

EXTENDED ABSTRACT

Determinant Factors Affecting the Compliance With the Use of Personal Protective Equipment (PPE) in Gas Plant

Utik Damayanti, Rendhar Putri Hilintang, Noeroel Widajati

Department of Occupational Health and Safety, Faculty of Public Health, Universitas Airlangga, 60115 Surabaya, Indonesia

SUMMARY

PT Samator Gas is an industry that produces a wide variety of gases, such as O₂, N₂, acetylene, oxican, and CO₂. Workers in the production department are at a great risk of exposure to harmful chemicals that may cause skin irritation or respiratory disorders. Personal protective equipment (PPE) is one of five hierarchies of hazard controls. The study aimed to analyze some factors affecting the compliance with the use of PPE. This study was descriptive and observational research with a cross sectional design. 36 workers in the production department were randomly selected. Independent variables of this study were predisposing factors (age, working period, knowledge and attitude) and enabling factors (availability of PPE, training and promotion). Meanwhile, dependent variable was the compliance of the use of PPE. The collected data then were analyzed by using Statistical Package for Social Science (SPSS). The results showed that 69.4% of the workforces did not use PPE accordingly, and 30.6% of them used PPE based on the standart operational procedure (SOP). The independent variable affecting the compliance with the used of PPE was the availability of PPE (significant p value at 0.018 < 0.05). While age, working period, knowledge, attitudes and promotions do not influenced workers' compliance in using PPE. Some factors that influenced the used of PPE were the enabling factors which included the availability of the equipment. Therefore, the management department must plan the needs of the equipment according to the number of workers and reserve a part of it in case some of PPE were damaged. Management department also should conduct regular checks on the availability of PPE in warehouses and identify what causes the unavailability of PPE. Besides that, they also need to hold training about the appropriate use and treatment of the equipment by workers.

Keywords: determinant factors, personal protective equipment, compliance, gas plant

Corresponding Author:

Noeroel Widajati

Email: noeroel2014@yahoo.co.id

Tel: +6285730961962

INTRODUCTION

Nowadays, Occupational and Safety Health (OSH) problems in Indonesia commonly can be seen through the high number of work accidents. Data from the Social Insurance Administration Organization of Employment showed an increase in the work accident rates. In 2016, 101.367 work accidents occurred and increased to 123.000 in 2017, while from January to March 2018 there were 5318 work accidents [1]. The high number of work accidents can cause some disadvantages for workers and companies. According to the International Labour Organization (ILO) there were more than 250 million accidents in the workplace every year, and more than 160 million workers became sick because of hazards at work [2]. The National Health Survey in 2016 in Indonesia reported that there were 21.80% of workers experiencing health problems in the electricity and gas industries [3]. According to Domino Model

of Bird and Germain, losses were caused by five interconnected factors including control, basic causes (knowledge, attitude, availability of PPE, training, skills, standard of work), direct causes (not using PPE and unsafe environment) due to contact with hazardous materials [4]. Mortality can be in the form of a work accident if the illness process occurs quickly or suddenly (acute). Also, it can be in the form of a work-related disease if the illness process is slow (chronic). According to Rachmansyah (2016), the biggest cause of accidents in the industries was human factor for about 80-85%, including the workforce characteristics. The characteristics included insufficient knowledge of the use of PPE, unawareness of the use of the equipment that causing disobedience [5]. In addition, the interpersonal factor is a substantial factor in estimating the compliance with PPE on Chinese migrant workers who got exposed to organic solvents [6]. The use of the equipment increased with negative attitudes of farmers towards pesticides, high levels of knowledge about pesticide hazards, frequent contact with information sources, and past poisoning experience during pesticide handling [7]. Some internal factors determined the relationship between gender, skill and intention to

perform safety behavior when they inspect a ship at the harbour. Besides, some external factors included the availability of PPE, tools and materials that influenced safety behavior when the workers inspect the ship [8]. PT Samator Industrial Gas is one of the largest gas industries in Indonesia. There were various types of gases produced by PT Samator, namely N2 and liquid gas, O2 and liquid gases, acetylene gas, Oxican, liquid CO2. In the production department, workers get a high risk of exposure to chemicals. One of the chemicals is rock carbide (Calcium carbide) which can cause respiratory problems, skin burning and eyes mucosa. To protect the workers, the company must provide PPE, as one of the labor obligations is to use PPE properly (OSHA, 2013). Based on the company’s medical check-up data, it was found that 49.5% workers experienced mild retention and obstructive pulmonary disease. There were 63.6% of workers rarely used PPE. According to Lawrence Green’s theory, behavior in response to the use of PPE is affected by three factors including predisposing factors, enabling factors, and reinforcing factors [9]. Currently, there are still some workers who are reluctant to use the equipment provided by PT Samator. Moreover, there are some others who use PPE improperly. The objective of this study was to identify the determinant factors affecting the compliance with the use of PPE by workers.

MATERIALS AND METHODS

This study was a cross-sectional research with simple random sampling. The samples in this study were 36 workers out of 39 total woekers in the production department. Primary data were collected from October to November 2017 by interview and observation. Independent variables of this study were predisposing factors such as age, working period, knowledge, and attitude. Meanwhile, the independent variables were included enabling factors such as the availability of PPE, training and promotion. Whereas, dependent variable of this study was the compliance with the use of PPE. Secondary data were obtained from PT Samator, including occupational health and safety policy and company regulations. The collected data then were analyzed by using Statistical Package for Social Science (SPSS).

RESULTS

Based on Table I, there were 69.4% workers who did not comply the work standard in using PPE, and 30.6% of the workers had complied to use them. The results of logistic regression showed that enabling factors have a significant influenced on the compliance with the utilization of PPE (Table II). This enabling factor was the availability of PPE (significant p value of 0.018 < 0.05).

DISCUSSION AND CONCLUSION

The results of this study were in line with the research

Table I: The Distribution Frequency of Perdisposing, Enabling Factors and PPE Compliance

Variables	n	Percentage
Predisposing Factors		
Age (years)		
<30	12	33.3
>30	24	66.7
Working Periode (years)		
<10	14	38.9
>10	22	61.1
Knowledge		
Good	19	52.8
Less	17	47.2
Attitude		
Good	13	36.1
Less	23	63.9
Enabling Factors		
Stock		
Enough	16	44.4
Less	20	55.6
Training		
Good	17	47.2
Less	19	52.8
Promotion		
Enough	35	97.2
Less	1	2.8
Compliance of PPE		
Obedient	11	30.6
Not obey	25	69.4

conducted by Arcury et al. (2002); Halfacre-Hitchcock et al. (2006); Perry et al. (2002) who reported that training to increase the knowledge might not be a factor that encourages someone to use PPE [10][11][12]. An increase in knowledge is required, but it is not enough to influence the workers’ behavior [13]. Workers’ attitude do not affected the compliance with the utilization of PPE. This is contrary to the research conducted by Federico Andrade et al. (2015) which stated that the ability to work fast and comfortably determined whether or not workers who use PPE [14]. Meanwhile, age has no influenced on the compliance with the use of the equipment. According to the previous study about the compliance of welders in PT PAL Indonesia, there were no correlation between age, working period, or education with compliance with the use of PPE based on the Standard Operating Procedure (SOP). The results of the research showed that there was a significant correlation between knowledge and the compliance with the use of PPE based on the SOP [15]. Meanwhile, another study pointed out that there was a correlation between age and the compliance with the use of PPE. However, there was no influence between knowledge and the compliance with the use of PPE [16]. Factor that significantly influenced the compliance in this study was the availability of the equipment. Mac Farlane (2013) reported that the compliance with the utilization of PPE

Table II: The Results of Logistic Regression That Determinant to The Use of PPE by Using Bootsrap Method

Variable	B	Bias	Std Error	Sig.(2-tailed)	95% Confidence Interval	
					Lower	Upper
Age	0.951	7.121 ^b	24.798 ^b	0.110 ^b	-54.380 ^b	61.468 ^b
Working P	-0.324	-2.856 ^b	18.568 ^b	0.298 ^b	-51.337 ^b	35.753 ^b
Knowledge	-0.106	-0.950 ^b	21.389 ^b	0.562 ^b	-55.937 ^b	36.846 ^b
Attitude	1.353	8.698 ^b	19.978 ^b	0.093 ^b	-24.837 ^b	55.967 ^b
Availability PPE	2.889	21.500 ^b	31.040 ^b	0.018 ^b	-1.433 ^b	105.989 ^b
Training	0.925	7.704 ^b	21.550 ^b	0.176 ^b	-33.902 ^b	57.868 ^b
Promotion	-19.099	14.023 ^b	21.363 ^b	0.418 ^b	-40.694 ^b	47.980 ^b

was influenced by the access to the equipment [17]. This report was correlated to the research conducted by Sharifzadeh et al. (2017) who stated that the availability of PPE was a prominent constraint [18]. The more complete the equipment is, the more obedient workers will be in using it [19]. An increase in available PPE will enhance the frequency of its uses. There was a relationship between the availability of personal protective equipment and safety behavior [8]. Based on the observation, it was found that there was no stock of PPE in the warehouse. PPE was budgeted annually based on the request of OSH division and will be given by request through the reporting mechanism. The equipment used in this company included safety helmets, masks, gloves, ear plugs, ear muffs, eye goggles, work clothes and safety shoes. For work clothes, they were given only once per year. According to International Loss Control Institute (ILCI) Model explained in Bird (1992), inadequate facilities can lead to sub-standard conditions which was the direct cause of unsafe behavior among workers [20]. If the organization do not provide the facilities, it will be difficult for the workers to carry out activities according to the SOP.

In summary, PT Samator has zero accident program. The management department of the company have demonstrated their commitment to ensure the availability of important resources in the form of human resources (experts), Occupational Health safety (OHS) organizational structure, and financial resources. These financial resources included the availability of PPE. This company has provided PPE in accordance to the Regulation of The Minister of Labor and Transmigration (No.8/MEN/X/2011) about PPE [21] and RI Regulation No. 1 of 1970 about Work Safety [22]. The company also has applied the Regulation of the Ministry of Labor No. 5 of 2018 about OHS Environment. The regulation stated that employers must control hazards by using appropriate PPE [23]. Moreover, the company also made a documented SOP for PPE. Advisory Committee of OHS have been formed, yet the supervision program is still lacking. An optimal identification on the needs for the stockpile of the equipment has not yet been performed as well. The managerial department needs to provide PPE according to the number of workers and reserve some extras in case of emergency. They also need to conduct regular check on the availability of the

equipment in warehouses and identify what causes the unavailability of the PPE. Besides that, they also need to hold training about the proper use and treatment of PPE by workers.

ACKNOWLEDGEMENTS

Special thank you to the PT Samator Gas which was supported this research. The author also would like to thank the lecturer from the Faculty of Public Health Universitas Airlangga-Surabaya who was guided this research.

REFERENCES

1. Priono NJ. <https://sadkes.net/2018/12/30/data-kasus-kecelakaan-kerja-di-indonesia/>. Accessed 2019-04-23
2. ILO. Keselamatan dan Kesehatan Kerja - Sarana untuk Produktivitas. Jakarta: International Labour Office; 2013.
3. Badan Pusat Statistik Indonesia. Profil Statistik Kesehatan 2016. Jakarta: 2017.
4. Tarwaka. Dasar-dasar Keselamatan Kerja serta Pencegahan Kecelakaan di Tempat Kerja. Surakarta: Harapan Press Solo; 2012.
5. Rachmansyah A. Analisa Perilaku Memakai Apd Sarung Tangan Berdasarkan Model Perilaku Abc Pada Tenaga Kerja Bagian Penimbangan Serbuk Menthol Di PT. Coronet Crown Sidoarjo. 2016;
6. Lu L, Shi L, Han L, Ling L. Individual and organizational factors associated with the use of personal protective equipment by Chinese migrant workers exposed to organic solvents. *Saf Sci* 2015;76:168–74.
7. Bondori A, Bagheri A, Damalas CA, Allahyari MS. Use of personal protective equipment towards pesticide exposure: Farmers' attitudes and determinants of behavior. *Sci Total Environ* 2018;639:1156–63.
8. Mubarok MA, Martiana T, Widajati N. An analysis of factors associated with the safety behavior of ship inspection employees safety in port health office class I Surabaya. *Indian J Public Heal Res Dev* 2018;9(5):142–7.
9. OHSAcademy. OSHAcademy Course 709 Study Guide - Personal Protective Equipment. Beaverton,

- Oregon: Geigle Safety Group, Inc.; 2013.
10. Arcury T, Quandt SA, Russel GB. Pesticide Safety among Farmworkers : Perceived Risk and Perceived Control as Factors Reflecting Environmental Justice Thomas A . Arcury ; Sara A . Quandt ; Gregory B . Russell. *Environ Justice* 2002;110(2):233–40.
 11. Halfacre-Hitchcock A, McCarthy D, Burkett T, Carvajal A. Latino Migrant Farmworkers in Lowcountry South Carolina: A Demographic Profile and an Examination of Pesticide Risk Perception and Protection in two Pilot Case Studies. *Hum Organ* 2015;65(1):55–71.
 12. Perry MJ, Marbella A, Layde PM. Compliance with required pesticide-specific protective equipment use. *Am J Ind Med* 2002;41(1):70–3.
 13. Yuantari MGC, Van Gestel CAM, Van Straalen NM, Widianarko B, Sunoko HR, Shobib MN. Knowledge, attitude, and practice of Indonesian farmers regarding the use of personal protective equipment against pesticide exposure. *Environ Monit Assess* 2015;187(3).
 14. Andrade-Rivas F, Rother HA. Chemical exposure reduction: Factors impacting on South African herbicide sprayers' personal protective equipment compliance and high risk work practices. *Environ Res* 2015;142:34–45.
 15. Ayu BF, Tualeka AR, Wahyudiono YDA. The analysis of factors which are related to the compliance of welder workers in using workplace personal protective equipment in Pt. Pal Indonesia. *Indian J Public Heal Res Dev* 2018;
 16. Prasetyawati DA, W S. The influence of personality types on adherence workers using personal protective equipment at Mega Andalan Kalasan Company. *Indian J Basic Appl Med Res* 2016;5(4):509–17.
 17. Macfarlane E, Carey R, Keegel T, El-Zaemay S, Fritschi L. Dermal exposure associated with occupational end use of pesticides and the role of protective measures. *Saf. Health Work* 2013;
 18. Sharifzadeh MS, Damalas CA, Abdollahzadeh G. Perceived usefulness of personal protective equipment in pesticide use predicts farmers' willingness to use it. *Sci Total Environ* 2017;609:517–23.
 19. Harlan AN, Paskarani I. Faktor Yang Berhubungan Dengan Perilaku Penggunaan APD Pada Petugas Laboratorium Rumah Sakit Phc Surabaya Arta Novita Harlan , Indriati Paskarini Departemen Keselamatan Dan Kesehatan Kerja Fakultas Kesehatan Masyarakat Universitas Airlangga. *Indones J Occup Saf , Heal Environ* 2014;1(1):107–19.
 20. Bird FE, Germain GL. Practical loss control leadership. 2., rev. e. Loganville, Georgia, USA: International Loss Control Institute Inc.; 1992.
 21. Peraturan Menteri Tenaga Kerja dan Transmigrasi. Peraturan Menteri Tenaga Kerja dan Transmigrasi Republik Indonesia PER.08/MEN/VII/2010. Indonesia: 2010.
 22. Pemerintah Republik Indonesia. UU No.1 Thn 1970 tentang Keselamatan Kerja. Indonesia: 1970.
 23. Kementrian Ketenagakerjaan. Peraturan Menteri Tenaga Kerja Nomor 5 tahun 2018 tentang Keselamatan dan Kesehatan Kerja Lingkungan Kerja. Indonesia: 2018.