Jurnal Dinamika Vokasional Teknik Mesin
Vol. 8, No. 1, April 2023, pp. 80-88
https://journal.uny.ac.id/index.php/dynamika/issue/view/60583
ISSN: 2548-7590, DOI: 10.21831/dinamika.v8i1.60583

Analysis of the application of personal protective equipment in the welding industry

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Article Info

Article history:

Received April 02, 2023
Revised April 20, 2023
Accepted April 30, 2023
Published April 30, 2023

Keywords:

Personal protective equipment
Welding
Workers

ABSTRACT

The welding industry is one of the informal workplaces at risk of accidents and occupational diseases. Workers can be directly exposed to foreign matter or radiation from visible rays and sparks from the welding process during the welding process. This is a problem for people who are engaged in the profession of welding workers. This study aimed to analyze the application of personal protective equipment used by workers in the welding industry. This research is classified in the type of survey research and data collection techniques by observation, interviews, and questionnaire distribution. The subjects of the study were all workers in the welding workshop of Kec. Bayah welding totaling 30 people using random sampling techniques. The research path consists of 3 stages: preparation, data exploration in the field, and analysis of findings. Data analysis using percentages. Based on the analysis of the use of personal protective equipment in 6 welding workshops, Bayah has 57% in the good category and 33% in the less category. As for the analysis of each indicator, the most significant percentage of use in welding glasses is 76%, and the lowest percentage of skin protection is 56%. This shows that the level of concern of each worker is not balanced towards using all personal protective equipment in the welding process, which can cause very vulnerable work accidents.

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INTRODUCTION

The welding industry is one of the informal workplaces at risk of accidents and occupational diseases. According to Alip, welding connects two metal parts by heating, pressing, or combining the two to merge like a whole object. During the welding process, workers can be directly exposed to foreign matter or radiation from visible rays and sparks from the welding process. This is a problem for people who are engaged in the profession of welding workers. Understanding and applying safety work in large

industries is better than in small companies or the informal sector because Personal Protective Equipment (PPE) alone does not necessarily exist in this sector (Yoto et al., 2020).

The welding workshop is one of the informal workplaces that are at risk for accidents and occupational diseases. During welding, radiation will arise from ultraviolet light, resulting in eye fatigue, blurred vision, photo phobias, chemotic conjunctiva, lens clouding, cataracts, and eye pain. Traumatic events in welding workers are also common such as mechanical trauma that can injure the palpebra, lacrimal system, conjunctival lacerations, corneal erosion, chemical trauma, and physical trauma such as burns and radiation injuries (Salawati, 2015).

According to Sonawan in. Welding is not an easy job because it has a very high physical risk, so the process requires special skills and equipment so that a welder (Sahputra &; Siregar, 2017) is not exposed to work accidents.

This study aimed to analyze the application of personal protective equipment used by workers in the welding industry. From the results of this study, the results of the analysis will be obtained in the form of a comparison of work results on the effect of implementing K3 in standards and those that do not meet safety work application standards.

Application to occupational safety and health rules is needed in all practical jobs to avoid unwanted things, such as work accidents. The implementation of Occupational Health and Safety (OHS) is one form of effort to create a safe, healthy, and free from environmental pollution, to reduce and be free from work accidents and occupational diseases, which can ultimately increase work efficiency and productivity.(Wijanartien & Irawan, 2019) , (Peutula et al., 2019).

According to the Occupational Safety and Health (K3) Law of 1970, Personal Protective Equipment is mandatory for welding operators to wear when welding. Personal Protective Equipment is an integral part of applying occupational safety and health in the laboratory, and work accidents can occur if you ignore the principle of "*Unsafe condition* and *unsafe action*" (Solichin et al., 2014).

Work accidents can cause physical disabilities and diseases to every worker in the welding process. It can cause the cessation of the production process, environmental damage, and work accident costs. In general, work accidents occur due to two causes, namely unsafe environmental conditions and human actions that do not meet occupational safety and health.

Personal factors are determinants of social interaction in shaping individual behavior. Personal factors become one of the causes or factors that underlie the occurrence of work accidents originating from humans or their workers (Ginting et al., 2020).

The legal basis for occupational safety and health, Law Number 1 of 1970, namely about occupational safety, includes:

- That every worker has the right to protection for his safety in doing work for the welfare of life and increasing national production and productivity.
- Everyone else in the workplace needs to be assured of their safety.

- That every production needs to be used and used safely and efficiently.

This states that all work can pose a risk of work accidents. Therefore, it must be considered, such as the work environment must ensure comfort and safety so that an accident does not occur, as well as complete PPE, tools, machines, and materials used in the welding industry.

In the regulation of the Minister of Manpower No. PER.05 / MEN / 1996 concerning occupational safety, it is also explained that:

Some important things about material storage are:

1. It should be easy for workers, forklifts, and mechanical handling equipment such as trolleys (buggies) and drum lifters to move around and around the warehouse.
2. Materials can be stored on shelves, drawers, and boxes
3. Special storage facilities, such as fireproof cabinets and security cans, are required for dangerous goods.
4. Chemicals should be clearly labeled and stored safely, i.e., dry, well-ventilated, away from workers.
5. The types of chemicals are supposed to be separated.
6. Limits on smoke, dust, and radiation levels should be monitored at warehouse sites and work areas.
7. The pungent smell, wisps of clouds, and dust from the smoke should have been investigated.
8. According to the provisions of Balai Hiperkes, the requirements for Personal Protective Equipment are as follows.
    a. PPE must be able to provide strong protection against specific hazards or hazards faced by the workforce
    b. The appliance's weight should be as light as possible and not cause excessive discomfort.
    c. Tools must be flexible
    d. The shape should be attractive enough
    e. Durable protective equipment for long wear
    f. The tool does not cause additional dangers to the wearer due to improper shape and danger or due to incorrect use.
    g. Protective equipment must meet existing standards.
    h. The device does not limit the wearer's movement and sensory perception. The spare parts must be easy to obtain to facilitate maintenance.

Welding is a process of hazardous work and is a unique combination of chemical and physical hazards to more than 560,000 workers in various industries. About 6% of fires in the property industry and other industries are also caused by welding activities, especially equipment that is not specifically designed or legalized for the job (Aditias et al., 2018).

Based on research, three factors cause work accidents in the Sinar Arum welding workshop, namely work behavior hazards, work posture hazards, and work environment hazards, with five potential hazards with a very high-risk level and 15 potential hazards with a substantial risk level. Furthermore, improvement recommendations were given, namely by communicating the dangers and importance of K3 by making visual displays of PPE usage, making SOPs on the use of PPE such as wear packs, heat-resistant gloves, earplugs, welding masks, and applying Housekeeping to work methods. (Saputra et al., 2018)

An accident is not a single event but is the result and a series of interrelated causes caused by the weakness of employers, workers, and unregulated work procedures. As well as the actions of unsafe workers resulting in a decrease in the level of work productivity. One way to prevent workplace accidents is to establish a management system that can protect workers and work accidents and avoid significant losses to the company. (Zeri Yusdinata et al., 2018)

Based on research data obtained from PT. Meindo Elang Indah, in 2015 the number of work accidents amounted to 17 incidents in the welding process. The occurrence of work accidents is based on investigations that accidents are caused by worker negligence, lack of facilities and auxiliary equipment, and workers do not comply with applicable SOPs in carrying out work activities in many activities. In operational activities, the company certainly has various potential occupational hazards related to worker safety and health, and this is very influential in the company's activities to achieve its targets (Alpharisee & James, 2015) .

Based on the research conducted, there is a relationship between Age, Education, Length of Service, Knowledge, Attitude Training, PPE Facilities, Punishment, Rewards, and supervision (Rahayu et al., 2018) in influencing the use of PPE in the informal welding industry. This can cause a work accident in an agency or welding industry.

RESEARCH METHOD

The method used in this study is using the type of survey research. This research model relies on statements and questions to get answers from each respondent—matters relating to the beliefs or behavior of an individual or group. Every question or statement will be significant when respondents provide answers to the characteristics of the expected variables (Adiyanta, 2019).

Data collection techniques by observation, interviews, and literature studies. According to Sugiyono, data collection techniques are the most strategic step in research because the primary purpose is to obtain data. The subjects of this study were workers in the welding workshop of Kec. Bayah, as many as 30 people, using (Malo et al., 2019) *random sampling* techniques. According to Patilima, every informer in research is an informant. The research path consists of 3 stages: preparation, data exploration in the field, and analysis of findings. Data analysis using percentages. This research was carried out from November 17, 2020, to December 27, 2020, at six welding workshops in Bayah district (Rif'ati & Sutanto, 2018).

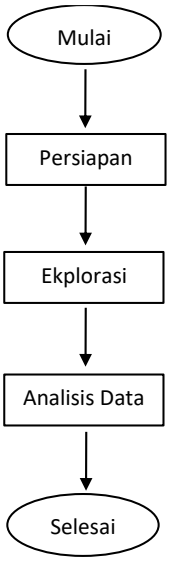

Figure 1. Mindset

RESULTS AND DISCUSSION

Result

Characteristics of Respondents

Respondents in this study consisted of: workers in 6 welding workshops in Bayah District totaling 30 people. The following are the characteristics of the respondents:

Table 1. Characteristics of welding workers

Respondent	Frequency	Percentage
Age		
20-30	20	67%
>30	10	33%
Period of Service		
1-2 yrs	17	57%
>2 yrs	13	43%
Education Level		
SD	8	27%
SMP	10	33%
SMA	12	40%
S1	0	0%

Based on Table 1. Above, 67% of workers in welding workshops are aged 20-30 years, and 33% of workers are over 30 years old. Workers with a working period of 1-2 years are 57%, and workers with a working period of more than two years are 43%. This shows that more workers have a 1-2 years working period. The highest level of education is the high school level of 40%, and 0% for the S1 level.

Frequency Distribution of PPE Use

The following is the frequency distribution of the use of tools and respondents' knowledge of each indicator of personal protective equipment in the welding workshop of the Bayah district.

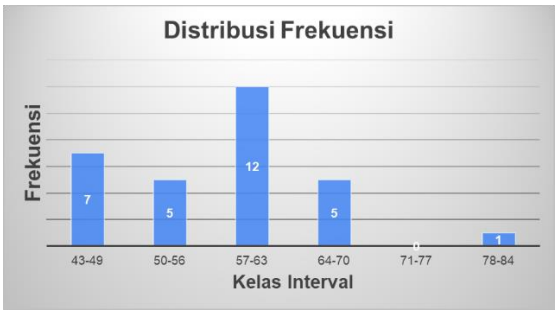

Figure 1. Frequency distribution of PPE use

Based on the figure above, it is explained that the most significant frequency is in the interval class 57-63, with as many as 12 respondents. Moreover, the lowest is 0 in the interval class 71-77.

PPE Usage Score Trends

The following is a graph of the percentage of tool use and respondents' knowledge of each indicator of personal protective equipment in the welding workshop of the Bayah district.

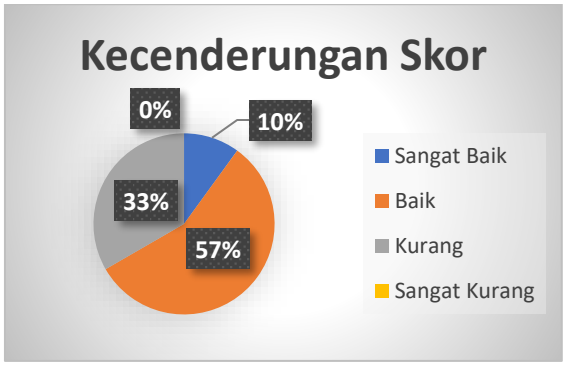

Figure 2. Graph of the percentage of welding PPE usage.

The picture above shows that using personal protective equipment in the welding workshop, Bayah district has 57% in the good category and 33% in the less category.

Analysis Results of Each Indicator

The following is a table of analysis results of each indicator of personal protective equipment for welding.

Table 2. Analysis results of each indicator

Indicators	Percentage
Skin protection	56%
Welding glasses	76%
Mask	74%
Welding gloves	74%
Wearpack	69%
Rubber shoes	68%
Ear protection	61%

The table above shows that personal protective equipment has the most significant percentage of use or understanding in welding glasses at 76%. As for the smallest percentage of use and treatment of skin protection, which is 56%.

Discussion

Characteristics of Respondents

Respondents in this study consisted of: workers in 6 welding workshops in Bayah District totaling 30 people. These respondents were selected because they wanted to know the extent to which workers understand PPE standards for the welding industry and workers' concerns about the use of PPE in the welding process. 67% of workers in welding workshops are aged 20-30, and 33% are over 30. Workers with a working period of 1-2 years are 57%, and workers with a working period of more than two years are 43%. This shows that more workers have a 1-2 years working period. The highest level of education is the high school level of 40%, and 0% for the S1 level. This shows that the analysis level of PPE use with K3 is still low. Because someone who is an expert or understands K3 analysis has a minimum education level of S1.

Frequency Distribution of PPE Use

The distribution of the frequency of use and understanding of welders on personal protective equipment (PPE) according to work operational standards (SOP) showed that the most considerable frequency was in the interval class 57-63, with as many as 12 respondents. Furthermore, the lowest is 0 in the interval class 71-77. This shows the percentage distribution of PPE use in 5 workshops in the Bayah district in the interval class 57-63.

PPE Usage Score Trends

The percentage of use or understanding of welders on welding PPE can be grouped into good categories having the most significant percentage of 57%. As for the percentage in the less category, it has a percentage of 33%. This shows that the use and understanding of each welder for personal protective equipment in 6 welding workshops in the Bayah district is classified in the excellent category and has a percentage of 57%. Therefore, based on the analysis results, the risk level of work accidents is low because the welders have a frequency in the good category.

Analysis Results of Each Indicator

The analysis results using the percentage obtained on using personal protective equipment (PPE) for the welding process in 6 welding workshops in Bayah District, with the most significant percentage of use in welding glasses at 76% and the lowest percentage in leather protection at 56%. From the results of this analysis, it can be said that the use of welding glasses is greater than the use of leather protection when working. This shows that the level of concern of each worker is not balanced towards using personal protective equipment in the welding process, which can cause very vulnerable work accidents.

CONCLUSION

As many as 67% of workers in welding workshops are aged 20-30, and 33% of workers are over 30 years old. Workers with a working period of 1-2 years are 57%, and workers with a working period of more than two years are 43%. Based on the analysis of the use of personal protective equipment in 6 welding workshops, the Bayah district has the most significant percentage of 57% in the good category and 33% in the less category. The use of welding process personal protective equipment (PPE) in 6 welding workshops in Bayah District with the most significant percentage of use in welding glasses at 76% and the lowest percentage in leather protection at 56%.

REFERENCES

Aditias, R. W., Suroto, & Denny, H. M. (2018). Analisis Kesenjangan Implementasi Standar Keselamatan Kerja Pengelasan SD-36-3020 di PT X Berdasarkan Standard NFPA 51 B : 2014. *JKM*, *6*(5), 625–635.

Adiyanta, F. C. S. (2019). Hukum dan Studi Penelitian Empiris: Penggunaan Metode Survey sebagai Instrumen Penelitian Hukum Empiris. *Administrative Law and Governance Journal*, *2*(4), 697–709. https://doi.org/10.14710/alj.v2i4.697-709

Alfarisi, F., & James. (2015). Analisa penilaian resiko pada proses pengelasan dengan metode job safety analysis (studi kasus: pt. meindo elang indah). *JK*.

Desatananda Mirza Wijanartien, H. Djoko Windu P Irawan, S. (2019). Penerapan Alat Pelindung Diri (APD) Pada Proses Pengelasan dan Pemotongan Besi di PT INKA Multi Solution (IMS) Madiun. *Jurnal Kesehatan*, *06*.

Ginting, R., Irmayani, & Harahap, A. I. P. M. D. (2020). Hubungan Faktor Personal dan Pengawasan Kerja Dengan Tindakan Tidak Aman pada Pekerja Pengelasan di Bengkel Las Abun Desa Skip Kecamatan Lubuk Pakam Kabupaten Deli Serdang. *Jurnal Kesma dan Gizi*, *3*(1), 98–104.

Malo, O., K, B., Farizal, & Manesi, D. (2019). Identifikasi Bahaya, Penilaian dan Pengendalian Risiko pada Bengkel Praktikum Pengelasan di SMK N 2 Kupang. *Komodo Jurnal Pendidikan Teknik Mesin*, *3*(2).

Peutula, M., Basri, K., & Fahrizal. (2019). Pelaksanaan Kesehatan kerja yang aman , sehat , dan bebas dari meningkatkan efisiensi dan produktivitas kerugian materi bagi pekerja dan akan berdampak pada mas. *JURNAL PTM*, *3*(April 2019), 47–54.

Rahayu, U. T., Effendi, L., & Andriyani. (2018). Penggunaan Alat Pelindung Diri pada Industri Informal Pengelasan di Kecamatan " X ", Kota Tangerang Tahun 2017. *Environmental Occupational Health and Safety Journal*, *1*(1).

Rif`ati, E. F., & Sutanto, A. (2018). *Analisis Penerapan Sistem Manajemen Keselamatan dan Kesehatan Kerja di Bidang Industri Migas dengan Pendekatan Risk Asessment Code (RAC)*. *8*(3), 10–23.

Sahputra, G., & Siregar, H. (2017). Pengaruh Penyuluhan Dengan Metode Ceramah dan di Kecamatan Percut Sei Tuan Tahun 2013. *Jurnal Penelitian Pendidikan Sosial Humaniora*, *2*(1), 158–173.

Salawati, L. (2015). Analisis Penggunaan Alat Pelindung Mata Pada Pekerja Las. *Jurnal Kedokteran Syiah Kuala*, *15*, 130–134.

Saputra, T. W., Astuti, R. D., & Jauhari, W. (2018). Penerapan Metode Hazard Identification and Risk Asessment Hira Pada Bengkel Las Sinar Arum Semanggi. *JTI*, 209–214.

Solichin, Endarto, F. E. W., & Ariwinanti, D. (2014). Penerapan Personal Protective Equipment (Alat Pelindung Diri) Pada. *Jurnal Teknik Mesin*, *1*, 89–103.

Yoto, Kustono, D., Marsono, & Qolik, A. (2020). Pelatihan Manajemen Keselamatan dan Kesehatan Kerja untuk Meningkatkan Keterampilan bagi Tenaga Kerja Bidang Pengelasan di Kota Malang. *JP2T*, *1*(1989), 90–102.

Zeri Yusdinata, Bora, M. A., & Arofah, N. (2018). Analisis Penerapan Keselamatan dan Kesehatan Kerja (K3) Dengan Menggunakan Metode Fishbone Diagram. *JT-IBSI*, *3*(2), 127–133.