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### Case Study of ARI in The Mining Industry Environment in Morosi District Konawe Regency

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#### ABSTRACT

**Introduction:** Indonesia is among countries rich in minerals (mining) such as gold, silver, copper, coal, oil, and natural gas. The use of natural resources on a large scale by ignoring the preservation of the environment can cause an Acute respiratory infection of negative impacts whether in the short term or long term.

**Method:** The research objective was to determine the level of air pollution produced by coal dust from the coal mining industry activities and to discover information about the relationship between exposures to coal dust and upper respiratory tract infections in the community that lived around the coal mining industry. The research uses a cross-sectional design.

**Result:** The results showed the quality of outdoor air, and the average value for SO<sub>2</sub> and NO<sub>2</sub> parameters were higher in the designation region than non-designation region. Furthermore, both designation and non-designation regions had the same average H<sub>2</sub>S parameter but the value of PM<sub>10</sub> in the designation region was higher than the designation region. Weather, humidity and wind speed were almostt the same in the two regions. The incidence of upper respiratory tract infections in the exposed locations was higher than non-exposed locations.

**Conclusion:** The incidence of Acute respiratory infection in exposed locations (designated area) is higher compared to non-exposed locations (not designated area).

## Introduction

The implementation of healthy environmental quality is one of the main parts of the health sector. Air as one of the most important environmental components in life needs to be maintained and improved in quality to provide support for living things to live optimally. Today's air pollution conditions are increasingly showing very alarming. Sources of air pollution can come from various activities such as mining, industry, transportation, offices, and housing. This activity is the biggest contributor to air pollutants released into the air. The impact of air pollution causes a decrease in air quality harms human health.<sup>[1]</sup>

Air is a basic need for humans that needs serious attention so that it becomes Indonesia's Health Development policy until 2025, where the air pollution control program is one of the top ten programs. Indonesia is a country rich in minerals (mining), including gold, silver, copper, nickel, oil, and gas. The nickel and coal mining industry can increase the country's foreign exchange but the exploitation and use of natural resources on a massive scale by ignoring the environment will hurt health both in the short and long term. The issue of energy sources has also become the government's main focus regarding the increase in oil prices. Indonesia's nickel and coal reserves are larger than oil and gas reserves, so the government is starting to see nickel and coal as alternative energy sources.<sup>[2]</sup>

Dust from ore and coal materials is a complex mixture of ISPA minerals, trace metals and organic matter with varying degrees of nickel and coal particulates.<sup>[3]</sup> Other research revealed an increasing number of asthmatics in children living near or far from open-pit nickel and coal mining sites. This shows that nickel and coal dust transmission is related to the nature of the dust that is easily carried by the wind.<sup>[4]</sup> Air pollution due to mobilization activities in the hauling processing plants or industrial products of nickel and coal mining will have a negative impact on the lungs of workers and communities around the mining industry area.<sup>[5]</sup> ARI disease generally due to exposure to nickel dust particles is a decrease in air quality to a level that is harmful to health and ultimately causes an increase in respiratory tract disorders such as ARI.<sup>[6]</sup>

One of the nickel and coal mining industrial areas in Indonesia is Morosi District, Konawe

Regency, Southeast Sulawesi. Based on preliminary research, data was obtained that ARI was the most common cause of disease in the last 2 years, (reports of the ten most diseases) in 2019 to 2020 in Morosi District (Profile of Morosi Health Center 2019 to 2020). It is feared the emergence of ARI is related to air pollution from mobilization activities for transporting nickel ore and coal materials in the Virtue Dragon Nickel Industry (VDNI) and Obsidian Stainless Steel (OSS) industrial areas because this area is also a residential area for some people in the Morosi sub-district. This article emphasizes the discussion of the relationship between air pollution and ARI in communities living around the mining industry.<sup>[7]</sup>

## Method

The study was conducted in residential areas around the Morosi District, Konawe Regency, Southeast Sulawesi Province, this type of research was non-intervention (observation). Based on the sample calculation with the formula  $n_1 = n_2$ , it is obtained that  $n_1 = 200$  households (households) and  $n_2 = 200$  households so a sample of 400 households is obtained. Measurement of air pollution measures the air quality inside the house (indoor) and outside the occupant's house (outdoor).

At each cluster will be measured as many as 20 households in the exposed area and 20 households in non-exposed areas. Outdoor air measurement with put the dust catcher near the door main entrance to the house, the air sample will be 10 points were taken at each location. Placement customized air sampling with the wind direction, 10 points are taken at the location expose.

## Result

**Table 1** shows that the condition of the kitchen in the household respondents mostly have rooms separated from other rooms, with the condition Cleanliness is categorized as clean as much as 77.8% and has as much air ventilation as 61.9% for the designated area. The non-designated area is categorized as clean as much as 81.3% and has air ventilation of as much as 31.8%. Most types of fuel used is coconut shell with the average amount being 100% and gas/LPG 93.1% in the designated area and 98.0% in the not allotment.

But some households use firewood as a reserve of LPG gas or even only use firewood as fuel for cooking, which is 7.4% for designated areas and 40.0% for non-designated areas. Density housing both in the designated area and in the most non-allocated area is 8 m<sup>2</sup>/person each as much as 82% and 91.9%.

**Table 2** shows the incidence of Acute respiratory infection disease according to health worker diagnosis, from 667 respondents in the designated area it was found that there were 116 people (17.4%) who suffer from Acute respiratory infection, while from 693 respondents in non-allocated areas there were 144 people (20.8%). Incident Acute respiratory infection disease according to the symptoms perceived by respondents, from 667 respondents in the designated area, there are 98 people (14.7%) who suffer from Acute respiratory infection, while out of 693 respondents at not the allotted area is obtained there are 7 people (1.0%). Acute respiratory infection incidence based on diagnosis by health workers or symptoms perceived, from 667 respondents in the designation area obtained is 206 people (30.9%) suffer from Acute respiratory infection, while from 693 respondents in the region, not the allocation, there are 152 people (21.9%).

Acute respiratory infection incidence according to diagnosis more health workers in the not designated area compared to area designation, but the results of statistical tests obtained p value = 0.113 (> 0.05). Could conclude that there is no significant difference meaning in the incidence of Acute respiratory infection according to the diagnosis of health workers between regions allotment compared to non-area allotment. However, the incidence of Acute respiratory infection according to symptoms in higher allotment areas compared to non-designated areas, from the results of statistical tests obtained p value = 0.000 (<0.05). It can be concluded that there significant difference in the incidence of Acute respiratory infection according to symptoms between designated areas compared to non-designated areas, Likewise with the incidence of Acute respiratory infection according to the diagnosis of a health worker or symptoms there is a difference between respondents in the designated area and are not a designation, 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 Acute respiratory infection according to the diagnosis health workers or symptoms between regions allotment compared to non-area allotment.

**Table 1**  
**Distribution of Households by Kitchen Condition, Cooking Fuel and Occupancy Density in the Nickel and Coal Mining Industry, in Morosi District, Konawe Regency 2021**

Kitchen Conditions, Cooking Fuel, and Occupancy Density	Sample Classification			
	Designated Area		Not Designated Area	
	n	%	n	%
<b>Kitchen condition</b>				
Separate space	161	93,1	194	98,0
Clean	147	77,8	161	81,3
Ventilation/chimney	117	61,9	63	31,8
Insect/animal meeting	46	24,3	37	18,7
<b>cooking fuel</b>				
LPG	176	93,1	194	98,0
Kerosene	10	5,3	5	2,5
Firewood	14	7,4	81	40,0
Coal briquettes	2	1,1	1	0,5
Coconut shell	189	100,0	197	100,0
Other	189	100,0	197	100,0
<b>Occupancy Density</b>				
8 m <sup>2</sup> /person	155	82,0	182	91,9
< 8 m <sup>2</sup> /person	34	18,0	16	8,1
<b>Total</b>	<b>189</b>	<b>100</b>	<b>197</b>	<b>100</b>

**Table 2**  
**Distribution of Respondents Based on Respiratory Disorders and Classification of Samples in the Nickel and Coal Mining Industrial Area, Morosi District, Konawe Regency 2021**

Respiratory Disorders	Sample Classification				P Value
	Designated Area		Not Designated Area		
	n	%	n	%	
<b>Diagnosis</b>					
Yes	116	17,4	144	20,8	0,113
Not	551	82,6	549	79,2	
Total	667	100,0	693	100,0	
<b>Symptom</b>					
Yes	98	14,7	7	1,0	0,000
Not	569	85,3	686	99,0	
Total	667	100,0	693	100,0	
<b>Diagnosis/Symptoms</b>					
Yes	206	30,9	152	21,9	0,000
Not	461	69,0	541	78,1	
Total	667	100,0	693	100,0	

### Discussion

The results of research conducted in the Morosi District show that there is a marked difference in the state of quality the air in the designated area is worse compared to areas, not allotment. This is in line with the results of research conducted by Sholihah, et al, found around Coal mining PT Kalimantan Prima Persada, South Kalimantan showed that the level of respiratory dust in the field slightly exceeds the threshold value normal is 2.19 mg/m<sup>3</sup>.<sup>[7]</sup>

The results in Konawe District show Acute respiratory infection incidence between designated areas compared to non-designated areas, based on statistical tests there is a difference between respondents in the designated area and the area is not a designation, but a number Acute respiratory infection obtained based on the results Riskesdas 2018 is still below the Acute respiratory infection number National (25.5%). Disturbance health-related conditions bad environment often cause disability and even cause death, so the principle key in providing services health for workers is to do prevention of interference with health.<sup>[8]</sup>

Acute respiratory infection is an abbreviation of Acute Respiratory Infection, this

term is adapted from the term in English Acute Respiratory Infections. An acute infectious disease that attacks one part and or more of the channel breath from the nose (upper tract) to the Alveoli (lower tract) including tissue adnexa such as sinus, ear cavity middle, and pleura. ISPA disease is a disease that often occurs in children because the child's body's defense system is still low.<sup>[9]</sup> The term Acute respiratory infection includes three elements namely infections, respiratory tract, and acute, where the meaning is as follows: (1) Infection, is the entry of germs or bacteria microorganisms into the human body and multiply so cause disease symptoms; (2) Respiratory tract, is the starting organ from the nose to the alveoli and organs adnexa such as sinuses, cavities middle ear and pleura.<sup>[10]</sup>

Acute infection is a direct infection for up to 14 days. 14 days limit is taken to indicate an acute process though for some diseases that can be classified in Acute respiratory infection, this process can last more than 14 days.<sup>[11]</sup>

According to UNEP, and WHO (2016), mucus secretion or cold symptoms occur in the common cold caused by due to infection with the type virus group rhinovirus and/or coronavirus. This disease may be accompanied by fever in children for a few hours to three days. Whereas air pollution is suspected to be the trigger of viral infection of the upper respiratory tract. Acute respiratory infection can be transmitted through saliva, blood, sneezing, and bad breath contains germs that are inhaled by people healthy to the respiratory tract supported by poor air quality conditions and dense housing density (< 8m<sup>2</sup>/person).<sup>[12]</sup>

In large doses, all the dust is stimulating and can cause a mild reaction. This reaction is excessive mucus production, if it continues glandular hyperplasia can occur in mucus. Research result that was done in Muara Enim shows that in the exposed area (area designation) respiratory tract disorders are higher than in the area not exposed (non-designated area).<sup>[13]</sup> This is in line with research conducted by Fitriyah (2016), who stated that there is a significant relationship between high dust concentration with the occurrence of lung function disorders.<sup>[14]</sup>

Dust that enters the inspiratory tract causes reactions to non-specific defense mechanisms in the form of coughing, sneezing, impaired mucociliary transport, and impaired macrophage

phagocytosis. System mucociliary disorders are also impaired and cause mucus production to increase and smooth muscles around the airway are stimulated thus causing constriction. In the same exposure period, with different abnormalities of Acute respiratory infection use in different respondents, the impact can be different.<sup>[15]</sup>

Acute respiratory infection cases in Morosi District occurred due to exposure to ore and coal dust for a long time and when viewed from the results of indoor and outdoor air quality inspections in the area, the allocation was higher than the non-designated area, but the value was still below the threshold. This is possible because the condition of the kitchen in the respondent's house mostly has a separate room from other rooms, with Cleanliness which is categorized as clean as much as 77.8% and has quite good air ventilation as much as 61.9% and the density of occupancy is quite good in both places. location (>82%), then with conditions like this descriptively it can be concluded that indoor and outdoor air quality has an impact on increasing the incidence of Acute respiratory infection cases in Morosi District.

## Conclusion

From the descriptions above, it can be concluded that the incidence of Acute respiratory infection in exposed locations (designated area) according to symptoms is higher compared to non-exposed locations (not designated area). The condition of the kitchen in the household Most of the respondents have a separate room from other rooms, with clean conditions categorized net as much as 77.8% and has air ventilation is quite good as much as 61.9 %, and sufficient occupancy density good in both locations (>82%). Dust exposure due to the mobilization of ore and coal material transport activities has an impact on disease Acute respiratory infection.

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