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Electrical Safety Education: Implementation of Electrical Safety for Diesel Operators at Pondok Modern Darussalam Gontor

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ABSTRACT

PMDG is an Islamic boarding school that has several activities that require large amounts of electricity and students as staff who manage electricity or are electrical and diesel operators. Electric and diesel operators at PMDG are young students and do not yet know the dangers of electricity. Apart from that, they also work without using PPE. It can cause work accidents and other major impacts such as explosions and fires. This service aims to identify, assess, and analyze risks using the HIRA method, provide knowledge about electrical safety, as well as provide PPE and how to use it. The methods used are pretest, education, posttest, and mentoring. Based on the results of the activities, it was found that four electrical activities had a high risk: installation of switches, installation of new electricity, installation of new MCBs at height and connection, and cleaning of generator handles with PLN voltage. There was an increase in participants' knowledge of 15.7%, increased skills in using PPE, and all participants were active. There needs to be continuity by providing intensive supervision and assistance regarding the implementation of electrical safety. Participants also need to be given training in dealing with work accidents caused by electricity.
Keywords: electrical safety, education, operator, Islamic boarding school

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INTRODUCTION

Pondok Modern Darussalam Gontor (PMDG) is the largest Islamic boarding school in Indonesia whose center is located in Ponorogo Regency, East Java. According to K.H. Imam Zarkasyi, PMDG is an Islamic educational institution with a dormitory system, where the kyai is the central figure, the mosque is the center of activities that animate it, and teaching is the main activity (Hidayat et al., 2020). Everything at Gontor is a curriculum. There is education in the form of assignments such as students being entrusted with managing electricity at Pondok by working in the diesel and electricity departments. There are several Santri who manage the food of thousands of Santri and ensure the Santri get enough food and nutrition and so on.

PMDG is one of the largest electricity consumers in Ponorogo Regency. Apart from daily activities at the Islamic boarding school, PMDG has several business units that require a large electricity intake, namely Darussalam Press Printing, Latansa Bakery, Amidas Gontor, and an ice cream factory. The entire unit requires more than >200 Kv (Kilovolt) amperes. The PMDG diesel and electricity department also manages all events and activities at PMDG such as the Annual ceremony. For each activity, 1 generator with a capacity of 150 KVA is provided to supply electricity at the annual ceremony, and 1 generator with a capacity of 40 KVA to supply the electricity needs in the modern cottage meeting hall. Drama Arena requires 2 generators with a capacity of 150 KVA for the sound system and a generator with a capacity of 250 KVA to supply needs (Humas Pondok Modern Darussalam Gontor, 2019). This illustrates the heavy duties and responsibilities of electrical and diesel operators at PMDG.

Work related to electrical tools or being in electrical circuits carries the risk of electrical hazards such as electric shock and short circuits which have fatal impacts on humans and cause property loss. Diesel and electrical department managers must pay special attention to electrical hazards to prevent fires and work accidents. Most of the electrical and diesel operators at PMDG are students who are classified as young workers. Electric and diesel operators at Pondok Modern Darussalam Gontor Pusat, Ponorogo, East Java, consist of 11 staff. The National Institute for Occupational Safety and Health (NIOSH) estimates that around 230,000 young workers under 18 years of age are injured due to work every year (Umam & Sanjaya, 2022). Young workers have a higher risk of work-related injuries compared to experienced workers (Claresta & Andarini, 2020). According to the CDC, young workers aged 15-24 are at twice the risk of occupational injury compared to those aged 25 or over (International Labour Organization, 2018).

Problem analysis has been identified through interviews and observations at all stages of PMDG electrical work. The problem that is of concern is that students as electrical and diesel operators have not received knowledge regarding the principles of working safely in electricity, electrical and diesel operators also change every period and are self-taught, students as diesel and electricity operators have not used electrical Personal Protective Equipment (PPE), and no occupational safety and health risk analysis or Hazard Identification and Risk Assessment (HIRA) related to electrical hazards. HIRA can reduce the impact of losses. HIRA is a method for identifying potential work hazards early on to prevent work accidents (Ambarani & Tualeka, 2017).

Therefore, it is necessary to control electrical hazards for electrical and diesel operators at PMDG by providing training and assistance in electrical occupational health and safety. This service activity aims to prepare HIRA documents for electrical activities and provide training and assistance related to electrical work safety for electrical and diesel operators at PMDG so that they can recognize, assess, evaluate, and control electrical hazards, and assist the PPE used. Therefore, it is necessary to control electrical hazards for electrical and diesel operators at PMDG by providing training and

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assistance in electrical occupational health and safety. This service activity aims to prepare HIRA documents for electrical activities and provide training and assistance related to electrical work safety for electrical and diesel operators at PMDG so that they can recognize, assess, evaluate, and control electrical hazards, and assist the PPE used.

METHOD

Community service activities are carried out using a learning approach method as in the picture below:

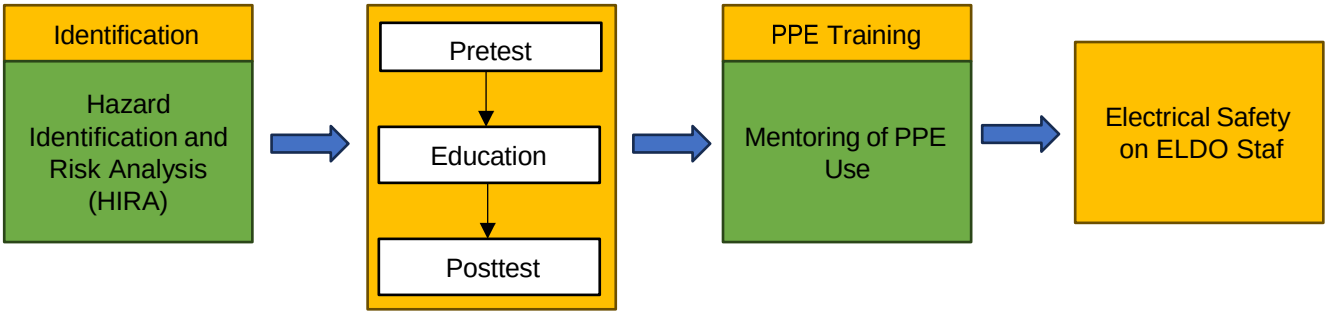

FIGURE 1. Method of community service activities

This service partner is the Electric and Diesel Operator (ELDO) at Pondok Modern Darussalam Gontor Ponorogo. Activities begin by identifying hazards and risks using the Hazard Identification and Risk Analysis (HIRA) method to analyze the risk priorities that must be followed up immediately. Based on the HIRA results, the team provided electrical safety education starting with a pretest and ending with a posttest. Next, the team assisted in the use of Personal Protective Equipment (PPE) and provided it to Partners. So it is hoped that ELDO staff can work safely.

RESULTS AND DISCUSSION

The following are the results of community service according to the activity stages:

Hazard Identification and Risk Analysis (HIRA)

Hazard Identification and Risk Analysis (HIRA) activities were carried out in the electrical and diesel operator section on Wednesday, 15 November 2023. The team was accompanied by the supervisor of the electrical and diesel operator section and participated actively when carrying out the HIRA with the following stages:

- Identify the work stages of electrical and diesel operators.
- Identify hazards and risks at each stage of work.
- Assess the hazards and risks of the work stages.
- Analyze the results with the HIRA table

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The following are the HIRA results for electrical and diesel operators:

TABLE 1. The result of hazard identification and risk assessment at electrical and diesel operator

Work Stage	Hazard	Type of Potential Hazard	Risk	Initial Risk			Risk Level	Recommendation Controls
				O	L	R		
Material Lifting 1	Manual lifting and folding	Getting entangled, falling, hit by cables	Minor injury, sprained leg	5	2	10	MEDIUM	Using a cart to carry cables, as well as providing ties on each side of the end
Electrical Voltage Installation	Inconvenient installation position, electrical voltage on the switch cable	Electric shock	Minor injury to the part affected by the electric shock	2	2	12	HIGH	Temporarily shut down building installations during repairs, use of PPE
Maintenance of street lighting facilities	Inconvenient installation position, lack of personal protective equipment at height	Fell from the stairs, got tangled in the rope	Serious injury to the body	4	3	10	MEDIUM	Use of PPE, use of stairs according to height
Material Lifting 2	Lifting position, passing many people, material weight exceeds the standard	Slipping, tripping over material	Minor Injury	4	3	10	MEDIUM	The lifting is carried out by two to three people, providing scaffolding because it is lighter and stronger
Installation of New Electrical 1	Remaining pieces of cable, dangerous installation locations, scattered waste materials	Slipping, falling on cast iron frames, tripping, being crushed by waste material	Bruises, minor injuries, punctured by iron binding wire	4	3	13	HIGH	Use of PPE in the form of a body harness, providing piles of wood on cast iron footings
Installation of New Electrical 2	The installation location is quite moist	Slipped, tripped	Slipped, tripped	2	2	6	MEDIUM	Use boots and a hoe fork to dig the soil
Regular Maintenance 1	The location of the water panel is covered by material and close to a rubbish dump	Pinched, electrocuted, crushed by mica covering	Moderate injury, bruises	3	2	10	MEDIUM	Use of PPE, provide warning stickers and danger limits

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Work Stage	Hazard	Type of Potential Hazard	Risk	Initial Risk			Risk Level	Recommendation Controls
				O	L	R		
Material Replacement	Installation is carried out at a height above 15 meters, installation locations are limited	Fallen, caught in the material	Major injury	4	4	15	HIGH	Use of PPE in the form of a body harness
Material Installation	Inconvenient installation location, unsafe electrical current intake	Slipping, tripping over cables, endangering others	Moderate injury, bruises	3	2	6	MEDIUM	The use of PPE takes electric current from the safest source, not the closest
Regular Maintenance 2	The installation location is obstructed by objects, and the installation and connection positions are unsafe	Electrocuted	Major injury	3	2	12	HIGH	Use complete PPE, turn off home installations temporarily
Regular Maintenance 3	Inappropriate removal of diesel fuel spilled diesel fuel	Slipped, low back pain	Moderate injury to the shoulder	2	2	10	MEDIUM	Use a pump hose to suck up the diesel fuel, placing a saucer under the filling tank
	Types of cables mixed with electricity, CCTV, sound and WiFi cables, places at the end of the building, wasp, and insect nests are falling	Falling, being electrocuted, slipping	Moderate injury	3	2	10	MEDIUM	Using scaffolding, using body harnesses, combing cable routes
Regular Maintenance 4	Installation is carried out by drilling holes in the wall with a drill which creates dust and smoke	Small particle material deposits	Eye injury, limited vision	4	3	10	MEDIUM	Use safety glass
The location of the radiator tank is very narrow, and adding fluid is very inconvenient	Caught in the generator part	Minor Injury	2	3	10	MEDIUM	Using the radiator fill hose	The location of the radiator tank is very narrow, and adding fluid is very inconvenient

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Work Stage	Hazard	Type of Potential Hazard	Risk	Initial Risk			Risk Level	Recommendation Controls
				O	L	R		
When the oil spills into the engine base area, turning the filter key is quite strong	Slipped, fell, got splashed with oil	Moderate Injury	3	2	10	MEDIUM	Use a cloth covering the filter so that the remaining oil doesn't gush out, and use a face shield or glasses so that oil splashes don't hit vital organs	When the oil spills into the engine base area, turning the filter key is quite strong

Based on Table 1 above, 4 activities are at a high-risk level, and 11 activities are at a medium-risk level. High-risk activities include installing switches on switch cables that have long been damaged without turning off the electricity and not using PPE (Risk Score=12), installing new electrical installations for bathrooms before casting (Risk Score=13), and installing new MCBs for lights 500-watt beam carried out at a height of more than 15 meters (Risk Score=15), and connecting, cleaning the generator handle with PLN voltage (Risk Score=12). Therefore, there needs to be immediate action on these four work activities with the priority being electrical work at height.

Working with electricity is dangerous because there is a risk of interacting with electric voltage, especially when it requires working without turning off the electric current, such as in repairs, maintenance, securing the electricity network, and expanding the network (Hariadi & Hartati, 2022). Apart from that, electrical work at heights must use appropriate PPE in the form of a body harness to prevent falls from heights (Aulia & Hermawanto, 2020). According to the CDC, young workers aged 15-24 are at twice the risk of occupational injury compared to those aged 25 or over. According to Industrial Technology Suppliers, workers need to understand the electrical safety regulations, especially regarding electric shock to reduce losses in the form of burns, serious injuries, death, and loss of property (Neyra Vela, 2020). Therefore, efforts are needed to prevent the risk of work accidents by identifying, assessing, and analyzing control efforts. Through the HIRA table, electrical and diesel operator supervisors can develop priority work programs to reduce the risk of work accidents.

Electrical Safety Education

Electrical safety education was held on Wednesday, 15 November 2023 at the Rabithah Hall of Pondok Modern Darussalam Gontor Ponorogo, which was attended by 28 participants. Participants are electrical and diesel operator staff. Education begins with a pretest to determine the participants' initial understanding before carrying out educational activities. The pretest sheet consists of questions that are appropriate to the educational material that will be presented by the speaker. Pretest and posttest methods are used to determine the effectiveness of educational activities (Damayanti et al., 2017).

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FIGURE 2. Electrical and diesel operators carry out the pretest and posttest

The activity was continued with educational activities by speakers who were experts in electrical safety. The educational material consists of the dangers of working with electricity, the principles of working safely with electricity, and dealing with work accidents caused by electricity. This educational activity was carried out to increase participants' knowledge about the dangers of working in electricity. Education is an effort to equip participants with knowledge about certain information in the hope of overcoming problems (Eryani et al., 2015). Participants actively discussed by conveying technical experiences in the field.

(a) (b)

FIGURE 3. Electrical and diesel operators discuss in educational activities

The presentation was delivered by the speaker for 45 minutes then continued with the posttest. The following are the results of the participants' pretest and posttest:

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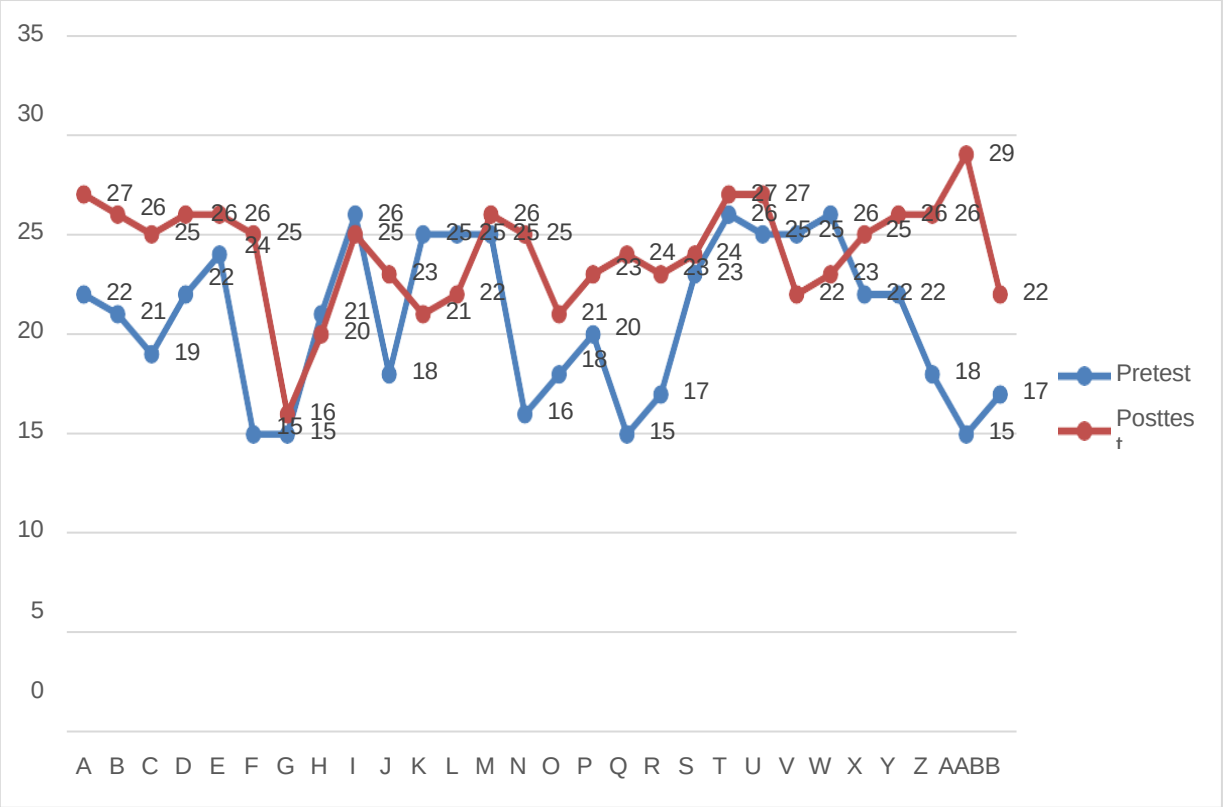

FIGURE 4. Pretest and posttest results of electrical safety education

Based on the results of Figure 4, it is known that there has been an increase in operator electrical and diesel knowledge by 15.7%. The average of the pretest was 20.82 and the posttest average was 24.10. It shows that educational activities can increase participants' knowledge about preventing the impact of work accidents caused by electricity. According to Smith and Sonesh, safety education can reduce the risk of work accidents, and knowledge of electrical safety education can increase workers' understanding of electrical hazards (Emidiana et al., 2022). Based on the pretest and posttest scores, participants still have a weak understanding of how to deal with work accidents caused by electricity. Electrical and diesel operators must receive first aid and emergency response plan training regarding appropriate electrical accident rescue techniques to minimize losses (Elsayed & Mekhmier, 2017).

Personal Protective Equipment (PPE) Training

The educational activities continued with training on Personal Protective Equipment (PPE) which must be used by electrical and diesel operators and their functions. Electrical activities are dangerous work that requires the use of PPE (Emidiana et al., 2022). The following is the PPE provided and donated by the service team to electrical and diesel operators according to the picture below:

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FIGURE 5. PPE provided by the community service team for electrical and diesel operators

Personal Protective Equipment (PPE) provided by the community service team to partners consists of (Emidiana et al., 2022; Mahdini & Abdul, 2019):

- Safety Helmet: to protect the head from falling objects, collisions with objects around the work site and to protect the head when falling from a height.
- Goggles: to protect staff from working in dusty areas and prevent sparks that might appear while working.
- Body Harness: to protect staff from the risk of falling from heights.
- Fireproof clothing: to protect the body from arc flash which may arise from electric current.
- Electrical Gloves: to prevent or inhibit the flow of electricity from entering the body because they have an electrical insulator feature.
- Protection Hood: to protect staff from flashes and sparks that target the neck or head. It can be used situationally or does not have to be worn all the time.
- Safety shoes: to protect the feet from electric currents and falling objects.

In training activities, participants enthusiastically and actively contributed to the simulation of using PPE as in the picture below:

FIGURE 4. Simulasi pemakaian PPE

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Through this training, participants know what PPE should be worn when working with electricity and its function. When the simulation, participants are also skilled in wearing PPE from head to toe. According to Rinawati, efforts to instill knowledge regarding PPE have an impact on the maximum, effective, and efficient use of personal protective equipment to improve employee safety and occupational health (Husna et al., 2019; Mahdini & Abdul, 2019).

CONCLUSION

Through this community service, Pondok Modern Darussalam Gontor has a Hazard Identification and Risk Assessment (HIRA) document for electrical and diesel operators. Activities that are high risk and require immediate action are installing switches, installing new electrical installations for bathrooms, installing new MCBs for 500-watt spotlights at heights above 15 meters, and connecting and cleaning generator handles and live PLN. Educational activities can increase electrical and diesel operators' knowledge regarding the principles of safe working in electricity by 15.7%. Participants are also skilled in using electrical PPE in the form of a safety helmet, goggles, body harness, fire-resistant clothing, electrical gloves, protection hoods, and safety shoes.

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