Risk Factors Analysis Influence Pulmonary Function Of Diesel Power Plant Workers In Samarinda City

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ABSTRACT: Diesel power plants are electric power that use diesel machine. Diesel machine has problem namely air pollution such as exhaust gas especially nitrogen dioxide (NO2) and sulfur dioxide (SO2) derived from the combustion of diesel fuel, which can affect pulmonary function disorders. This study aimed to analyze factors that influenced pulmonary function disorder among the workers. This study using quantitative method with observational research and cross sectional by using logistic regression analysis wald test. Population of Respondent was totally 58 persons with 29 divisions of each in diesel power plants and in the office. Result of pulmonary function status known that the worker in diesel power plants more experience pulmonary function disorder with percentage 65.52% while 24.14%. Logistic regression analysis showing some factors influenced pulmonary function disorder (CI ± 95%) namely age, nutrition status, smoking habit, use of PPE, sport and period of working habit. Workers in diesel power plants more risky experience pulmonary function disorder compared with office worker. Risk factors caused pulmonary function disorder based on the highest risk namely nutrition status variable, personal-protection equipment, exercise habit, smoking habit, period of working and age.

Keywords : diesel power plants, diesel fuel, pulmonary function, worker

1 INTRODUCTION

In the report of International Labor Organization (ILO) (2005), about pulmonary illness cause of working approximately pulmonary illness incidence means namely one case per 1000 workers every year or 0-30%. A Diesel power plant of Mahakam sector is one of diesel power plants area has become electric centre for 36 years in Samarinda city, east Kalimantan. The result of burning produce smoke and some gasses like SO_2 and NO_2 can be disturb workers health like respiratory disturbance. The result of worker health in diesel power plant of Mahakam in 2013, showing that 56.8% or 54 workers from 95 workers indicated experience pulmonary disorder where in this case particularly occurs to the workers in machine department. Beatrix, et al (2006), state that one of air pollution caused by diesel machine exhaust like nitrogen dioxide (NO2), ozone (O3) and sulfur dioxide (SO2). The results of these emissions can cause chronic respiratory problems to exposure in the long term. Deviandhoko (2012), state that the possibility of other potential factors such as the presence of pollutants such as NO2 and SO2 gas which is certainly also one of the factors that had an impact on the capacity of pulmonary function decline. This research aimed to analyze risk factor influenced pulmonary function to diesel power plants worker of Samarinda city.

2 MATTER AND METHOD

This research uses quantitative research approach method with observational study and cross sectional approach. This study conducted in diesel power plant of Mahakam, Samarinda city. This research conducted in December 2014 – January 2015. Population of this study is worker who working in field (diesel power plant) namely 37 people and who is working in the office as many as 30 people, then obtained sample by using hypothesis test formula namely each of 29 people in diesel power plant and office with total sample as 58 people. Variable of this research consist of independent variable namely individual factor (age, nutrition status, smoking habit, using of respiratory, and exercise habit) and working factor

(period of working), and dependent variable with pulmonary function. Technique of data collection using interview technique with questionnaire, observation with checklist and the measurement of pulmonary function by using spirometri method and work environment. Data analysis to effect tested of this study was using logistic regression wald test.

3 RESULT

Result of distribution of measurement pulmonary function

Results of measurement pulmonary function have been conducted to 58 respondents (29 workers in diesel power plant and 29 workers in office) obtained from result of spiometri measurement as follow:

Table 1. Respondent distribution based on work location with pulmonary function in PT PLN Persero of Mahakam sector year 2015.

Pulmonary Function Criteria	Work Location Responden				Total	
	PLTD		Work Place			
	Frequency	%	Frequency	%	Frequency	%
Normal	10	34,48	22	75,86	32	55,2
Abnormal	19	65,52	7	24,14	26	44,8
Totaly	29	100	29	100	58	100

Based on table 1 result know that the total of worker which experience pulmonary function majority in diesel power plant as many as 19 people, whereas worker of office experience

pulmonary function as many as 7 people. Pulmonary function disorder is the total of air enters to the pulmonary decrease from normal. Status of pulmonary function has several criteria namely obstruct, restriction and combination. The result of pulmonary function status showing 26 people experience pulmonary function which will be divided in to three category as table as follow:

Table 2. *Distribution of pulmonary function disorder based on work location in PT PLN Persero of Mahakam sector year 2015.*

Criteria	PLTD		Work Place	
	Frequency	%	Frequency	%
Obstruct	10	52,7	3	42,4
Restriction	2	10,5	2	28,8
Combination	7	36,8	2	28,8
Totaly	19	100	7	100

The results in Table 2, it can be seen that the majority or half of the respondents who are most susceptible to interference obstruction in diesel with a percentage of 52.7%, while for the office of 42.4%. Criteria mixture in the diesel has a percentage of 36.8% and 28.8% in offices, as well as to the criteria in the diesel restriction of 10.5% while 28.8% in office. The number of workers who have pulmonary majority of work in the diesel and for workers who work in office only a few who have pulmonary function. It can be distinguished by different working conditions, conditions in the field, namely diesel are in an environment that there are many diesel engines emit exhaust gases or pollutants (eg, NO2, SO2, and dust) so that workers can be exposed to diesel pollutants.

Results of Age Factor Analysis
The results of the research on the age factor analysis results obtained following the age of the respondents as follows:

Table 3. *Effect of Age Against Pulmonary function At respondents in diesel Power Sector Mahakam 2015.*

	B	Wald	df	Sig	Exp(B) CI 95%	95% C.I for EXP(B)	
						Lower	Upper
Age	0,107	9,657	1	0,002	1,113	1,040	1,191

Based on the test results wald on logistic regression in Table 3 of the analysis of the effect of age on pulmonary function can be seen that there is a significant influence of age on pulmonary function with P value (sig) <of the value of alpha (α) is 0.002 <0.05 with value EXP (B) 1.113. Pulmonary condition of respondents based analysis shows that, the old or any age improve one year then the risk of experiencing pulmonary 1.113 times.

Results of Factor Analysis Nutritional Status
The results of the research on the nutritional status of analysis results factor obtained following the age of the respondents as follows:

Table 4. *Effect of Nutritional Status Against Pulmonary function In Respondents in diesel power plant sector Mahakam 2015.*

	B	Wald	df	Sig	Exp(B) CI 95%
Nutritional Status		15,165	2	0,001	
Nutritional Status (1)	2,944	6,255	1	0,012	19,000
Nutritonal Status (2)	0,588	0,250	1	0,617	1,800

Based on the results of logistic regression analysis of Table 4 about the influence of nutritional status through a body mass index of the pulmonary function with the base line on the nutritional status of the category of thin, with a P value (sig) <of the value of alpha (α) is 0.001 <0.05. The conclusion from these results stating that the obese category is more at risk of developing pulmonary function 19 times comparable to the nutritional status of underweight category.

Results of Factor Analysis Using Personal Protective Equipment (respirator)
The results of the study on the use of personal protective equipment (respirator) factors analysis of the results obtained following the age of respondents as follows:

Table 5. *Effect of use of PPE Against Pulmonary function of Respondents in diesel power generation sector Mahakam 2015.*

	B	Wald	df	Sig	Exp(B) CI 95%
PPE		6,518	2	0,038	
PPE 1	2,659	5,790	1	0,016	14,286
PPE 2	1,833	2,357	1	0,125	6,250

Based on the results of logistic regression in Table 5 on the analysis of the effect of personal protective equipment (respirators) use on pulmonary function with the base line on the category of always wearing PPE, it is known that there is a significant relationship between the use of respirators against pulmonary function with a P value (sig) < of the value of alpha (α) is 0.038 <0.05. From the results it can be seen that the respondents were not using PPE when working 14.286 times more at risk of experiencing pulmonary function compared with respondents who always using PPE at work.

Smoking Habit Factor Analysis Results
The results of the research on smoking habits factor analysis results obtained following the age of the respondents as follows:

Table 6. Effect of Smoking Habit Against Pulmonary function In Respondents in diesel power generation sector Mahakam 2015.

	B	Wald	df	Sig	Exp(B) CI 95%
Smoking Habit		9,771	3	0,021	
Smoking Habit (1)	1,658	2,625	1	0,105	5,250
Smoking Habit (2)	2,100	6,387	1	0,011	8,167
Smoking Habit (3)	1,764	6,467	1	0,011	5,833

Based on the results of logistic regression in Table 6 on the analysis of the effect of smoking on pulmonary function at baseline in the category of non-smokers, it is known that there is a significant relationship between the use of respirators against pulmonary function with a P value (sig) <of the value of alpha (α) is 0.021 <0.05. From the analysis, it can be seen that the respondents who are in the habit of smoking in the category of being at work 8 times more at risk of experiencing pulmonary function compared with those who did not have the habit of smoking. Meanwhile, respondents who have the habit of smoking with mild category at work 5 times, more at risk of experiencing pulmonary function compared with those who did not have the habit of smoking.

Sports Habit Factor Analysis Results.
The results of the research on exercise habits factor analysis results obtained following the age of respondents as follows:

Table 7. Habit Sports Against Pulmonary Function in Respondents In Diesel Power Generation Sector Mahakam 2015.

	B	Wald	Df	Sig	Exp(B) CI 95%
Sports Habit		7,547	2	0,023	
Sports Habit (1)	2,976	7,124	1	0,008	14,286
Sport Habit (2)	2,958	6,795	1	0,009	6,250

Based on the results of logistic regression in Table 7, on the analysis of the influence of exercise on pulmonary function habit at baseline in the category of always exercising, it is known that a significant difference between the habit of exercise on pulmonary function with a P value (sig) <of the value of alpha (α) is 0.023 <0.05. From the results it is known that the respondents who do not exercise 14 times the risk of experiencing pulmonary function compared with respondents who frequently exercise. While respondents who rarely exercise 6 times more at risk of experiencing pulmonary function compared with respondents who always or regularly exercise.

Results of Factor Analysis Work Period
The results of the study of tenure factor analysis results obtained following the age of the respondents as follows:

Table 8. Effect of the Work Period Against Pulmonary Physiology At respondents in diesel Power Sector Mahakam 2015.

	B	Wald	df	Sig	Exp(B) CI 95%	95% C.I for EXP(B)	
						Lower	Upper
Work Period	0,088	8,006	1	0,005	1,092	1,027	1,161

Based on the test results wald on logistic regression in Table 8 of the analysis of the effects on pulmonary function working lives can be seen that there is a significant relationship between tenure on pulmonary function with P value (sig) <of the value of alpha (α) is 0.005 <0.05 with Exp (B) 1.092. Pulmonary condition of respondents based analysis shows that, increasingly have a long service life of one year or any increase will be more at risk of experiencing pulmonary 1.092 times.

4 DISCUSSION

Influence of age toward pulmonary function
the result of this study showing that age have influence significantly toward pulmonary function cause the occurrence disorder or decrease of pulmonary function toward diesel power plants worker of Samarinda city with the increasing of age every year with risky factor as many as 1.113 experience pulmonary functional disorder. Wardhna (2010) states that pulmonary functional will increase with the additional of age, the value of pulmonary start. Ward (2010) states pulmonary function increases with age, pulmonary function values ranging from childhood continue to increase until it reaches the optimum point in the age of 22-30 years. After that there is a decrease, after reaching a point in young adulthood, diffusion pulmonary, pulmonary ventilation, O2 uptake and all parameters will pulmonary decreases with age changes. This is proved by the research Mengkidi (2006) stated that more than 30 years of age is a risk factor for pulmonary disorder which means that employees with more than 30 years of age potential gain pulmonary disorder 1.7 times more likely than employees who are younger than 30 year old.

Effect of Nutritional Status Against Pulmonary function
The results of this study stated that the nutritional status has a significant effect on pulmonary function that caused the decline in pulmonary function or disorder. Based on baseline is nutritional status skinny. So, the nutritional status of obese riskier impaired pulmonary function 19 times comparable to the nutritional status of underweight category. It can be concluded that workers who had normal nutritional status (either fat or thin), increase the risk for workers also impaired pulmonary function or decreased pulmonary function. These results are also consistent with research I Dewa Nyoman Supariasa (2002) which states that a person's nutritional status can affect pulmonary vital capacity.

Influence of Personal Protective Equipment Against pulmonary function.

The results of analysis in this study indicate that the PPE has an influence on pulmonary function that caused the decline or pulmonary disorders, with baseline respondents who always wear PPE. Based on known results of those respondents who did not use PPE when working over 14.286 times the risk of impaired pulmonary function compared with respondents who always using PPE at work. Respiratory protective equipment is an important tool, considering that 90% of cases poisoning as a result of the entry of toxic chemicals or corrosion through the respiratory tract. Respiratory protective equipment itself provides protection against hazards in the workplace air as air pollution by gases, pollution by particles (dust, smoke), lack of O2 (Suma'mur, 2009).

Effect of Smoking Habit Against Pulmonary function

The results of the analysis in this research note that, smoking also affects the pulmonary conditions that cause deterioration or pulmonary disorders, with baseline in the category of non smoking. Based on the analysis show that the respondents who are in the habit of smoking category when working over 8 times the risk of impaired pulmonary function compared with those who did not have the habit of smoking. Meanwhile, respondents who have the habit of smoking with mild category at work 5 times more at risk of impaired pulmonary function compared with those who did not have smoking habit. Smoking habits will accelerate the decline in pulmonary function. The decline in forced expiratory volume is 28.7 mL per year for non-smokers, ex-smokers to 38.4 mL and 41.7 mL for active smokers. Effect of cigarette smoke can be greater than the effect of dust is only about a third of the adverse effects of cigarettes (MOH, 2003).

Influence of Sports Habits against the Pulmonary function

The results of the analysis in this study showed that, exercise habits have a significant effect on pulmonary function that caused the decline or pulmonary disorders, with baseline in the category of always exercising. Based on known results that respondent who do not exercise 14 times the risk of impaired pulmonary function compared with respondents who frequently exercise. While respondents who rarely exercise 6 times more at risk of impaired pulmonary function compared with respondents who always or regularly exercise. This is in line with the results of Mary (2005) which states that the exercise habits of factors influence the pulmonary function disorders due regard to maintaining pulmonary vital capacity. Because, someone who has a good pulmonary vital capacity then in sports activities he/she is not easy to feel tired and with regular exercise then that person is vital pulmonary capacity will be well maintained. Exercise is important to prevent the onset of disease. Regular exercise can improve a person's immunity to disease.

Effect of Work Period Toward Pulmonary Function

The analysis has been conducted in this study obtained that the result namely period of working have influence significantly toward pulmonary function caused the occurrence of decrease or pulmonary function disorder. Based on the analysis shows that increasingly have a long working life or every increase of one year will be 1.092 times more at risk of impaired pulmonary function. Workers who are in the work environment with high dust levels in a long time have a higher risk of pulmonary obstruction. Based on the studies show that the service life of over 10 years is at risk of pulmonary obstruction on the dusty industrial workers (Sugeng, 2003). According Suma'mur (2009), the longer a person in the work, the more he/she was exposed to the danger posed by the work environment. The longer a person works in a place that contains dust, the higher the risk of health problems, especially in respiratory tract.

CONCLUSIONS

Based on the result know that there are 26 people experience pulmonary function disorder with work location in diesel power plant more experience pulmonary experience with percentage of 65.52% while in the office 24.14%. Analysis about risk factor influence toward pulmonary function to the worker can be concluding that:

1. Individual factor including nutrition status, the using of personal-protection equipment (respiratory), exercise habit, smoking habit and age have influenced toward the status of pulmonary function where factor of nutritional status is a dominant factor influenced toward pulmonary worker with fat nutritional status risk as 19 times experience pulmonary functional disorder compared with thin nutritional status.

2. Working status namely period of time influenced significantly toward pulmonary functional status with risk as many as 1.092 times, the longer the period of employment at increased risk of pulmonary disorders.

ADVICE

Advice can be given to the company, readers, and respondents with this study are as follows:

1. PT. PLN (Persero) Mahakam Sector technically should have to pay attention to in dealing with leaky pipes that can be immediately repaired or replaced so that the exhaust gas does not pollute the environment of many work (home machine), the need to provide personal protective equipment that is air purifying respirator or chemical cartridge respirator.

2. Handling of management needs further examination held again for the workers, the need to consider setting up a more appropriate job rotation for workers who are already old and workers who have health problems and need to be made rules for nonsmoking areas in the workplace, or banned smoking in the workplace.

3. Workers as operators need to raise awareness to stop smoking and also the need for the workers improve their sporting activities, in order to improve the fitness of workers.

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