

AIR QUALITY MONITORING OF KALABAH-ALOR'S SEAPORT-EAST OF NUSA TENGARA

Rikson Siburian ¹⁾; Minsyahril Bukit ²⁾; Herlince Sihotang ¹⁾; Saur Lumban Raja ¹⁾; Minto Supeno ¹⁾; Cristina Simanjuntak ¹⁾; Nurhaida Pasaribu ¹⁾; Sri Pratiwi Aritonang ³⁾

¹Chemistry Department

Faculty of Mathematics and Natural Sciences, University of Sumatera Utara, Medan-Indonesia

Email : rikson@usu.ac.id

²Physic Department

Faculty of Sciences and Engineering, Nusa Cendana University

³Agriculture Department

Faculty of Agriculture, University of Methodist Indonesia

Abstract

ABSTRACT

Evaluation of environment of seaport is needed as well as our responsibility to nature sustainability. The Alor's seaport belongs to Pelindo III. In order to know the air quality of Alor's seaport, we did this study. Our aims are to know level quality of air at Alor's seaport and compare to the government regulation. This study refers to Pararosaniline (SO_x), Saltzman (NO_x), Particle Calculation (dust) and decibel (noisy) methods. We used four locations, those are A-1 (Entrance gate of PELINDO (8013'09.12"S, 124031'07.21"E)); A-2 (In front of passengers terminal (8013'08.75"S, 124031'01.60"E)); A-3 (Exit gate Kalabahi's seaport (8013'08.2"S, 124031'00.87"E)) and A-4 (In front of port of the people (8011'09.12"S, 124031'07.21"E)). Results show that the averages level of SO_x, NO_x and dust of A-1, A-2 and A-3 are 103.01, 104.65 and 107.47 (µg/Nm³), 37.87, 30.62, and 39.73 (µg/Nm³), 56.64, 47.47 and 50.72 (µg/Nm), respectively. On the other hand, the level of noisy of A-1, A-2, A-3 and A-4 are 68.76, 65.69, 65.20 and 73.60 (dBA), respectively. Base on all of data, we conclude that the air quality of Alor's seaport is still appropriate according to government regulation (PP. No. 4, 1999).

Keywords : Alor's seaport, air quality, SO_x, NO_x, noisy.

1. INTRODUCTION

The port is a place or service facility to serve ships that come and go in the dock area, including waste handling facilities. Ports according to Article 1 of PP Number 61 of 2009 concerning Ports are places that consist of land and surrounding waters with certain limits as a place of government and economic activities which are used as a place for ships docking, boarding and unloaded goods that are equipped with shipping safety facilities and port support activities as well as places for intra-movement and inter-mode transportation [1,2,3]. Port of a marine transportation infrastructure has a strategic role in connecting the islands to other trade and public transport activities. At present, the port has proven itself to be the entry gate of goods - the basic needs

that are shipped with containers and life cycle [4,5].

Alor is one of the regency of Nusa Tenggara Timur province. The capital city of Alor is Kalabahi. The main port of Alor regency was established in Kalabahi since 1911 [6]. Kalabahi port belongs to Pelindo III. It provides of port services as: Berthing, Fuel and clean water supply, Passenger and vehicle transportation service, Container and cargo handling service, Warehouse and storage service for cargo, Handling equipment and port equipment, Container terminal, dry and liquid bulk cargo and Ro-Ro service, Cargo handling service (loading/discharging), Distribution and consolidated cargo service and Vessel tugging service [7]. Alor port is a dynamic port. In October 2015, there were 358 ship units for voyaging and distributing various materials in

Alor port. Base on the April, 2014 data, the total flowing and visiting ships were 96 units (96,108 GT) and flowing of goods based on trade and distribution (13,097 tons; 8,042 m³; 12,530 tons/liters) [8]. It means the Kalabahi's port is very potential as well as a seaport to be much more develop for future. However, the high activity in-out of ship for passengers, cargo and also local transportation has contributed for the environment air quality around the Kalabahi's port. Therefore, monitoring of air quality in Kalabahi's port is needed. This report described the periodic air quality of Kalabahi's port. So, we may protect ecosystem cycle on Kalabahi's port.

2. METHOD

This research was conducted in Kalabahi-Alor public seaport on land owned by PT (Persero) Indonesian port III Branch Kupang. Its land area is 71,131 m² and working area of waters 1,880 Ha. While the monitoring environmental area is 1,813 Ha. It has two types docking namely dock I (4 × 5 meters) and dock II (115 × 10 meters). The monitoring areas are included in the Teluk Mutiara urban area, Teluk Mutiara district, Alor district of NTT province. This activity was monitored for air quality monitoring on activities of PT (Persero) Indonesia III seaport Kupang Branch at Kalabahi-Alor seaport. The environmental management activities were intended to minimize negative impacts and

maximize positive impacts on the environment, especially the air environment. Environmental impact management was intended to prevent and mitigate impacts through: Site selection with minimum impact and stabilization of buffer zones to neutralize impacts or emergencies and rehabilitation/afforded station to prevent and mitigate impacts.

As refer to the environmental evaluation document of PT. (Persero) Pelabuhan Indonesia III Branch Tenau Kupang (SK DELH No. Kp 0503 / 23.I / P.III-2011) dated September 12, 2011), there were some activities that have been and estimated to have negative impacts, including: air quality and noise. The impact sources include: (a) air quality, (b) dust content, (c) gas (CO, SO_x, NO_x), (d) hydrocarbons and (e) noise.

Air Sampling Location at Port Kalabahi Alor was taken from several location points:

A.1 = PELINDO entrance gate (8°13'09.12"S, 124°31'07.21" E); A.2 = Infront of Passenger Terminal (8°13'08.75"S, 124°31'01.60"E); A.3 = Exit gate of Seaport's Kalabahi (8°13'08.2"S, 124°31'00.87"E); BA.1 = PELINDO entrance gate (8°13'09.12"S, 124°31'07.21"E); BA.2 = Infront of Passenger Terminal (8°13'08.75"S, 124°31'01.60"E); BA.3 = Exit of Seaport's Kalabahi (8°13'08.2"S, 124°31'00.87"E) and BA.4 = Infront of Pelra (Pelabuhan Rakyat) (8°11'09.12"S, 124°31'07.21"E)

3. RESULT AND DISCUSSIONS

The air sampling location at Kalabahi Alor's seaport was taken from several points of picking location. The types of important impacts which are occurring at Kalabahi's seaport namely air quality degradation that can be monitored by analysis of dust, SO_x, NO_x, respectively as well as increasing noise as a result of activities at the seaport. The results of air quality and noise analysis can be seen in Table 1.

Siburian, R. et al. Air Quality Monitoring Of Kalabah – Alor's Seaport – East Of Nusa Tenggara.

Table 1. Air Quality and Noise

Sample Code	SO _x (µg/Nm ³)	NO _x (µg/Nm ³)	Dust (µg/Nm ³)	CO (µg/Nm ³)
A-1	31,64	86,06	47,37	220,44
A-2	47,6	181,01	82,10	313,57
A-3	79,51	215,07	101,5	1116,17
Average	52,91	160,71	76,99	550,06
Standard of quality(µg/Nm ³)	900	400	230	30.000
Sample Code	DbA	Average	Method	
BA-1	66,58	65,95	SLM	
BA-2	66,52			
BA-3	64,98			
BA-4	65,74			

Note : Standard of Quality refers to PP. No. 41 Tahun 1999

Monitoring in the Kalabahi's seaport area of the air quality component is shown in Table 1. All of data show that the test results of some ambient air quality have not passed the national ambient air quality standard based on the Government Regulation on the control of air pollution. Measurement results for Sulfur Dioxide (SO_x) parameters are A1 (31.64 µg/Nm³), A2 (47.6 µg/Nm³), and A3 (79.51 µg/Nm³). The data shows that the ambient air quality at Kalabahi's seaport is still below the established standard of 900 µg /Nm³. While, the concentration of Nitrogen Dioxide (NO_x) at A1 (86.06 µg/Nm³), A2 (81.01 µg/Nm³), and A3 (215.07 µg/Nm³), meaning they are still below of standard quality that is determined that 400 µg /Nm³.

The CO concentrations are A1 (220.44 µg/Nm³), A2 (313.57 µg/Nm³), and A3 (1116.17 µg/Nm³). Levels of dust are A1 (47.37 µg/Nm³), A2 (82.10 µg/Nm³), and A3 (101.5 µg/Nm³). On the other hand, NO_x average = 160,71 µg/Nm³, SO_x = 52,91 µg/Nm³, while for average of dust = 76,99 µg/Nm³, average of CO = 550,06 µg/Nm³. So with reference to PP. No. 41 of 1999 on the Ambient Air Quality Standard shows that all categories of air quality monitoring results are

still below the Standards of Environmental Quality Standards.

The noise intensity conditions at the measuring site are BA-1 (66.58 dB), BA-2 (66.52 dB), BA-3 (64.98 dB) and BA- 4 (65.74 dB). So it can be said that both in the neighborhood and on the roadside in front of the office and on the dock shows that the activities are not comfortable, because the source of noise in the form of dock operational activities and land transportation around the pier is still quite busy at certain hours. The average measured result shows 65.95 dB (A) (Table 1). Based on Ministerial Decree No. Kep-48 / MENLH / 11/1996, on Noise Quality Standards, the measurement results show that it has not exceeded the ambient noise level limit of 50-70 dB (A). The Kalabahi Port area has average mean noise level = 65.95 dB (A), this indicates that the noise level at Kalabahi Port has already exceeded the standard noise level for residential areas (BM = 55 dBA), but still below the level standard of noise quality for industrial area (BM = 70 dBA). The important sources of impact in the Kalabahi's seaport area come from: Land transportation activities; Sea transportation; Use of heavy equipment within the port area; Activities of belting of goods ship / passenger

ship; Expansion of the pier; Pertamina Activities and Emission of hazardous materials / exhaust gases from the vessel.

The measurement of air quality change can be seen from the addition of noise level and air quality based on ambient air quality standard according to LH NO Decree. Kep-48 / MENLH / 11/1996 on Noise Quality Standards, and PP. No. 4 of 1999 on the Ambient Air Quality Standard. Furthermore, in the management of significant impacts on air quality can be done: Rehabilitation/reforestation to prevent and mitigate impacts, adding to the Green Open Space. The criteria of the plant structure are the leaf half densely, dominant green color, the roots do not disturb the foundation, the growth velocity varies, the dominant annual crop species, in the form of local plant habitats and cultivation plants, and the distance of plants half of the area of the greened; Reducing / minimizing of noise in the community; Conducting socialization to the community; Not doing work at breaks and religious events and Equipping the worker with a silencer using earplug (earplugs).

4. CONCLUSION

Environmental monitoring in the Kalabahi's seaport area implemented on air parameters and laboratory analysis shows that all parameters which are measured still under the quality standards permitted by government regulations.

The sources of significant impacts of noise in the Kalabahi's seaport area come from: Pertamina activities and belting of goods ship / passenger.

5. ACKNOWLEDGMENTS

The authors gratefully acknowledge that the present research is supported by Ministry of Research and Technology and Higher Education Republic of Indonesia. The support is under the research grant Non -PNBP USU of Year 2018 Contract Number 172/UN5.2.3.2.1/PPM/2018

6. REFERENCES

1. Ministry of Environment of the Republic of Indonesia, 2011, Jakarta Bay Strategic Environmental Assessment (KLHS) Implementation Recommendations (Pantura Tangerang, Jakarta and Bekasi), Jakarta.
2. Ministry of Environment of the Republic of Indonesia, 2009. Decree of the Minister of Environment No. 5 of 2009 concerning Waste Management at the Port, Jakarta.
3. Ministry of Public Works Republic of Indonesia, 2007. Regulation of the Minister of Public Works No. 40 / PRT / M / 2007 concerning Guidelines for Spatial Planning for Reclamation Beach, Jakarta.
4. Heru Sutomo, Joewono Soemardjito, Assessment Model of the Port Effectiveness and Efficiency, *Procedia - Social and Behavioral Sciences* 43, 2012; 24-32.
5. Roger H. Charlier, Life cycle of ports, *International Journal of Environmental Studies*, 70, 2013; 594-602.
6. Klara Puspa Indrawati, The Sea around "Alor Kecil" Vernacular Society: A critical threshold for ecological and cultural survival, *Journal of the International Society for the Study of Vernacular Settlements* 4, 2016; 1-15.
7. Anonim, Towards ICT Based Enterprise, Annual Report, Pelindo-Surabaya, 2016; 1-734.