



ANALYSIS OF CONSTRUCTION SAFETY RISK MANAGEMENT BASED ON PU MEMORY NUMBER 10 THE YEAR 2021 “ Case Study: Provision of Sanitation Facilities in Institutions Religious Education”

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<p>Abstract</p> <p>Due to workers' lack of awareness regarding the implementation of Occupational Health and Safety (OHS) in the workplace, the level of work safety in Indonesia still needs to be higher. Construction projects require effective risk management in order to reduce workplace accidents. The construction project for the provision of sanitation facilities and infrastructure at religious education institutions works on the construction of the bathroom, latrines, toilets, ablution facilities, hand washing facilities, and clothes washing facilities, as well as a domestic wastewater treatment plant (WWTP). This study aims to identify hazards based on the project under study, analyze the OHS risk assessment based on the Minister of Public Works Regulation No. 10 of 2021, and analyze the hazards and risk control efforts at each project stage. The result of this study showed that there are 78 risks found in 9 stages of work. Based on the risk assessment of the project under study, two levels of risk were identified, namely low risk and medium risk. A score of a moderate risk level of 6.57 was found in the installation of fabricated WWTP that showed injury risk due to materials and equipment at the Al-Muttaqin Islamic Boarding School, Mubarak Islamic Boarding School, and Darul Hidayah Islamic Boarding School, falling risk due to uneven surface conditions in the Pondok Pesantren Darul Ihsan Islamic Boarding School and the risk of falling into a dug hole at the Nahdotus Shibiyan Islamic Boarding School.</p>	<p>Article history: <i>Submitted 16-10-2022</i> <i>Revise on 20-01-2023</i> <i>Published on 28-02-2023</i></p> <p>Keyword: <i>Risk Analysis, Sanitation Construction, OHS</i></p>
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1. Introduction

The construction industry is considered to be the most vulnerable to accidents; most of the work accidents are caused by human error, electrocution, and being hit by objects from a height (Soekiswara, 2020). It is related to the unique characteristics of construction projects, different work locations and affected by the weather, limited execution times, dynamic and demanding goods demanding, and also using a lot of trained workers. Construction takes the first place as the most dangerous job in the world. In the construction industry, the risk of

fateful work accidents is 5 times higher, and the risk of significant injury is 2.5 times higher than in the manufacturing sector (Khosravi, 2014). Work safety is the protection of work security experienced by workers both physically and mentally in the work environment (Bangun Wilson, 2012), while according to Mangkunegara (2013), occupational health refers to conditions that are free from physical, mental, emotional, or pain that caused in the work environment. Generally, there are two categories of causes for work accidents: fundamental causes and immediate causes.

Less or weak knowledge, skills, and motivation are categorized as the primary causes. Work accidents can also happen because of things at work or in the environment. While the immediate causes of work accidents include unsafe conditions, those are the actions that will cause accidents such as inadequate or unqualified safety equipment, protective equipment, or obstacles. Other than those dangerous conditions, dangerous actions can also directly cause work accidents. Misbehavior, operating equipment without permission, not giving warnings and safety precautions, working at the wrong speed, making the safety equipment break down, moving the safety equipment, using broken equipment, using the equipment wrong, and not using protective equipment or personal safety properly are all examples of these dangerous actions (Sugeng, 2003).

The construction of 6,000 public bathing, washing, and toilet facilities in educational institutions nationwide spread to West Kalimantan, and the development is planned to include bathrooms, toilet facilities, ablution places, hand washing, and clothes washing facilities, as well as domestic wastewater treatment plants. Environmental sanitation affects public health by affecting the state of latrines, sewers, garbage disposal, and healthy homes that do not meet health requirements, which can lead to diseases like diarrhea, dengue fever, lung disease, Etc. (Utami, 2017). Sanitation is a disease-prevention effort that focuses on environmental health efforts that help stop the spread of toxins and food contamination caused by addictive substances (Marsanti Sakula & Terno Widiarini, 2018).

Based on this, it is necessary to identify the hazards experienced by workers to find out what hazards can arise from each work, analyze the risk assessment of OHS, and find out how to prevent the risks caused.

After the accident model theory was made and environmental and health problems became more common in the 1980s, the idea of risk management was brought into occupational safety and health. Risk management is preventive against losses and accidents (Tantri, 2016). A risk can be prevented/minimized. Minister of Public Works Regulation Number 10 of 2021 can be used as a reference/basis for knowing the level of risk of a job.

2. Materials and Methods

2.1. Theoretical Frame Work

This research is a case study to identify and analyze occupational safety and health (OHS) risks based on the Minister of Public Works Regulation Number 10 of 2021 on the

Sanitation Facilities and Infrastructure Provision project in Religious Education Institutions to obtain the most dominant risks.

After determining the risks that pose the greatest threat, the next step is to consider risk management and then test the validity and reliability of the data. Validity and reliability tests were conducted to test the questionnaire instrument's validity and reliability using IBM SPSS Statistics 25 software.

The course of the research is summarised in the following research flow chart;

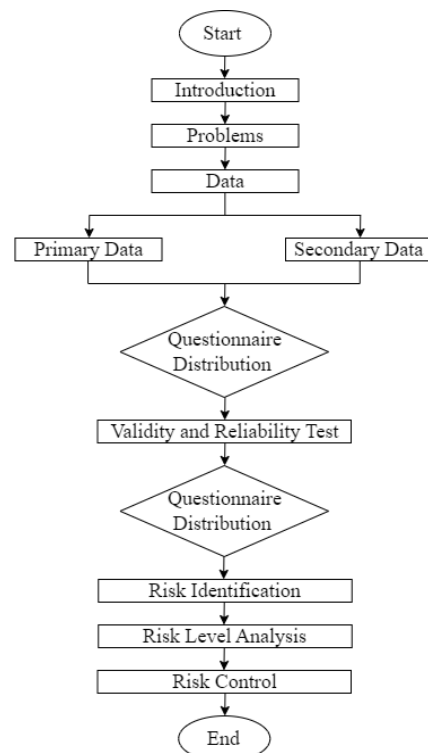


Fig. 1 Research Flowchart

2.2. Research Location

The research was carried out on the project for the Provision of Sanitation Facilities and Infrastructure at Religious Education Institutions located in 10 Religious Education Institutions in Kubu Raya Regency, Kalimantan Barat Province

2.3. Data

The first data came from surveys, where people went directly to the field, took pictures, and wrote down the information. Both primary and secondary data were used in this. Respondents were chosen based on the primary data they provided from interviews, written records, and the distribution of questionnaires.

The interview aims to obtain results regarding the risks that may occur in the research location. Secondary data is data that has been processed first and only obtained by

researchers from other sources as additional information. Secondary data used in this study include the Minister of Public Works No.0. 10 of 2021 concerning Guidelines for Construction Safety Management Systems, previous research, and research location data.

2.4. Analysis Method

Data analysis in this study used quantitative analysis methods. Quantitative methods are used to present data in the form of numbers. Questionnaires were distributed to 68 respondents using the scale specified in the Minister of Public Works Regulation No. 10 of 2021, the following is a table of the frequency level determination scale used :

Table 1. Determination of the frequency level

Frequency	Description	Definition
5	It's almost certain to happen	- There is a high possibility of accidents while doing work. - Possibility of accidents more than 2 times in a year.
4	Very possible	- Possibility of accidents while doing work in almost all conditions. - The possibility of an accident occurring once in the last 1 year.
3	Might happen	- There may be accidents while doing work under certain conditions. - Possibility of accidents 2 times in the last 3 years.
2	Less likely to happen	Less chance of accidents when doing work in certain conditions. Chance of an accident 1 time in the last 3 years.
1	Rarely happened	An accident may occur while doing work under certain conditions.

Source: Minister of Public Works Regulation No. 10 of 2021

In addition to determining the level of frequency, filling out the questionnaire is also done based on the severity level, the following table determines the severity level.

Table 2. Determination of Severity

Severity	Safety Consequence Scale
5	incidence of <i>fatality</i> is more than 1 person dies or more than 1 person is permanently disabled.
4	incidence of <i>fatality</i> 1 person died; or 1 person with a permanent disability.
3	There was an incident that resulted in more than 1 worker with inpatient medical treatment, losing work time.
2	There was an incident that resulted in 1 worker with inpatient medical treatment, losing work time.
1	There are incidents handled only through basic first aid, not losing work time.

Source: Minister of Public Works Regulation No. 10 of 2021

Risk analysis in risk management is the process of assessing the consequences and frequency of identified risks. This process is carried out by compiling risks based on their effect on project objectives. The measurement scale that becomes the standard is the Minister of Public Works Regulation No. 10 of 2021. risk analysis:

$$FV = \frac{R1 + R2 + R3 + R4 + R5 + \dots n}{\text{Number of Respondent}}$$

Information :

- FV = Frequency Value
- CV = Consequence Value
- R1 = Respondent 1
- R2 = Respondent 2
- R3 = Respondent 3
- R4 = Respondent 4
- R5 = Respondent 5

After obtaining the average frequency value and the average effect value, these values are used to calculate the risk value in the following way:

$$FV \times CV = IS$$

Information :

- F : Frequency
- C : Consequence
- V : Value
- FR : Frequency Rate
- IS : Impact Score (severity)
- RV : Risk Value

After obtaining the risk value, the value is distributed to the risk matrix to determine the level of risk, along with the risk matrix.

Table 3. Risk Level Matrix

	Severity				
Frequen	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Source: Minister of Public Works Regulation No. 10 of 2021

Information :

- 1-4 : Low-risk level
- 5-12 : Moderate level of risk
- 15-25 : High risk level

After knowing the level of risk, then carried out the risk control.

3. Results and Discussion

The initial stage that can be done in risk identification is a literature study. A Literature study was conducted to find out what occupational safety and health risks often occur in a construction project. Risk identification is also carried out by conducting interviews with expert staff and field observations. The risk variables were tested for validity and reliability to know whether the risk variables could be used as a questionnaire instrument.

3.1 Risk Identification

Based on the results of the research conducted, obtained 78 OHS risk variables of OHS, and each variable is determined from each activity in the sanitation project development. After obtaining the OHS risk variable, then doing a survey was carried out through a questionnaire regarding the consequences and frequency of OHS risks.

Table 4. Risk Variables

No	Risky Jobs	Hazard Identification
A. PREPARATION		
1	Land Clearing	Shortness of breath occurs due to dust pollution during land clearing
		Minor injuries due to work equipment
2		Stepped on a nail when measuring/ survey
		Wounded by falling equipment

		Preparation of Equipments and Materials	Dust
B. FOUNDATION WORK			
1	Soil excavation	Workers fall into digging holes	
		Wounded by falling excavated material	
2	Foundation Site Repair	Experiencing bodily injuries due to being hit by the reinforcing steel	
		Wounded due to being hit by pieces of equipment during column reinforcement	
3	Foundation Tread Casting	Iron clamped workers	
		The worker's hand is scratched by iron	
3		Wounded to body parts when pouring concrete	
		Irritation of the skin due to the mixing of chemicals	
		Respiratory problems due to dust/cement	
C. REINFORCED CONCRETE FLOOR WORK			
1	Sloof Repetition	The worker's hand is scratched by iron	
		Wounded to the skin due to being hit by iron binding wire	
2	Sloof Formwork Installation	Experiencing injuries due to being stabbed by reinforcing steel	
		The workers fall due to uneven surface	
3	Sloof Casting	Wounded from being hit by equipment during formwork installation	
		Wounded when pouring concrete	
		The workers fall while pouring concrete	
		Respiratory problems due to dust/cement	

4	Column Repetition	The worker's hand is scratched by iron
		Experiencing injuries due to being stabbed by reinforcing steel
5	Column Formwork Installation	The worker's hand is scratched by iron
		Injured due to falling material during formwork installation
		Wounded from being hit by a piece of equipment during formwork installation
6	Column Casting	Wounded when pouring concrete
		Injuries due to equipment
		Irritation due to the mixing of chemicals in concrete
		Workers fall from scaffolding
		Workers are crushed during scaffolding installation
7	Beam Reinforcement	The worker's hand is scratched by iron
		Wire pierced worker
		Experiencing injuries due to being stabbed by reinforcing steel
8	Beam Formwork Installation	Injured due to being hit by formwork material
		Wounded due to being hit by formwork material
		Workers fall from scaffolding
		Workers are crushed during scaffolding installation
9	Beam Casting	Wounded when pouring concrete
		Irritation due to the mixing of chemicals in concrete
10	Sand Pile	Injured as a result of falling from scaffolding
		Wounded to the body due to manual equipment
		Eye pain due to sand entering the eye

11	Floor Reinforcement	Injured as a result of being hit by the reinforcing steel
		Experiencing Wounded due to being stabbed by reinforcing steel
12	Floor Formwork Installation	Injured due to falling material during formwork installation
		Wounded from being hit by equipment during formwork installation
		Legs/hands pinched by reinforcing iron
13	Floor Casting	Irritation of the skin due to the mixing of chemicals
		Respiratory problems due to dust/cement
		Wounded when pouring concrete

D. WALL WORK

1	Brick Installation	Experiencing bodily injury due to being hit by bricks during installation
		Wounded from falling from scaffolding
		Injury from falling from scaffolding
2	Wall Plastering	Irritation of the skin due to the mixing of chemicals
		Respiratory problems due to dust/cement
		Irritation of the skin due to the mixing of chemicals
		Wounded due to being hit by a piece of equipment during plastering installation

E. DOOR WORK

1	Frame Installation	Injury due to falling material
		Wounded by falling material
2	Door Installation	Injury due to falling material
		Wounded by falling material

F. ROOF WORK

1	Light Steel Roof Frame Installation	Injuries from falling from a height
		Broken bones from falling from a height
		Wounded from falling from a height
		Wounded by material
2	Roof Installation	Injuries from falling from a height
		Broken bones from falling from a height
		Wounded from falling from a height
		Wounded by material
3	List plank installation	Injuries from falling from a height
		Broken bones from falling from a height
		Wounded from falling from a height
		Wounded by material

G. CERAMIC INSTALLATION WORK

1	Ceramic Cutting	Injured by ceramic pieces
2	Ceramic Installation	Wounds due to material scratches
		Irritation due to the mixing of chemicals in concrete

H. PAINTER WORKS

1	Wall Painting	Wounded from falling from scaffolding
		Injury from falling from scaffolding
		Broken bones due to falling from scaffolding
		Irritation due to the mixing chemicals in paint

I. FACTORY WWTP INSTALLATION WORK

1	Soil excavation	Workers fall into digging holes
		Wounded due to being hit by excavated material
		Respiratory problems due to dust/cement
2	WWTP installation	Wounded by falling material

3	WWTP stockpiling	Falls due to uneven surface conditions
		Wounded from being hit by an equipment
4	WWTP Casting	Irritation due to the mixing of chemicals in concrete
		Wounded while pouring concrete
		Respiratory problems due to dust/cement

3.2 Risk Level Analysis based on Minister of Public Works Regulation No. 10 of 2021

The parameters used in the risk assessment are frequency and effect, from the results of processing the questionnaire with the help of the excel program, the average value of the frequency, and the average value of the risk in each work section that is obtained. After processing the data with the help of the excel program, it can be seen the level of risk in each part of the work with the provisions that have been determined in the risk matrix based on the Minister of Public Works Regulation No. 10 of 2021.

Based on a study, it can be seen that the work that has the highest risk is the installation of Manufacturing WWTPs with a value of 6.56.



Fig. 2 Fabrication WWTP Installation Work

According to Sugeng (2003) Less or weak knowledge, skills, and wrong motivation are the basic cause of work accidents, as well as according to Suma'mur (2013) one of the causes of work accidents is doing work that is not under skills. Installation of manufacturing WWTPs is a new job for workers, so the lack of experience causes risks that have an impact on workers and the company.

3.3 Risk Control

According to Ramli (2010), risk control is a decisive step in overall risk management.

Concerning OHS risk, strategies for risk control are carried out in several ways, namely: reducing the likelihood, reducing consequences, and risk transfer.

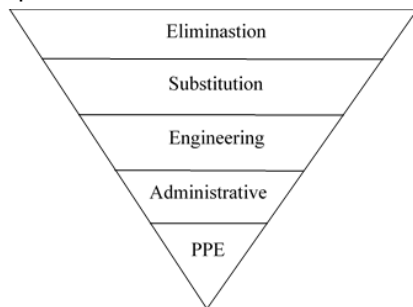


Fig. 3 Hierarchy of Risk Control
(Source: Ramli, 2010)

Risk can also be controlled by making a list and using PPE from each work section, implementing SOPs, and making work implementation methods. Other than that, in minimizing the risk the company can reduce probability by making control sheets so that they can always supervise workers, conduct safety talks regularly, reduce consequences by storing pieces of equipment and materials in place, and avoid risks by replacing pieces of equipment those are no longer suitable for use. The risks and controls at each stage are as follows:

3.3.1 Preparatory Work

The preparatory stage has the highest value of 5.71 in the moderate category, namely, there is a risk of suffocation due to dust pollution during land clearing at the Baitul Mubarak Islamic Boarding School and being stepped on by nails during a measurement/survey that took place at the Mambaul Ulum Islamic Boarding School. The risk of shortness of breath due to dust pollution is caused because there are workers who have a history of asthma but do not use Personal protective equipment (PPE). This risk can be controlled with the use of PPE. The PPE that must be used in the emergence of these risks is by using respiratory protective equipment that functions to protect the respiratory organs by channeling clean and healthy air or filtering chemical contamination, micro-organisms, particles in the form of dust, fog, steam, smoke, and so on. The risk of being stepped on by nails when measuring/surveying. Workers' undisciplined in implementing SOPs also has an impact on the risk of being stepped on by nails during measurements/surveys, so, at this risk, workers must use protective foot equipment such as safety shoes.

3.3.2 Foundation Works

The foundation work stage has the highest value of 5.57 with a moderate risk level, namely

the risk of injury to the body when pouring concrete at the Darul Hidayah Islamic Boarding School, this risk occurs when casting the foundation site. The occurrence of this risk is caused by workers falling due to the surface/conditions around the workplace so accidents are experienced by workers. At this risk, it can be controlled by designing a safer workplace, for example by moving pieces of equipment/materials to a storage area so that it does not interfere with other work, besides that it can be controlled administratively by making work procedures.



Fig. 4 Foundation Tread Casting

3.3.3 Reinforced Concrete Floor Works

The reinforced concrete floor work stage has the highest value of 5.83 with a moderate risk level, namely the risk of injury due to being hit by formwork material when installing beam formwork at the location of the Raudlatul Huda Islamic Boarding School. The occurrence of this risk is due to a lack of communication between workers so that the formwork material falls on the workers, this risk can be controlled by administrative control, namely by carrying out work procedures.

3.3.4 Wall Works

The wall work stage has the highest value of 5.87 with a moderate risk level which is the risk of experiencing shortness of breath due to inhaling dust pollution from cement at the Baitul Mubarak Islamic Boarding School and the risk of injury due to falling from scaffolding at Pondok Darul Ihsan. This risk occurs in the same worker, work air pollution caused by dust from cement causes the recurrence of diseases that have become a history of workers, namely asthma, this can be minimized by using pieces of equipment for respiratory protection. The use of PPE is expected to prevent respiratory problems due to dust/cement.

3.3.5 Door Work

The door work stage has the highest score of 5.3 with a moderate risk level which is the risk of injury due to material in the installation of

frames at the Darul Hidayah Islamic Boarding School. This risk occurs because workers work on it individually so that the existing load cannot be held by the worker, the control that can be done is by administrative control, and administrative control is carried out by implementing safety procedures / apply SOPs.

3.3.6 Roofing Works

The roofing work stage has the highest value of 5.42 with a moderate risk level, namely the risk of injury due to falling from a height during the installation of list boards that occurred at the Baitul Mubarak Islamic Boarding School location. This risk occurs because workers do not re-check the standing position of the ladder used in the installation of the lisplank, the ladder stands on an uneven surface position, besides this, the emergence of this risk is caused by workers not using PPE and workers do not focus on work so that in standing they do not pay attention to the surrounding conditions. Controls that can be carried out on the risk of injury due to falling from a height are design control by modifying/designing pieces of equipment, administrative control by implementing security procedures, implementing SOPs and equipment inspections, and controlling by using PPE.



Fig. 5 Lisplank Installation

3.3.7 Reinforced Concrete Floor Works

The ceramic installation stage has the highest value of 5.33 with a moderate risk level, namely the risk of injury due to scratched material on cutting ceramics at the location of the Al-Muttaqin Islamic Boarding School. This risk occurs because workers are not disciplined in applying the use of PPE and are not careful at work. According to Iskandar (2010), *Safety gloves* are protective equipment that serves to protect the hands and fingers from exposure to fire, hot temperatures, cold temperatures, electromagnetic radiation, ionizing radiation, electric current, chemicals, impacts, and blows. and scratched, infected with pathogenic substances (viruses, bacteria), and micro-

organisms. Based on this, it can be seen that this risk control can be done by using PPE in the form of gloves.

3.3.8 Painting Works

The painting stage has the highest value of 5.04 with a moderate risk level in risk of injury due to falling from scaffolding at the Darul Ihsan Islamic Boarding School. This risk is caused because workers do not carry out work procedures so it can cause work risks, control can be carried out by administrative control, namely by implementing safety procedures where workers must store pieces of equipment and materials in storage places so as not to cause harm. risk in other occupations.



Figure.6 Painting the Wall

3.3.9 Fabrication WWTP Installation Works

The installation stage of the Manufacturing WWTP has the highest value of 6.57 with a moderate category at risk of injury due to being crushed by WWTP installation material at Al-Muttaqin Islamic Boarding School, Baitul Mubarak Islamic Boarding School, and Darul Hidayah Islamic Boarding School, risk of falling due to uneven surface conditions at Islamic Boarding School Darul Ihsan and the risk of workers falling into a dug hole at the Nahdotus Shibyan Islamic Boarding School, being injured by falling material and falling due to uneven surface conditions. According to Sugeng (2003) Less or weak knowledge, skills, and wrong motivation are the basic causes of work accidents, as well as according to Suma'mur (2013) one of the causes of work accidents is doing work that is not under skills. Installation of manufacturing WWTPs is a new job for workers, so the lack of experience causes risks that have an impact on workers and the company. At the risk of workers falling into excavation holes at the excavation stage due to workers slipping due to slippery surfaces and workers being undisciplined in the use of PPE, at the risk of workers being injured due to being hit by material caused by a combination of the

size of the material and the unsafe surface/condition of the WWTP installation, at the risk of falling due to an uneven surface due to the surface in the excavation there are tree trunks and wood, causing workers to fall. Of these three risks can be controlled by design control, administrative control, and the use of PPE, design control is done by designing a safer workplace, administrative control is done by giving safety signs, and giving signs of dangerous areas, and PPE control is by applying the discipline of using PPE. From the three controls, it is expected that it can minimize the risks posed to the installation work of the WWTP manufacturing.

4. Conclusion

Based on the results of data processing and work safety analysis on the project under study, it can be concluded as follows:

1. The results of the identification of occupational accident hazards that can occur in the Project for Providing Sanitation Facilities at Religious Education Institutions in 2021 there are 78 risks in 9 jobs.
2. Based on the risk assessment of Occupational Health and Safety based on the Minister of Public Works Regulation No. 10 of 2021 in the project under study there was no major risk level, 2 levels of risk were found, namely small risk and medium risk. The score of the moderate risk level of 6.57 found in the installation of the fabricated WWTP on the risk of injury due to materials, and pieces of equipment at the Al-Muttaqin Islamic Boarding School, Baitul Mubarak Islamic Boarding School, and Darul Hidayah Islamic Boarding School, the risk of falling due to uneven surface conditions in the Pondok Pesantren Darul Ihsan Islamic Boarding School and the risk of falling into a dug hole at the Nahdotus Shibyan Islamic Boarding School.
3. Control of all occupational accident risks according to the level of risk is carried out by making a list and using PPE from each work section, implementing SOPs, and making work implementation methods. In addition to this, in minimizing the risk the company can reduce probability by making control sheets so that they can always supervise workers, conduct safety talks regularly, reduce consequences by storing pieces of equipment and materials in place, and avoid risks by replacing pieces of equipment that are no longer suitable for use.

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6. Author's Note

Everything written in this article is original by the author. I, as the author of this article, state that no conflict occurs in the publication of this article. The authors confirmed that the paper was free of plagiarism.

7. References

- A.M. Sugeng Budiono. (2003). **Bunga Hiperke dan Kesehatan Kerja**. Semarang : Universitas Diponegoro.
- Bangun, Wilson. (2012). **Manajemen Sumber Daya Manusia**. Jakarta : Erlangga.
- Francis, Tantri. (2016). **Manajemen Pemasaran**. Depok : PT Raja Grafindo Persada.
- Iskandar, S. 2010. **Peraturan Menteri Tenaga Kerja dan Transmigrasi Republik Indonesia Nomor PER.08/MEN/VII/2010 tentang Alat Pelindung Diri**. Jakarta : Kementerian Tenaga Kerja dan Transmigrasi RI.
- Khosravi, Y. (2014). **Factor Influencing Unsafe Behavior and Accident on Construction Site: A Review', International Journal of Occupational Safety and Ergonomics, 20(1). Pp. 111-125**. International Journal of Occupational Safety and Ergonomics.Iran
- Mangkunegara, Anwar Prabu A.A. (2013). **Manajemen Sumber Daya Perusahaan**. Bandung : Remaja Rosdakarya.
- Marsanti, A. S. dan Widiarini, R. (2018) Buku Ajar Higiene Sanitasi Makanan. Edited by P. A. Wibowo. Sidoarjo: Uwais Inspirasi Indonesia.
- Peraturan Meteri Pekerjaan Umum. (2021). *Pedoman Sistem Manajemen Keselamatan Konstruksi*. Jakarta : Kemetrian Pekerjaan Umum dan Perumahan Rakyat.
- Ramli S.(2010) Sistem Manajemen Keselamatan dan Kesehatan Kerja. Jakarta: Dian Rakyat.
- Rethyna, Marsya. (2018). Analisis Risiko Keselamatan dan Kehatan Kerja (K3) pada Bangunan Gedung Bertingkat.

Jakarta : Universitas Persada
Indonesia.

Soekiswara, T. E. F. (2020). Faktor Kecelakaan Dan Keselamatan Kerja Pada Penggunaan Crane Di Proyek Konstruksi. *Jurnal Menara*, 18(2), 42–50.

Suma'mur.(2013). **Higiene Perusahaan Dan Kesehatan Kerja (HIPERKES)**.Jakarta : Cv. Sagung Seto.

Utami, Endang Sri. (2017). **Hubungan Kualitas Mikrobiologi Air Baku dan Higiene Sanitasi dengan Cemaran Mikroba pada Air Minum Isi Ulang di Kecamatan Tembaleng**. *Jurnal Kesehatan Masyarakat*. Semarang : Universitas Diponegoro.

Wijayanti, Nia Tri. (2008). **Pengaruh Penerapan Safety Management Terhadap Kinerja Produktifitas Tenaga Kerja**. Jakarta :.Fakultas Teknik Universitas Indonesia