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ENVIRONMENTAL QUALITY IN INDUSTRIAL AREAS: CASE STUDY OF A COMPANY IN BANYUASIN REGENCY, SOUTH SUMATRA PROVINCE

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Bagas Pandu MURSANTO[1]
[1]Master of Environmental Engineering, Department of Environmental Engineering, Faculty of Civil Engineering and Planning, Islamic University of Indonesia
Corresponding author: Bagas Pandu Mursanto
E-mail: pandumursanto@gmail.com

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Abstract:
With the emergence of industry in the Banyuasin district area, especially in Gasing Village, there are more job opportunities for residents and Banyuasin residents. However, the industry's rapid growth in the Banyuasin district can also hurt the environment, including air and water pollution. This research was carried out through descriptive observations of environmental conditions at the case study site. Data is collected and evaluated based on environmental elements, especially ambient air, emissions, noise and wastewater. At the case study location at an agro-industrial company in the Banyuasin district, the quality of ambient air, noise, emissions and wastewater from the WWTP was tested, and samples were taken. The test results show that the quality of ambient air, noise, emissions and wastewater produced by the WWTP around the factory area is classified as good, and all parameters meet the standards. If the measurement results of this research are looked at, there is no critical threshold value that attracts attention. This research shows that the industry must monitor the quality of the environment to make improvements and reduce the company's negative impact on the environment and the surrounding community's health.

Keywords: Ambient Air, Emissions, Environment, Wastewater

INTRODUCTION

Industrial areas are places for all specialized businesses in locations equipped with facilities and other infrastructure. With the emergence of industry in the Banyuasin Regency area, especially in Gasing Village, there are more job opportunities for residents and Banyuasin residents. However, the industry's rapid growth in Banyuasin Regency can also hurt the environment, including air and water pollution. Pollution causes environmental quality to decline (Carolina et al., 2024). As a result, it is essential to monitor environmental quality in the Banyuasin Regency industrial area.

The case study is in an industrial and residential area in Banyuasin Regency. Residential areas are increasingly developing on the west and south sides of the study location. This can result in environmental impacts that influence each other, both on the study location and the settlement. Because every action has an impact on the environment, preparation is needed. Efforts must be made to reduce its negative impacts. Therefore, the company must conduct an environmental evaluation based on the environmental management and monitoring that has been carried out.

METHODS

This research was conducted by descriptive observation describing the environmental conditions at the case study location. Data were collected and then analyzed based on several aspects. The research was conducted by collecting primary and secondary data to collect information on various aspects of the environment, especially ambient air, emissions, noise and wastewater.

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Ambient Air. Measurements were made using measuring instruments, including HVAS and Inpinger, analyzed by an accredited laboratory, and data was analyzed using statistical methods. The study's results are essential for maintaining the quality of the environment at the case study location.

Table 1. Ambient Air Testing Methods

1	Carbon monoxide (CO)	SNI 7119.10:2011
2	Sulfur Dioxide (SO_2)	SNI 7119.7-2017
3	Nitrogen Dioxide (NO_2)	SNI 7119.2 2017
4	Oxidant (O_3)	SNI 7119.8 2017
5	Dust (TSP)	SNI 19 7119.3 2005
6	Lead (Pb)	SNI 7119.4 2017

Noise. Measurements are made using a calibrated Sound Level Meter (SLM) according to SNI 15.06/IK.UA/LL/2014.

Emissions. The calculated emissions are non-moving emissions generated from supporting activities like boilers at the case study location.

Table 2. Emission Testing Methods

1	Nitrogen Dioxide (NO_2)	15.6/IK.ESTB/LL/2018
2	Sulfur Dioxide (SO_2)	15.6/IK.ESTB/LL/2018
3	Ammonia (NH_3)	SNI 197117.6 2005
4	Hydrogen Fluoride (HF)	SNI 197117.9 2005
5	Hydrogen Chloride (HCl)	SNI 197117.6 2005
6	Isokinetic Particulates	SNI 7117.21:2021

Wastewater. Analysis to determine the condition of wastewater at the outlet of the Wastewater Treatment Plant (IPAL) at the agro-industrial company where the case study was conducted. The reference used in monitoring wastewater uses the test method in Table 3.

Table 3. Wastewater Testing Method

1	pH	SNI 6989.11:2019
2	BOD	SNI 6989.72:2009
3	COD	SNI 6989.2:2019
4	TSS	SNI 6989.3:2019
5	Oils and Fats	SNI 6989.10:2011
6	Total Ammonia	SNI 6989.30:2005
7	Total Coliform	SM 23 Ed., APHA 9221 B & C

RESULT AND DISCUSSION

Trend evaluation is an evaluation to see the trend of changes in environmental quality in a particular space and period. Monitoring data is needed occasionally to conduct a trend evaluation because changes in trend values can be done with different monitoring. In this case, the data presented in monitoring environmental quality at the case study location is time series data from the previous 2 tests. The data displayed will create a trend evaluation trend (Paramitha et al., 2024).

Ambient Air. Air quality testing is one of the efforts to monitor the quality of air inhaled by humans and prevent the adverse effects of air pollution on human health. Ambient air testing refers

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to Government Regulation No. 22 of 2021 concerning Environmental Protection and Management Organizers. The 6 parameters above are carbon monoxide (CO), Sulfur dioxide (SO2), Nitrogen dioxide (NO2), Oxidants (O3), Dust (TSP), and Lead (Pb). These are critical parameters in ambient air testing. According to environmental documents, the results of ambient air testing at the case study location in one of the agro-industrial companies are the results of the last 2 tests at 2 test locations.

Table 4. Ambient Air Test Results

Parameter	Unit	East Side		West Side		NAB
		2022	2023	2022	2023	
Carbon monoxide (CO)	Ug/m³	1145	1145	1145	1145	10000
Sulfur Dioxide (SO_2)	Ug/m³	41.2	41.2	40.3	36.3	75
Nitrogen Dioxide (NO_2)	Ug/m³	40.1	39.5	40.3	36.2	65
Oxidant (O_3)	Ug/m³	51.2	40.3	50.9	38.5	150
TSP (Dust)	Ug/m³	145	121	127	111	230
Lead (Pb)	Ug/m³	0.035	0.034	0.039	0.034	2

Air pollution can cause various diseases, including respiratory disorders, cancer, and cardiovascular problems (WHO, 2019). The concentration of PM10, PM2.5, SO2, NO2, and O3 particles in the air has been associated with various health effects. For example, PM2.5 particles can penetrate lung tissue and cause lung inflammation, while SO2 and NO2 can irritate the respiratory tract (Liu et al., 2019). Therefore, it is essential to monitor ambient air quality and take preventive measures to prevent the adverse effects of air pollution on human health. The following is an evaluation of the trend in ambient monitoring at the case study location.

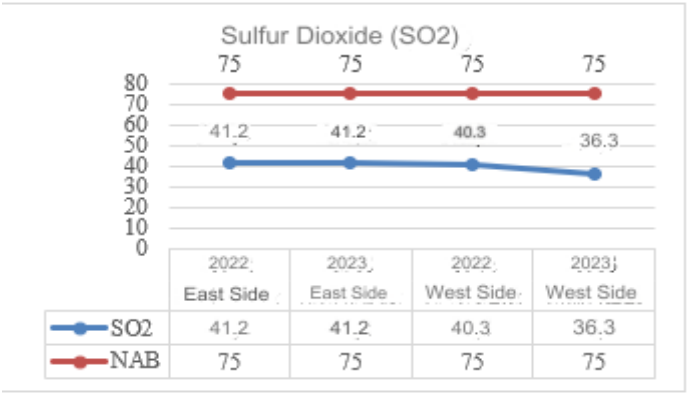

Figure 1. SO_2 Trend Evaluation

Sulfur dioxide (SO2) content comes from fossil and biomass combustion. Examples include car engine and generator combustion in the case study area. Open land and road activities bring dust particles, affecting air quality. The results of SO2 quality monitoring show that it is still below the specified quality standards.

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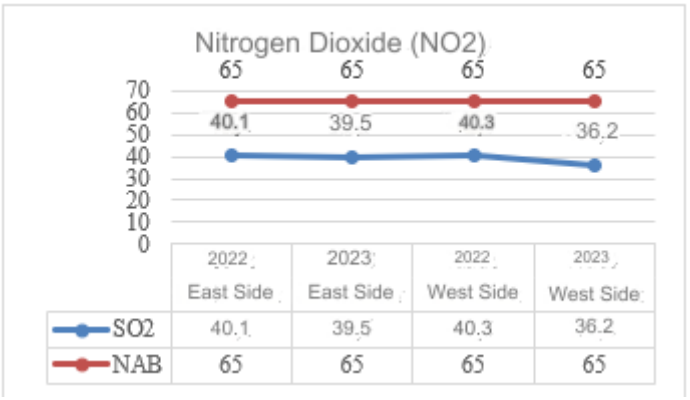

Figure 2. Evaluation of Nitrogen Dioxide (NO_2) Trend

Nitrogen dioxide (NO2) is one of the test parameters in ambient air. Vehicle and engine activities increase nitrogen dioxide (NO2). The results of monitoring the quality of nitrogen dioxide (NO2) at the case study location show that it is still below the specified quality standard.

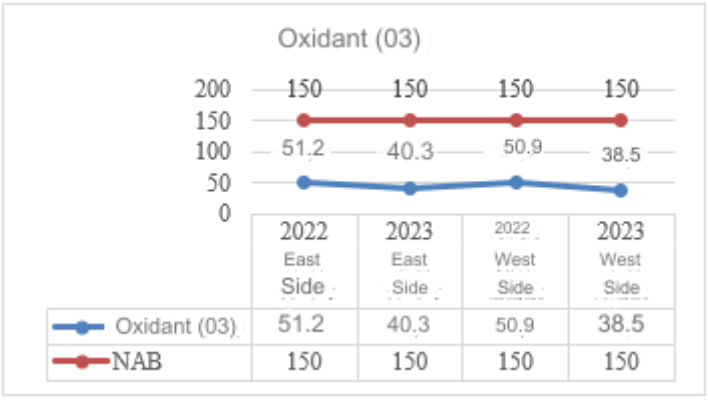

Figure 3. Evaluation of Oxidation Tendency (O3)

Oxidant (O3) is an air compound that acts as an oxidizer. The oxidant measurements at the study location show that monitoring the oxidant value (O3) decreased in 2023, and the results are still below the predetermined quality standards.

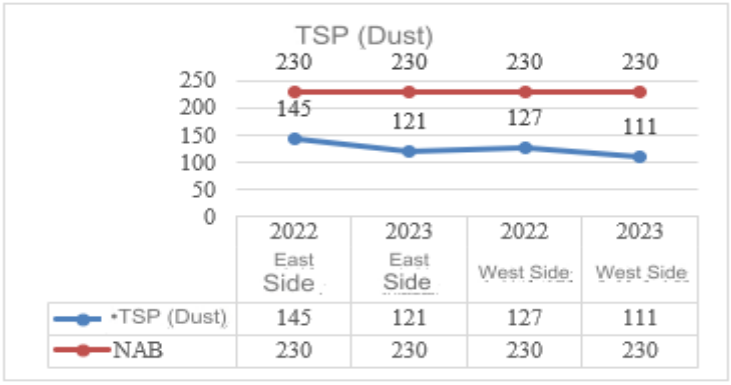

Figure 4. TSP Tendency Evaluation

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Total Suspendent Particulate (TSP) is a dust particle with a diameter of less than 100 microns. Dust (TSP) is a mandatory parameter for air measurements. TSP values , in a certain amount, will hurt human health. From the trend data in the image above, the dust value (TSP) is still within reasonable limits and below the specified quality standards, so it is still in reasonable conditions (Rini et al., 2022).

Noise. Noise measurement is a mandatory parameter during environmental monitoring and is regulated by the Decree of the Minister of Environment No. 48 of 1996. A sound level meter calibrated with decibel A (dBA) units is used for noise measurement at a location. The following are the test results at 2 case study test locations.

Table 5. Noise Monitoring Results

Parameter	East Side		West Side		NAB
	2022	2023	2022	2023	
Noise	51.5	52.5	59.8	58.6	70

High noise exposure can cause health problems, such as sleep disorders, cognitive problems, and the risk of cardiovascular disease. Based on the noise testing results at the case study location in one of the agro-industrial companies. Noise conditions outside the company are still within the established quality standards. Noise levels can increase in general due to the activities of transport vehicles and generating machines in the Company (Balakrishnan et al., 2021). The evaluation of the tendency of noise values in the 2 periods is as follows.

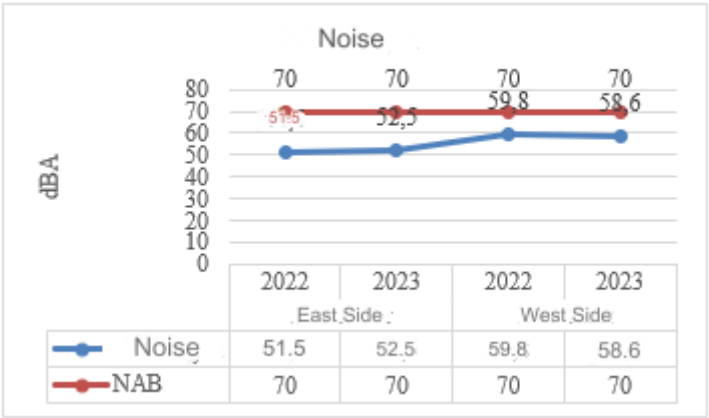

Figure 5. Noise Tendency Evaluation

From the noise value at 2 (two) monitoring locations in industrial areas, the quality standard of 70 dbA shows a fluctuating trend and tends not to change. Noise at the case study location at one of the agro-industrial companies still needs to be below the specified quality standard.

Emission. Emission is energy or other components produced from an activity that enters the ambient air and contains pollutant elements. The emissions monitored are the results of boiler combustion with palm shell fuel. Refer to the Regulation of the Governor of South Sumatra no. 6 of 2012 with the following monitoring results.

Table 6. Boiler Emission Test Results

Parameter	2022	2023	NAB

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Nitrogen Dioxide (NO_x)	142	83	800
SO_2	3	0,9	600
Ammonia (NH_3)	0,084	0,089	1
Hydrogen Fluoride (HF)	2,68	3,97	8
Hydrogen Chloride (HCl)	2,93	3,06	5
Isokinetic Particulates	107	100	110

Air emissions from boiler combustion at the case study location of the agro-industrial company have values that tend to fluctuate. The fuel from the boiler used uses biomass in the form of palm shells, where, in general, the emission results from the combustion of palm shells are relatively low compared to fossil fuels in the form of coal or diesel. Compared to the 2 (two) monitoring that has been carried out, the evaluation of the tendency in each parameter is still below the established quality standards. It does not have a high critical value.

Wastewater. The wastewater produced by this agro-industrial company is produced from the wastewater treatment plant (IPAL) process. The IPAL process uses physical and biological processes where the type of IPAL is integrated (domestic and production waste). The company must maintain the quality of the wastewater produced so as not to damage the quality of the surrounding environment. Therefore, the company must have a wastewater treatment plant (IPAL) to process the waste produced before being discharged into water bodies with predetermined standards. The wastewater is taken at two points to find out the quality of the wastewater. The first point is the inlet wastewater before being processed in the IPAL, and the second is the outlet wastewater after being processed in the IPAL, as shown in Table 6 below.

Table 7. Results of Inlet and Outlet Wastewater Monitoring

Parameter	Inlet	Outlet	Quality standards
pH	4,9	7,4	6-9
BOD	89,6	36,4	69
COD	1571	168	188
TSS	96,9	40,1	92
Oils and Fats	32,7	4	18
Total Ammonia	<0,041	0,041	10
Total Coliform	7900	2400	3000

The results of wastewater monitoring at the IPAL show that the outlet value for the COD parameter is in the high category. However, it is still below the established quality standard, so it is still safe. The Outlet value is still far from the established quality standard for other parameters, such as pH, BOD, TSS Oil and fat, Total ammonia and Total coliform.

CONCLUSION

Environmental Quality Monitoring at the case study location in an agro-industrial company in Banyuasin Regency involves testing/sampling ambient air, noise, and emissions and testing wastewater from the wastewater treatment plant at the agro-industrial company. The test results show that the measurement of ambient air quality and noise produced around the factory area is classified as good and still meets the air quality standards for all parameters below the specified quality standards. In addition, this study also measures air emissions produced from the factory boiler. The boiler used is fueled by palm shell biomass. The results of the measurements are promising, with all parameters meeting the specified quality standards.

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Finally, the wastewater measurement at this agro-industrial company's case study location was carried out at its wastewater treatment plant. The wastewater treatment plant system with physical and biological systems is classified as good, and the monitoring results on critical parameters such as COD, TSS, and oil and fat are still below the specified quality standards. When viewed from the measurement results in this study, there is no critical threshold value of concern. This study shows the importance of environmental quality monitoring for industry so that companies can improve and reduce negative impacts on the environment and the surrounding community's health.

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