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# Factors Associated with Occupational Sickness in Employess of PT. Virtue Dragon Nickel Industry

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### ABSTRACT

**Introduction:** According to the Ministry of Energy and Mineral Resources, 24 processing and refining facilities are operating in Indonesia as of the end of 2017, consisting of 15 nickel smelters, 4 iron smelters, and 2 bauxite smelters, 2 manganese smelters, and 1 copper smelter. One of the nickel smelters that have been operating to date is PT. Dragon Virtue Industry located in Morosi Village, Kec. Morosi, Kab. Konawe.

**Method:** This type of research is quantitative research with explanatory survey method, research that explains causality and hypothesis testing. located near 71 employees who visit and seek treatment at the health centers, a sample is taken from the formula so that a sample of 60 people is obtained.

**Result:** From the results of the study, it is known that there is a relationship between Worker Age, Length of Work, Length of Work, and Use of Personal Protective Equipment with work-related events or diseases, where workers over 40 years of age can experience work-related illnesses.

**Conclusion:** it can be concluded that there is a significant relationship between all variables and it is hoped that workers will have more self-protection by adjusting their abilities and age in doing work and for companies or industries they are expected to put more pressure on occupational health and safety officers to be more optimal in supervising workers in the company.

### Introduction

Mining is part or all of the stages of activities in the context of research, management,

and exploitation of minerals or coal which include general investigations, exploration, feasibility studies, construction, mining, processing and

refining, transportation and sales, as well as post-mining activities.

Nickel (Ni) occurs naturally in the earth's crust and is widely distributed in the environment. Nickel occurs in combination with arsenic, antimony (Sb), oxygen, sulfur, oxides, silicates, sulfides, and arsenides such as millerite (NiS) and garnierite, namely silicate-magnesium-nickel in various compositions. Nickel is also found in alliance with iron (Fe) in meteors, while the earth contains quite a lot of Ni. Ni is usually formed together with chromite and platinum in ultramafic rocks such as peridotite.<sup>[1]</sup>

The enactment of Law Number 32 of 2004 concerning Regional Government, gave the authority to manage natural resources, especially mining to each region.<sup>[2]</sup>

Mining activities have positive and negative impacts, the positive impact is by increasing foreign exchange for our country and increasing Regional Original Income increasing community economic activities and employment. While the negative impact is an increase in natural damage, because ex-mining land that is not quickly reclaimed and reforested has the potential to cause landslides, river turbidity disrupts the life of flora and fauna which in turn has an impact on global climate change.<sup>[3]</sup>

As a nickel exporting country, Indonesia has nickel reserves reaching 3.2 billion tons or 5% of the world's nickel reserves. In 2009 Indonesia's ferronickel production was 12,550 metric tons, and nickel production was 6.52 million metric tons. World ferronickel production is 1.38 million tonnes and consumption is 1.3 million tonnes. World nickel production and consumption are increasing from year to year, reaching 2.4% per year.<sup>[4]</sup>

According to the Ministry of Energy and Mineral Resources, there were 24 units of processing and refining facilities or smelters operating in Indonesia until the end of 2017, consisting of 15 nickel smelters, 4 iron smelters, 2 bauxite smelters, 2 manganese smelters, and 1 copper smelter. . One of the nickel smelters that have been operating to date is PT. Virtue Dragon Industry is located in Morosi village, Kec. Morosi, Kab. Konawe. PT. VDNI has 632 foreign workers and is a foreign worker from China with the addition of workers in 2019 from foreign workers

reaching 240 people and in 2020 the total number of foreign workers is 1,121 people.<sup>[5]</sup>

The Southeast Sulawesi Province is an area that is quite rich in various types of mining. The types of mining products that are prominent in this area are nickel and asphalt mining. This is one of the factors that has caused several national and foreign investors engaged in the mining sector to be interested in investing in this area. There are several areas where mining companies carry out exploration, mainly in South Konawe, North Konawe, Buton, and Konawe Regencies.<sup>[6]</sup>

For the years 2018-2021, no data has been found related to the death rate due to work so if you look at the annual trend of around 2%, it can be assumed that the death rate is around 3,000-4,500 deaths per year. From the data found, there are indeed some data that need to be re-verified and raise several questions. One of them is the increase in the number of work accidents in Indonesia which increased drastically in 2020. Given that in 2020, many companies carried out Work From Home (WFH) due to the Covid-19 pandemic.

It is known that the Morose Health Center is the first level health facility for the Morose Subdistrict and closest to PT Virtue Dragon Nickel Industri which is in the Morose Health Center's working area, it is hereby known that although the company has a clinic, most of the employees are resident and domiciled in the area when experiencing problems. health workers are more likely to seek treatment and check themselves at the Morose Health Center.

Health problems in the Konawe district can be seen from the Health Profile data that from 27 sub-districts in Konawe Regency in 2019 the highest order of cases of Respiratory Tract Infections (ARI) reached 75.93%, data on visits to the Morosi Public Health Center in 2019 with a total of 92,080 visits seen From the data, the 10 biggest diseases are ARI 28.16%, Gastric Ulcer 15.11%, Hypertension 15.09%, Influenza 8.35%, Skin and Subcutaneous Tissue Diseases 7.56%, Other Neurological Disorders 6.61%, Diarrhea 5.85% Accident 5.35%, Diabetes Mellitus 4.03% and other skin diseases due to fungus 3.85%.<sup>[7]</sup>

The data for 2020 has increased with a total of 10 special visits for the biggest diseases, namely 97,252 visits, namely ISPA 28.42%, Hypertension 15.25%, Gastric Ulcers 14.91%, Influenza 8.71%, Skin, and Subcutaneous Tissue

Diseases 7, 30%, Other Neurological Disorders 6.38%, Diarrhea 5.81% Accidents 5.15%, Diabetes Mellitus 4.22% and other skin diseases due to fungi 3.80%. For this data, 98 percent are natives of the Morosi area because virtue dragon has its clinic to service all workers in the mining area. Data on patients with work-related illnesses with employee status of PT Virtue Dragon Nickel Industri who visited the Morosi health center are known to number 71 people.<sup>[8]</sup>

## Method

This type of research is quantitative research with explanatory survey methods, research that explains causality, and hypothesis testing.<sup>[9]</sup> It is known that the population is 71 employees who visit and seek treatment at the health centers and then a sample is drawn using the formula, a sample of 60 people is obtained.<sup>[10]</sup>

## Result

The results of this study can be described in the form of a table for each research variable:

### 1. Worker Age

**Table 1. Age Relationship with Occupational Sickness**

Age	Work Sick				Σ	%	Chi-Square	φ	X tabel
	Yes		No						
	f	%	f	%					
<40 Years	5	35,71	42	89,36	47	77,05	14,65	0,536	3,84
>=40 Years	9	64,29	5	10,64	14	22,95			
Total	14	100	47	100	61	100			

It is known from the results of data analysis and obtained the value of X Count or Chi-Square 14,653 > from 3.84 or X table and the Phi value of 0.536 which means it has a moderate relationship.

### 2. Length of Service

**Table 2. Relationship between a work period and work-related illness**

Length of Service	Work Sick				Σ	%	Chi-Square	φ	X tabel
	Yes		No						
	f	%	f	%					
<5Years	6	42,86	41	87,23	47	77,05	14,65	0,536	3,84
>=5Years	8	57,14	6	12,77	14	22,95			
Total	14	100	47	100	61	100			

It is known from the results of data analysis and obtained the value of X Count or Chi-Square 9.633 > from 3.84 or X table and the value of Phi 0.444 which means it has a moderate relationship.

### 3. Long working

**Table 3. The Relationship of Length of Work with Occupational Sickness**

Long Working	Work Sick				Σ	%	Chi-Square	φ	X tabel
	Yes		No						
	f	%	f	%					
8 Hours	5	35,71	42	89,36	47	77,05	14,65	0,536	3,84
12 Hours	9	64,29	5	10,64	14	22,95			
Total	14	100	47	100	61	100			

It is known from the results of data analysis and obtained the value of X Count or Chi-Square 14.65 > from 3.84 or X table and the Phi value of 0.536 which means it has a moderate relationship.

### 4. Use of Personal Protective Equipment

**Table 4. The relationship between the use of PPE with a work-related illness**

Use of Personal Protective Equipment	Work Sick				Σ	%	Chi-Square	φ	X tabel
	Yes		No						
	f	%	f	%					
Use	5	35,71	40	85,11	45	73,77	11,17	0,472	3,84
Not Use	9	64,29	7	14,89	16	26,23			
Total	14	100	47	100	61	100			

It is known from the results of data analysis and obtained the value of X Count or Chi-Square 11.17 > from 3.84 or X table and the value of Phi 0.472 which means it has a moderate relationship.

## Discussion

### Age Relationship with Occupational Sickness

From the results of the study, it is known that there is a significant relationship between the age or age of workers and work-related illnesses at PT Virtue Dragon Nickel Industri in Morosi District, of the 61 samples found 9 people out of 14 workers with age over 40 years. And there are only 5 people from 47 workers under the age of 40 years.

It can be concluded that the incidence of work-related illness is more common in vulnerable ages, namely the age above equal to 40 years, where the function of the organs in the body decreases, and is easy to get sick.

There are several causes of occupational diseases that commonly occur in the workplace which are classified based on the causes of the diseases that exist in the workplace, including physical groups (noise, radiation, extreme temperatures, air pressure, vibration, lighting), chemical groups (all chemicals in the workplace). in the form of dust, vapor, gas, solution, mist), biologic group (bacteria, virus,

fungus, etc.), physiological/ergonomic group (workplace design, workload), and psychosocial group (psychic stress, work monotones, job demands).<sup>[11]</sup>

At the age of over 40 years, a person is easily stressed, energy or physical function is reduced, and is easily exposed to diseases due to a declining immune system, thus it is highly recommended for those aged over 40 years for mining industry workers to be more protective of themselves. by increasing safety as self-protection from the risk of infection and injury.

### Relationship between a work period and work-related illness

It is known that there is a moderate relationship between working period and work-related illness, this is based on the results of the study that found 8 out of 14 workers with a working period of more than 5 years and 6 out of 47 workers with a working period of under 5 years were declared Occupational Sickness. at PT Virtue Dragon Nickel Industri, Morosi district.

Workers with a long working period are considered to have a better experience than new workers, however, exposure to industrial waste that is too long for a long time is very at risk of disease, this is influenced by the work environment and exposure to dust and smoke in industry. nickel.

The impact of the nickel industry on the environment is the difference between the environmental conditions before construction and those that are expected to exist after construction. The development in question includes nickel mining activities that can have an impact on the environment in general.<sup>[12]</sup>

Impacts on physical conditions include water pollution caused by contamination with waste left over from mining industrial activities, air pollution due to contamination from mining exhaust gases, as well as noise pollution from mining activities such as (blasting) or trucks transporting mining goods, which also have a negative impact. to the physical conditions in the area around the mining industry.<sup>[13]</sup>

The longer the employee works, the more risky or susceptible to illness the eating and drinking patterns consumed must be ensured to be safe with low exposure due to the nickel industry. Industrial activity accounts for most of the variability of nickel deposition on the earth's surface, but deposits from meteorites and volcanic eruptions can exceed release from anthropogenic sources. Point source emissions increase nickel exposure, but the health impacts of these emissions have not been conclusively documented.<sup>[14]</sup>

Little is known about risk groups in the general population, occupations have a higher exposure than other groups in the population. The concentration of nickel in workroom air, particularly in the refining industry, can be significantly increased compared to ambient air. An increased risk of cancer has been repeatedly demonstrated in the refining industry but not for nickel secondary users. The nickel air level in the workrooms of nickel secondary and end-users is generally much lower than in the refining industry.<sup>[15]</sup>

Thus, both new and old workers remain consistent in implementing work SOPs that are considered effective in minimizing the incidence of work-related illnesses.

## **The Relationship of Length of Work with Occupational Sickness**

There is a significant relationship between the length of work and work-related illness, it is known that the results of statistical tests with a sample of 61 people who worked time for 12 hours there are 9 employees from 14 people who are sick due to work and for a length of work with 8 hours a day found 5 people from 47 employees who were declared sick due to work.

A growing body of evidence shows that long working hours harm the health and well-being of workers. Studies have linked overtime and extended work schedules to an increased risk of hypertension, cardiovascular disease, fatigue, stress, depression, musculoskeletal disorders, chronic infections, diabetes, general health complaints, and all-cause mortality. Several reviews and meta-analyses have been published summarizing the findings of this study. Systematic reviews generally conclude that long working hours are potentially harmful to workers' health.<sup>[16]</sup>

Exposure levels in working room air in the refining industry are estimated to be 1-5 mg/m<sup>3</sup> for soluble nickel, and from less than 2 mg/m<sup>3</sup> to more than 9 mg/m<sup>3</sup> for nickel sulfide. Exposure to nickel oxide may have exceeded 10 mg/m<sup>3</sup>. Moreover, mixed exposures have become the rule rather than the exception. Secondary users of nickel are usually exposed to less than 0.1 mg/m<sup>3</sup> with occasional levels up to 1 mg/m<sup>3</sup>.<sup>[17]</sup>

Nickel oxide remains in the lungs after exposure. In gold hamsters exposed to aerosolized nickel oxide artificial (unspecified; MMD 1.0–2.5 m), 20% of inhaled nickel oxide remained early elimination, and 45% of this was still present after 45 days. Continuous inhalation (for 6 weeks) of nickel oxide (NiO) at a concentration of 50 g/m<sup>3</sup> gave comparable figures. Nickel leaching from nickel-enriched fly ash does not appear to occur to some extent.

Nickel can undergo redox metabolism to produce trivalent forms to form reactive oxygen species. The release of intracellular nickel ions after phagocytosis of oxide and/or nickel sulfide particles is an important metabolic pathway. Nickel-containing minute particles have been demonstrated to be close to the nuclear membrane. Nickel ions can also enter cells directly, although the possible transport mechanism is unclear.<sup>[18]</sup>

Severe lung damage has been noted following acute inhalation exposure to nickel carbonyl. Reversible renal effects (in workers), allergic dermatitis (most commonly in women), mucosal irritation and asthma (in workers) have been reported after exposure to inorganic nickel compounds. Renal effects and dermatitis may be related to nickel absorption by both inhalation and ingestion, in addition to skin contact for dermatitis.<sup>[19]</sup>

Allergic skin reactions to nickel (dermatitis) have been documented in nickel workers and the general population. However, the importance of nickel as a cause of skin reactions is reduced. On the other hand, there is evidence that nickel is increasingly becoming a major allergen in the general population, especially in women. About 2% of men, and 11% of women show positive skin reactions to patch tests with nickel sulfate. Ear piercing greatly increases the risk of nickel sensitization.<sup>[20]</sup>

### **The relationship between the use of PPE with a work-related illness**

The results of the study found that there was a significant relationship between the use of personal protective equipment and work-related illness where workers were found using personal protective equipment below 4 standards out of 14 maximum personal protection, namely 9 people out of 16 workers with work-related illnesses and for the use of PPE above 4 standards. its use was found to be 5 out of 45 workers, it is known that the use of PPE that is relatively complete has minimal risk of work-related illness,

Companies, where they work, are equipped with personal protective equipment for their workers but the use of personal protective equipment often causes discomfort, and limits the wearer's movement and sensory, so the potential for work accidents with a work-related illness often occurs.

The use of personal protective equipment is the last measure of control that functions to reduce the severity of the hazard posed, Personal Protective Equipment is a set of safety equipment used by workers to protect all or part of their bodies from the possibility of exposure to potential hazards of the work environment to accidents and diseases caused by work.<sup>[21]</sup>

Personal Protective Equipment (PPE) can be divided into 3 groups, namely: Head Protective Equipment including Helmet (Safety Hat), Safety

Glass (Safety Goggles), Masks, Respirators, Ear Plugs (Ear Covers). Protective equipment for members of the body includes Protective Shoes (Safety Shoes/Boot), and Gloves (Hand Gloves).<sup>[22]</sup>

Occupational Health and Safety is one aspect of labor protection to achieve optimal work productivity. Technological control of potential hazards or occupational diseases is an effective control in preventing work-related accidents and occupational diseases. However, due to various obstacles, these efforts have not been carried out optimally.<sup>[23]</sup>

The purpose of using personal protective equipment is to protect the body from occupational hazards that can cause work-related accidents and occupational diseases. So that the use of personal protective equipment is useful not for maintaining the safety of the workers themselves but also for those around them.

### **Conclusion**

From the results of the study, it is known that there is a relationship between Worker Age, Length of Work, Length of Work, and Use of Personal Protective Equipment with work-related events or illnesses, where the age of employees over 40 years has the potential to experience work-related illness. work-related illness due to long exposure to nickel, for the length of work it is known that working 12 hours is more likely to cause work-related illness because the body's immunity decreases and rest tend to be less and for the factor of using PPE with work-related illness it was found that the use of PPE with less than 4 standard use is more prone to work accidents or work-related illness. Thus, it is hoped that workers will have more self-protection by adjusting their abilities and age in doing their jobs, and for companies or industries, it is hoped that more emphasis is placed on occupational health and safety officers to be more optimal in carrying out supervision of workers in their companies.

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