Dust Exposure and Symptomps of Respiratory Disorder on Worker of Sikatak Bridge Development Project

Muhammad Fadli Ramadhansyah*, *Nikie* Astorina YD*, Onny* Setiani

Department of Environmental Health, Faculty of Public Health, Diponegoro University, Semarang, Indonesia

Abstract. Respiratory disorders are health problems that are often suffered by workers who are in the work environment or types of work that are at risk of being exposed to high levels of dust. This study aimed to determine the risk factors for respiratory disorders symptomps on workers of Sikatak bridge construction project workers. This research was an observational analytic study using *a cross sectional approach in October to December 2019*. Samples in this study were taken from all population as many as 50 people with *a total sampling technique, total sampling is a sampling technique where the number of samples is equal to the population*. Statistical test results found that there was a significant association between duration of exposure (p = 0.042; PR = 1.565; 95% CI = 1,040-2,354) to the incidence of symptomps of respiratory disorders on workers of Sikatak bridge construction project. Based on this study it can be concluded that symptomps of respiratory disorders have a proportion of respiratory disorders symptoms 1.565 times greater when working more than 8 hours per day. To avoid the risk of respiratory disorders, it can be done by regulating lifestyle, reducing smoking and using personal protective equipment.

Keywords. Dust Exposure, Symptomps of Respiratory Disorders, Project Workers

1. Introduction

Air pollution is influenced by several factors, namely meteorological, climatic and topographic factors such as temperature that regulates air humidity, direction and wind speed that carries air pollutants flying everywhere, rainfall, and humidity that can affect concentration pollutants in the air. Therefore, the construction of bridges to be built must meet the standards of development to avoid problems arising from development activities. Air pollution has become a major environmental health problem in the world, especially in developing countries, both indoor and outdoor air pollution. Project workers in a development project are examples of work that is often directly exposed to dust when doing work. This has a level of risk for experiencing health symptoms and diseases, both infectious

* Corresponding author: mhmdfadlir@gmail.com

and non-infectious diseases. Respiratory problems are the most common health problems in construction activities [1].

The result of total dust measurement in the bridge construction area was 263 µg / Nm^3 and inhalation dust measurement was 17 mg/m^3 indicated that the measurement exceeds the threshold value stated in Government Regulation No. 41 of 1999 which states that the threshold value at total dust of 230µg / Nm^3 and inhaled dust or unclassified particulates of 3mg/m^3[2]. According to epidemiological studies, each addition of 10mg / m^3 PM 10 can increase the risk of chronic cough by 10-25%. Despite the symptoms, the worker has never done a health because these symptoms are usually considered as due to the worker's age factor [3].

Dust that is inhaled by workers can increase the risk of respiratory symptoms. This is characterized by a decrease in lung function which can cause a decrease in lung elasticity to accommodate the air volume so that this can be associated with the occurrence of respiratory disorders. Dust entering the respiratory tract, causing non-specific defense mechanism reactions in the form of coughing to sneezing. Smooth muscle around the airway can be stimulated so that it causes narrowing. This situation occurs usually the dust content exceeds the threshold value [4].

According to estimates from the International Labor Organization, there are 2.2 work-related deaths each year, 350,000 fatal accidents and 270 million non-fatal work accidents. Every year, 160 million workers suffer from work-related diseases. With a range of 30-40% of the occupational illness is the germ of chronic diseases and 10% can become permanent disabilities [5].

Respiratory symptoms are symptoms that are felt in the form of coughing up both phlegm and cough with phlegm, shortness of breath, chest pain, and wheezing during the morning, afternoon, and night. Respiratory symptoms are events that have various causes. Several studies have shown risk factors that have an influence on the incidence of respiratory disorders symptoms [6].

The results of the interviews showed that all workers who did the Sikatak bridge construction project did not all workers use personal protective equipment, namely masks as many as 28 respondents while doing project work because based on the results of interviews from respondents who were previously interviewed gave the answer that masking was only given at the beginning of the project, and masks provided for each worker amounted to one piece. Some respondents chose an alternative by using an unused cloth to be used as a mask, and some other respondents considered using masks to only make work more complicated because the respiratory tract becomes obstructed by dust that is already deposited in the surface of the masks. The research conducted by Pradesi in 2018 stated that the work period, smoking habits, and the use of personal protective equipment can be modified so as to minimize the incidence of respiratory symptoms [7].

From these results, the researchers wanted to conduct research on the risk factors for respiratory symptoms symptoms in the Sikatak bridge construction project workers. This is due to the fact that the symptoms of respiratory disorders have been a health problem that needs to be minimized. If left untreated and not given treatment will cause damage to target organs and can narrow the volume of the lung space so that oxygen entering the lungs will be less.

2. Research Methods

This research was a quantitative research using analytic observational method with a cross-sectional approach. The population of this observation were all of the construction workers of the Sikatak bridge project Samples were taken in research by using total sampling techniques. The independent variables in this study were individual risk factors with details

of age, lung disease history, and smoking habits, occupational risk factors with details of length of service, duration of exposure, type of work, and compliance in the use of personal protective equipment (PPE).

The location of this research is the area of the construction of Sikatak bridge located in Tembalang. The construction project area which has a high level of risk of dust exposure is located on the foundation that was previously extending the soil so that the foundation and bridge structure can be made. While the respondent population in this study were workers at the Sikatak Bridge construction project. Samples in this study were 50 respondents, to determine whether or not there were symptoms in project workers were interviewed with a number of questions related to whether there were symptoms and whether there were factors affecting it such as age, lung disease history, smoking habits, years of service, duration of exposure, type of work and compliance with the use of personal protective equipment.

Univariate analysis using a frequency distribution table to describe the characteristics of research respondents. Bivariate analysis using alternative fisher exact test with significance level p = 0.05. The significant level used is 95% with a significance value of 5%.

3. Result and Discussion

Respondent characteristics in this study include age, history of lung disease, smoking habits, length of work, duration of exposure, type of work, and compliance with the use of personal protective equipment (PPE). The distribution will be displayed in the following table:

Table 1. Frequency Distribution of Respondent Characteristics

Research Variabel	frequency	%
Ages		
> 40 Years	5	10
≤ 40 Years	45	90
History of lung disease		
Yes	12	24
No	38	76
Smoking Habit		
Smoking	29	58
Not Smoking	21	42
Working Period		
> 5 Years	35	70
≤ 5 Years	15	30
Exposure Time		
> 8 Hours/Day	29	58
≤ 8 Hours/Day	21	42
Type of Work		
Risky	26	52
Not Risky	24	48
Use of PPE		
Not Using PPE	28	56
Using PPE	22	44
Gender		
Male	50	100

Table 1 shows that of the 50 Sikatak bridge construction project workers, 10% had > 40 years of age, 24% had a history of lung disease, 58% had a smoking habit, 70% had a > 5 year service life, 58% were exposed for more than 8 hours / day, 56% of workers do risky work, 56% do not use PPE and all workers are male.

The distribution of respiratory disorders symptoms among the Sikatak bridge construction project workers is shown in the following table:

Table 2. Frequency Distribution of Symptoms Respiratory disorders

Symptomps of Respiratory Disorders	frequency	%
With Symptomps	32	64
With no Symptomps	18	36
Total	50	100

Table 2 shows that, of the 50 respondents who did the Sikatak bridge construction project work there were 64% of respondents who experienced respiratory symptoms. Based on interviews, 22 respondents (44%) experienced coughing, 13 respondents (59%) experiencing regular coughs and 9 respondents (41%) experiencing phlegm coughing, asphyxiation as many as 22 respondents (44%), and coughing and shortness of breath as many as 11 respondents (22%). When observing, the majority of workers on the project did not wear masks that did either risky or non-risky work, thereby increasing the likelihood of direct contact between dust exposure and workers. Based on interviews, several respondents who did work on the Sikatak bridge construction project complained of coughing and shortness of breath while doing work. Cough response and other respiratory symptoms such as shortness of breath caused by increased resistance to elasticity of the lung or increased resistance to nonelasticity such as asthma, bronchitis, and emphysema.

Respiratory symptoms are symptoms that are felt in the form of coughing up both phlegm and cough with phlegm, shortness of breath, chest pain, and wheezing during the morning, afternoon, and night. Respiratory symptoms examined in this study were symptoms felt by respondents while doing their work. Cough response and other respiratory symptoms such as shortness of breath occur due to increased resistance to lung elasticity or increased resistance to nonelasticity such as asthma, bronchitis, and emphysema.

The accumulation of dust <10 microns in the respiratory tract such as the lungs causes narrowing of the respiratory cavity so that the capacity of air inhaled by workers decreases and workers will experience decreased tissue oxygenation, increased oxygen demand, and increased respiratory work because oxygen demand is very large but oxygen is inhaled only a little so that they experience respiratory problems such as shortness of breath and cough response[1].

These results are in line with research conducted by Putri conducted in 2017. Putri states that the percentage of findings of people who experience respiratory symptoms more than people who do not experience symptoms of respiratory disorders. The percentage of people who experience symptoms of respiratory disorders as much as 80% while people who do not experience symptoms of respiratory disorders are as much as 20%. Respiratory symptoms occur because workers do not use personal protective equipment in areas that have high dust exposure so that direct contact between workers and sources of exposure can cause dust accumulation in the respiratory tract and cause respiratory disorders symptoms when the amount of dust levels accumulated in big amount.[8]

The few cases of respiratory symptoms are found as a result of limited time and research methods. Respiratory symptoms are a disease that can be caused by many factors. The longer the worker is exposed to large amounts of dust, the more the person is at risk of experiencing respiratory symptoms. Symptoms of respiratory disorders can be prevented if prevention is done. Therefore, to prevent the occurrence of respiratory disorders symptoms, workers need

to use personal protective equipment for breathing in the form of masks, not smoking, and conduct periodic health checks.

Table 3. Relationship between Individual Risk Factors and Respiratory Symptoms

Risk Factors	Symptoms of Respiratory Disorders						*p value*	Prevalence Ratio (PR) and 95% CI
	With Symptomps		Without Symptomps		Total			
	n	%	n	%	n	%		
Ages								
>40 Years	4	8	1	2	5	10	0,642	0,778
≤ 40 Years	28	56	17	34	45	90		(0,475-1,274)
History of lung disease								
Yes	8	16	4	8	12	24	1,000	1,056
No	24	48	14	28	38	76		(0,661-1,686)
Smoking Habit								
Smoking	19	38	10	20	29	58	1,000	1,058
Not Smoking	13	26	8	16	21	42		(0,691-1,622)

Table 4. Relationship between Occupational Risk Factors and Respiratory Symptoms

Risk Factors	Symptoms of Respiratory Disorders						*p value*	Prevalence Ratio (PR) and 95% CI
	With Symptomps		Without Symptomps		Total			
	n	%	n	n	%	n		
Working Period								
> 5 Years	23	46	12	24	35	70	0,754	0,913
≤ 5 Years	9	18	6	12	15	30		(0,566-1,472)
Exposure Time								
> 8 Hours/Day	15	30	14	28	29	58	0,042	1,565
≤ 8 Hours/Day	17	34	4	8	21	42		(1,040-2,354)
Type of Work								
Risky	18	36	8	16	26	52	0,557	1,187
Not Risky	14	28	10	20	24	48		(0,776-1,814)
Use of PPE								
Not Using PPE	19	38	9	18	28	56	0,565	0,871
Using PPE	13	26	9	18	22	44		(0,566-1,340)

Test results using alternative fisher exact methods in tables 3 and 4 show that of the 7 variables, there is 1 variable that has a association with the incidence of respiratory disorders symptoms in the Sikatak bridge construction project workers, namely the duration of exposure with p value 0.042. Length of exposure is one of the variables that has a association with symptoms of respiratory disorders with a prevalence ratio 1.565 that means the proportion of respiratory disorders is 1.565 times greater in workers who are exposed > 8

hours a day and variables such as age (p = 0.642), history of lung disease (p = 1,000), smoking habits (p = 1,000), years of service (p = 0.754), type of work (p = 0.557) and use of PPE (p = 0.565) have no association with symptoms of respiratory disorders. These results indicate that the longer a person works, the more likely there is contact with dust and the longer a person is in an area at risk, the amount of dust exposure accumulated in the respiratory tract which will ultimately cause adverse effects on the respiratory tract [9].

The results found that 5 respondents (10%) had age > 40 years and 45 respondents (90%) had age ≤ 40 years. Respondents aged > 40 years and experiencing symptoms of respiratory disorders as many as 4 respondents and 1 other respondent did not experience symptoms of respiratory disorders. While 28 respondents who had age ≤ 40 years experienced symptoms of respiratory disorders and 17 other respondents did not experience symptoms of respiratory disorders. After statistical tests, the value of p = 0.642, so that age does not have a association with respiratory symptoms. The results of this study are in line with Pradesi's research in 2017 which shows that age has no association with respiratory symptoms with a p value of 0.575[10].

The results of the study are not in line with the theory which states that physiologically with increasing age, the ability of body organs decreases so that it can cause respiratory disorders. The older a person is, the more likely there is a decrease in lung function with breathing symptoms becoming heavier and decreased breathing capacity [1]. The function of respiratory work will increase in line with increasing age so that there is a decrease after reaching the point of adulthood both lung diffusion and oxygen inspiration process in accordance with changes in age. As we get older, our respiratory system becomes more susceptible to disorders or diseases especially when there is a great opportunity to be exposed to components that can cause a reaction [11]. Project workers carry out their work every day and are indirectly in direct contact with dust continuously. Project workers are jobs that do not require an age limit to work. Most project workers with various ages can experience respiratory symptoms.

When conducting interviews with project workers, construction activities that produce the most dust are when doing land clearing and building bridge foundations while for other processes do not produce as much dust as land clearing and building bridge foundations. And each bridge construction process, the amount of dust levels decreases because the activities carried out are increasingly reduced. Therefore, to reduce the risk of respiratory disorders symptoms, workers must carry out health checks especially those who are more than 40 years old and who have the habit of smoking to find out whether there is respiratory disease or not. And to minimize the amount of dust that is inhaled, each worker is required to use personal protective equipment such as masks.

The results found that 12 respondents (24%) had a history of lung disease and 38 respondents (76%) had no history of lung disease. Respondents who had a history of pulmonary disease and experienced symptoms of respiratory disorders were 8 respondents and 4 other respondents did not experience respiratory symptoms. While 24 respondents who did not have a history of lung disease experienced symptoms of respiratory disorders and 14 other respondents did not experience symptoms of respiratory disorders. After doing statistical tests, the value of p = 1,000, so that the history of lung disease has no association with symptoms of respiratory disorders. The results of this study are in line with Putra's 2014 study which showed that a history of pulmonary disease had no association with vital lung capacity that caused respiratory symptoms p value 0.157[12].

The findings of the study are not in line with existing theories, health conditions can affect a person's vital lung capacity. If someone has or has a temporary respiratory system disease, it will increase the risk of respiratory system disease if exposed to dust. Respiratory diseases that can affect lung capacity include pneumonia, pulmonary TB, bronchitis and asthma.

Exposure to dust generated from construction activities that enter through the nose and mouth will cause deposits in the lungs. In the long run it will have an effect especially due to irritation. Someone who has had lung disease tends to reduce the volume of the lung, resulting in a decrease in oxygen levels in the blood. Diseases such as asthma, pneumonia, emphysema and other lung function disorders will increase the risk of respiratory symptoms when doing work in areas that have high levels of dust levels [12]. To reduce the risk of recurrence or emergence of respiratory disease, it is better for workers to use personal protective equipment and conduct routine checks to check the health of workers, especially those who have a history of lung disease in order to minimize the severity or recurrence rate of the disease.

The results found that 29 respondents (58%) had smoking habits and 21 respondents (42%) did not have smoking habits. Respondents who have the habit of smoking and experiencing symptoms of respiratory disorders as many as 19 respondents and 10 other respondents did not experience symptoms of respiratory disorders. Statistical test found that the analysis was obtained the value of p = 1,000. This study is in line with Apsari's research in 2018 showing that there was no association between smoking habits and respiratory symptoms p value 0.139[13].

Smoking habits may have a risk 4 times in causing obstruction compared to people who do not smoke. Smoking is one of the main factors causing respiratory diseases. Smoking can change the function of the human respiratory tract so that it can result in increased damage to alveoli and inflammation of cells in the lung tissue. These changes that result in clinical abnormalities until the emergence of ostruction that occurs continuously.

Cigarette smoke causes damage to the lungs' defenses. Cilia movement will slow down so that the longer it will get weaker. In smokers, large respiratory tract mucosa cells can enlarge and mucous glands increase. Whereas in small respiratory tract congestion can occur due to narrowing of the channel caused by cigarette smoke and dust in the work environment [14]. Therefore, the smoking habits of workers especially during breaks must be reduced and the construction must monitor workers by conducting health checks to reduce the risk of respiratory symptoms.

The results found that 35 respondents (70%) had a working period of more than 5 years and 15 respondents (30%) had a working period of less than 5 years. Respondents who have work period for more than 5 years and experience symptoms of respiratory disorders as many as 23 respondents and 12 other respondents did not experience symptoms of respiratory disorders. Statistical test found that there is no association between work period and symptoms of respiratory disorders with p value = 0.754. The results of this study are in line with Apsari's research in 2018 showing that work period has no association with respiratory symptoms with a p value of 0.691[13]. However, this is contrary to the theory which states that the longer a person's working period in a dusty work environment, the greater the likelihood of damage to the lung organs and the period of exposure with a period of> 5 years will result in pulmonary disorders. Work tenure is a risk factor for COPD, especially for dusty industrial workers with more than 5 of working period [15].

The theory of work period is the period of time or the length of time a workforce works in a place. Work period is the period of time of people who have worked (in an office, agency, etc.). Length of service can affect performance positively or negatively. Will have a positive influence if the longer the work period of workers, the more experienced in carrying out their duties. On the contrary it will have a negative effect if the longer working period will cause health problems for workers due to work environment or work materials that have been exposed and accumulated for a long time. This is based on a theory that with exposure to the same levels of fibrogenic dust, at least around 5 years it is suspected that inhaled dust can cause pneumoconiosis, which is a type of lung disorder caused by accumulation of dust in the lungs [16]. Therefore, if the worker has a long working period, it is required to conduct a

health screening to see the condition of each individual worker whether the worker needs to take precautions or treatment.

The results found that exposure time per day for 29 respondents (58%) more than 8 hours per day and 21 respondents (42%) less than 8 hours per day. Respondents who worked for more than 8 hours per day had symptoms of respiratory disorders as many as 15 respondents from a total of 29 respondents and 14 other respondents did not experience symptoms of respiratory disorders. After the analysis was obtained the value of p = 0.042 and prevalence ratio (PR) = 1.565 (95% CI = 1,040-2,354), so the duration of exposure had a significant association with respiratory symptoms and showed that workers for more than 8 hours of exposure had a proportion to experience respiratory symptoms 1,565 times higher than workers who work less than 8 hours. The results of this study are in line with Apsari's research in 2018 showing that the duration of exposure has a association with symptoms of respiratory disorders with a p value of 0.046[13]. This is different from Mengkidi's research in 2009 showing that there is no association between duration of exposure with impaired lung function p value = 0.960. The dust that was studied in the research was the dust of cement containing silica. Although the dust studied has the same characteristics, the results of this study are different because of different characteristics of workers and different environmental conditions (temperature and humidity) [17].

Results from observing the activities of project workers with flying dust exposure Dust can float in the air for a long time. Project workers breathe dusty air. The dust can enter the body's organs through the mouth and nose and into the respiratory tract so that dust is inhaled continuously by workers for a long time there will be accumulation of dust in the respiratory tract that causes respiratory disorders such as coughing, shortness of breath, and chest pain.

Long exposure is the time someone spent in the work environment. Generally, workers spend around 6-8 hours a day, if the work time is extended it will cause high inefficiencies and can even trigger the onset of illness caused by the duration of exposure received by workers in the work environment [18]. According to Law No.13 of 2013 Regarding Employment, work time does not exceed 8 hours every day or 40 hours every week [19]. The duration of exposure is related to the number of working hours spent by construction project workers. So the longer the worker does his work, the longer the dust exposure he receives, so that the likelihood of experiencing lung dysfunction will also be greater, but it also depends on the concentration of dust available and the clearance mechanism of each individual, the chemical nature of dust size, dust particle content and individual susceptibility.

To reduce the level of risk of respiratory disorders symptoms due to workers taking precautions such as personal protective equipment in the form of masks to reduce the exposure received by workers and the amount of dust inhaled can be minimized so that the likelihood of respiratory disorders symptoms can be minimized. Then education can be given about the importance of not smoking in order to maintain health for workers so that it does not trigger lung diseases such as asthma and bronchitis. And the last can be done periodically checking to find out whether workers who do project work have lung disease or not so that monitoring can be done to workers who have the disease and are at risk for experiencing symptoms of respiratory disorders.

The results also found that 26 respondents (52%) did risky work and 24 respondents (48%) did not do risky work. Risky work is work that is directly exposed to sources of pollutants such as heavy equipment use, cement and other an organic materials during work, land clearing, and carrying building materials, while for non-risk work is work where the level of pollution exposure tends to be low. Respondents who did risky work and experienced symptoms of respiratory disorders as many as 18 respondents out of 26 respondents and 8 other respondents did not experience symptoms of respiratory disorders. After the analysis was obtained the value of p = 0.557, so that the type of work has no association with symptoms of respiratory disorders. The results of this study are not in line with the research

Ipmawati in the year showed that the type of work has a association with symptoms of respiratory disorders with a p value of 0.003[20]. The results of observations found that the majority of workers do risky work compared to non-risk workers. Factors that support the high number of respondents who experience respiratory disorders symptoms in the project area include dust generated in each high risk work and workers doing work in open spaces where dust can easily move from one place to another.

Types of occupations at risk have a higher level of risk for experiencing symptoms of respiratory disorders. Occupational diseases are caused by unsafe actions and unsafe conditions. At the stage of the process of risky work such as casting, heavy equipment use, land acquisition and carrying building materials can cause high levels of air pollution caused by the amount of dust produced is much higher compared to other types of work so that if.

Seen from the development process carried out, it is possible for dust exposure, especially for workers who do risky work if the worker does not use personal protective equipment to minimize himself from exposure and minimize the possibility of respiratory disorders symptoms. If the respondent carries out risky work, it is required to use personal protective equipment such as masks to minimize the amount of dust inhaled by the respondent so as to minimize the possibility of symptoms of respiratory disorders due to work [21].

The use of personal protective equipment (PPE) found that 28 respondents (56%) did not use PPE in the form of masks while working and 22 respondents (44%) used PPE in the form of masks while working. Respondents who did not use PPE in the form of masks and experienced respiratory symptoms as many as 19 respondents from a total of 28 respondents and 9 other respondents did not experience respiratory symptoms. Whereas 13 respondents who used PPE experienced symptoms and 9 other respondents did not experience symptoms of respiratory disorders. After the analysis was obtained the value of $p = 0.565$, so that the use of PPE in the form of a mask has no association with symptoms of respiratory disorders. The results of this study are in line with the research Ipmawati in 2018 showing that the use of Personal Protective Equipment has no association with symptoms of respiratory disorders p value 0.137[20].

Observation results showed that the average respondent did not use PPE in the form of masks in the project area, but there were some respondents who used masks because different locations and types of work produce more dust so respondents used masks when working and types of masks in the form of masks originating from cloth / clothes that have not been effective at blocking incoming dust because of the size of the dust. In addition, workers also use masks only when doing work and when the work is done, the worker takes off the mask. The masks that are used when doing work are personal masks with cloth / t-shirts, based on the results of interview respondents that the construction party only gave a mask once when they first worked.

Reducing the entry of dust particles into the respiratory tract can use a mask with a predetermined standard. Respiratory protection devices that can be used to protect respiratory organs due to pollutants in the work environment, the respiratory protective devices are called masks. The Sikatak bridge construction project workers deal directly with pollutants such as dust coming from the soil, the environment, as well as from building materials in the form of sand and cement [21]. Most respondents do not wear respiratory protective equipment when doing their work. Construction parties or proponents must provide PPE for project workers in accordance with Indonesian National Standards (SNI) or applicable standards and must be provided free of charge, not only the construction / proponent is required to provide PPE but workers must use PPE when entering the work area according to potential hazards and risks. Respiratory symptoms can be caused by negligence or non-compliance of workers in using PPE in the form of masks during work [22].

Meanwhile in Permenakes No.48 of 2016 concerning Occupational Health and Safety standard, one of which is occupational health improvement, in the form of an increase in

occupational health knowledge, so it is expected that the construction can provide information and education regarding the use of good and correct masks when working in dusty areas and health effects that may be caused[23].

4. Conclusion

The biggest risk factor for respiratory disorders symptoms is duration of exposure. Where workers do work more than 8 hours per day has a risk of 1.565 times greater to experience symptoms of respiratory disorders. Project workers are expected to be able to apply a healthy lifestyle so that they have strong endurance and use personal protective equipment (PPE) for breathing in order to avoid direct dust exposure so that the incidence of respiratory symptoms can be avoided.

The proponent should also have priority on the health of workers by prioritizing occupational safety and health. For the proponent to be able to provide information regarding the importance of not smoking so that health can be maintained and can facilitate personal protective equipment for project workers and periodic health checks to find out whether workers who perform work at risk and are in environments with high levels of dust exposure have health problems.

References

1. Arif M. Asuhan Keperawatan Klien dengan Gangguan Sistem Pernapasan (Jakarta: Salmeka Medika; 2008)
2. Baku Mutu Udara Ambien Nasional. Peraturan Pemerintah Nomor 41 Tahun 1999 (1999)
3. Merenu IA, Mojiminiyi FBO, Njoku CH, Ibrahim MTO. The Effect of Chronic Cement Dust Exposure on Lung Function of Cement Factory Workers in Sokoto, Nigeria. African Journal of Biomedical Research. **10**, 139-143 (2007)
4. Soedjono, Setiani O, Wahyuningsih NE. Pengaruh Kualitas Udara Terminal terhadap Gangguan Fungsi Paru pada Pedagang Tetap Terminal Bus Induk Jawa Tengah. Jurnal Kesehatan Lingkungan Indonesia. **2**(1):27-31 (2003)
5. International Labour Organization. Preventing Lung Occupational Diseases in Indonesia. (2015)
6. Mirza S. Risks to The Health of Wood Workers: What Can Be Done. *Zagazig Journal of Occupational Health and Safety*. **3**(1), 1-8 (2010)
7. Pradesi R. Analisis Hubungan Paparan Debu Semen dengan Kapasitas Vital Paru pada Pekerja Departemen Produksi PT. X Jawa Tengah. Jurnal Kesehatan Masyarakat. **6**(2) (2018)
8. Putri TR. Hubungan Karakteristik Pemulung dan Penggunaan Alat Pelindung Pernapasan dengan Gejala Gangguan Pernapasan pada Pemulung di TPA Jatibarang, Semarang. [Repository]. (2017)
9. Hamzah NA, Tamrin SBM, Ismail NH. Metal Dust Exposure and Lung Function Deterioration Among Steel Workers: an Exposure-Response Relationship. International Journal of Occupacional and Environmental Health. **22**(3) (2016)
10. Pradesi R. Analisis Hubungan Paparan Debu Semen dengan Kapasitas Vital Paru pada Pekerja Departemen Produksi PT. X Jawa Tengah. J Kesehat Masy.**6**(2). (2018)
11. Rahmannia H. Hubungan Paparan Debu dan Karakteristik Individu dengan Status Faal Paru Pedagang di Sekitar Kawasan Industri Gresik. J Kesehat Lingkung. **11**(2):132–40. (2019)
12. Putra ND. Faktor-Faktor yang Berhubungan dengan Kapasitas Vital Paru pada Pekerja

Bengkel Las di Kelurahan Cirendeu Tahun 2014. J Fakultas Kedokteran dan Ilmu Kesehat Masyarakat UIN Syarif Hidayatullah Jakata. **4**:30–8 (2015)
13. Apsari L, Budiyono SO. HUBUNGAN PAPARAN DEBU TERHIRUP DENGAN GANGGUAN FUNGSI PARU PADA PEKERJA PERTAMBANGAN PASIR DAN BATU PERUSAHAAN X ROWOSARI KOTA SEMARANG. Jurnal Kesehatan Masyarakat. **6**(4). (2018)
14. Brinkman GL CEJ. The Effect of Bronchitis, Smoking, and Occupation on Ventilation. Am Rev Respir Dis.**87**:684–93 (1963)
15. Irjayanti A, Nurjazuli SA. Hubungan Kadar Debu Terhirup (Respirable) dengan Kapasitas Vital Paksa Paru pada Pekerja Mebel Kayu di Kota Jayapura. Jurnal Kesehatan Lingkungan Indonesia .**11**(2):182–6. (2012)
16. Suma'mur. Higiene Perusahaan dan Kesehatan Kerja. (Jakarta: Sagung Seto; 2009)
17. Dorce M. Gangguan Fungsi Paru dan Faktor-Faktor yang Mempengaruhinya pada Karyawan PT. Semen Tonasa Pangkep Sulawesi Selatan. J Kesehat Lingkung Indones.**5**(2). 2006
18. Williams N. Ilmu Kesehatan Anak. (Jakarta: EGC; 2007)
19. Undang-Undang Nomor 13 Tahun 2003 tentang Ketenagakerjaan. (2003)
20. Ipmawati PA. Analisis Faktor-Faktor yang Mempengaaruhi Tingkat Keracunan Pestisida pada Petani di Desa Jati, Kecamatan Sawangan, Jawa Tengah. Jurnal Kesehatan Masyarakat .**4**(1) (2016)
21. Yulaekah S AM. Pajanan Debu Terhirup dan Gangguan Fungsi Paru pada Pekerja Industri Batu Kapur (Studi di Desa Mrisi Kecamatan Tanggungharjo Kabupaten Grobogan). Jurnal Kesehatan Lingkungan Indonesia. **5**:24–32. (2007)
22. Sandra C. Pengaruh Kualitas Udara terhadap Fungsi Paru dan Keluhan Pernapasan pada Polisi Lalu Lintas Polwitabes Surabaya. J IKESMA. **9**(1) (2013)
23. Permenakes No.48 Tahun 2016 Tentang Standar K3. (2016)