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, *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

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

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](image)

![Figure 6. Levels of Employee Education](image)

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
Hola, B., & Szóstak, M., Modelling of the accidentality phenomenon in the construction industry. Applied Sciences (Switzerland), 9 (9). 2019.


Triyono Dr M. Bruri., Textbook of Occupational Safety and Health (K3) (I). Yogyakarta State University. . 2014.


Biography
Ekalia Yanasari Putri is a student at Universitas Mercu Buana majoring in industrial engineering.

Sawarni Hasibuan is an associate professor in the Industrial Engineering Department at Mercu Buana University, Jakarta, Indonesia. He completed his Masters in Industrial Engineering at the Bandung Institute of Technology and obtained a Doctorate in Agro-industrial Technology, at Bogor Agricultural University. She has carried out several research and publications in industrial management, green & sustainable manufacturing, supply chain management, and renewable energy.