguisher inspection form used includes columns for filling in the date, condition of the fire extinguisher, and remarks by the personnel conducting the inspection
Total Score			31			

Calculation of the total score for the implementation of Fire Extinguisher

$$= \frac{Total\ Score}{Maximun\ Score} \text{ x } 100\%$$

$$= \frac{31}{34} \text{ x } 100\%$$

$$= 91\%$$

The percentage result indicates the level of compliance with the implementation of fire extinguishers referring to the National Fire Protection Association (NFPA) 10 at PT Wijaya Karya Beton Tbk. Pasuruan is 91%, categorizing it as having a good level of compliance with the implementation requirements. Out of the 17 essential assessment criteria, there is 1 requirement that is not fulfilled, and 1 requirement that partially meets the established standards.

Figure 1 Fire extinguisher at PT Wijaya Karya Beton Tbk. Pasuruan

The types of fire extinguishers available in the production area of PT Wijaya Karya Beton Tbk. Pasuruan have been identified and tailored to their use according to the types of hazards present in each area. Since a significant portion of the production area involves metal and electricity, the potential fire hazards may include Class C fires (fires involving energized electrical equipment) and Class D fires (fires involving solid metal objects). However, during the concrete production process, chemicals such as diesel, LPG gas, and printing oil are also utilized. As a result, the Concrete Product Plant (Pabrik Produk Beton - PPB) 1 Kejapanan also has the potential for Class B fires.

The provision of fire extinguishers at PT Wijaya Karya Beton Tbk. Pasuruan is currently in good condition. This is because the seals, placement, weight, operating instructions, and inspection processes of the fire extinguishers meet the internationally established standards. According to Minister of Manpower Regulation No. PER.04/MEN/1980 on the Installation and Maintenance Requirements of Fire Extinguishers, fire extinguishers placed outside buildings should be installed with cabinets (boxes). However, PT Wijaya Karya Beton Tbk. Pasuruan has not fully complied with this requirement. Out of the 24 fire extinguishers located outside the building, 8 of them are installed without using cabinets. The fire extinguishers are simply placed hanging outdoors, exposed to sunlight and rain, which can cause corrosion to the extinguisher cylinders and reduce their effectiveness when used. Additionally, all fire extinguishers at PPB 1 Kejapanan are also positioned more than 200 meters apart, potentially complicating the firefighting process in the event of a fire.

3.2. Evaluation of The Hydrant Suitability in the Production Unit of PT Wijaya Karya Beton Tbk. Pasuruan

Hydrant serves as a connection point that channels water to the location of a fire. Firefighters can utilize hydrants to access the available water supply at the incident site for firefighting purposes. PT Wijaya Karya Beton Tbk. Pasuruan has hydrants consisting of yard hydrants and building hydrants. There are a total of 4 hydrants in PPB 1 Kejapanan scattered throughout the factory. Measurements were conducted through direct field observations, interviews with HSE personnel, and a review of company documents. The method used was a checklist based on SNI 03-1745 Year 2000 and Minister of Public Works Regulation No. 26/PRT/M/2008. The following are some basic requirements for hydrant provision in the workplace based on SNI 03-1745 Year 2000 and Minister of Public Works Regulation No. 26/PRT/M/2008.

Table 3 The Suitability Assessment Results of Hydrants at PT Wijaya Karya Beton Tbk. Pasuruan

No	Regulations	Recommended Rules	Compliance Level Scores			Description
			0	1	2	
1.	SNI 03-1745-2000	The hydrant cabinet is solely used for housing firefighting equipment			√	The contents of the hydrant cabinet consist of hoses, nozzles, and hydrant pillar keys
2.	SNI 03-1745-2000	Each hydrant cabinet is painted with a conspicuous color			√	All hydrant cabinets are painted in red color with white lettering 'HYDRANT' for clear visibility
3.	SNI 03-1745-2000	Every hose connection used must be installed with a length not exceeding 30 m			√	The hose connections used for hydrant applications have a length not exceeding 20 m
4.	SNI 03-1745-2000	The yard hydrant is equipped with a siamese connection that is compatible with firefighting vehicles	√			The yard hydrant pillar is not equipped with a Siamese connection compatible with firefighting vehicles
5.	SNI 03-1745-2000	Hose connections and hydrant boxes must not be obstructed			√	Hose connections and hydrant boxes are unobstructed, and there is no production activity permanently situated in the area that could impede the hydrants
6.	Permen PU No. 26/PRT/M/2008	The water supply for the hydrants must be at least 38 liters per second at a pressure of 3.5 bar			√	In the last hydrant test in 2023, the water pressure at the hydrant was measured at 8 bar
7.	Permen PU No. 26/PRT/M/2008	There are hydrants along the firefighting vehicle route located within a radius of 50 meters from each hydrant			√	The hydrant is located along the main route of Concrete Product Plant (PPB) 1 Kejapanan, which serves as the entry route for firefighting vehicles

No	Regulations	Recommended Rules	Compliance Level Scores			Description
			0	1	2	
8.	Permen PU No. 26/PRT/M/2008	The yard hydrant/hydrant pillar hose box must be inspected every 3 months			√	All hydrant contents, including hoses, nozzles, hydrant pillar keys, and hydrant pillars, are inspected every month
9.	Permen PU No. 26/PRT/M/2008	The yard hydrant must undergo an annual test to ensure its functionality			√	The Concrete Product Plant (PPB) 1 Kejapanan conducts hydrant testing every 6 months to ensure that the hydrants are in good condition and ready for use
10	Permen PU No. 26/PRT/M/2008	The history of inspection, testing, and maintenance records must be retained			√	The history of inspection, testing, and maintenance records is stored and documented in a dedicated folder for routine documentation
Total Score			18			

Based on the checklist table for the examination and evaluation of hydrant implementation at PT Wijaya Karya Beton Tbk. Pasuruan, the following results were obtained:

Calculation of the total score for hydrant implementation

$= \frac{Total\ Score}{Maximum\ Score}$ x 100%

$= \frac{18}{20}$ x 100%

= 90%

Figure 2 Hidran at PT Wijaya Karya Beton Tbk. Pasuruan

The percentage results indicate the level of compliance with the implementation of hydrants at PT Wijaya Karya Beton Tbk. Pasuruan, referring to SNI 03-1745 Year 2000 and Minister of Public Works Regulation No. 26/PRT/M/2008, reaching 90%. This falls into the category of good compliance with the implementation requirements. There are a total of 4 hydrants in PPB 1 Kejapanan scattered throughout the factory. The available hydrants in this company are Class 2 hydrants with a water flow rate of 1000 gallons per minute and a pressure of 100 Psi or 1000 Jpm. The hydrant has a diameter of 2.5 inches. The hydrant boxes are equipped with nozzles, hoses, and hydrant pillar keys. The hydrants are securely installed, and clear usage instructions are provided on the front of the hydrants. The hydrant boxes are painted in a striking red color with white lettering "HYDRANT" for easy identification. The front of the hydrant box also includes instructions for using the hydrant and contact information for the fire brigade that can be reached in case of emergencies.

The hose connections used are in accordance with national standards, with a length of 30 meters. Additionally, the type of hose used is made of rubber, which has been tested for its resistance to water pressure ranging from 18-20 bar. The

water source for PT Wijaya Karya Beton Tbk. Pasuruan is supplied from the municipal water system (PAM). Therefore, the availability of these hydrants is expected to provide protection and sufficient water supply during emergencies. The hydrants at PT Wijaya Karya Beton Tbk. Pasuruan are also equipped with an electric main pump fire pump, which aims to provide specific pressure during firefighting processes. The electric main pump for hydrants is the primary electric pump used to supply water to the hydrant system in firefighting situations. This hydrant system typically consists of pipes, nozzles (openings for spraying water), and pumps that function to provide a large amount of water with sufficient pressure to extinguish the fire.

In the last hydrant test in 2023, the water pressure at the hydrant was measured at 8 bars, which complies with national standards. Additionally, hydrant inspections are routinely conducted every month, and hydrant testing is performed every six months to ensure that the hydrants are in a ready-to-use condition. However, it is noted that the provision of hydrants at PT Wijaya Karya Beton Tbk. Pasuruan still has a deficiency, as the yard hydrant is not yet equipped with a pillar with a siamese connection that matches the connection used by firefighting vehicles.

3.3. Evaluation of the Fire Alarms Suitability in the Production Unit of PT Wijaya Karya Beton Tbk. Pasuruan

Fire alarms are devices designed to provide signals or alerts for the occurrence of early-stage fires, which can be in the form of manual or automatic alarms. There are 6 fire alarms at PT Wijaya Karya Beton Tbk. Pasuruan, distributed throughout the factory area. The evaluation of the implementation of fire alarms is conducted using a checklist method that refers to the National Fire Protection Association (NFPA) 72, which is related to the national fire alarm and signaling code. There are 11 requirements presented in the form of key assessment criteria for meeting fire alarm standards at PT Wijaya Karya Beton Tbk. Pasuruan.

Table 4 The Suitability Assessment Results of Fire Alarms at PT Wijaya Karya Beton Tbk. Pasuruan

No	Regulations	Recommended Rules	Compliance Level Scores			Description
			0	1	2	
1.	NFPA 72	There is a fire alarm system			√	There is a fire alarm system divided into 4 emergency zones
2.	NFPA 72	The Manual Call Points (MCP) are clearly visible			√	The MCP are clearly visible as they are located on the main pathway frequently used in the factory. The MCPs are also painted red for easy visibility
3.	NFPA 72	The Manual Call Points (MCP) are positioned along the exit route at a height of 1.4 meters from the floor			√	The installed MCP are positioned on the main pathway of the factory at a height of 1.5 meters above the floor surface
4.	NFPA 72	The Manual Call Points (MCP) are in good condition and ready for use			√	The MCP are in a ready-to-use condition as routine inspections are conducted every month
5.	NFPA 72	The distance of the Manual Call Points (MCP) should not exceed 30 meters from all parts of the building	√			The MCP at PT Wijaya Karya Beton Tbk. Pasuruan are situated at a distance greater than approximately 50 meters from all parts of the building
6.	NFPA 72	The alarm can sound on every floor and is audible throughout all rooms			√	The alarm has a very loud and distinctive sound, capable of being heard throughout the entire factory area
7.	NFPA 72	The alarm has a distinct sound and rhythm, making it easily recognizable as a fire signal			√	The alarm sound has a distinctive rhythm. This was evident during the

No	Regulations	Recommended Rules	Compliance Level Scores			Description
			0	1	2	
						alarm testing, as all workers and employees could easily recognize it
8.	NFPA 72	Fire alarm inspections are conducted at least once a year			√	Fire alarm inspections are conducted regularly, every six months
9.	NFPA 72	The distance between manual alarms is not more than 61 meters	√			The distance between manual alarms is more than approximately 70 meters
10.	NFPA 72	The Manual Call Points (MCP) are red in color, button-type models, and must be equipped with glass that is non-hazardous if broken		√		The Manual Call Points (MCPs) are red, button-type models, but are not equipped with protective glass for electronic components
11.	NFPA 72	The fire alarm has backup power from batteries or a generator with a capacity of 4 hours	√			The fire alarm does not have a backup power source
Total Score			15			

Calculation of the total score for the implementation of fire alarms

$= \frac{Total\ Score}{Maximum\ Score}$ x 100%

$= \frac{15}{22}$ x 100%

= 68%

Based on the compliance with fire alarm inspection requirements, PT Wijaya Karya Beton Tbk. Pasuruan achieved a total score of 68%, indicating that the conformity of implementation falls into the satisfactory category. The assessment criteria used align with the NFPA 72 standards for the installation, inspection, and testing of fire alarms. The available fire alarm system includes push-button fire alarms and alarm bells.

Figure 3 Fire Alarms at PT Wijaya Karya Beton Tbk. Pasuruan

The fire alarm system at PT Wijaya Karya Beton Tbk. Pasuruan consists of a manual fire alarm system divided into 4 zones, thus complying with the standards for fire alarm evaluation. Additionally, all installed manual call points are in good condition and ready for use. Regarding the sound and rhythm of the alarm, it is effective as it has a distinctive rhythm and can be heard throughout the entire factory area. However, the location of the fire alarms is not clearly visible. The Manual Call Points (MCP) at PT Wijaya Karya Beton Tbk. Pasuruan are situated more than 30 meters away from all parts of the building, thus not meeting the reference criteria for evaluation. The MCPs are also not red in color and lack protective glass, providing no protection for electronic components. The distance between manual alarms is approximately 70 meters, potentially delaying timely warnings or actions in the event of a fire.

4. Conclusion

- The percentage results indicate a compliance level of 91% for the evaluation of fire extinguisher implementation at PT Wijaya Karya Beton Tbk. Pasuruan, based on NFPA 10. This places the implementation of fire extinguishers in the "good" category.
- The percentage results show a compliance level of 90% for the evaluation of hydrant implementation at PT Wijaya Karya Beton Tbk. Pasuruan, based on SNI 03-1745 Year 2000 and Minister of Public Works Regulation No. 26/PRT/M/2008. This categorizes the implementation of hydrants as "good".
- The percentage results indicate a compliance level of 68% for the evaluation of fire alarm implementation at PT Wijaya Karya Beton Tbk. Pasuruan, based on NFPA 72. This classifies the implementation of fire alarms as "satisfactory".
- Therefore, the overall evaluation results for the implementation of active fire protection systems at PT Wijaya Karya Beton Tbk. Pasuruan are 83.33%, which falls into the "good" category.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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