

Implementation of Risk Control Hazards Identification using PDCA Method to Reduce Potential Work Accidents at Tissue Company

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Abstract

A work accident is an incident when a worker is at work that causes injury or health problems. According to the Indonesian Ministry of Industry's Data and Information Center (2019), Work accident cases in several companies in Indonesia in 2018 were 173,105 people. The death rate due to work accidents was 5318 people. The tissue company has several machines because it produces many types of tissue. The facial engine produces tissue for the face, while the napkin machine produces tissue to eat or place on the dining table, and the rolling machine produces tissue placed on the toilet. The number of production processes makes the level of risk of work accidents and occupational diseases have a high probability. The number of work accidents fluctuates and is influenced by occupational safety and health. This study aims to determine the factors that cause work accidents and eliminate the risk of harm in work activities in the HIRADC form. The research method used is qualitative. The primary data of this study were obtained from distributing questionnaires to 150 employees who work in the production area, interviews, and the results of focus group discussions. Testing this research hypothesis by testing the validity and reliability using SPSS software, the method used in this study is the PDCA method and uses the HIRADC form. Three indicators cause work accidents: SOPs, work environment, and work programs.

Keywords

Work Incident, Health Safety Environment, PDCA, Hazard Identification and Risk Assessment

1. Introduction

According to International Labor Organization (ILO), health and safety work is increase and look after para workers by physical, mental and well-being social in all types of work, prevent happening disturbance occupational health, protect workers on each her job from risk possible danger make accident work, put workers in the neighborhood work in accordance ability with condition physiological and psychological worker and for creating compatibility between profession with worker and every worker with his job. Accident work is incident moment worker currently work that causes injury or disturbance to health.

According to the Center for Data and Information Ministry of Industry of the Republic of Indonesia (2019), Figure 1 describes case accident work on some there are 173,105 companies in Indonesia in 2018 experience enhancement if compared to within 2015 as many as 110,285 people.

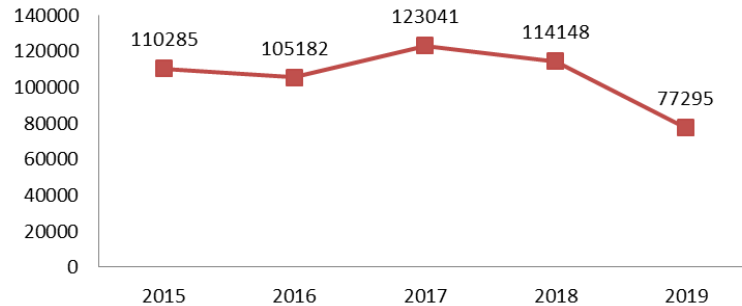


Figure 1. Work accident in Indonesia 2015 – 2019
(Source: Data and Information Center of the Indonesian Ministry of Industry, 2019)

Amount number of accidents increased work in tune with numeric data dead consequence accident work from years 2011 to 2017, which is described in Figure 2. In 2018, a significant increase happened in as many as 5318 (Data and Information Center of the Indonesian Ministry of Industry, 2019).

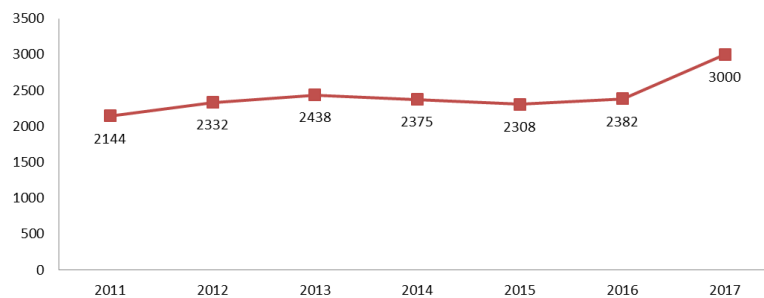


Figure 2. Cases of death due to work accidents in 2011 - 2017
(Source: (Data and Information Center of the Ministry of Industry of the Republic of Indonesia, 2019)

The tissue company has several machines because they produce many types of tissues. Machine facial produces tissue for face, while napkin engine produces tissue for eating or placed on the table eat and machine roll produces tissue that is placed on the toilet. Amount series of production processes make level risk accident work, and disease consequence work has a high probability. Work accident data in 2017 showed 30 cases of work accidents, while in 2018, there were 39 work accidents.

2. Literature Review

1) Work accident

Minister of Manpower Regulation No. 03/Men/98 concerning work accidents are unexpected conditions that can cause fatalities, physical injury, or death. OHSAS 18001:2007 defines a work accident as an event that is related to the work done.

2) PDCA

According to (Lewis, 1999), PDCA is an abbreviation in English, namely *plan* (plan) *do* (implementation), *check* (checking), and *action* (action) is the process of solving a problem by using four alternative steps that are commonly used in quality control.

3) HIRADC

According to the Indonesian national encyclopedia, e risk is used to express circumstances that have the potential desired result of an act or activity. Risk is often associated with potential events and their impacts. (Ponda et al., 2019) while risk control is a stage that has successive levels used in risk prevention and control.

4) Previous Study

In previous studies, several journals were used as reference references. The journals used were from 2010 to 2020. Research wire draw approach that uses the PDCA method, not use studied by the previous researcher. Previous research that is relevant to the research to be carried out is summarized in Table 1.

Table 1. Previous research related to HIRADC

No	Author, Year	Objective	Method	Results
1	(Shamsuddin et al., 2014; Pratiwi & Ningrum, 2021)	Identify the risk of work accidents	HIRADC	Implement four programs regularly to reduce work accidents for employees
2	(Busyairi et al., 2012)	Increase employee productivity	F Test and T. Test	Work safety has a significant influence on employee productivity
3	(Rahadian et al., 2015)	<i>Zero Accident</i>	PDCA	The number of work accidents has decreased significantly
4	(How & Karuppiah, 2015)	Arrangement of first aid services in work accidents	HIRARC	The effectiveness of implementing HIRARC in the workplace
5	(Ramdan & Handoko, 2016)	Analyze <i>unsafe actions</i> and <i>unsafe conditions</i>	Chisquare test	there is a relationship between unsafe acts and unsafe conditions with work accidents
6	(J. et al., 2017)	Knowing the risk of work accidents	FMEA	Iron cutting activities (fabrication) on beam ironwork have the highest risk of work accidents
7	(Verma & Chaudhari, 2017)	Improvements in improving work skills	Fuzzy	The results of the analysis show that skill-based errors are the most critical
8	(J. et al., 2017)	Knowing the level of safe behavior of workers	FMEA	Iron cutting work needs attention to increase its safety against work accidents
9	(Hasrul et al., 2019; MJ & Hasibuan, 2020)	Improvement of occupational safety and health in the company area	HIRARC	There are 33 activities studied and three activities that have a high risk.
10	(Irmawati et al., 2019)	<i>Zero Accident</i>	Cross-Sectional	The application of K3 from human and environmental factors is good
11	(Hoła & Szóstak, 2019)	Reduce work accidents	SEM	Work accidents that often occur are falling from a height
12	(Ouyang & Cheng, 2019)	Analyze the factors of work accidents	PDCA	Improving decision making for ship engine <i>preventive</i>
13	(Abdul Aziz et al., 2019)	Identifying the causes of work accidents	SPSS	There are four main factors of work accidents, namely human, workplace, organization and management, and external
14	(Bae et al., 2019)	Knowing the income of construction workers after having a work accident	Anova	The decline in revenue is much greater in construction due to accidents
15	(Jiménez et al., 2019)	Reviewing the factors of work accidents	PDCA	Optimizing production, mitigating possible risks faced by operators
16	(Misiurek & Misiurek, 2020)	Analysis of improvement in the workplace	5s and 6s	Correlation between quality improvement and 6s implementation
17	(Lu et al., 2020)	Analysis of work accident victims at chemical companies	Bayesian	The losses experienced are property losses and loss of life
18	(Sugak, 2020)	Prevention of hazardous factors to minimize work accidents	PDCA	PDCA implementation is significant to reduce work accidents
19	(Nugroho et al., 2020)	Risk control to minimize work accidents	HIRARC	How to minimize work accidents by elimination, administrative control, use of personal protective equipment.

3. Research Methodology

The research method used is qualitative. The data collection technique in this study is to use PDCA (*Plan-Do-Check-Action*). The population in this study were all production employees, including *staff*, operators, admins, shift heads, section heads, and department heads. The number of production employees is 225 employees. In carrying out the research, steps are needed to solve problems and achieve goals. Research Steps as present in Figure 2.

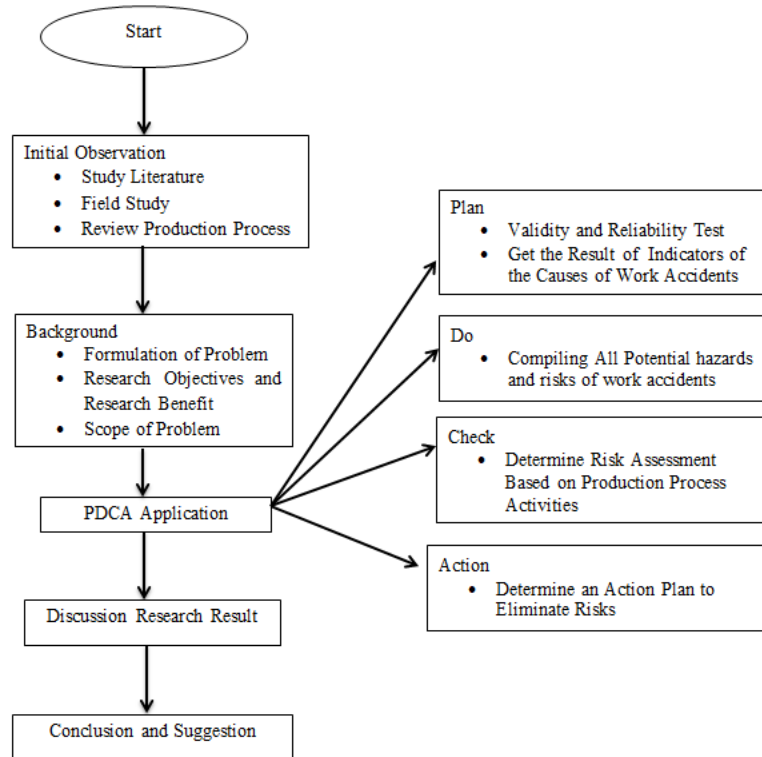


Figure 3. Steps of Research.

Figure 3 explains the steps of research from start to conclusion, there are initial observations, namely the data to be used in this study, the problems from the research and the benefits of the research, the application of PDCA to reduce work accidents, details related to the results of the analysis in this study, conclusion, and suggestions in this research.

Application of the PDCA method:

a. Plan

1. Collect data from the causes of work accidents in the work area of the *tissue processing industry* using a Likert scale questionnaire to all employees.
2. Conduct validation and reliability tests of questionnaire results using *SPSS Statistics 22* to be able to proceed to the next stage of research.

b. Do

1. We are conducting FGD with 3 (three) resource persons (experts) from the operational units of all production section heads as many as 3 (three) people, namely the head of the production section, the head of the production department, and the head of the safety section.
2. Drafting HIRADC based on FGD results.

c. Check

Checking and reconfirming the FGD resource persons regarding incidents related to work safety.

d. Action

1. Compile a complete HIRADC table with *severity* and *probability scoring*
2. Produce a complete corrective action plan with a ranking or priority scale to improve work safety in the *tissue processing industry*.

4. Results and Discussion

Based on the results of data collection on 150 respondents, the characteristics of respondents based on age, length of work, and education can be explained. All respondents are male. In Figure 4. The largest age distribution of employees working in production is in the age range of 26 to 35 years, as much as 58%.

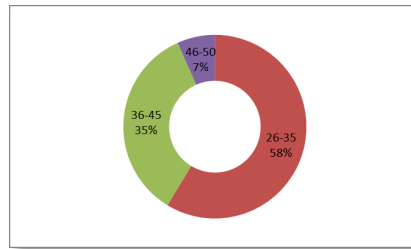


Figure 4. Age of Production Employees

In Figure 4 for the age range of 46 to 50 years, as much 7%. As for the age range of 36 to 45 years, as much 35%. The number of respondents in Figure 5. who worked for 6 to 10 years was 56% of the total 150 employees, namely 84 people. Education level in Figure 6. respondents and the majority are senior high school graduates as many as 60% of 15 employees, namely 90 people.

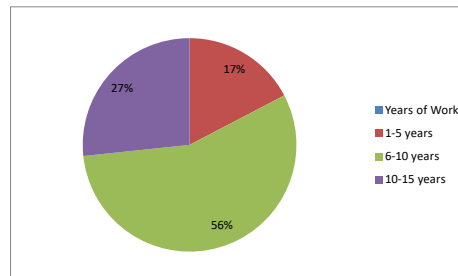


Figure 5. Length of Work Employees

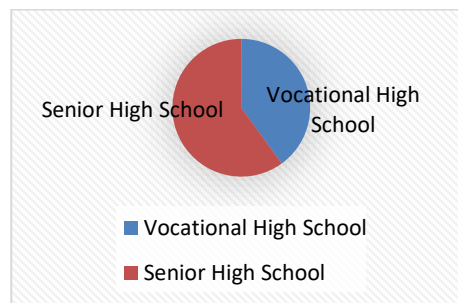


Figure 6. Levels of Employee Education

Figure 5 employees who work 1 to 5 years as much as 17% while employees who work 10 to 15 years are 27%. In Figure 6 as many as 40% of employees have vocational high school education levels.

Data Processing

At the planning stage, three indicators cause work accidents, namely the work environment, SOPs, and work program. Based on the results of the reliability test will be stated *reliability* if the value of *Cronbach's alpha* is greater than the value of 0.7. The *Cronbach alpha value* is $0.738 > 0.7$, so the results of the questionnaire for all indicators are said to be reliable. Researchers tested the validity of 150 respondents. The *degree of freedom* (df) using the $n-2$ formula is obtained $df = 148$ with a significance of 5%, then the R table is 0.1348. So when the validity test is carried out, the Pearson value is greater than the R table, all statements are declared valid

At the do stage of compiling all the potential hazards and risks of work accidents in *tissue processing companies*, all production processes can be identified what the potential hazards and sustainable regulations are. Activities that have light risk are manual *sealing machine processes*, placing finished goods onto pallets, and packing processes by operators.

At the *check stage*, the HIRADC assessment is determined based on the production process activities with a focus group discussion. At the *check stage*, there are two activities with *extreme* risk, namely bringing jumbo rolls from the *raw material warehouse* to the machine area using a clam forklift lifting and laying jumbo rolls using a hoist crane. The activity of carrying jumbo rolls from the *raw material warehouse* to the machine area using a clam forklift has several hazards, namely work activities using powered devices, carrying forklifts with a visible angle, checking forklift brakes. before work starts. Meanwhile, the lifting and laying of jumbo rolls using a hoist crane has 4 (four) hazards, namely *lifting* and *rigging activities*, the remote button does not function properly, the sealing cable is not suitable for use, the hook movement is not precise when lifting and placing it to *unwind the* jumbo roll.

The *action stage* determines the *action plan* to eliminate risk. After completing the *focus group, discussion* solutions are obtained to minimize the risk of work accidents in detail. *Engineering control*: Paying attention to lanes, areas, signs, or prohibition signs as well as forklift driving speed limits. Ensure and perform *start-ups* or check that the *remote control* is functioning properly before use. Administration: Conduct *training* related to the dangers and risks of driving a forklift, Work instructions related to crane operation. Personal protective equipment: Use a *safety helmet*, mask, and *safety belt*.

5. Conclusion

- 1) Three indicators cause work accidents, namely the work environment, SOPs, and work programs. The highest indicator in causing work accidents is the K3 program.
- 2) *Extreme* risk, namely bringing jumbo rolls from the *raw material warehouse* to the machine area using a clam forklift, lifting and placing *jumbo rolls* using a *hoist crane*. *Action plans* are carried out to minimize *extreme risks* using *engineering control*, administration, and personal protective equipment.

Reference

- Abdul Aziz, NA, Mohd Nordin, R., Ismail, Z., Yunus, J., & Hashim, N, Occupational Safety and Health (OSH) Concept Towards Project Performance. *Built Environment Journal*, 16 (2), 55. 2019.
- Bae, SW, Oh, SS, Park, WM, Roh, J., & Won, JU (2019). Changes in income after an industrial accident according to industry and return-to-work status. *International Journal of Environmental Research and Public Health*, 16 (14), 1–13. 2019.
- Busyairi, M., Tosungku, LOAS, & Oktaviani, A, Allgemeine Depression Scale (ADS). *Psychiatrische Praxis*, 39 (06), 302–304. 2012.
- Central Bureau of Statistics, *Manufacturing Industry Production Growth Statistics*. 38, 1–12, 2020.
- Center for Data and Information of the Ministry of Industry of the Republic of Indonesia, Industry development analysis edition IV - In *Pusdatin Kemenperin*. <http://bmeb-bi.org/index.php/BEMP/article/view/47> _2019.
- Hasrul, N., Ngadiman, A., Mansur, R., Sirat, R., & Mohd, MF , Safety and Risk Evaluation using HIRARC Model at Palm Oil Mill. *International Journal of Innovative Technology and Exploring Engineering*, 8 (11), 790–797. 2019.
- Hoła, B., & Szóstak, M., Modelling of the accidentality phenomenon in the construction industry. *Applied Sciences (Switzerland)*, 9 (9). 2019.
- How, V., & Karupiah, K. , *Filling the Gaps of the Workplace First Aid Assessment by considering the Guidelines on Occupational Safety and Health, Malaysia*. 1 (1), 23–28. . 2015.

- Ihsan, T., Edwin, T., & Octavianus Irawan, R. (2017). K3 Risk Analysis With Hirarc Method In The Production Area Of Pt Cahaya Murni Andalas Permai. *Andalas Public Health Journal*, 10 (2), 179., 2017.
- Irmawati, I., Kresnowati, L., Susanto, E., & Nurfalah, TI , Occupational Health and Safety (K3) in the Filing Section. *Indonesian Journal of Health Information Management*, 7 (1), 38. . 2019.
- J., A., H., S., & WI, E. , Work Accident Risk Analysis on Building Projects Using the Fmea Method. *Journal of Muara Sains, Technology, Medicine and Health Sciences*, 1 (1), 115–123. . 2017.
- Jiménez, M., Romero, L., Fernández, J., Espinosa, M. del M., & Domínguez, M. , Extension of the Lean 5S methodology to 6S with an additional layer to ensure occupational safety and health levels. *Sustainability (Switzerland)*, 11 (14), 1–18. 2019.
- Lewis, WE (nd). *PDCA / TEST*. 2020.
- Lu, Y., Wang, T., & Liu, T. , Bayesian network-based risk analysis of chemical plant explosion accidents. *International Journal of Environmental Research and Public Health*, 17 (15), 1–20., 2020.
- Missues, K., & Misiurek, B., Improvement of the safety and quality of a workplace in the area of the construction industry with the use of the 6S system. *International Journal of Occupational Safety and Ergonomics*, 26 (3), 514–520, 2020.
- MJ, S., & Hasibuan, S., Strategi mitigasi risiko proyek konstruksi utilitas piping dan sipil: Studi kasus PDAM Jakarta. *Operations Excellence: Journal of Applied Industrial Engineering*, 12(1), 74-87. , 2020.
- Nugroho, SH, Suharjo, B., Bandon, A., & Haryanto, AT, *Analysis of Occupational Safety and Health Risk Management on the Indonesian Navy Ship Project Using Hazard Identification, Risk Assessment and*. 11 (02), 124–132, 2020..
- Ouyang, K., & Chang, H.-H., Guidelines for Unmanned Autonomous Vessels. *International Journal of Organizational Innovation*, 12 (2), 155–167, 2019.
- Ponda, H., & Fatma, NF, Hazard Identification, Assessment and Control of Occupational Safety and Health (K3) Risks at the Foundry Department of Pt. Sicamindo. *Heuristics*, 16 (2), 38–47., 2019.
- Pratiwi, I., & Ningrum, I. , Analisis Potensi Bahaya Pada Proses Produksi Barecore Menggunakan Metode HAZOP dan OHS Risk Assessment. *Operations Excellence: Journal of Applied Industrial Engineering*, 13(1), 11-22. , 2021.
- Rahadian, D., Nursanti, E., & Gustopo, D., . *Work Accident Control Planning Towards Zero Accident In NBH Sugar Factory Industry*. 1 (2), 17–21. . 2015.
- Ramdan, IM, & Handoko, HN, WORK ACCIDENT ON INFORMAL CONSTRUCTION WORKERS IN "X" KOTA SAMARINDA Work Accident of Informal Construction Workers in District "X" Samarinda City. *Journal of Mkmi*, 12 (1), 1–6. . 2016.
- Riyantini., PDCA Approach In Monitoring Activities PDCA Approach In Monitoring Quality Control. *Scientific Journal of VISION PGTK PAUD and DIKMAS*, 12 (20), 143–153. 2017.
- Shamsuddin, KA, Ani, MNC, & Ismail, AK, Investigation the effectiveness of the Hazard Identification, Risk Assessment, and Determining Control (HIRADC) in the manufacturing process. *International Journal of Innovative Research in Advanced Engineering*, 2 (8), 5. 2014..
- Sugak, EB, Methodological Features of the Management of Modern Labor Protection in the Construction. *IOP Conference Series: Materials Science and Engineering*, 728 (1). 2020.
- Sujoso, ADP , Basic Book – Basic Occupational Health & Safety. In *Public Health*. <http://penerbitan.unej.ac.id/wp-content/uploads/2018/11/dasar-dasar-kesafean-dan-kesehatan-kerja.pdf>. 2012.
- Triyono Dr M. Bruri., Textbook of Occupational Safety and Health (K3). In *Occupational Safety and Health (K3) (I)*. Yogyakarta State University. . 2014.
- Verma, S., & Chaudhari, S., Safety of Workers in Indian Mines: Study, Analysis, and Prediction. *Safety and Health at Work*, 8 (3), 267–275. 2017.

Biography

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