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Fire Extinguisher System Hard Skill Improvement Training at the Inalum Building Batubara Regency

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ABSTRACT

A fire alarm is an early warning system for the danger of Fire. If early warning of the danger of Fire is active, officers immediately look for fire spots to extinguish. If the Fire is still small or medium, the Fire can be extinguished with a light fire extinguisher. If the Fire is big, it is extinguished with a sprinkler or water from the hydrant system. The Inalum building only started operating in 2021, and the workers in building management have yet to experience fire extinguisher systems. For this reason, it is necessary to carry out hard skills training regarding fire extinguisher systems. The aim is for workers to understand how the fire extinguisher works and that the building is ready to face the dangers of Fire. The training results showed that the workers' hard skills increased by 21.03%, initially only 74.48% before and increased to 95.51% after the training. This learning process was considered satisfactory by the training participants. The benefits of the training received a score of 4.89 on a scale of 5 by the participants.

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INTRODUCTION

Fire is one of the most frequent disasters in Indonesia (Marfuah et al., 2020). In the event of a fire, the fire extinguisher system is often not functioning properly. The hydrant pipe is empty, and there is no water. There are many reasons why there is no water in a hydrant. For example, the hydrant pump is not working(Badan Pusat Statistik Indonesia, 2020). Another cause is due to installation leaks in the pipe (Rachmawati et al., 2020; Seni et al., 2023). Handle a hydrant pipe leak most quickly by closing the gate valve. These conditions cause the fire extinguisher system not to function properly (Indrawati, 2022; Kurniawan;, 2018).

Before the fire alarm system works, the building has several other protections. *Fire alarm* is an early warning system that will work if the sensor responds to a fire. The alarm will sound if it detects smoke, gas, or heat. Apart from the fire alarm system, there is still a light fire extinguisher or APAR (Agusri & Kimi, 2018; Marfuah et al., 2020). APAR is used when the fire is small or medium. Using fire extinguishers when the fire is already large is very ineffective. Meanwhile, if the fire is still small, avoid extinguishing it with a hydrant because the impact of its use can damage the condition of the burned area due to very strong water(Amini et al., 2023; Azrini et al., 2016; Tambun et al., 2023).

The problem often encountered when a fire occurs is that the fire extinguisher system does not work. One of the causes is that the hydrant pipe is empty and has no water. This pipe may happen for various reasons, for example, a damaged pump. Another possibility is the installation of leaking pipes. Delayed repairs will be very dangerous if a fire occurs.

The fire extinguisher system in the Inalum Building is still new. This building is an office building and the head office of PT Inalum (Persero), a State-Owned Enterprise company of Government Republic of Indonesia operating since January 2021(Ruliyanta et al., 2023). Some pipes still need to be filled with water at the proper pressure. Therefore, it is necessary to provide fire extinguisher system training for responsible technicians and related employees.

The training aims to provide additional hard skills regarding fire extinguisher systems. This training provides knowledge about how to work and maintain the fire extinguisher system(Fatmah, 2009; Lanti Annistyaningrum, Ekawati & Bina Kurniawan, 2015). This training hopes that workers can operate and maintain the fire extinguisher system. In the end, this building belonging to the government of the Republic of Indonesia was protected from the danger of fire.

METHOD

The method used in this community service is training to increase hard skills regarding fire extinguisher systems. Participants will be given the basic theory of the fire extinguisher system (Haerani et al., 2023; Maulana Iqbal Lubabun Najib et al., 2023). Next, training participants will receive fire extinguisher system components and maintenance. The process flow of this activity is given in Figure 1.

This training consisted of 29 participants, namely 13 people from engineering, nine from security, and seven from housekeeping. The training location is in the Inalum building in Batubara Regency, North Sumatra Province. The activity was held on Wednesday, 27 October 2021.

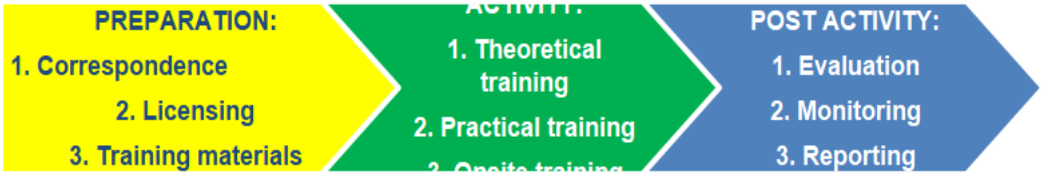

FIGURE 1. Activity process flow

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Preparation for activities begins with correspondence with partners. A letter was sent to the building management regarding the prospect of carrying out service activities following the partners' needs. In preparation for this training, an initial visit is carried out to see the condition of the equipment at the partner's premises. Figure 2 shows the condition of the hydrant pump room on the basement floor. The main obstacle to this activity is the implementation of the COVID-19 Protocol in the Inalum building(Cahyadi et al., 2022; Waani, 2016). Several requirements must be met to gain access to the building.

FIGURE 2. Inspection of the hydrant pump system during the preparation period

RESULTS AND DISCUSSION

Training Process

- Fire extinguishers are only used on large fires. It is recommended to use an light fire extinguisher for small or light fires (Abidin & Ramadhan, 2019). Extinguishing fires with fire hydrants can be done automatically or manually. Automatically uses sprinkler heads installed within a certain area. Meanwhile, manual fire extinguishing can be done using a fire hose connected to a nozzle. Figure 3 (a) shows the training atmosphere in the class when the material is delivered(Abidin & Ramadhan, 2019; Fatmah, 2009). In Figure 4, a technician is checking the condition of the Diesel pump battery voltage.

(a)

(b)

FIGURE 3. (a) Delivery of material in class (b) Diesel Pump inspection during training

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The Fire Extinguisher Pump consists of three pumps. The pump includes:

- Jockey Pump, the function of this pump is to maintain the water pressure in the pipe at the desired pressure. The water pressure in the pipes may drop. The main cause of a pipe leak could also be an active sprinkler head, or a nozzle being used. Water pressure settings in pipes vary from one building to another. This pressure depends on the height and area of the building. According to the National Fire Protection Association 20, hydrant pipe pressure is maintained between 6 to 8 bar or 8 to 10 bar (Agusri & Kimi, 2018; Cahyadi et al., 2022).
- Electric Pump, the way this pump works is to support the Jockey pump. The electric pump works if the Jockey pump cannot maintain the water pressure and the pressure continues to drop. The pump works at a pressure of 4~8 bar or 4~10 bar. Both types of pumps work with an electric source.
- Diesel Pump, when the two Jokey and Electric pumps cannot maintain water pressure, the third pump, the Diesel Pump, functions. Under certain conditions, the electricity will be turned off if a fire occurs in a building. As a result, the Jokey and electric pumps cannot be used. This reason is why the Diesel Pump is used. This pump is powered by diesel fuel (BBM). This pump works at a pressure of 3~8 or 3~10 bar. An important parameter that must be considered in a diesel pump is the electrical system. Batteries or accumulators must be always controlled. The pump must be warmed up once a week to ensure the engine is in ready-to-use condition.

Table 1 is an example of the pressure settings for each pump. This setting is important for every training participant to understand the water pressure regulation in the pipe. This setting is done on the pressurized switch of each pump control panel.

Table 1. Range of Pressure

Type of Pump	Range 1	Range 2	Marks
Jocky	6 – 8 Bar	8 – 10 Bar	Auto ON, Auto OFF
Electric	4 – 8 Bar	6 – 10 Bar	Auto ON, Manual OFF
Diesel	3 – 8 Bar	3 – 10 Bar	Auto ON, Manual OFF

In a normal system, if there is flow in the hydrant pipe, the flow switch will trigger an alarm in the building. Hydrant pipe accessories are very diverse. Table 2 provides several important components of a fire extinguisher system.

Table 2. Important components of a fire extinguisher system

Equipment	Marks
Water Tank	Water source to extinguish the fire
Pump room	Hydrant pump location
Pipeline	Pipe network systems in buildings
Pump	Jockey Pumps, Electric and Diesel
Panel Control	Pump operational panel
Pipa Header	Main pipe
Suction pipe	Place for suction water from the reservoir
Pressure tank	Pressure tank
IHD	Indoor Hydrant Box
OHD	Outdoor Hydrant Box

Figure 4 shows the Indoor Hydrant Box (IHB); officers must record all the equipment. IHB must be routinely checked for completeness and function. An example of a list of equipment that must be checked in the IHB is given in Table 3.

Table 3. Accessories of Inndoor Hydrant Box

Equipment	Mark
Box	Clean
Nozzle	1 piece
Hose/hose reel	1 piece

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Equipment	Mark
Valve	closed
Hose rack	1 piece
Alarm Bell	1 piece
Alarm Lamp	Active
Glass Brake	Stand by
Water	Ready ON

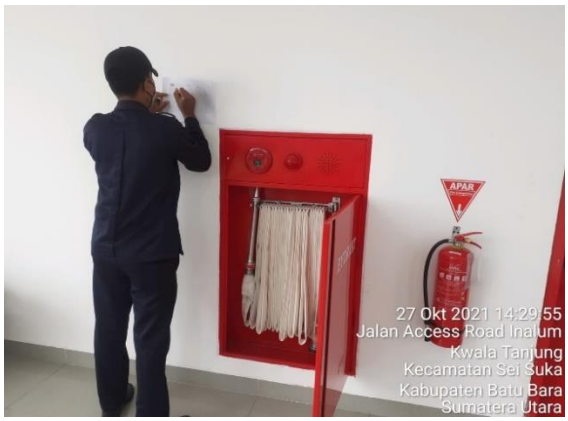

FIGURE 4. Checking the function and completeness of the IHB by officers

Extinguishing the fire using a hose was done manually. This use is done when officers detect a fire. The fire system in the building also has protection with sprinkler heads. The general shape of a head sprinkler is given in Figure 5.

FIGURE 5. Sprinkler head

Following Figure 5, the red liquid is on the sprinkler head or glass bulb. This red one is mercury, which will burst when exposed to heat at 68 °C. When the bulb breaks, water will flow out of the pipe. Haed sprinklers are regulated in the Indonesian National Standard (SNI) 03-3989-2000 concerning procedures for planning and installing automatic sprinklers to prevent fire hazards in buildings. Also, sprinkler installations are regulated through the NFPA 13 standard. Following NFPA 13, sprinklers must be able to work even if the water pressure is only 0.5 bar. When the sprinklers work, the water jet cannot be turned off automatically. The pipe must be shut off at the gate valve, or the pump must be turned off. We must replace the head sprinkler whose bulb has broken with a new one. Therefore, technicians are required to keep spare sprinkler heads in the warehouse.

The hydrant pipe is an open system, meaning that the water in the pipe cannot be circulated. Water in the pipe will cause corrosion of the pipe. For this reason, hydrant pipes must be maintained. The easiest and cheapest way is to dispose of pipe water at the bottom of the drain line. The water must be glow down the drain pipe at least once a month, depending on the water quality in the building. Just the amount of water that is thrown away is sufficient. It is best to let the brownish-black water come out of the drain pipe.

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Apart from using the glow-down method, the water in the pipe should be removed or replaced every six months. Water that needs to be thrown away or replaced is carried out using the fire extinguishing training method with a nozzle. Water can be sprayed into empty spaces outside the building or inside the building, as well as to test the performance of the fire extinguisher system.

Monitoring and Evaluation of Activity

The way to monitor this training activity is by providing an assessment form to training participants. Participants are asked to give satisfaction scores on a scale of 1 to 5. A score of 1 means the training participant is very dissatisfied, and a score of 5 means very satisfied. The assessment results for 29 training participants are given in Figure 6. The graph in Figure 6 shows the average value.

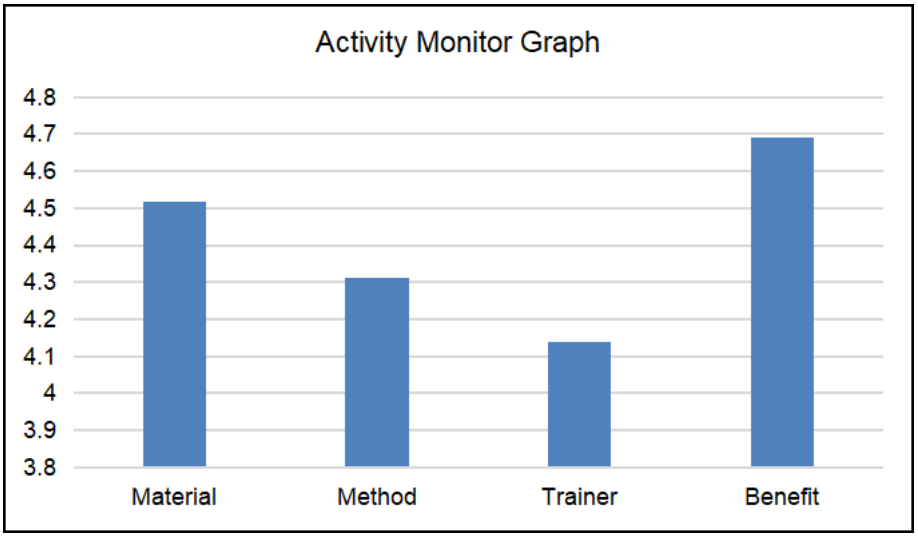

FIGURE 6. Training activity monitoring graph

Next, to evaluate the training process, we created 12 short questions. Participants are asked to fill out before and after the training. The list of questions is given in Table 4. The graph of the training success monitor is given in Figure 7. The graph shows the total correct answers from all training participants.

Based on Figure 7, the training results show an increase in the hard skills of the training participants. The pre-test results were originally 74.48% correct, increasing to 95.51%. These results experienced an increase of 21.03%.

TABLE 4. List of questions for evaluating the training process

Mark	Question	Answer options
Q1	What is the main purpose of firefighting actions?	a. Save property b. Save lives and property c. Secure the surrounding area d. Rescuing pets
Q2	What type of extinguisher is most suitable for electrical equipment fires?	a. Save property b. Save lives and property c. Secure the surrounding area d. Rescuing pets
Q3	What should you do first when you hear the fire alarm going off?	a. Remain calm and continue your activities b. Turn off the alarm c. Get out of the building as quickly as possible d. Take photos and videos for documentation
Q4	What is the function of	a. Save human lives

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Mark	Question	Answer options
	personal protective equipment (PPE) in firefighting duties?	b. Ensure fire sustainability c. Accelerates the rate of fire d. As decoration while on duty
Q5	What to do if someone's clothes catch fire?	a. Panic and run b. Roll on the ground to put out the fire c. Ask for help from others d. Pour oil or liquid to extinguish the fire
Q6	What is the function of a hydrant in a fire department?	a. Provide drinking water to firefighters b. Supplies large amounts of water for fire fighting c. Provide firefighting clothing d. Filter water for daily needs
Q7	Why is it important to have clear evacuation routes in buildings?	a. To speed up the fire process b. To make it easier to spread fire c. To facilitate evacuation in an emergency d. To provide additional challenges to firefighters
Q8	What should one do if someone is trapped in a room filled with thick smoke?	a. Stay where you are and wait for help b. Taking respiratory medications c. Scream for help d. Crawl to the floor and move towards the outside
Q9	What needs to be checked periodically to ensure the fire extinguisher is working properly?	a. Extinguisher paint colour b. Expiry date on the warranty card c. Pressure on the manometer d. Fire certificate
Q10	Where are portable fire extinguishers usually placed in a building?	a. Near the exit b. Near the kitchen c. On the roof d. Under the floor

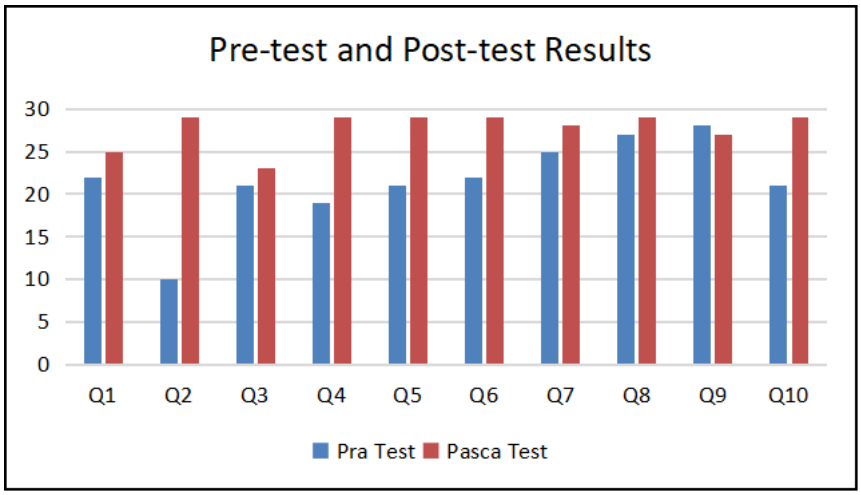

FIGURE 7. Graph of training achievement evaluation results

Obstacles during Training

An obstacle during the training was that the water pressure in the partner needed to be standard due to the gate valve being closed. Furthermore, it has been standardized and returned to normal. During training, the fire alarm system is turned off (silenced) to avoid an alarm occurring when there is water flow. The fire extinguisher system at our partner premises has been integrated with a fire alarm.

Training time for participants still needs to be increased. Many discussions still want to be carried out but with consideration of time carried out on-site in the area. Understanding all the components of a fire extinguisher takes more than a day.

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CONCLUSION

With this training, participants gain additional hard skills in the fire extinguisher system. There was an increase in knowledge of 21.03%, originally only 74.48% before the training, and increased to 95.51% after the training. This learning process was considered satisfactory by the training participants. The benefits of the training received a score of 4.89 on a scale of 5 by the participants.

An emergency response simulation in a building or Safety Induction is recommended for further training. This training is an integrated part of the occupational health and safety system, especially in high-rise buildings.

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