

Preparedness for Fire Emergency in the Nutrition Laboratory at University X in Semarang: as a Safety Education for University Students

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Abstract: The Occupational Safety and Health Administration (OSHA) indicates that academic laboratories are 11 times more dangerous than the industrial sectors. The nutrition laboratory is a place that has a high potential to cause fire because there are cooking activities, where these activities are very risky because they deal directly with fire and gas cylinders there. If the gas cylinder has a leak, it can cause a fire risk. This study aims to look at the preparedness of fire disaster management in the Nutrition Laboratory at University X in Semarang city. The research design used in this research was a descriptive qualitative. There were 3 informants, namely the person in charge of the nutrition laboratory and 2 students of the Nutrition Study Program. Data collection techniques used in this research was in-depth interviews. The results showed that the nutrition laboratory at University X in Semarang city already had management related to fire prevention such as the availability of fire extinguishers, evacuation routes, and assembly points. It is recommended that related parties complete active and passive protection systems, improve fire prevention teams, train and socialize, and conduct regular testing of active protection facilities in the Nutrition Laboratory.

Keywords: Fire emergency management, laboratory, preparedness

INTRODUCTION

According to the latest estimates by the International Labour Organization (ILO) in 2018, more than 1.8 million work-related deaths occur annually in Asia and Pacific regions, of which two-thirds of the world's work-related deaths occurred in Asia. As many as 2.78 million workers died every year due to work accidents and work-related diseases. Approximately 2.4 millions or 86.3% of these deaths were caused by occupational diseases, while more than 380,000 or 13.7% were caused by work accidents (Ridasta, 2019). Based on the Badan Penyelenggara Jaminan Sosial Kesehatan (BPJS) or Social Health Insurance Administration Body annual employment report, the number of work accidents in Indonesia in 2018 was 173,105 cases, in 2019 there were 114,000 cases, and in 2020 there were 177,000 work accident cases (Aishakina et al., 2021). Work accidents are caused by physical and human factors. Physical factors such as unsafe working conditions, while the human factor is the behavior of workers who do not meet safety, due to carelessness, drowsiness, and fatigue (Aishakina et al., 2021; İşsever et al., 2008).

The laboratory is an important part of university education, scientific research, and is closely related to a hazardous work environment for learning and work, and it is also very close with various potential hazards including chemical, biological, and physical agents (Ayi & Hon, 2018). The Occupational Safety and Health Administration (OSHA) indicates that academic laboratories are 11 times more dangerous than the industrial sectors (Nasrallah et al., 2022). University laboratories are considered more hazardous than industrial laboratories due to a more relaxed management or safety culture and lower safety investment compared to industrial plants (Y. Yang et al., 2019). The construction rate of the laboratory has increased significantly, but laboratory safety accidents occur from time to time (Keckler et al., 2019; Ménard & Trant, 2020; Olewski & Snakard, 2017; Salazar-Escoboza et al., 2020; Samaranayake et al., 2022; Walters et al., 2017; Wirth et al., 2020; Wu et al., 2008; J. F. Yang et al., 2022).

According to global reports, accidents in university laboratories resulting in students and laboratory staff suffering serious injury or death (Y. Yang et al., 2019). On December 18, 2015, a laboratory in Beijing exploded and caused a big fire which caused the death of a postdoctoral student. On December 26, 2018, another explosion occurred in a laboratory in Beijing which resulted in the death of three people (Chen et

al., 2020). On March 16, 2016, a postdoctoral student lost an arm in an explosion at the University of Hawaii laboratory while mixing carbon dioxide, hydrogen, and oxygen from separate cylinders to produce a bacterial growth medium (Trager, 2017). On December 29, 2008, a research assistant died in a laboratory fire accident while working with pyrophoric chemicals at the University of California, Los Angeles (UCLA). This accident prompted rapid and comprehensive laboratory safety reform at UCLA (Gibson et al., 2014).

The laboratory is a place for university students to develop knowledge and skills in learning. As a base for scientific teaching and research, the university laboratory is not only an important place to train students' experimental abilities and skills but it is also an important base for cultivating students' innovation abilities (Lu, 2023). The construction of laboratories is very important for the development of higher education institutions, where the level of construction and management directly reflects the level of teaching, scientific research and management of higher education institutions (Li & Wang, 2022; Li & Zhang, 2022). However, the laboratory has potential hazards that can harm practitioners, namely lecturers and students in the teaching and learning process. In the laboratory, there are potential hazards and risks of accidents that can be caused by practicum tools and materials if the work is not in accordance with occupational safety and health procedures in the laboratory (Husna, 2023).

The nutrition laboratory is one of the laboratories at University X in Semarang city which is used as a support for education by students. The nutrition laboratory has potential physical hazards (knife cuts and fire), chemical hazards (poisoning due to leaking gas cylinders), biological hazards (fungus and bacteria), ergonomic hazards (musculoskeletal problems), and psychosocial hazards (stress due to workload). The nutrition laboratory is a place that has a high potential to cause a fire because in the nutrition laboratory there are cooking activities, where these activities are very risky because they deal directly with fire and gas cylinders. If the gas cylinder has a leak, it can cause a fire risk (Ardiyanto et al., 2021). Using an oven has potential hazards such as exposure to heat and fire (Ridasta, 2019). Short circuit due to excessive and careless use can cause a fire (Ratnayanti et al., 2019). The nutrition laboratory is a place that has the potential for accidents to occur because in the nutrition laboratory there are many tools and equipment that can be dangerous if the practitioner does not understand how to use them correctly and safely. Another factor that can cause work accidents is equipment that is not designed properly to be equipped with sufficient safety (Ardiyanto et al., 2021).

Therefore, we need a fire suppression system that can prevent and overcome fires. This study aims to look at the preparedness for fire disaster management in the Nutrition Laboratory at University X in Semarang city through fire protection facilities, fire management teams, as well as training and socialization related to fire disasters which are important elements in preparedness in dealing with fire disasters.

METHODS

The research method used in this research was qualitative one with a descriptive approach. This research aims to analyze the readiness of fire emergency response in the nutrition laboratory at University X in Semarang city. The Primary data of this study was collected from observations and interviews. There were 3 informants in this study consisting of the person in charge of the laboratory and 2 students of the Nutrition Study Program. The independent variable in this study is fire emergency response preparedness. The dependent variable in this research is the nutrition laboratory. The data were processed using the data triangulation method, namely the technique of checking the validity of the data by comparing the results of interviews with the results of observations.

RESULTS AND DISCUSSION

ACTIVE PROTECTION

Based on the observation results, the fire extinguisher provided was outside the nutrition laboratory room. The nearest fire extinguisher was in the lobby of the building which was right in front of the nutrition laboratory room with a distance of less than 15 meters from the other fire extinguishers which were in the corridor of the 1st floor. In the 1st floor there were three fire extinguishers. The existing fire extinguishers were the dry chemical powder type. Fire extinguishers with chemical powder has a function to block oxygen from entering the fire triangle because it has a low melting point and can form a barrier so that oxygen cannot enter the fire point. The existing fire extinguishers have never been regularly inspected/tested. Prevention and control of fires through active protection systems that have not been implemented are the installation sprinklers, heat detectors, smoke detectors, fire alarms and hydrants.

PASSIVE PROTECTION

Emergency Stairs

Based on the results of observations in the building of the nutrition laboratory at University X Semarang, there are no emergency stairs. If there is a fire disaster in the nutrition laboratory, the stairs used are the main stairs that lead to the lobby exit. However, there is another staircase near another exit that leads directly to the gathering point location, so that there is no accumulation on the main staircase during an emergency. The ladder has a handle on one side and is not slippery.

Emergency door

Based on the results of observations in the building of the nutrition laboratory at University X in Semarang city, there is no emergency exit. If there is a fire, the nutrition laboratory will use the normal door. The building has 2 exits that can be used as evacuation routes in the event of fire. The door to the lobby functions as the main route in the event of fire, while the door on the side of the building functions as an alternative route so that congestion does not occur in the event of fire.

Evacuation Route

The Building of the the nutrition laboratory at University X in Semarang city, already has an evacuation route that is listed in the evacuation plan on each floor. The evacuation route leads to the outside of the gathering point area. When there is a fire disaster in the nutrition laboratory, practitioners can immediately evacuate themselves to the gathering point area. Based on the results of the observations, around the nutrition laboratory room there are evacuation route directions that leads to the outside of the building and direct people to the gathering point area.

Gathering Point

Based on the results of observations in the the nutrition laboratory at University X in Semarang city, there is one gathering point that can be seen in the evacuation plan, the gathering point is on the side of the building close to alternative evacuation routes. The location of the gathering point is wide, in an open space, access to the gathering point is not difficult, but the gathering point is less than 20 meters from multi-storey buildings so that it is too close to a risk of danger in the event of fire and emergency.

Fire Fighting Team

The nutrition laboratory at University X in Semarang city, already has a team of firefighters who are part of the Emergency Response and Occupational Safety and Health team which are specifically coordinated for the fire management team. The firefighter team coordinator has the main duties and functions. The main duties and functions of the firefighting coordinator are to carry out fire fighting using all fire extinguishing facilities within the campus environment in a safe, secure and effective manner and to report any deficiencies/damage of the fire fighting facilities and infrastructure within the campus environment to the Emergency Response Coordinator. The emergency response organizational structure is listed on the floor plan next to the nutrition laboratory room, but the plan was last updated in 2014.

Training and Outreach

Based on the results of observations and interviews with informants from the nutrition laboratory, it was concluded that training on the use of fire extinguishers have never been conducted for students. Fire training has only ever been carried out by the person in charge of the nutrition laboratory so that the practitioner is not sufficiently prepared in fire disaster management because not all of the trainees have received training in using fire extinguishers. Fire prevention training such as fire emergency evacuation has never been carried out. The socialization provided is in the form of Standard Operating Procedures (SOP) or rules that must be obeyed by students when using the laboratory.

ACTIVE PROTECTION

Active fire protection system is a fire protection system, either automatically or manually to extinguish fires actively in detecting fires and in extinguishing efforts. According to the Regulation of the Minister of Public Works No. 26 of 2008 regarding active protection systems consisting of fire extinguishers, sprinklers, heat detectors, smoke detectors, fire alarms and hydrants.

Based on the observation results, the fire extinguisher provided is outside the nutrition laboratory room. The nearest fire extinguisher is in the lobby of the building which is right in front of the nutrition laboratory room with a distance of less than 15 meters from the other fire extinguishers which are in the corridor in the 1st floor. In the 1st floor there are three fire extinguishers. The existing fire extinguishers are

dry chemical powder type. Fire extinguisher with chemical powder has a function to block oxygen from entering the fire triangle because it has a low melting point and can form a barrier so that oxygen cannot enter the fire point. Fire extinguisher with dry chemical powder is effective for almost all classes of fires, namely class A which is triggered by flammable objects, class B which is caused by flammable liquids, class C which arises from an electric short circuit, and class D caused by metals (Zulkifli & Mangindara, 2020). The existing fire extinguishers have never been inspected/tested on a regular basis, this is not in accordance with Permen PU No. 26/PRT/M/2008, where fire extinguishers must always be maintained in full condition and ready to operate and must be maintained at all times in a designated place when the device is not in use. The fire extinguishers must be inspected from the time it is placed and functioned and thereafter at intervals of approximately 30 days and maintenance is carried out for a period of not more than 1 year.

Fire prevention and control through active protection systems that have not been implemented are installing sprinklers and heat detectors, smoke detectors, fire alarms and hydrants. Even though a fire alarm is really needed because the nutrition laboratory is prone to fires and as a notification in the event of a fire.

PASSIVE PROTECTION

Emergency Stairs

Emergency stairs are ladders for evacuation routes when an emergency occurs. Emergency stairs are used as an exit in the event of fire. Emergency stairs are equipped with emergency exits, emergency lighting and smoke control. Emergency stairs must be safe and protected, constructed permanently and designed to be non-flammable. Emergency stairs function only for evacuation in the event of an emergency and may not be used as a place to store goods (Ikhsanudin, 2011). Based on the results of observations in the building of the nutrition laboratory at University X in Semarang city, there are no emergency stairs. If there is a fire disaster in the nutrition laboratory, the stairs used are the main stairs that lead to the lobby exit. However, there is another staircase near another exit that leads directly to the gathering point location, so that there is no accumulation in the main staircase during an emergency. The ladder has a handle on one side and is not slippery.

Emergency door

Emergency door is a means of passive fire protection that is used as an evacuation route in the event of a fire disaster. Emergency exits are doors that lead directly to the emergency stairs and may only be used in case of fire. Emergency doors function only for evacuation in the event of an emergency and may not place items in front of the emergency exit. The emergency door is in front of the emergency stairs as an insulator so that heat does not enter the stairwell, on every floor the door opens towards the stairs except on the ground floor, the door opens to the outside (Ikhsanudin, 2011).

Based on the results of observations in the building of the nutrition laboratory at University X in Semarang city, there is no emergency exit, the normal door in case of fire is used in the nutrition laboratory. The Building of the nutrition laboratory at University X in Semarang city has 2 exits that can be used fire, while the door on the side of the building functions as an alternative route so that congestion does not occur in the event of a fire.

Evacuation Route

Evacuation routes are routes specially provided to connect rooms or buildings to safe areas in the event of a fire. In the event of a disaster, to reduce loss of life and loss of property, people who are in or near the building need to be evacuated to a safe place, namely a gathering point (Gao et al., 2023). Evacuation route signs and emergency exit signs are used in buildings to guide occupants to a safe place and away from danger in the event of a fire (Filippidis et al., 2021). The Building of the nutrition laboratory at University X in Semarang city, already has an evacuation route that is listed on the evacuation plan on each floor, the evacuation route leads outside to the gathering point area. When a fire disaster occurs in the nutrition laboratory, practitioners can immediately evacuate themselves to the gathering point area. Based on observations, around the nutrition laboratory there are evacuation route directions that lead outside the building to the gathering point area.

Gathering point

According to Minister of Public Works No. 14/PRT/M/2017 a gathering point is a place used by building users and visitors to a building to gather after the evacuation process. Assembly points are an important part of emergency response planning, if a fire occurs, users and visitors to the building must be able to get out of the building to the gathering point, so it is very important to know the location of the

gathering point and the reason for this place being the gathering point location. As a guarantee for practicing on campus in the event of a fire disaster, gathering points must meet the requirements, namely easy, safe and reliable access. Easy access is the main requirement that must be met as a gathering point location. This makes it easier to immediately go to the gathering point location the first time a fire disaster occurs, which can guarantee the safety of lecturers, students and visitors. Safe and reliable are basic requirements for assembly points. Where it must be square, open space, as far as possible, and there must be no buildings nearby that could collapse and injure people (Fang & Lu, 2001).

Based on the results of observations in the Building of the nutrition laboratory at University X in Semarang city, there is one gathering point that can be seen in the evacuation plan, the gathering point is on the side of the building close to alternative evacuation routes. The location of the gathering point is wide, is in an open space, access to the gathering point is not difficult, this is in accordance with Permen PU No. 14/PRT/M/2017, but the gathering point area is not functioning as it should, the gathering point is less than 20 meters from multi-storey buildings so that it is too close to a risk of danger in the event of a fire emergency, this is not in accordance with Permen PU No. 14/PRT/M/2017.

Fire Fighting Team

The fire prevention team is a team consisting of people who are trained and ready to fight fires. The fire fighting team is based on Minister of Public Works Regulation No. 20/PRT/M/2009 concerning technical guidelines for fire protection management in urban areas which reads that building owners or users are required to carry out fire prevention by forming an organization whose model can be a fire prevention team,

The nutrition laboratory at University X in Semarang city, already has a team of firefighters who are part of the Emergency Response and Occupational Health and Safety team, which is specifically coordinated for the fire management team. The firefighter team coordinator has the main duties and functions. The main duties and functions of the firefighter coordinator are to carry out fire fighting using all fire extinguishing facilities in the campus environment in a safe, secure and effective manner and to report any deficiencies/damage to fire fighting facilities and infrastructure in the campus environment to the emergency response coordinator. In addition, the emergency response team includes an area coordinator, PK3 team coordinator, evacuation team, security team coordinator, external communication team coordinator, internal communication team coordinator, and the meet up area team coordinator. The emergency response organizational structure is listed on the floor plan next to the nutrition laboratory room, but the plan was last updated in 2014.

Training and outreach

The training and outreach aims to train practitioners to always be prepared in dealing with emergencies so that when a fire disaster occurs, the practitioner already knows the first thing to do in an emergency. Practitioners are at the forefront of safety, they must participate in hazard analysis and fire-related mitigation processes, which support the implementation of corrective and preventive actions. To avoid unplanned or unforeseen events that have a negative impact it is necessary to adopt adequate safety measures and improve safety culture, practice and training in the nutrition laboratory. Inadequate safety knowledge and low safety awareness from practitioners and those in charge are the main factors for accidents in the laboratory (Ayi & Hon, 2018; Chen et al., 2020; Husing & Silbey, 2013). Effective accident prevention can be done by strengthening training for laboratory practitioners and administrators, to create a good safety culture at the university (Chen et al., 2020).

Based on the results of observations and interviews with nutrition laboratory informants at University X in Semarang city, it was concluded that training on the use of fire extinguishers have never been conducted for nutrition students. Fire training has only ever been carried out by the person in charge of the nutrition laboratory so that the practitioner is not sufficiently prepared in fire emergency management because not all of the trainees have received training in using fire extinguishers. Fire prevention training such as fire emergency evacuation has never been carried out. The socialization provided is in the form of Standard Operating Procedures (SOP) or rules that must be obeyed by students when using the laboratory. The SOP is in the form of a document but is not displayed in the nutrition laboratory. The SOP is delivered by the person in charge of the laboratory before students start learning in the nutrition laboratory. Examples of SOPs given are the obligation to use special aprons and sandals when in the nutrition laboratory and are not allowed to place flammable materials around the stove in the laboratory room. Work safety culture in the laboratory, such as complying with SOPs, is important to apply to prevent work-related accidents (Eighmy et al., 2020).

CONCLUSION

There is no active protection system at the nutrition laboratory of X University in Semarang city. The active protection system is in the Public Health Sciences Department building in the form of a Fire Extinguisher. However, the existing fire extinguishers have never been regularly inspected/tested. Based on the Regulation of the Minister of Public Works No. 26 of 2008 active protection that is still lacking, namely heat and smoke detectors, sprinklers, fire alarms, and hydrants, so that the building of the Public Health Sciences Department of University X Semarang does not comply with the regulations. Passive protection systems in buildings are evacuation routes and assembly points. Access to the gathering point is not difficult. This is in accordance with Minister of Public Works No. 4/PRT/M/2017, but the gathering point is too close, less than 20 meters to multi-storey buildings. Students should be given socialization through safety induction (introduction to potential hazards, hazard control, PPE) as well as training in prevention and evacuation procedures in the event of a fire disaster. Recommendations to those in charge of the nutrition laboratory and building of the nutrition laboratory at University X Semarang, to equip and improve their active protection systems and monitoring/testing of active protection systems is required on a regular basis. They should improve their passive protection systems such as repairing the gathering point area, updating the fire management team and increasing the ability of their human resources as fire prevention and management.

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