Factors Related to Pulmonary Disorders in Waste Transport Officer in District Temanggung.

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ABSTRACT

Waste that is not managed properly will cause problems for the environment and the population around it. The result of the decay of organic waste can cause the appearance of dust and dangerous toxic gases. The Waste Transport Officer is the person who has a potential to be affected, because of the nature of his work which requires direct contact with the waste. The aim of research was to analyze the relationship between concentrations of H_2S and dust in the working environment, and the use of Personal Protective Equipment (PPE) and pulmonary disorders in the Waste Transport Officers in District Temanggung. This research is an observational research by using a cross sectional data collection technique. The population consisted of 79 Waste Transport Officers in District Temanggung, with a sample of 55 male Waste Transport Officers and have no diseases history which have been selected by the Simple Random Sampling Technique. Research data have been collected by taking samples, interviewing using questionnaires, and measuring in the field. There is no relationship between concentration of H_2S in the working environment with pulmonary disorders in the Waste Transport Officer (p value = 0.446 > α = 0.05; OR = 1.343; 95% CI = 0.372 - 4.864). There is a relationship between the concentration of dust in the working environment with pulmonary disorders in the Waste Transport Officer (p value = 0.005 < α = 0.05; OR = 7.042; 95% CI = 1,894 - 26,174). There is no relationship between the use of Personal Protective Equipment (PPE) in the working environment with pumonary disorders in the Waste Transport Officer in District Temanggung (p value = 0,700> α = 0,05; OR = 0,659; 95% CI = 0,202 - 2,153).

Keyword: Pulmonary disorders, H_2S, dust, Personal Protective Equipment (PPE), Waste Transport Officer, Temanggung

BACKGROUND

The world's population has a rapid growth from time to time. Increasing the rate of urbanization, standards of quality of life standards, as well as the rapid development of technology gives a contribution o increasing the amount and variety of waste due to industrial activities, households, and other activities.(1) WHO estimates that total waste from healthcare products in the majority of low-income countries around 0.5-3 kg per person each year, while this type of waste is included in the hazardous waste sub-category. Poor waste management causes contamination of water, air and soil. Waste is also a potential place for the development of disease vectors, providing aesthetic disturbances if the land or

container is left open, as well as social impacts, especially for the community in the environment as a waste disposal site.(2)

Research on the generation of household waste containing hazardous waste and Toxic ("B3") in Sleman, Yogyakarta states that hazardous and toxic materials ("B3") contained in household waste such as: batteries, electric lights, medical waste, and syringes can threaten human health and the environment if treated as domestic waste ordinary. Waste transport workers have the risk of contracting occupational diseases arising from waste, and physical effort in handling waste. Work-related illnesses suffered by waste transport workers include joint injuries or the backbone as a result of lifting heavy waste bins. Respiratory disease due to inhalation of pollution source gases, infection due to direct contact with the source of contamination, injecting injuries caused by risk of contracting tetanus, hepatitis or the Human Immunodeficiency Virus (HIV). Scratches due to sharp objects, headaches due to waste gas such as methane gas and CO2 gas, and poisoning of heavy metals resulting from the burning of materials containing heavy metals such as batteries and paint.(3)

Occupational diseases that target lung organs are called lung diseases due to work. The American Thoracic Society (ATS) states that occupational lung disease is a group of diagnoses caused by inhalation of dust, chemicals, and proteins.(4) The results of research conducted on waste management officers in India stated that as many as 21% suffer from lung disease (infection / allergy).(5) The results of research conducted in Indonesia on waste transport officers in the city of Manado stated that as many as 90.5% of respondents had respiratory disorders (mild disturbances 57.2%, moderate disorders 25.7% and severe disorders 7.6%) (6) Therefore it is necessary to detect respiratory disorders as early as possible.

The amount of waste generation in District Temanggung in 2016 was 139,908 tons and increased to 141,143 tons in 2017. It is estimated that in 2023 with an average population growth of 0.88%, the amount of waste generated will reach 168,565 tons. The current waste transport service is 9.16% or 3,481 tons of waste transported in 2017 and is estimated to reach 17,678 tons in 2023. (7) The Waste Transport Officer in District Temanggung works for an average of seven hours a day without a break for holidays, unless unable to attend due to important reasons. Work begins at six in the morning until noon. Waste Transport Officers do not have a special time to take a rest during doing his works, while the transportation of waste in Temanggung Regency is still done manually. The Waste Transport Officers will empty the trash cans and waste containers by hand, without the use of protective gloves and masks on a regular basis.

The increase in the amount of waste production that is balanced by the increasing amount of waste transported by the Waste Transport Officers provide the potential for exposure to dust and gas from inhaled waste discharges becoming higher. The higher level of exposure to inhaled dust and exhaust gases, will increase the risk of pulmonary disorders to the Waste Transport Officers. (6)

RESEARCH METHOD

This type of research is observational research. The technique to collect the samples of research using Cross Sectional approach. While, the technique of selecting research sample using Simple Random Sampling. Reseach data are analyzed using Fisher's Exact Test (95%, $\alpha = 0.05$) and Chi-Square Test (95%, $\alpha = 0.05$). The population consisted of 79 Waste Transport Officers in District Temanggung with 55 reseach samples of male Waste Transport Officers, had no history of the diseases, and had a minimum working period of 12 months.

This research uses primary data and secondary data. Primary data consisted of the measurements of H_2S concentrations in the working environment using the Odalog 7000. Measurement of pulmonary disorders by using the SpiroLabIII MIR Spirometer. Measurement of dust concentration in the

working environment by using the Personal Dust Sampler (PDS).

The interview used a questionnaire to find out the characteristics of the respondents namely age, level of education, years of service, nutritional status, use of Personal Protective Equipment (PPE), smoking habits, and exercise. Secondary data consisted of literature review, data from the Department of Environment, and the Central Bureau of Statistics in District Temanggung.

RESEARCH RESULT

a. The Frequency Distribution Based on Respondent Characteristic

Tabel 1. The Frequency Distribution Based on Respondent Characteristic

Respondent Characteristic	Category	n	%
Age	< 40 Years	25	45.5
	≥40 Years	30	54.5
Nutrition	Not Good	10	18.2
	Good	45	81.8
Years of Service	Old Employee ≥6 Years	39	70.9
	New Employee < 6 Years	16	29.1
The Used of Personal Protective Equipment	Used	19	34.5
	Unused	36	65.5
Smoking Habit	Smoking	38	69.1
	Not Smoking	17	30.9
Exercise / Sport Habit	Exercise / Sport	26	47.3
	Not Exercise / Not Sport	29	52.7
Pulmonary Function	Abnormal	17	30.9
	Normal	38	69.1
Total		**55**	**100.0**

The age of waste transport officer ≥ 40 years and < 40 years is relatively the same, only a difference of 5 peoples. The youngest age of the waste transport officer is 25 years, the oldest age is 59 years with a standard deviation of 9,183.

The sNutritional status is obtained from the calculation of Body Mass Index (BMI) by calculating the weight ("BB") and Height ("TB") of the waste transport officer. The average weight of respondent is 62.04 kg, the standard deviation is 8.018. The lightest weight is 47 kg and the heaviest is 83 kg. The average height of the respondent is 163.67 cm, the standard deviation was 5.972. The lowest height is 152 cm and the tallest is 178 cm. The average nutritional status of respondents is 23.18 with the lowest value of 18.13 and the highest of 31.64 with a standard deviation of 2.982. Respondents are classified as normal 45 peoples (81.8%) and obese 10 peoples (18.2%).

The work period is the period of time the waste transport officer starts working until the time the research is conducted. The average tenure of respondents is 14.42 years with a minimum service period of 2 years and a maximum of 38 years, with a standard deviation of 9,347. Respondents with new tenure (29.09%) and long tenure of 39 peoples (70.91%).

The Personal Protective Equipment (PPE) referred to in this study can be in the form of face masks, handkerchiefs or the like, or covering with hands when working. Respondents use PPE when working as many

as 19 peoples (34.55%) and respondents who do not use PPE when working 36 peoples (65.45%).

Respondents who have a smoking habit are 38 peoples (69.09%) and who do not have a smoking habit as many as 17 peoples (30.91%). Of the 38 respondents who had the habit of smoking when viewed from the number of cigarettes smoked in a day the highest proportion was 6-12 cigarettes totaling 30 peoples (78.94%), then < 6 cigarettes as many as 4 peoples (10.53%) and> 13 sticks as many as 4 peoples (10.53%). Respondents who have exercise / sport habits 29 peoples (52.73%) and respondents who do not have exercise / sport habits 26 peoples (47.27%).

The measurement of the pulmonary function of the waste transport officer by using a spirometer, from the measurement results will be obtained "FEV" and "FVC" values that determine whether the pulmonary function is classified as normal or abnormal (restrictive, obstructive and mixed). Based on the examination of the capacity pulmonary function of the respondents, there are 17 peoples (30.91%) who had abnormal pulmonary function and 38 peoples (69.09%) had normal pulmonary function. Respondents who have abnormal lung function can be categorized as obstructive disorder (FEV1 / FVC <80%) as many as 11 peoples (64.71%), patients with restrictive disorders (FVC <80% predicted) 4 peoples (23.53%) and people with mixed disorders 2 peoples (11.76%).

b. The Measurement of Air Quality Measurement in The Working Environment of Waste Transport Officer in Distric Temanggung

Tabel 2. The Measurement of Air Quality Measurement in the Working Environment of Waste Transport Officer in Distric Temanggung

No	Group of Waste Collection	Location of Waste Measurement	O2 (%)	LEL (%)	CO (ppm)	H_2S (ppm)	NO_2 (ppm)	SO_2 (ppm)
1	Group 1	TPS 3R Maduasri	20.9-21.0	0	2	0	0	0
2	Group 2	Depo Transfer Jampirejo	20.9-21.0	0	0	0	0	0
3	Group 3	TPS Dangkel	20.9-21.0	0	0	0	0	0
4	Group 4	TPS Manden	20.8-21.0	0	0	0	0.4	0
5	Group 5	TPS Sari Ayam	20.6-21.2	0	5	0	0.3	0
6	Group 6	TPS Sidorejo	21.1-20.9	0	0	1	0.3	0
7	Group 7	TPS RSUD	21.1-20.9	0	0	1	0.1	0
8	Group 8	TPS Perintis Kemerdekaan	21.1-20.6	0	3	1	0.2	0
9	Group 9	TPS 3R (Depo Transfer) Kauman Parakan	20.9-20.9	0	14	0	0	0
10	Group 10	TPS 3R Blimbing	20.9-20.9	0	2	0	0	0
11	Group 11	TPS Nogo Salamsari	20.9-21.1	0	1	0	0	0
12	Group 12	TPS 3R Muntung	20.7-20.9	0	3	0	0.3	0
13	-	TPA Sanggrahan Zona Aktif	20.6-21.3	1	59	0	0	0.4
14	-	TPA Sanggrahan Zona Pasif	20.8-21.3	1	1	1	0,2	0

The measurement of H2S concentration at sample points that are considered to have high H2S concentrations in each waste transport group showed that there were 4 locations whose concentrations exceeded the Threshold Limit Value (TMV >

0.02 ppm), are TPS Sidorejo, TPS RSUD, TPS Perintis Kemerdekaan, and Sanggrahan Landfill. That waste transport group has a concentration of up to 1 ppm.

c. The Distribution of H_2S Concentration in The Working Environment of Waste Transport Officer in District Temanggung

The frequency distribution of waste transport officer is exposed to H_2S at sampling points other than the Sanggrahan TPA is stated in the following table:

Table 3. The Distribution of H_2S Concentration in The Working Environment of Waste Transport Officer in District Temanggung

No	Concentration of H_2S in The Working Environment	Total	%
1	Above TLV (>0.02 ppm)	14	25.5
2	Below TLV (≤0.02 ppm)	41	74.5
	Total	55	100.00

The measurement of H_2S at the sample collecting points have been found that on TPS Sidorejo, TPS RSUD, dan TPS Perintis Kemerdekaan have a concentration of H_2S above the Treshold Limit Value (TLV). There are 14 waste transport officers are working on that route, who and 5 peoples have an an abnormal pulmonary function.

d. The Distribution of Dust Concentration in the Working Environment of Waste Transport Officer in District Temanggung

The measurement of dust concentration by using a Personal Dust Sampler (PDS) attached to the waste transport officer during a 60-minute period, is stated in the table as follows:

Tabel 4. The Distribution of Dust Concentration in The Working Environment of Waste Transport Officer in District Temanggung

No	Concentration of Dust in The Working Environment	Total	%
1	Above TLV (>3 mg/m3)	25	45.5
2	Below TLV (≤ 3 mg/m3)	30	54.5
	Total	55	100.00

Respondents with dust concentrations below the Threshold Limit Value (TLV) are more than respondents with dust concentrations above the Threshold Limit Value (TLV). The percentage of respondent with dust concentrations below the Threshold Limit Value (TLV) is 54.5% with a total of 30 respondents. The percentage of respondent dust concentrations above the Threshold Limit Value (TLV) is 45.5% with the total of 25 respondents.

e. The Relationship between Concentration of H_2S Concentration in The Working Environment with Pulmonary Disorders in Waste Transport Officer in District Temanggung

Tabel 5. The Relationship between Concentration of H2S Concentration in The Working Environment with Pulmonary Disorders in Waste Transport Officer in District Temanggung

No	Concentration of H_2S	Pulmonary Function						OR	95% CI	
		Abnormal		Normal		Total				
		n	%	n	%	n	%		Lower	Upper
1	> TLV (> 0.02 ppm)	5	35.7	9	64.3	14	100	1.343	0.372	4.864
2	≤ TLV (≤ 0.02 ppm)	12	29.3	29	70.7	41	100			
	Total	17	30.9	38	69.1	55	100			

p – value = 0.446

The relationship between concentration of H_2S in the working environment with pulmonary disorders are analyzed using crosstabs and statistical tests using the Fisher Exact Test. It is because there is 1 cell (25%) that had an expectation value of less than 5. The measurement of H_2S concentrations in the working environment using the 7000 Odalog tool placed at waste collection sites (TPS / TPS3R) with the highest amount of waste generation on each waste transportation route. More waste generation is thought to have higher concentrations of H_2S.

The Waste Transport officers in District Temanggung who are exposed of H_2S > Threshold Limit Value (TLV) are 14 peoples (25.45%) and those who are exposed to ≤ Threshold Limit Value (TLV) are 41 peopleS (74.54%). The Waste Transport Officers in District Temanggung who are exposed to H2S concentrations above the Threshold Limit Value (TLV) and have pulmonary disorders are 5 peoples (35.7%). While 9 peoples (64.3%) have not pulmonary disorders.

Odds Ratio (OR) = 1,343 indicates that The Waste Transport Officers in District Temanggung who are exposed to H2S concentrations in the working environment above the Threshold Limit Value (> 0.02 ppm) has a risk of pulmonary disorders as much as 1,343 times compared to officers who are exposed to H2S concentrations below or equal to the Threshold Limit Value (≤ 0.02 ppm).

Statistical calculations and analysis are performed by using the Fisher's Exam Test because there was 1 cell (25%) which had an expectation value of less than 5. The result of statistical calculation is obtained a probability value (p-value) = 0.446 > $\alpha = 0.05$. This means that there is no relationship between concentration of H_2S levels in the working environment and pulmonary disorders in the waste transport officers in District Temanggung.

f. The Relationship between Concentration of Dust in The Working Environment and Pulmonary Disorders in Waste Transport Officer in District Temanggung

Tabel 6. Analisi Hubungan Konsentrasi Debu di Lingkungan Kerja dengan Gangguan Fungsi Paru pada petugas pengangkut Sampah di Kabupaten Temanggung

No	Concentration of Dust	Pulmonary Function						OR	95% CI	
		Abnormal		Normal		Total				
		n	%	n	%	n	%		Lower	Upper
1	> TLV (>3 mg/m3)	13	52.0	12	48.0	25	100	7.042	1.894	26.174
2	≤ TLV (≤ 3 mg/m3)	4	13.3	26	86.7	30	100			
	Total	17	30.9	38	69.1	55	100			

p value = 0.005

The relationship of dust concentration in the working environment with pulmonary disorders is analyzed using crosstabs and statistical tests using the Chi Square Test ($\chi 2$). Measurement of dust concentration, Personal Dust Sampler (PDS) is applied to the waste transport officers who are doing their daily work. The tip of the pipe that absorbs dust is placed at nose level. Dust concentration is obtained by measuring the weight of the filter which is useful for capturing dust entering the absorbent pipe before and after exposure to dust.

The Waste Transport Officers in District Temanggung who are exposed to dust concentration above the Threshold Limit Value (TLV) who have pulmonary disorders are 13 peoples (52.0%), while 12 peoples (48.0%) have no pulmonary disorders. lung function disorders. The Waste Transport Officers in District Temanggung who are exposed to dust concentrations below the Threshold Limit Value (TLV) who have pulmonary disorders are 4 peoples (13.3%), while 26 peoples (86.7%) have no pulmonary disorders.

Odds Ratio (OR) = 7.042 indicates that The waste transport officer in District Temanggung who is exposed to dust concentrations in the working environment above the Threshold Limit Value (> 3 mg / m3) has a risk of pulmonary disorders as much as 7.042 times compared to the officer who is exposed to dust concentration below or equal to the Threshold Limit Value (≤ 3 mg / m3).

The results of statistical calculation by using Chi Square is obtained the probability value (p-value = 0.005 < α = 0.05). There is relationship between concentration of dust in the working environment with pulmonary disorders in waste transport officer in District Temanggung.

g. The Relationship of the Use of Personal Protective Equipment (PPE) in The Working Environment with Pulmonary Disorders in Waste Transport Officer in District Temanggung

Tabel 7. The Relationship of the Use of Personal Protective Equipment (PPE) in The Working Environment with Pulmonary Disorders in Waste Transport Officer in District Temanggung

No	Wearing PPE	Pulmonary Function						OR	95% CI	
		Abnormal		Normal		Total				
		n	%	n	%	n	%		Lower	Upper
1	Unwearing	10	27,8	26	72,2	36	100	0,659	0,202	2,153
2	Wearing	7	36,8	12	63,2	19	100			
	Total	17	30,9	38	69,1	55	100			

p value = 0,700

The relationship between the use of Personal Protective Equipment (PPE) and impaired pulmonary disorders is analyzed using crosstabs and statistical tests using the Chi Square Test ($\chi 2$). Personal Protective Equipment used by waste transport officers when working in the form of the use of masks, handkerchiefs, or covering with his hands when doing their duties. The most of waste transport officers do not wear Personal Protective Equipment (PPE) ate 36 peoples (65.45%) and the reasons stated during the interview are because of discomfort and do not feel disturbed by the smell or dust exposed during work.

The waste transport officers in District Temanggung are equipped with masks, handkerchiefs, or cover their mouths and noses with their hands while doing their job. Based on the results of interviews and

field observations, the majority of officers as many as 36 people (65.45%) did not wear Personal Protective Equipment (PPE) due to feel uncomfortable and didn't feel being disturbed by the smell or dust exposed during collecting and transporting waste in District Temanggung.

The waste transport officers in District Temanggung who Personal Protective Equipment (PPE) at the working environment and have pulmonary disorders are 7 peoples (36.8%), while those who do not pulmonary disorders are 12 peoples (63.2%). The waste transport officers in District Teamnggung who do not wear Personal Protective Equipment (PPE) while working and have pulmonary disorders are10 peoples (27.8%), while those do not have pulmonary disorders are 26 (72.2%).

Odds Ratio (OR) value = 0.659 indicates that The Waste Transport Officers in District Temanggung who do not wear Personal Protective Equipment (PPE) in the working environment have a risk of pulmonary disorders as much as 0.659 times compared to officers who use Personal Protective Equipment (PPE).

Statistical calculation by using the Chi Square is obtained the probability value (p-value = 0,700> α = 0.05). There is no relationship between the use of Personal Protective Equipment (PPE) in the working environment with pulmonary disorders in the waste transport officer in District Temanggung.

ANALYSIS

Based on Regional Regulation No. 10 of 2016 concerning the Establishment and Composition of the District Temanggung, Waste management in the District Temanggung is carried out by the Office of the Environment. The fields that are handling are the Solid Waste Department, which is strengthened by 12 waste fleets, the Final Disposal Site totaling 1 area with an area of 4.72 Ha, Landfills totaling 14 units, waste banks totaling 145 units and 79 waste transport officers. The waste transport group is divided into 12 groups by taking into account the number of fleets and personnel. Until 2019, the government and the private sector have an ability to serve 30.44% of villages in the district of Temanggung. A small fleet of pick-ups will transport 2 times a day, morning and evening with different personnel.

The legal standing which is the basis of policy in waste management with the aim of achieving a clean, healthy, and beautiful environment for the realization of public health and welfare is realized with the enactment of Regional Regulation number 29 of 2011 concerning waste management. [8] Waste that is regulated and managed in the regional regulation consists of household waste, household-like waste, and specific waste. Its scope includes rubbish from households, commercial areas, industrial zones, special zones, social facilities, public facilities, and / or other facilities, rubbish containing hazardous and toxic materials, rubbish containing hazardous and toxic waste, rubbish arising from disasters , building demolition debris, technological waste which cannot yet be processed and / or periodically generated waste.

Research conducted by Siswanto et al. in Distric Sleman on household waste toxic hazardous materials shows that the quantity is 2.44 g / person / day or 0.49% of domestic waste. Although a small percentage, the heavy metal content can damage the organs of living organisms exposed. This household waste toxic hazardous materials is included in the specific waste category where the average quantity in the world shows 1% of municipal waste. [3] Measurement of household waste toxic hazardous materials in District Temanggung in the future needs to be done because the handling of this type of waste is still treated the same as other domestic waste, so the risk of exposure by garbage transport officers is very high. The population of District Temanggung over 10 years who have a livelihood as a farmer is 58.17% so the possibility of waste containing toxic hazardous materials from the packaging of

pesticides and other agricultural medicines is quite high.[9]

Waste transportation in District Temanggung is still conducted manually where waste transporters emptied trash bins and waste containers by hand, without the use of protective gloves and masks on a regular basis. The waste transport officer will be in a waste fleet with the waste that has been transported during the trip transporting the waste to the Final Disposal Site.

The results of air quality measurements using the 7000 Odalog tool especially the concentration of H_2S in Sanggrahan's Final Disposal Site, in the passive zone of 1 ppm and 0 ppm active zone. When compared with the air quality standard according to Decree of The Minister of Environment Decree No. 50 of 1996 amounted to 0.02 ppm then the concentration of H_2S in the passive zone was classified as very high.[10] These results are in line with the results of research conducted at the Ganet – Tanjungpinang's Final Disposal Site with an open dumping system where the H2S measurement results reached 0.06 ppm.[11] The same results were also shown from the results of H_2S concentration measurements in the Mrican's Final Disposal Site in District Ponorogo conducted by Ratih Andhika and Tofan Agung where the active zone reached 0.024 ppm and the passive zone 0.022 ppm.[12] The results of H_2S concentration measurements at all sample points turned out to be concentrated is very hard to find. Only the number of landfills that can be measured in H_2S concentrations are at landfill in Regional General Hospital - Temanggung, Perintis Kemerdekaan's Landfill, Depo Transfer of Kauman – Parakan, Sanggrahan's Final Disposal Site. The results of the analysis using the Fisher Exact Test obtained p-value > 0.05 which is 0.446, which means there is no relationship between H_2S concentrations in the working environment with pulmonary disorders in the waste transport officer. These results are consistent with the results of research on the population around the Sukawinatan's Final Disposal Site (p-value = 1,000) and Rubber Factory in Gandus City (p-value = 0.626) where there is no relationship between pulmonary disorders and Interleukin-6 levels. Interleukin-6 is one of the proinflammatory cytokines in the human body whose levels are increased due to air pollution, where one of these pollutants is H_2S. [13] Similar results are obtained from the analysis of H_2S concentrations of scavenger respiratory disorders complaint at Ganet's Final Disposal Site - Tanjungpinang with p value = 0.194.[11] However, these results are not in line with studies on Mrican landfill scavengers with RO = 0.137 Similar results were obtained from the analysis of H2S concentrations of scavenger respiratory disorders at the Ganet's Final Disposal Site in Tanjungpinang City with p value = 0.194.[11] This research is not inline with the research on Scarvenger Mrican's Final Disposal Site, with RO = 0.137 and the scarvenger has a probability 12% may suffer from from respiratory disorders.[12]

H_2S concentrations are rarely found in Landfill because the waste dumped is relatively fresh because the garbage is taken every day so that the decomposition process is still relatively low and H_2S concentrations resulting from decomposition of waste are rarely found. Waste from organic material will decay if left unmanaged, sulfate compounds in the waste are processed into sulfides by spoilage bacteria. Chemically this process reacts lactate with sulfate to acetate, sulfide, water and CO^2. Sulfide ions will react with H + and Fe2 + to become H2S and FeS in the form of a smelly black liquid. Decomposition in conditions without oxygen (anaerobic), organic material will become ammonia gas, hydrogen sulfide (H_2S), methane (CH_4) and other simpler compounds. While in enough oxygen (aerobic) conditions, decomposition will produce H_2O and CO^2, as well as other compounds in the form of nutrients. The results of this discharge which causes an unpleasant odor from the waste, at concentrations of 0.001-1.5 ppm immediately recognized the smell like rotten eggs in some peoples, the smell is stronger at a concentration of 3-5 ppm, and above 30 ppm the smell is described as sweet but deadly.[14][15] Working environment

conditions outside the room also cause H_2S concentrations to not accumulate due to wind and air speed factors.

Although there is no relationship, however, low doses of H_2S are also quite dangerous if prolonged exposure occurs. The gas that comes from a variety of organic spoilage can cause breathing problems and irritate the eyes at a concentration of 15 mg / m cubic in 1987 WHO has reported that exposure to H_2S 30 mg / m cubic (20 ppm) will cause disturbances in concentration and headache. The results of long-term research in epidemiological, H_2S at a dose of 0.075 mg / m cubic (0.05 ppm) cause disruption enzyme synthesis in reticulocytes.[16]

Analysis of the relationship of dust concentration in the working environment with pulmonary disorders in the waste transport officer was analyzed with a crosstabs table and statistically with the Chi Square Test with $\chi 2$ count = 7.822 and p-value = 0.005. The results of p-value <0.05 so that it can be said that dust concentrations in the working environment is a risk factor for pulmonary disorders with an Odds Ratio (OR) of 7.042 which means that workers exposed to dust have a risk of pulmonary disorders 7 times greater than workers who are not exposed to dust. This result is inline with research by Isa Ma'rufi, which is the effect of wood exposure to pulmonary disorders where the correlation of dust concentrations correlates with pulmonary disorders with p-value < 0.05.[17] This research is also in line with Ardam's research on workers overhaul power plant at PT. PJB of the Eastern Regional Maintenance Service Unit in Gresik City, East Java in 2015 stated that there was a significant relationship between dust exposure and pulmonary disorders (p-value = 0.00 <0.05).[18] According to research in the United States in 1968, dust or particles accounted for 1.1 million tons / year from waste disposal, whereas in Indonesia particles accounted for 1.33% of all air pollutants from transportation pollutants in Indonesia. Dust is a scattered particle floating in the air in the form of solid granules due to the blowing of wind. [19] When inhaling, air containing particles will be inhaled into the lungs where every minute we breathe air 15-17 times. Every breath of air in a big city will also be inhaled around 60,000 particles into the lungs. The particle will fall and stick to our environment and our breathing will be disturbed by the particle.[16] The size of dust particles that enter the lungs will determine the location of the attachment or deposition of these particles. particles less than 5 microns will survive in the upper airway, while particles of 3 to 5 microns will be held in the middle respiratory system. Smaller particles, 1 to 3 microns, enter the pulmonary air sac, attaching to the alveoli. Even smaller particles of less than 1 micron will come out when the breath is exhaled.[19]

Dust inhaled into the pulmonary reduces the optimal use of the respiratory potential to take acid (O_2) from the air. dust is a particle of solid chemicals caused by natural or mechanical forces such as processing, crushing, softening, fast packing, blasting and other things, both organic and inorganic, such as stone, wood, ore, metal, coal, and other dust. The characteristic of this dust do not flocculate except by the electric pull, do not diffuse and go down by the gravity.

Chemical in the form of particles can be as an aphrodisiac, toxic, cause fibrosis of pulmonary tissue, cause allergies, cause fever and inert.[20] Exposure to dust obtained during the task of transporting the waste is obtained, among others, when collecting waste from the source of waste into the transportation fleet, during travel through traffic, and is obtained when unloading and washing the waste fleet. The requirement to work for the waste transport officers to be around the waste bin / container, and handle waste manually increase the chance of exposure to bioaerosol. There is increasing evidence in many developing countries where waste is transported manually or traditionally, there is a relationship between bioaerosol exposure and respiratory diorders.[21]

Personal protective equipment (PPE) is a device that functions to protect a person, either part or all the body from potential hazards in the workplace.[22] Personal protective equipment (PPE) on workers

dealing with waste that produces dust and gas is a respiratory protective device. This Personal protective equipment (PPE) serves to protect the respiratory organs by providing clean air and / or filtering out polluting chemicals, gases / fumes, dust, micro-organisms, steam, fog (aerosols), smoke, and so on.

A research conducted at Addis Ababa - Ethiopia on waste transport officers showed that those who did not use Personal Protective Equipment (PPE) at all times while on duty had a 2.62 times higher chance than officers who used it at any time.[23] The research is Addis Ababa – Ethiopia is not inline in line with this research where the test results statistics with the Chi Square Test stated that there is no relationship between the use of PPE and pulmonary disorders (X2 = 0.148; p-value = 0.700). The results of observations and interviews with respondents obtained indicate that respondents who use Personal Protective Equipment (PPE) only use makeshift fabrics such as unused t-shirts or rectangular cloth used when riding two wheels as a protective mask of self from odors and dust. As many as 34 respondents (61.8%) did not feel disturbed by the smell and dust at work and stated that it was uncomfortable to use Personal Protective Equipment (PPE). But, this research in line with research Sholihati et.al. in 2017 who examined the relationship between work period and the use of Personal Protective Equipment (PPE) with pulmonary disorders in the street sweepers in Semarang stated that there was no relationship between the use of nose cover and pulmonary disorders (p-value = 0.317> a = 0.05). [21] This research is also in line with Agung and Andika's research in 2016 on the effect of exposure to CH4 and H2S on waste pickers in the Mrican landfill, Yogyakarta stated that there was no relationship between the use of Personal Protective Equipment (PPE) with complaints of respiratory disorders.[12]

Referring to the result of interview, the waste transport officers ever got the distribution of masks from the department. After the masks became dirty and could not be reused then they preferred to use cloth or t-shirts as Personal Protective Equipment (PPE). The use of Personal Protective Equipment (PPE) which not follow the standard may cause dust to enter the respiratory system. The most influential factor for pulmonary disorders is the particle dimension because it determines how far the particle penetration into the respiratory system. The defense system to prevent the entry of particles can be in the form of nasal hair to prevent the entry of particles of large dimensions, whereas particles with smaller dimensions will be prevented by mucous membranes found along the respiratory system, which is the surface where the particles will adhere. Particles that enter and stay in the lungs may be harmful to human health because the bias is a hazardous material, is inert / sedentary and can absorb harmful substances.[20] The use of Personal Protective Equipment (PPE) will not function effectively in reducing the risk of pulmonary disorders in waste transport officers if not used continuously, because of the nature of the work carried out outdoors via a highway or road that is traversed by a motorized vehicle, sometimes in a waste container / container or standing behind it where exposure to dust and other hazardous chemicals will be exposed by waste transport officers. Based on the results of research conducted by Shin We Sim et al. about using face masks to prevent respiratory infections it can be concluded that Personal Protective Equipment (PPE) will be used if it is associated with emergencies and is associated with life-threatening diseases. The habit of using Personal Protective Equipment (PPE) is also associated with an understanding of the benefits, comfort in use and comfort in terms of visual or appearance. Therefore, the Personal Protective Equipment (PPE) that is used in addition to meeting standards must also be comfortable and increase the confidence who used it.[24]

Pulmonary diorders suffered by waste transport officers in addition to being motivated by risk factors such as a habit to use Personal Protective Equipment (PPE), H_2S concentration, and dust in the working environmen. On top of those factors, there are

still various variables that influence it. Variable of age, years of service, nutrition, exercise /sport, and smoking habits as previous researches have been known to contribute to pulmonary disorders. Therefore, action needs to be taken to prevent the risk factors variables that can still be controlled, such as improving nutrition, getting used to do an exercise / sport, and reducing the consumption of cigarette.

CONCLUSION

1. There is no relationship between concentration of H_2S in the working environment with pulmonary disorders in the Waste Transport Officer in District Temanggung (p-value = 0.446 > α = 0.05).
2. There is a relationship between the concentration of dust in the working environment with pulmonary disorders in the Waste Transport Officer in District Temanggung (p-value = 0.005 < α = 0.05).
3. There is no relationship between the use of Personal Protective Equipment (PPE) in the working environment with pulmonary disorders in the Waste Transport Office in District Temanggung (p-value = 0,700 > α = 0.05).
4. The Waste Transport Officer in District Temanggung who are exposed to H2S concentrations in the working environment above the Threshold Limit Value (> 0.02 ppm) has a risk of pulmonary disorders as much as 1,343 times compared to officers who are exposed to H2S concentrations below or equal to the Threshold Value (≤ 0.02 ppm) (OR = 1.343; 95% CI = 0.372 - 4.864).
5. The Waste Transport Officer in District Temanggung who are exposed to dust concentrations in the working environment whose values are above Threshold Value (> 3 mg / m3) have a risk of pulmonary disorders as much as 7,042 times compared to officers who are exposed to dust concentrations below or equal to the Threshold Limit Value (≤ 3 mg / m3) (OR = 7.042; 95% CI = 1,894 - 26,174).
6. The Waste Transport Officer in District Temanggung who does not wear Personal Protective Equipment (PPE) in the working environment have a risk of pulmonary disorders as much as 0.659 times compared to officer who uses Personal Protective Equipment (PPE) (OR = 0.659; 95% CI = 0.202 - 2,153).

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