The Analysis of Safety Culture of Welders at Shipyard

Rizky Maharja[1], Abdul Rohim Tualeka[1], Tjipto Suwandi[2]

[1]Departement of Occupational Health and Safety, Faculty of Public Health, Airlangga University, Surabaya, Indonesia, [2]The Indonesian Association of Occupational Health and Safety, Jakarta Pusat, Indonesia

ABTRACT

Welding have several potential to cause work accidents. Therefore, it is necessary to prevent work accident, one of them through safety culture. Safety culture is made up of three factors: psychological factors, job factors, and situational factors. The purpose of this study is to analyze safety culture based on the factors of safety culture in welders in shipyard company. This research was an observational research using cross-sectional design. The variables were safety climate, safety behavior, and safety culture. The results showed that most respondents had a very good perception of OSH and the safety climate profile was in a good category, most respondents had good safety behavior and safety behavior profile was in a good category. In addition, most respondents had a very good safety culture and profile of safety culture was 74,89% and in a good category. Based on these results, it is expected to develop the safety culture and make some efforts to improve the safety behavior of welder. The management of this shipyard company may take action to perform an analysis of safety culture level as a form of oversight of the existing safety culture.

Keywords: *safety culture, safety climate, safety behavior, welder, shipyard*

INTRODUCTION

Work accident is an unexpected incident that can cause loss, both of direct loss and indirect loss that affect workers, property, and production process[1]. Work accident can happen in entire work, include welding. Welding has several hazards including light hazard, smoke and welding gas, noise, heat, electric current hazard, fire hazard, and explosion hazard that can cause work accidents[4]. A Study have reported that welding is ranked second as work that can be causing workers to have eye injuries[2]. Also, every year there are 100 welding workers injured during welding process, which are 25 of them suffered serious injuries[3]

Therefore, it is necessary an effort to prevent the work accident, one of them is through safety culture[5]. Safety culture is included in a sub-component of an organizational culture that directly related to individuals, job, and organizations that have a role and influence in safety and health[6]. Safety culture is formed by 3 factors: psychology or individuals factor is measured by safety climate (perception), job factor is measured safety behavior observations, and situational factor is measured by the audit or inspection of safety management system[7]

The purpose of this study is to analyze safety culture based on the factors of safety culture, so it can be done the development of safety culture as an approaching form of work accident prevention on welders during work up to retirement and can improve the performance of welding workers in work.

MATERIAL AND METHOD

This research was an observational research using cross-sectional design. Research location was in the Division of Warship in a shipyard company. Participants were 58 welders. The variables studied were safety climate, safety behavior, and safety culture. Safety climate was used the Nordic Occupational Safety Climate Questionnaire (NOSACQ-50), safety culture was measured by questionnaire from the Workcover New South Wales, and safety behavior was observed for 15-20 minutes in each worker twice for 2 days. Besides that, the safety management audit result data was obtained from audit results conducted by the company. All of the questionnaires were calculated by the validity and reliability test.

FINDINGS

Safety Climate Factor of Welders

Table 1. The Frequency Distribution of Respondent's Safety Climate

Variable	Category	Percentage (%)
Safety Climate	Very good	29.3
	Good	25.9
	Poor	17.2
	Very Poor	27.6

Table 1 shows that most of the respondent has a very good perception of OSH as many as 29.3%. The percentage of the safety climate is:

The percentage shows that the safety climate profile is in a good category.

Safety Behavior Factor of Welders

Table 2 The Frequency Distribution of Respondent's Safety Behavior

Variable	Category	Percentage (%)
Safety Behavior	Good	41.4
	Enough	25.9
	Poor	32.8

Table 2 presents that most of the respondents have a good safety behavior as many as 41.4%. The percentage of the safety climate is:

The percentage shows that the safety behavior profile is in a good category.

Safety Culture of Welders

Figure 3 The Frequency Distribution of Respondent's Safety Culture

Variable	Category	Percentage (%)
Safety Culture	Very good	53.4
	Good	46.6

Figure 3 explains that most of the respondents have a very good safety culture on aspects of training and supervision, safe working procedures, consultation and communication, safety reporting, management commitment, injury management and return to work.

Table 4 The Safety Culture Profile

Factors	Percentage (%)	Safety Culture Profile
Safety Climate	75%	74.89%
Safety Behavior	64.14%	
Audit of OSH Management	85.54%	

Based on the percentage of safety climate (75%), safety behavior (64.14%), and audit result of OSH management system (85,5%), the average score of safety culture is 74,89%. Table 4 reveals that safety culture profiles at a good level.

DISCUSSION

Safety Climate of Welders

Safety climate is an individual factor in safety culture. Safety climate was the worker's perception of occupational safety and health in the workplace[9]. Based on the research results obtained that most of the respondents have a good safety climate. This indicates that the respondents have a good perception related to occupational safety and health in workplace, particularly related to safety management priorities, commitment and competencies, management authority on safety, equity management in safety, workers commitment to safety, safety workers priorities and risk-taking, learning, safety communication, and trust in competence, workers believe in the ability of the safety system.

Based on interviews, most of the respondents considered that everything that management do related to OSH aims to avoid the work accidents and to protect workers from hazards potential during the welding process. This indicates that respondents have positive responses to the OSH efforts conducted by the management. The safety climate indicated a real cultural indication in the organization[10]. The current study found that creating an appropriate and positive safety climate would further motivate workers to pay more attention to activities related to occupational safety and health compared with the negative safety climate[11].The perception was a dynamic and changeable thing[6]. So that

one's view would change if the environment changes[12]. Therefore, the management should create possible conditions that enable the perception of workers to be better so that OSH program could be effective in the implementation.

One of the efforts that can be done to create a positive safety climate is to create a good and complete OSH management system. This is caused by safety climate gave a subjective assessment of various safety characteristics, while the safety management system tends to provide objective evidence[7]. This shows that safety climate and safety management system complete each other. Besides that, changes in the safety management system would effect to the worker's perception[6]. Therefore, the management should create and maintain a good safety management system. Safety management system was a system used to manage all aspects of OSH in the company[13]. Implementation of OSH management is an absolute thing to be done because the government has obliged this through legislation. This company has implemented OSH management well. This was proved by the result of OSH management audit that shows the achievement with a percentage of 85,54%. This result proved that entire levels of workers in this company were committed and support the implementation of OSH in the workplace.

Safety Behavior of Welders

Safety behavior is job factors in safety culture. Safety behavior which was the focus of this research was the use of the correct PPE and appropriate with the procedure in the welding process. Welding process had several hazard potential that was health and safety hazards. Health hazard obtained from welding gas, noise, vibration, and ergonomic, while safety hazards consist of fire and explosion, lack of oxygen in confined spaces, electricity, slipping and falling[14].

The potential hazards of the welding process could be minimized by using PPE. Personal Protective Equipment (PPE) is one tool that had the ability to protect someone which function was to isolate part or whole body from potential hazards in the workplace.The PPE used in welding process appropriate to the prevailing standard procedure in the Division of Warship are helmets, work clothes or coverall, stiwel or foot protector, safety shoes, long leather gloves, leather apron, hand/head cap, head sheat, welding respirator, hand sheat, and ear plug.

The result of the research shows that most of the respondents have good enough safety behavior in the use of PPE. The most commonly used PPE by respondents are helmets, work clothes, safety shoes, long leather gloves, leather apron, hand/head cap, welding respirator, and hand cover. However, there is still PPE that is rarely used by the respondents such as earplug, stiwel, and leather apron. A small percentage of respondents rarely use earplug because they feel disturbed and uncomfortable. The respondents also rarely use stiwel because they feel enough use work clothes and safety shoes. While leather apron is used in certain working position and the management does not provide leather apron in accordance with the number of workers due to economic reason. Helmets are rarely used during the welding process because the head cap form is not possible to use a helmet, so the helmet is used except that work or after finish the welding process. Besides that, some PPE also used imperfectly, for example, the head sheat is not buttoned so that it still has the potential to be exposed by fire sparks, not using black glass that can cause visual disorder due to welding light, and not be hooking the helmet.

Based on the observation, respondents realize are aware of the importance of using PPE for example immediately replace the filter mask if it is dirty or unfit for use and replace the gloves if there is a hole or tear. While research, filter mask for welding runs out so that the workers use two fabric masks inserted into the mask as a replacement. This indicates that workers are aware and willing to perform safety behavior, but the availability of PPE facilities is still awaiting purchase and distribution.

Safety Culture of Welders

Safety culture was the value of individuals and groups, perceptions, attitudes, competencies, and behaviors that can determine the running of OSH management system in company[15]. In addition, safety culture was the impact of the organization that influenced attitudes and workers behavior associated with risks at work[10]. The results show that most of the respondents have a very good safety culture related to the six aspects of safety culture. The six aspects are training and supervision, safe working procedures, consultation and communication, safety reporting, management commitment, injury management and *return to work*.

The six aspects show that respondents judge everything done by the management to improve OSH at work has been very good. Based on them, it can be concluded that safety culture is good or strong. The literature said that management's behavior in strong safety culture could be seen in all decision taken considering related risk aspect, safety became the main part from company tried to understand the risks that could arise and the solution that can be given, provided appropriate resources with job risks, able to learned from experience of OSH problems faced, and made efforts to improve the poor performance of OSH[12].

In addition to the six aspects described above, safety culture was sub-component from the organizational culture that was an interaction from safety climate, safety behavior, and audit of OSH management system[7]. Based on the percentage of these three aspects obtained the safety culture profile in a good category in the Division of Warship. Safety culture in a good category was a positive safety culture. The reference said that characteristics of positive safety culture are open communication and feedback on suggestions and inputs to all levels in organization, all workers focused on all things that could prevent work accident to happen as well as the disease because of work, there is commitment of entire workers and the management in following all the rules and the process to created an healthy and safety work environment, prioritizing safety factors from all factors that could affect the performance of the company, and all workers were appreciated and protected[16].

Safety culture in the good category also indicates that the scope of each forming factor is good and integrated. This indicates that each of these factors interconnects and interacts with each other. These findings were in line with the previous study that there was an interrelationship between safety climate and safety behavior, safety behavior and OSH management system, and safety climate and OSH management system[7]. These result also further support the idea that safety culture was formed from a set of components of belief, motivation, personality skills, and intelligence, behavior, and environment[10].

Besides that, safety culture is a concept that involved the human aspect that had internal aspects that were not visible (mind/perception) and observable external aspects (behaviors) that are within a social context (organization)[16]. *Business Process Model of Safety Culture* indicated that safety climate, safety behavior, and OSH management system were combinations of inputs in the process of establishing a safety culture[8]. Therefore, this three factors can't stand alone, so the representation of the safety culture should involve this three factors and not only use one indicator from one of that factors.

Although the safety culture results have shown the good results, still needed efforts to develop the safety culture. Culture concept, in general, is adaptive that could change according to human needs[17]. Based on this, it can be concluded that safety culture can be developed, formed, or created in accordance with the goals and characteristics of the company. According to the previous study said that in the development of safety culture needed to pay attention to several things that the measurement of safety behavior, observation of worker's readiness, observation of work environment condition, and management commitment[18]. Besides that, development is done by various ways, for example through the leadership approach, Behavioral Based Safety (BBS) program, integration of OSH management system, improves supervision and etc[16]. Also, it is necessary to analyze the power of OSH culture aimed at understanding the shifting mindset and behavior from time to time, so that the safety culture can develop well and mature.

CONCLUSION

This study has shown that the safety culture of welders in shipyard company was excellent and the percentage of safety culture profile is in a good category it means that all forming factors of safety culture that are individual factors, job factors, and situational factors interconnected and interact with each other.

The management of this shipyard company may take action to perform a level of analysis or a safety culture ladder as a form of oversight of the existing safety culture. This study was not possible to assess safety climate, safety behavior, and safety culture at each level of workers. So, further research needs to measure them at each level of workers to get more varied results and can be compared with others, so that can be determined the best solution in developing the safety culture in the future.

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: This study was approved by Health Research Ethics Committee, Faculty of Public Health, Airlangga University

REFERENCES

1. Tarwaka. Dasar-Dasar Keselalmatan Kerja Serta Pencegahan Kecelakaan Di Tempat Kerja. Surakarta: Harapan Press. 2012.
2. Wahyuni, A. Sri S. Keluhan Subjektif Photokeratitis Pada Tukang Las Bogor, Bandung. Skripsi. Bandung: Fakultas Ilmu Masyarakat, Universitas Indonesia. 2012.
3. Japan Ministry of Health, Labor, and Welfare. A Safety Manual for Technical Intern Trainees: Preventing Accidents While Engaged in Welding and Related Operations. Ministry of Health, Labour, and Welfare. Japan. Preventing Accidents While Engaged in Welding and Related Operations; 2012 [updated 2012 March; citaced 2017 December 5]. Available form: https://www.jitco.or.jp/download/data/saigaibousi_English.pdf
4. American Federation of State, County, and Municipal Employees. Welding Hazards [Internet]. AFSCME Research and Collective Bargaining Department, Health, and Safety Program; 2011 [updated 2011 September; citaced 2017 6 September]. Available from: https://www.afscme.org/news/publications/workplace-health-and-safety/fact-sheets/pdf/Welding-Hazards-AFSCME-fact-sheet.pdf (sitasi 6 September 2017)
5. Hudson, P.T.W. Implementing A Safety Culture in A Major Multi-National. 2007. Safety Science (45):697-722.
6. Cooper, D. Improving Safety Culture: A Practical Guide. United Kingdom: Applied Behavioral Science. 2001.
7. Cooper, M.D. Towards A Model of Safety Culture. Applied Behavioural Science (36):111-136
8. Cooper, D. Surfacing Your Safety Culture. Proceedings Major Hazards Commission at The Federal Ministry of Environment: Human Factors Conference. 2002.
9. Zohar, D. Safety Climate in Industrial Organizations: Theoritical and Applied Implications. 1980. Journal of Applied Psychology 65 (1):96-102
10. Guldenmund, F.W. The Nature of Safety Culture: A Review of Theory and Research. 2000. Safety Science (34):215-257
11. Lisnanditha, Y. Pengaruh Kepemimpinan, Budaya Keselamatan Kerja, dan Iklim Keselamatan Terhadap perilaku Keselamatan Kerja: Studi Kasus di PT. Krama Yudha Ratu Motor [Internet]. Univeritas Indonesia;2012 [updated 2012; citaced 2017 November 30]. Available from: http://lib.ui.ac.id/file?file=digital/20318379-S-Yudithia%20Lisnanditha.pdf
12. Gunawan, F.A. Safety Leadership: Kepemimpinan Keselamatan Kerja. Jakarta: Penerbit Dian Rakyat. 2013.
13. Ramli, S. SMART SAFETY: Panduan Penerapan SMK3 yang Efektif. Jakarta: PT. Dian Rakyat. 2013
14. Health and Safety Executive. Health and Safety at Work: Summary Statistic for Great Britain [Internet]. Health and Safety Executive; 2016. [updated November 2016; citaced 2017 July 2017] Available from: http://www.hse.gov.uk/statistics/overall/hssh1516.pdf?pdf=hssh1516
15. International Atomic Energy Agency. Safety Culture: A Report by The International Nuclear Advisory Group. Vienna: International Atomic Energy Agency. 1991.
16. Tarwaka. Keselamatan, Kesehatan Kerja, dan Ergonomi (K3E) dalam Perspektif Bisnis. Surakarta: Harapan Press. 2015.
17. Indrawijaya, A.I. Teori, Perilaku, dan Budaya Organisasi. Bandung: PT Refika Aditama. 2015.
18. Amirah, N.A., Asma, W.I., Muda, M.S., Aziz, W.A., dan Amin, W. M. Safety Culture in Combating Occupational Safety and Health Problems in the Malaysian Manufacturing Sectors. 2017. Asian Social Science. Vol9. No.3. 2013.