Waluya The International Science Of Health Journal
Vol.1 No.2

ISSN:2829-2278

WALUYA THE INTERNATIONAL SCIENCE OF HEALTH JOURNAL

Analysis of Increasing Case of Acute Respiratory Infections (ARI) in Nickel Mining Environment in Pomalaa District, Kolaka Regency, Southeast Sulawesi

Musrifa Kudus[1], Erwin Azizi Jayadipraja[3],Amir Syam[2], Lili Suriani[3]

[1]Environmental Services of Kolaka
[2]Wolo Health Center, Kolaka Regency, Indonesia
[3] Mandala Waluya University, Indonesia
Correspondence : ivhaputri971@gmail.com

ARTICLE INFO

Article history
Received : May 18 th, 2022
Revised : May 24 th, 2022
Accepted : May 30 th, 2022

Keywords
Nickel Dust,
ARI.

ABSTRACT

Introduction: The mining process that has been carried out for a long time in large quantities often ignores environmental sustainability which in the end can result in various negative impacts that are felt in the short and long term. The purpose of the study was to determine the level of air pollution by Nickel dust and to analyze the relationship between exposure to Nickel dust and ARI disease in people living around the Nickel mining industry in Pomalaa District.

Method: This study uses a cross-sectional design using a non-interventional type of research conducted in residential areas around the mining area of PT Aneka Tambang Tbk, Kolaka Regency, Southeast Sulawesi Province as a mining designation area, namely in Pomalaa District.

Result: The results showed that the average outdoor air quality for the $S0_2$ parameter in the designated area was higher than in the non-designated area, as well as for the $N0_2$ parameter, for the H_2S parameter in both areas the average value was the same, but for the PM10 value in the designated area is higher than in the non-designated area, while the temperature, humidity, and wind speed in the two areas are almost the same.

Conclusion: This is in line with the results of research conducted by Qomariyatus S (in 2007) conducted around the coal mine of PT Aneka Tambang,Southeast Sulawesi showed that the level of respirable dust in the field slightly exceeded the normal threshold value of 2.19 mg/m^3.

Introduction

The realization of a healthy environmental quality is a key part ofhealth. Air as one of the environmental components that are very important in life needs to be maintained and improved so that it canprovide optimal support for living things. Today's air pollution is increasingly showing a very alarming condition. Sources of air pollution can come from various activities, including mining, industry, transportation, offices, and housing. These various activities are the biggest contribution to air pollutants that are released into the free air. The impact of air pollution causes a decrease in air quality, which has a negative impact on human health.

Air is a basic need for humans that needs serious attention so that it becomes Indonesia's Health Development policy until 2015.[1] When the air pollution control program is one of the top ten programs. The growth of development such as mining, industry, transportation, addition to having a positive impact but on the other hand will have a negative impact in the form of air pollution and noise both that occur indoors (indoor) and outdoors (outdoor) which can endanger human health and the occurrence of disease transmission.

Southeast Sulawesi, especially Kolaka Regency, is one of the regions in Indonesia that is rich in minerals (mines), including gold, silver, copper, and Nickel. The Nickel mining industry can increase the country's foreign exchange but the exploitation and use of natural resources on a large scale by ignoring the environment results in health impacts both in the short and long term. The issue of energy sources is also the main focus of the government to rising oil prices. Indonesia's Nickel reserves are bigger than oil and natural gas reserves, so the government is starting to see Nickel as an alternative energy source.

Nickel dust is a complex mixture of various minerals, trace metals, and organic matter with varying degrees of Nickel particulate. Nullolli et al's research revealed an increase in the number of asthmatics in children living near or far from open-pit Nickel mining sites. This indicates that the disease caused by Nickel dust is related to the nature of the dust that is easily carried by the wind. Air pollution due to the processing or the results of the Nickel mining industry will have a negative impact on the lungs of workers and communities around mining areas. Respiratory diseases that generally arise due to exposure to Nickel dust particles are decreasing air quality to a level that endangersthe health and ultimately causes and increases respiratory tract diseases such as ARI.

One of the areas that carry out Nickel mining in Indonesia is Pomalaa District, KolakaRegency, Southeast Sulawesi. Based on preliminary research, it was found that ARI was the most common disease case (reports of ten most diseases) from 2019 to 2021 in Pomalaa District.[2] It is feared that the ARI incident is related to pollution from Nickel mining because in this district there is PT Aneka tambangNickel Mine which has been operating for up 30th decades.

This paper is part of the Special Research on Environmental Pollution in Southeast Sulawesi in 2019. This paper emphasizes the discussion of the relationship between air pollution and ARI in the people who live around the Nickel mining industry

Method

This study uses a cross-sectional design using a non-interventional (observational) type of research conducted in residential areas around the mining area of PT Aneka Tambang Tbk, Kolaka Regency, Southeast Sulawesi Province as a mining designation area, namely in Pomalaa District.

The sample size is calculated using the estimation formula for the difference between two averages like this formula :

$$Sp^2 = \frac{[(n_1-1)S_1^2+(n^2-1)S_2^2]}{(n_1-1)+(n_2-1)} \qquad n = \frac{z^2_{1-\alpha/2}\,2\sigma^2}{d^2}$$

Based on the sample calculation with the formula $n_1 = n_2$, it is obtained that $n_1 = 150$ households (households) and $n_2 = 150$ households, so a sample of 300 households is obtained.

The measurement of air pollution measures the quality of the air inside the house (indoor) and outside the resident's house (outdoor). Parameters for indoor air quality include PM2,5, H_2S, SO_2, NO_2, temperature, humidity, light intensity, and ventilation rate, and outdoor air quality parameters include PM10, H_2S, SO_2, NO_2, temperature, humidity, wind direction, and wind speed.

Indoor air measurement by placing a dust catcher in the main room where ART is often

located. In each cluster, measurements will be carried out as many as.

20 households in exposed areas and 20 households in non-exposed areas.Measurement of outdoor air by placing a dust catcher near the main entrance to the house, air samples will be taken at 10 points at each location. The placement of the air sampling is adjusted to the wind direction, 10 points are taken at the locationexpose and 10 points are taken in the non .area expose. The incidence of ARI by using a questionnaire was asked to respondents about the incidence of ARI that they suffered in the last 1 month

Result

The average value for the $S0_2$ parameter in the designated area is higher than in the non-designated area. Similarly, the $N0_2$ parameter and the H2S parameter in the two areas have the same average value, but the PM10 value in the designated area is higher than in the non-designated area. Meanwhile, the temperature, humidity, and wind speed in the two regions are almost the same. Judging from PP No. 41 of 1999 on 26 May 1999 outdoor air quality parameters $S0_2$, $N0_2$, H_2S, and PM10 in designated areas and in non-designated areas are still below the specified threshold value.permitted, for details can be seen in table 1 and table 2:

Table 1. Outdoor Air Quality in the Nickel Mining Designated Area, in Pomalaa District, Kolaka Regency, Southeast Sulawesi Province, 2019

Parameter	N	Max	Min	Mean
SO2 (µg)	10	28.220	88.4900	55.981000
NO2 (µg)	10	22.700	56.5500	33.214000
H2S(µg)	10	.003	.0107	.006860
PM10(µg)	10	71.3	174.62	113.4810
temperature ^{O}C	10	28.4	30.40	26.7100
Density (%)	10	43.5	74.00	61.0500
Wind Speed	10	.11	1.80	.8660

The average value for the $S0_2$ parameter in the designated area is higher than in the non-designated area, as well as for the $N0_2$, H_2S, PM2.5 parameters in the designated area, which is higher than in the non-designated area, while the temperature and humidity in the two areas are almost the same. , unless the average luminance value in non-designated areas is higher than in designated areas. Judging from PP No. 41 of 1999, indoor air quality parameters $S0_2$, $N0_2$, H_2S, PM_2,5 in designated areas and in non-designated areas are still below the permissible threshold value, for details, see table 2.

Table 2.Indor Air Quality in the Nickel Mining Designated Area, in Pomalaa District, Kolaka Regency, Southeast Sulawesi Province, 2019

Parameter	N	Max	Min	Mean
SO_2 (µg)	10	.01	.053	.036480
NO_2 (µg)	10	.00	.020	.012895
H_2S(µg)	10	.00	.005	.002815
PM_{10}(µg)	10	23.	148.5	84.2800
temperature ^{O}C	10	27.	33.0	28.8250
Density (%)	10	48.	85.5	65.3900
ventilation rate	10	.00	.30	.1675
Lighting	10	4.	114.0	47.7350

Table 3 presents the distribution of respondents experiencing respiratory tract disorders based on diagnosis, symptoms, and diagnosis/symptoms by mining designation area in Pomalaa

Table 3. Distribution of Respondents by Respiratory Tract Disorders and Classification of Samples in the Nickel Mining Area of Pomalaa District, Southeast Sulawesi Province, 2019

Respiratory Disorders (ARI)	Sample on Mining Area		
	n	%	P Value
Diagnosis			
Yes	116	17,4	0,113
No	551	82,6	
Total	667	100,0	
Indication			
Yes	98	14,7	0,000
No	569	85,3	
Total	667	100,0	
Diagnosis/Indication			
Yes	206	30,9	0,000
No	461	69,0	
Total	667	100,0	

The incidence of ARI disease according to the diagnosis of health workers, from 667 respondents in the designated area, it was found that there were 116 people (17.4%) who suffered from ARI, while from 693 respondents in the non-designated area, it was found that there were 144 people (20.8%). The incidence of ARI disease according to the symptoms felt by the respondents, from 667 respondents in the designated area, it was found that there were 98 people (14.7%) who suffered from ARI, while from 693 respondents in the non-designated area, it was found that there were 7 people (1.0%). The incidence of ARI was based on a diagnosis by health workers or symptoms felt, from 667 respondents in the designated area, it was found that 206 people (30.9%) suffered from ARI, while from 693 respondents in the non-designated area, it was found that there were 152 people (21.9%). For details, see table 3.

The incidence of ARI according to the diagnosis of health workers was more in non-designated areas than in designated areas, but the results of statistical tests obtained p-value = 0.113 (> 0.05). It can

be concluded that there is no significant difference in the incidence of ARI according to the diagnosis of health workers between designated areas compared to a non-areasallotment. However, the incidence of ARI according to symptoms in the designated area is higher than that in the non-designated area, from the statistical test results, the p value =0.000 (<0.05). It can be concluded that there is a significant difference in the incidence of ARIaccording to symptoms between designated areas.

compared to non-designated areas, as well as the incidence of ARI according to the diagnosis of health workers or symptoms there is a difference between respondents in the designated area and the non-designated area, with statistical test results obtained p value = 0.000 (< 0.05), so it can be concluded that there is a significant difference. means the incidence of ARI according to the diagnosis of health workers or symptoms between designated areas compared to non-designated areas

Discussion

The results of the research conducted in Pomalaa showed that there was a significant difference in the air quality condition of the designated area being worse than that of the non-designated area. This is in line with the results of research conducted by QomariyatusS(3) conducted around the coal mine of PT Aneka Tambang,Southeast Sulawesi showed that the level of respirable dust in the field slightly exceeded the normal threshold value of 2.19 mg/m^3.

The results in Pomalaadistric show the incidence of ARI between designated areas compared to non-designated areas, based on statistical tests there is a difference between respondents in designated areas and non-designated areas, but the ARI rate obtained based on the results of Riskesdas 2007 is still below the National ARI rate (25.5%). The difference in ARI rates between designated and non-designated areas is in accordance with the results of research conducted by Qomariyatus S.[3]In the vicinity of the PT Aneka Tambang Nickel Mine, Southeast Sulawesi, indicating that there are respiratory problems in PT Aneka Tambang field workers, where respiratory problems often occur. suffered is cough with phlegm and dry cough. Health problems associated with poor environmental conditions often lead to disability and even death, so the main principle in providing health services for workers is to make efforts to prevent health problems.[4]

In large doses, all dust is stimulant and can cause a reaction even if it is mild. This reaction is in the form of excessive mucus production, if it continues, mucus gland hyperplasia can occur.[5] The results of the research conducted in Pomalaa showed that in the exposed area (designated area) respiratory tract disorders were higher than in the non-exposed area (non-designated area). This is in line with research conducted,[6] which states that there is a significant relationship between high dust concentrations and the occurrence of lung function abnormalities[7]. Dust that enters the inspiratory tract causes a non-specific defense mechanism reaction in the form of coughing, sneezing, impaired mucociliary transport and impaired phagocytosis of macrophages.[8] The mucociliary system is also impaired and causes increased mucus production and stimulated smooth muscle around the airways, causing constriction. In the same exposure period, abnormalities that arise in different respondents, the impact can also be different.[9]Cases of ARI in thePomalaa occur depending on exposure to coal dust for a long time and ifassessed by the results of indoor and outdoor air quality inspections in designated areas which are higher than those in non-designated areas, but the value is still below the threshold, this is possible because the kitchen conditions in respondents' households mostly have separate rooms from other rooms, with clean conditions.[10] Categorized as clean as much as 77.8% and having quite good air ventilation as much as 61.9% and a fairly good occupancy density in both locations (> 82%), so with this kind

of condition descriptively it can be concluded that indoor and outdoor air quality has an impact in increasing the incidence of ARI cases in Pomalaa.

Conclusion

From the descriptions above, it can be concluded as follows:

1. The condition of indoor air quality for parameters PM2.5, H_2S, SO_2, NO_2, in exposed areas was higher than in non-exposed areas, as well as outdoor air quality parameters PM10, H_2S, SO_2, NO_2, in exposed areas was higher than non-exposed areas, but all of these figures are still below the permissible threshold value.
2. The incidence of ARI in exposed locations (designated areas) increased significantly compared to non-exposed locations (not designated areas) in Pomalaa district.

Reference

1. Indonesian Ministry of Health. *Air Pollutant Parameters and Its Impact on Health*. Jakarta: Director General of Public Health, Ministry of Health; 2009.

2. Pomalaa Health Center, *Pomala Health Center Profile (2020).* Kolaka District Health Office.

3. Bambang Sukana, Heny Lestari, Miko Hananto (2013), Case Study of ARI in Coal Mining Environment in Muara Enim Regency. South Sumatra. *Journal of Health Ecology*. Vol 12 No. September 2013.

4. Sulistomo, A (2000). *Formal Education Human Resources Occupational Health*, Community Medicine Department, FK UI, Jakarta

5. Vallyathan, Val, et al (2000), Change in Bronchoalveolar Lavage Indices Associated with Radiographic Classification in Nickel Miners, *American Journal RespiratoryCritical Core Medicine*; 162; 958-965.
6. Lestari, K. (2000), Effect of Dust Exposure on Pulmonary Ventilation Function of Plywood Workers. *Hyperkes and Occupational Safety Magazine,* No. 33:2.

7. Robbins, Kumar, Cotran. (2010). Robbins & Cotran Pathological Basis of Disease 7th edition. *WB Saunders Company*. ISBN: 978-0-721601-878
8. Novotny, V., H. Olem. (1994). *Water Quality: Prevention, Identification, and Management of Diffuse Pollution*. New York: vanNostrand Reinhold.

9. Prabu, (2009) , Acute Respiratory Infection (ARI), *http://putraprabu.wordpress.com/2009/01/04/infection-saluran-pernafasan-akut-ispa/, January4, accessed: Wednesday, 15/02 /2012*.

10. Mirror of the World of Medicine, No. 136:5-7. *ISPA Sub-Directorate, ARI Control Program, ISPA Sub-Directorate*, Dit. PPML Directorate General of PP & PL Ministry of Health RI, 2011