

Analysis of Testing and Measuring the Work Environment against Air Microorganisms in PT. PLN (Persero) UPK Nagan Raya

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ABSTRACT

Working environment conditions that do not meet the requirements can cause health problems in workers. Air quality, temperature, radiation, ventilation, lighting, and various chemicals in the building are very important causes of complaints and symptoms of microorganisms. This study aims to determine the air microorganisms in the K3 room of PT. PLN UPK Nagan Raya and analyze the air for microorganisms in the K3, WTP, and environmental rooms. Based on the study's results, the multiple linear regression test (simultaneously) obtained a p-value of 0.656, a p-value value > 0.05. It can be concluded that all independents significantly affect dependent variables. The partial test results showed significant values, namely 0.699 and 0.656, and the test results of the multiple linear regression equations obtained values $Y = -1702,500 X1 + 20,650 X2$.

Keywords: Mikroorganisme, Testing Analysis, Work Environment

Introduction

Industrial and office activities have developed rapidly. Support its development, adequate facilities and infrastructure are needed. The development of industrialization can bring various risks affecting workers and their families. The risks of industrialization include the possibility of occupational disease, work-related diseases and work-related accidents that can cause disability and even death. The risk arising from the existence of working environment conditions that do not meet the requirements can cause health problems in workers, this also applies to workers who work indoors [1]–[6].

A luxuriously constructed building room equipped with adequate infrastructure and indoor air conditions that can be adjusted as comfortably as possible is considered comfortable places to work. But it is precisely in this kind of room that the health of people who work is mainly disturbed. Various complaints and symptoms can also arise when a person is in a building. Air quality, temperature, radiation, ventilation, lighting, and multiple chemicals in the shelter are potential causes of complaints and symptoms of microorganisms in workers inside the building. A room temperature that is too low can cause someone in the room to experience cold and chills. In contrast, high room temperature can cause the body to overheat, and sweat, so too low and too high can interfere with activities [7]–[11]. Air quality in a room is a significant factor that can affect the degree of health of the workforce [12].

Microorganisms in the air are elements of pollution that are very meaningful as the cause of various diseases, including eye irritation, skin, respiratory tract (ARI), and others. ARI is characterized by fever and one or more systematic reactions, such as chills, headaches, malaise, and anorexia. Sometimes in children, there are gastrointestinal disorders [13]–[16]. Microorganisms can be in the air, especially from logging dust. The number of colonies of microorganisms in the air depends on indoor activity and the amount of dust and other impurities. A dirty room will contain air that contains a lot of microorganisms than a clean room [17]. In Bornehag (2005), the presence of microorganisms in the room is generally in the form of fungal spores in places such as ventilation systems. In addition, moisture is a trigger for the growth of bacteria and fungi [18]–[22].

Microorganisms in the air can be found outdoors and indoors. The outside air rarely contains pathogenic germs, while the indoor air contains pathogenic germs that come from the skin, hands, clothes, and the human airway [23]–[27].

The Indonesian government has regulated air quality requirements in office spaces by issuing the regulation of the Decree of the Minister of Health of the Republic of Indonesia No.1405 / MENKES / SK / XI / 2002 in the decree stated that the germ number is less than 770 colonies / m³ air, and is free of pathogenic germs.

Previous research by Mayasari [28], as many as 30 hospital rooms are pretty high. The humidity and lighting in RS II are good, while in RS III, it is classified as humid, and RS I is not well-lit. The average number

of air germs looks high in this RS. Fithri [10] this study wanted to know the number and variety of microorganisms, especially bacteria, and fungi, and the relationship between temperature, humidity, and lighting in classrooms at Esa Unggul University. Based on the correlation test, there is a relationship between temperature and the number of bacteria ($r=-0.22$) and fungi (0.13) in the air, there is a relationship between humidity and the number of bacteria ($r=28$) and fungi ($r=-33$) in the air, and there is a relationship between lighting and the number of bacteria ($r=-039$) and there is also no relationship between lighting and the number of fungi ($r=13$) in the air.

The purpose of the study was to find out the air microorganisms in the K3 room of PT. PLN UPK Nagan Raya and also to analyze the air for the presence of microorganisms in the K3, WTP, and environmental spaces.

Research Methods

This study uses analytical methods with a cross-sectional approach. In cross-sectional analytical studies, researchers study the relationship between factors of working environment conditions and diseases (effects), and observation or measurement of free variables (work environment factors) and bound variables (outcomes) is carried out once at the same time. The method used in collecting data is measurement methods which include temperature, humidity, lighting, and airflow speed.

The instruments used in this study were temperature, and humidity measuring devices with WBGT, lighting with Environment Meter, and airflow speed with Anemometer.

Results and Discussion

a. Results of Measuring Working Environment Conditions

Measurement of work climate (temperature, humidity, and airflow speed) in Room K3, WTP Room, and Environment Room was measured three times during eight working hours, namely the beginning of work shifts, the middle of work shifts, and the end of work shifts. Exposure measurements are carried out with general lighting by measuring repeats three times in each room.

Table 1. The results of measuring the working environment of the 3rd floor at PT. PLN (Persero) UPK Nagan Raya

Lighting	Room k3	Wtp	Environmental space
300 lux encapsulation threshold value in the workspace	561 lux	164 lux	156 lux
	Bacteria		
Value threshold max.85db/8 working hours	100cfu/m ²	100cfu/m ²	90 cfu/ m ²
	Mushroom		
Value threshold max.o,8661 m/s2	100cfu/m ²	100cfu/m ²	90 cfu/ m ²

Based on the measurements above results, it shows the working environment conditions on the 3rd floor at PT. PLN (Persero) UPK Nagan Raya has some data on the threshold.

b. Distribution of Occurrences of Air Microorganisms

The following can be seen employee complaints while indoors related to work environment conditions based on the results of the questionnaire interview can be seen in the following table:

Table 2. Distribution of symptoms felt by employees in room K3, WTP and environment room

No	Symptom	Sum (n)	Percentage (%)
1	Red eyes	16	47,05
2	Watery eyes	18	52,94
3	Itchy eyes	11	32,35
4	Hot eyes	9	26,47
5	Itchy nose	17	50,00
6	Dry nose	7	20,58
7	Sneezing nose	6	17,64
8	Dry throat	19	55,88
9	Dry skin	20	58,82
10	Itchy skin	25	73,52
11	Red skin	27	79,41
12	Drowsiness	5	14,70
13	Headache	27	79,41
14	Fatigue	13	38,23
15	Difficulty concentrating	15	44,11
16	Shortness of Breath	19	55,88
17	Coughing	10	29,41

It can be seen in table 2 showing the symptoms experienced by employees who meet the criteria are symptoms of disappearing when leaving the building or at home. In this study, 20% to 50% of employees who felt these symptoms.

c. Multiple Linear Regression Coefficient Test

Multiple linear regression analysis was performed to see the influence of working environmental conditions on microorganisms by looking at p-values, which were carried out with simultaneous tests. The following can be seen the results of multiple linear analysis simultaneously can be seen in the following table:

Table 3. Multiple Linear Regression Test (Concurrent)

Model	Sig
Regression Residual Total	0.656

Source: SPSS Processing Results, 2023

It can be seen that based on the results of multiple linear regression tests (simultaneously) obtained a p-value of 0.526, a p value of > 0.05 can be concluded that the entire independent (lighting, noise, vibration and magnetic field radiation) has no significant effect on the dependent variables.

Furthermore, the results of the multiple linear regression analysis test can be seen in the partial test in the following table:

Table 4. Multiple linear regression test (Partial)

Model	Sig
1 (Constant)	0.699
Jamur	0.656

Based on the partial test results, it shows significant values obtained, namely 0.699 and 0.656.

d. Multiple Linear Regression Analysis

It can be seen in the table below of the multiple linear regression equation:

Table 5. Regression Test

Model	Unstandardized Coefficients		
		B	Std.Error
1 (Constant)	-1702.500		3327.466
Jamur	20.650		34.381

Based on the table above, it can be seen that the multiple linear regression equation is as follows: $Y = -1702.500 X_1 + 20.650 X_2$.

Conclusion

Based on the results of multiple linear regression tests (simultaneously) obtained a p-value of 0.656, a p-value value > 0.05 can be concluded that all independents have a significant effect on dependent variables.

Based on the results of the partial test, it shows that the significant values obtained are 0.699 and 0.656. Based on the multiple linear regression equation obtained $Y = -1702.500 X_1 + 20.650 X_2$

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