

## Environmental Assessment in Several Project Locations in Aceh Province

### Kondisi Lingkungan Hidup di Beberapa Lokasi Proyek di Provinsi Aceh

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#### Abstract

Environmental problems in the last few decades have raised concerns for the general public. Various ways to overcome environmental pollution caused by various constructions such as factories, industries, building construction and others have been carried out. One way is to supervise every industrial activity that is carried out. The main objective of this research is to study the extent to which technological approaches in environmental management have been carried out so far. In addition, this paper aims to find out what technologies can be used to minimize the impact on society when construction is carried out. The findings indicate that the noise level measured at the activity location is still below the safe point. The highest noise level is 50.2 dBA, while the quality standard for residential areas is 55 dBA. The results of vibration measurement at the location of the activity are also still at a safe point or below the established quality standards. Meanwhile, the results of air pollution analyzed at the research location are still relatively safe. Overall, the results of the analysis carried out showed that it was still below the established quality standards. However, when construction activities are carried out, it is estimated that they will increase significantly. Thus, several technological approaches are needed to detect noise, vibration and air pollution when construction has started.

*[Permasalahan lingkungan dalam beberapa dekade terakhir telah menimbulkan kekhawatiran bagi masyarakat pada umumnya. Berbagai cara untuk mengatasi pencemaran lingkungan yang disebabkan oleh berbagai konstruksi seperti, pabrik, industri, pembangunan gedung dan lain-lain telah dilakukan. Salah satunya adalah*

*dengan melakukan pengawasan dari setiap kegiatan industri yang dilakukan. Tujuan utama dari penelitian ini adalah untuk mempelajari sejauh mana pendekatan teknologi dalam manajemen lingkungan telah dilakukan selama ini. Selain itu, makalah ini bertujuan untuk mengetahui teknologi apa saja yang dapat digunakan untuk meminimalkan dampak pada masyarakat pada saat konstruksi dilaksanakan. Hasil temuan menunjukkan bahwa tingkat kebisingan yang diukur pada lokasi kegiatan menunjukkan masih di bawah titik aman. Tingkat kebisingan tertinggi sebesar 50,2 dBA, sementara baku mutu untuk wilayah pemukiman sebesar 55 dBA. Untuk hasil pengukuran getaran pada lokasi kegiatan juga masih berada pada titik yang aman atau di bawah baku mutu yang ditetapkan. Sementara untuk hasil pencemaran udara yang dianalisis pada lokasi penelitian juga masih terhitung aman. Secara keseluruhan hasil analisis yang dilakukan menunjukkan masih dibawah baku mutu yang ditetapkan. Namun, pada saat kegiatan konstruksi dilaksanakan diperkirakan akan meningkat secara signifikan. Dengan demikian, diperlukan beberapa pendekatan teknologi untuk mendeteksi terhadap kebisingan, getaran dan pencemaran udara ketika konstruksi telah dimulai.]*

**Keywords:** technology approach; environmental policy; sustainable industrial development; environmental regulation

## I. Introduction

Environmental issues have become a very broad discussion throughout the world including Indonesia, one of them. In several regions in Indonesia environmental problems have come to a very worrying point. This is due to the increasing global economic pressure that has exacerbated environmental pollution and changed the model of economic development in an economic and environmental sustainability manner. In Indonesia, environmental management has been stated in Law Number 23 since 1999. Its implementation has been regulated by government regulation Number 27 1999. This regulation aims to provide opportunities for the community to participate in highlighting environmental problems. So that it can guarantee the security and comfort that is felt when people feel disadvantaged, for example; when there is a disaster caused by industrial developers in their area.

Environmental problems have also been faced by various countries in the world. Environmental problems such as in China which are caused by industrial development have faced various pressures such as shortages of resources, energy, environmental pollution, and economic recession (Jin, Peng, & Song, 2019; Yi & Xiao-li, 2018). The perspective on policy, environmental regulations is an important institutional factor in promoting sustainable development (Ramanathan, Ramanathan, & Bentley, 2018). A well-designed environmental policy can help increase competitiveness by carrying out various technological innovations as described in (Porter & Van der Linde, 1995). A flexible environmental policy by applying Porter's hypothesis can improve the company's economic performance (Jaffe & Palmer, 1997). Flexible environmental policy

instruments, such as pollutant disposal fees, environmental subsidies, emissions trading, environmental taxes, etc. To regulate the company's emission behavior through market signals and encourage to reduce the level of pollution so that pollution to society as a whole can be optimized (Hahn, 1984; Ramanathan et al., 2018). However, inflexible environmental policy tools, such as legally enforced standards, are not conducive to corporate innovation (Majumdar & Marcus, 2001; Ramanathan et al., 2018). Flexible and market-based environmental policies are the same as described in (Ramanathan et al., 2018). From the perspective of environmental policy practice, it is important for the government to adopt a flexible environmental policy so that environmental protection and economic development can be carried out.

The problem is whether flexible environmental management can achieve sustainable development with a technological approach. This can be pursued in two aspects so that sustainable industrial development can be realized. First, it must go through a technological approach. Second; must reduce high energy consumption, high emission, and high pollution. Environmental pollution caused by industrial development is a problem of negative externalities, because the costs of the ecological environment are not included in the industrial growth accounting system. The technological approach can minimize costs with maximum benefits (Hafezi & Zolfagharinia, 2018; Wang, 2018). In addition, environmental regulatory enforcement can positively moderate the relationship between flexible environmental policies and technological approaches due to market failures. The most important factors are environmental policy issues; environmental regulation enforcement so that it has influenced policy implementation as has been done by the Chinese government (Marquis & Bird, 2018). Some local ministries that make environmental regulations formally and produce fake documents have resulted in poor implementation of environmental policies and environmental pollution. Several studies have explained that the impact of environmental policy implementation depends on local institutional circumstances (Du & Li, 2019; Qi & Zhang, 2014). The technology approach directly determines the integration of industrial development in a sustainable manner (Sirmon, Hitt, & Ireland, 2007).

This research is a review from various sources, especially the *Analisis Mengenai Dampak Lingkungan* (AMDAL/Environmental Impact Assessment) document with the aim of studying the extent to which technological approaches in environmental management have been carried out so far. In addition, this paper aims to find out what technologies can be used to minimize the impact on society that is caused when construction is carried out.

Contributions that can be made from this research include such as an institutional point of view, the impact of flexible environmental policies on sustainable industrial development. The technological approach can explore the impact of flexible environmental policies, so that development is more dynamic in

a sustainable manner and enrich the study of hypotheses. Additionally, consider institutional scenarios to expand the conditions for hypothesis formation.

## **II. Literature Review**

It is very important to do an assessment of the environmental impacts caused by industrial companies or better known (AMDAL). In this way, the impact on society on planning the establishment of a business or industrial activity to be implemented can be minimized. Environmental impact analysis is the answer to community concerns about the negative impacts resulting from each activity, especially environmental pollution from industrial activities. The negative impacts that are often discussed in the AMDAL include community unrest with noise and vibration caused by heavy equipment when construction is actually carried out. In addition, community unrest regarding land acquisition used, environmental pollution and so on. However, this research specifically discusses the technological approach in environmental management. So that public unrest, especially noise and vibration when construction is carried out can be reduced.

### ***a. Noise***

Noise is a sound that can disturb the environment, causing a decrease in environmental quality. Loud noise from an activity can cause environmental and public health discomfort (Sunu & Putra, 2001). Disturbance factors caused by sound as described by (Maisonneuve, Stevens, Niessen, Hanappe, & Steels, 2009), which can be such as:

- a) The intensity, frequency and magnitude of sound originating from an activity  
For example; a very loud sound that can disturb and even cause hearing health for humans around the environment. Besides, it sounds with an irregular pattern due to the movement of an object.
- b) Sound source  
For example; noise caused by vehicle traffic or sound originating from aircraft.
- c) At the time of the sound  
For example; loud noise of an activity at night.
- d) Place/location of sound source  
The sound of an industrial or construction activity adjacent to residential and urban neighborhoods.

The noise that arises can reduce the health and comfort of the people who are close to the location of activities or sound sources. Therefore, the permissible noise limit is not to interfere with public health and comfort as recommended by the National Institute for Occupational Safety and Health (NIOSH). Activities that result in loud noise must require a study beforehand so that the community can be protected from continuous or intermittent noise. Everything from the

implementation of building construction will certainly generate noise because every construction carried out uses machines, materials and heavy equipment (Soemarwoto, 1999).

The noise threshold value set in Indonesia does not exceed 85 dBA as stated in the Circular of the Minister of Manpower, Transmigration and Cooperatives No. 1/1978. The standard noise level designated for an area/environment originates from activities as stated in the Decree of the State Minister for the Environment No. KEP-48/MENLH/11/1996 is shown in Table 1.

**Table 1.** The standard noise level determined (Kepmen LH, 1996)

<b>For the Region/Environment</b>	<b>Standard set (dBA)</b>
<b>1. For Populated Areas</b>	
Housing or Settlements	55
Trade and Services	70
Offices	65
Outdoor	50
Industry	70
Public/Government Facilities	60
Recreation areas	70
airport	*
Railway station	*
Seaports	70
Cultural heritage	60
<b>2. Activity Environment</b>	
Hospitals and the like	55
School	55
Places of Worship/Mosque/Tower	55

\*) adjusted to the provisions of the Minister of Transportation in 1996

*Source: Compilation of Regulations in the Field of Environmental Impact Control*

### **b. Vibration**

The State Minister for the Environment in his decree states that vibration is the back and forth movement of a mass through a state of equilibrium towards a reference point, whereas what is meant by mechanical vibrations is vibrations generated by human activity facilities and equipment (Kepmen LH, 2014). The magnitude of the vibration is expressed in terms of the square root of the acceleration in meters per second (m/sec<sup>2</sup> rms). The vibration frequency is expressed as revolutions per second (Hz).

Vibration or vibration, can be caused by air vibrations or mechanical vibrations such as machines or other mechanical tools, therefore it can be divided into 2 forms:

- a) Vibration due to air vibrations whose main influence is on acoustics.

- b) Vibration due to mechanical vibrations results in the occurrence of resonance/participation of the vibrations of the body organs and affects the organs of the body which are also mechanical in nature (Jumini, 2018).

The vibration level standard is the maximum allowable vibration level from a business or activity on solid media so that it does not cause disturbance to the comfort and health and integrity of the building. Likewise, the maximum level of train vibration should not interfere with the comfort and health of the surrounding community, when the train passes through the vibration it must be at a level not disturbing, so that it still guarantees comfort. This vibration level standard determination has been regulated in a Decree of the State Minister for the Environment No. KEP-49/MENLH/11/1996 is shown in Table 2.

**Table 2.** Maximum Limit of Vibration (Kepmen LH, 1996)

Frequency (Hz)	Vibration Level Value, in Microns ( $10^{-6}$ meter)			
	Do not disturb	Disturb	Uncomfortable	Painful
4	<100	100-500	>500-1000	>1000
5	<80	80-350	>350-1000	>1000
6,3	<70	70-275	>275-1000	>1000
8	<50	50-160	>160-500	>500
10	<37	37-120	>120-300	>300
12,5	<32	32-90	>90-220	>220
16	<25	25-60	>60-120	>120
20	<20	20-40	>40-85	>85
25	<17	17-30	>30-50	>50
31,5	<12	12-20	>20-30	>30
40	<9	9-15	>15-20	>20
50	<8	8-12	>12-15	>15
63	<6	6-9	>9-12	>12

Conversion:

$$\text{Acceleration} = (2 \pi f)^2 \times \text{deviation}$$

$$\text{Speed} = 2 \pi f \times \text{deviation}$$

$$\pi = 3,14$$

*Source: Compilation of Regulations in the Field of Environmental Impact Control*

### c. Air Pollution

Air pollution is one of the substances such as physical chemistry or biology in the atmosphere that has a dangerous amount to the health of humans, animals, plants and all other living things that can disturb comfort and damage various properties. The emergence of air pollution can be caused by several natural sources as well as from various human activities/activities. Some definitions that can be physically disturbing are radiation, light pollution and air pollution itself. Natural air can cause air pollution directly, locally, nationally and also on a global level.

Air pollution can be classified into several types including:

- a) Gas  
For example; Sulfur Dioxide (SO<sub>2</sub>), Hydrogen Sulfur (H<sub>2</sub>S), Aerosol Sulfate, Nitrogen Oxide (N<sub>2</sub>O), Carbon Monoxide (CO), Hydrocarbons, Vinyl Chloride and Mercury Vapor.
- b) Air pollution in the form of particles  
For example; minerals (inorganic) such as lead, mercury. Organic materials such as alkaline chlorination, hydrocarbons, benzene and living things such as worm eggs, bacteria and viruses.
- c) In addition, there is also outdoor air pollution and indoor air pollution.

### III. Research methodology

This study uses secondary data collected from several AMDAL documents related to the Environment. Meanwhile, the methods and data analysis used in this study are as explained one by one below:

#### a. Noise Analysis and Methods

The analysis for noise levels can be calculated using the formula as in equation 1. This is in line with the logarithmic ratio as stated by (Canter & Wood, 1996).

$$SPL = 20 \text{ Log}_{10} \left( \frac{P}{P_0} \right) \dots\dots\dots (1)$$

Where:

- SPL = Sound pressure level, in dBA
- P = Sound pressure, in μBar
- P<sub>0</sub> = Reference pressure = 0,0002 μBar.

The reference pressure (P<sub>0</sub>) was chosen as the reference because the sound pressure of 0.0002 μBar is the weakest sound that can still be received by the human ear at a sound frequency of 1,000 Hz. The intensity of noise that exceeds the allowable limit can affect psychophysiobiology in the form of anxiety, anxiety, insomnia, increased irritability, susceptibility to high blood pressure, heart disease, and so on. The main effects of noise in the workplace, among others, can cause work errors, reduce morale, accelerate fatigue, hinder communication, cause damage to the senses of listeners and can disturb the calm of the environment.

#### b. Vibration Method and Analysis

Equipment for measuring the level of vibration can use the following tools:

- a) Vibration catcher (Accelerometer or seismometer)
- b) Measuring instruments or vibration analysis tools (Vibration meter or vibration analyzer)
- c) Filter 1/3 octave or narrow band (1/3 octave filter or Narrow Band)
- d) Vibration level recorder (Level or X - Y recorder)

e) Analyzer for measuring vibration level (FFT Analyzer)

While the measurement of vibration on the object of research carried out can be done in several ways, such as:

First; Vibration for Comfort and Health;

- a) The vibratory catcher is implanted on the floor or surface that is vibrating, and connected to a vibration meter which is equipped with a filter;
- b) The measuring instrument is attached to the deviation. In the case of equipment: not equipped with that facility, a conversion of quantities may be used;
- c) Reading and recording is carried out for each frequency 4 - 63Hz or by sweeping by a vibration recording device;
- d) The measurement results of 13 data are shown in Table 2.

Second; Vibration for Building Integrity:

The measurement method is the same as the vibration measurement for human comfort and health, only the quantity used is the peak velocity.

*c. Methods and Data Analysis of Air Pollution*

The method for analyzing air pollution samples on each of the parameters studied were as follows: Lead (Pb) using the Dithizon method, CO using the titrimetric method with Iodine pentoxide, SO<sub>2</sub> using the West Gueka method and NO<sub>2</sub> using the Saltzman method. Furthermore, all samples collected at the research location are analyzed in the laboratory and compared with the quality standards set by the Ministry of Environment.

In addition, technology that can reduce the impact of noise and vibration can also use bore pile technology such as (Dry drilling and Wash drilling). Bore pile is another alternative if the location is very difficult or risky, when using a spoon pile. Such as the problem of mobilizing equipment, the impact on the surrounding environment (vibration, noise, etc.) and other conditions that can affect work activities.

Supported by experienced experts in the field of drilling and good workshops and complete tools for all fields, we provide drilling services for piles using the Bored Pile method.

## IV. Results

*a. Noise*

Based on the results of measurements and data analysis that have been carried out in this study, it shows that the noise level at the activity planning location is in the range (46.2 -50.2) dBA as shown in Table 3. These results are still included in the safe point category for residential areas compared with quality standards

stipulated in the Decree of the State Minister for the Environment No. Kep = 48 MENLH/11/1996 shown in Table 4.

**Table 3.** The results of the measurement of the noise level around the study site

Sampling Location	Coordinate point	Noise Level (dBA)
<b>Tower T-390</b>		
➤ Around the village road ± 100 meters	E= 95° 16' 28,57"	49,3
➤ Rice fields	N= 5° 30' 20,48"	
<b>Tower T-383</b>		
➤ Community garden area	E= 95° 16' 9,61"	50,2
➤ Around the township road	N= 5° 29' 12,54"	
<b>Tower T-378</b>		
➤ Hilly area	E= 95° 15' 48,75"	48,8
	N= 5° 28' 35,23"	
<b>Tower T-345</b>		
➤ Hilly area	E= 95° 15' 12,68"	46,3
➤ At a distance of ± 100 meters	N= 5° 24' 14,21"	
<b>Tower T-340</b>		
➤ Located in a hilly area and close to road infrastructure ± 100 meters	E= 95° 15' 34,97"	46,2
	N= 5° 23' 27,33"	

Noise is unwanted sound that can have a negative effect on humans. Sounds are mechanical waves/vibrations in air or solid objects that can still be picked up by normal human ears, ranging in frequency from 20 - 20,000 Hz. The quality of a sound is largely determined by its frequency and intensity. Frequency is the number of vibrations/second, while the sound intensity or level is the logarithmic ratio between the two sound stresses.

**Table 4.** Noise Quality Standards

Noise Level (dBA)	Environmental Criteria	Noise Quality Standards
More than 100	Too noisy (dangerous)	
71 to 100	Annoying and dangerous	70 dBA for regions industry
51 to 70	Do not disturb	55 dBA for region settlement
20 to 50	Does not raise	
0 to 20	noise	

**b. Vibration**

Vibration is the movement back and forth of a mass through a balanced state towards a reference point (PerMen LH No. 49 of 1996 concerning Vibration Level Standards). The measurement of vibration only takes place suddenly and momentarily so that the standard for the vibration level used is the standard for the shock vibration level. Based on the results of measurements of the initial

environmental baseline conditions, the location of the PLTA Kumbih-3 development plan (the border of Aceh - North Sumatra) has a vibration level of 0.2 mm/s to 0.4 mm/s shown in Table 5. When compared with the standard of instantaneous vibration level, the vibration condition is still within safe limits because it is below the maximum vibration speed. While the quality standards for the level of vibration are set as shown in Table 5.

**Table 5.** Results of Measurement of Vibration Levels at Research Sites

Measurement Location	Coordinate		Test results (mm/s)
	E	N	
Power House area	98°04' 32.912"	02° 36' 24.108"	0,2
Settlements	98° 06' 22,46"	02° 37' 41,790"	0,2
Intake	98° 06' 59,13"	02° 38' 59,13"	0,4

Information:

1. Designation and ancient buildings that have high historical value: 2 mm/sec
2. Buildings with existing damage, visible cracks in the walls: 5 mm/sec
3. The building is in good technicality, there are minor damage such as cracked plaster: 10 mm/sec
4. "Strong" buildings (e.g. industrial buildings made of concrete or steel): 10-40 mm/sec

### c. Air pollution

The air pollution parameters monitored in the planned location for the Kumbih-3 hydropower plant and their quality standards can be seen in Table 6. Air quality standards are regulated in Government Regulation Number 41 of 1999 concerning Air Pollution Control for Ambient Air Quality and KepMen LH Number 50 of 1996 concerning Odor Level Standards.

**Table 6.** Measured Parameters and Air Quality Standards

Parameter	Unit	Quality standards	Result	Information
SO <sub>2</sub>	µg/m <sup>3</sup>	900	52,70	1 hour-24 hour
NO <sub>2</sub>	µg/m <sup>3</sup>	400	21,70	1 hour -24 hour
CO	µg/m <sup>3</sup>	30000	377,91	1 hour -24 hour
NH <sub>3</sub>	ppm	2*	<0,061	1 hour -24 hour
H <sub>2</sub> S	ppm	0,02*	<0,004	1 hour -24 hour

National Ambient Air Quality Standards according to PPRI No. 41 of 1999

\*) According to the Minister of Environment Decree No. 50 of 1996

The analytical methods and tools used for monitoring can be seen in Table 6. The monitoring method was carried out by direct sampling in the field and continued with analysis in the laboratory. The location for environmental monitoring is the project site for the development plan of the Indonesian Art and

Culture Institute of Aceh and the location around residential areas. The National Ambient Air Quality Standard attached to Government Regulation Number 41 of 1999 has 13 test parameters, test parameters number 10 to 13, namely the total Flourides, Flour Index, Chlorine and Chlorine Dioxide, and the Sulphate Index only applies to industrial areas/areas Basic chemistry. Meanwhile, Oxidants (O<sub>3</sub>), Hydro Carbon (HC), PM<sub>10</sub>, PM<sub>2,5</sub>, Pb, and dust fall were not carried out, because particulates in the form of smoke, dust and vapor were very small in diameter (ranging from 1 μ to 500 μ) are secondary particulates, namely particles that are formed in the atmosphere from combustion gases that undergo physico-chemical reactions in the atmosphere, for example sulfate and nitrate particles formed from SO<sub>2</sub> and NO<sub>x</sub> gases (not fire-prone and industrial locations). In addition, the Pb parameter is also not tested, because Pb pollution in the air comes from organic Pb compounds found in gasoline fuel (gasoline used today no longer contains Pb). The location for environmental monitoring is the ISBI Aceh location and a location adjacent to residential areas. The results of monitoring ambient air quality around the activity location can be seen in Table 6.

## V. Discussions

The results of the noise level analysis from 5 (five) different locations were carried out in this study including; Tower T-390, T-383, T-378, T-345 and T-340 on the Calang (Aceh Jaya) - Meulaboh (Aceh Barat) transmission. The analyzed noise levels show that all of them are still below the quality standards set by the Ministry of Environment. The highest noise level was recorded at location T-383 of 50.2 dBA at coordinates E = 95 ° 16 '9.61 "N = 5 ° 29' 12.54", while the lowest noise level was found at location T-340 with coordinates E = 95 ° 15 '34.97 "N = 5 ° 23' 27.33". While the quality standard set for residential areas is 55 dBA and industry is 70 dBA. However, it is estimated that this noise level can increase during construction and during operations.

The results of the measurement of vibrations that are carried out only take place suddenly and momentarily so that the standard for the vibration level used is the standard for the shock vibration level. Based on the results of measurements of the initial environmental baseline conditions that around the location of the planned activity, the vibration level is 0.2 mm/s to 0.4 mm/s shown in Table 5. When compared with the standard instantaneous vibration level, the vibration conditions are still within the limits safe because it is below the maximum vibration speed.

The results of the measurement of air pollution that are monitored at the location of the activity show that it is still at a safe point or below the established quality standards shown in Table 6. However, these results can change significantly or increase when the activity has been carried out. So it is necessary for further monitoring so that air pollution that causes public health can be minimized.

Meanwhile, the results of the analysis of air pollution at different locations show that they are still below the quality standard set. The results of this measurement were also carried out on several parameters of ambient air quality, the condition of the air quality at the location of the planned activity was generally still below the required quality standards (Government Regulation of the Republic of Indonesia Number 41 of 1999 concerning Air Pollution Control). This shows that the air quality around the location of the planned Kumbih-3 PLTA (*Pembangkit Listrik Tenaga Air*/Hydroelectric power plant) development activity is still sufficient. The results of the full ambient air quality analysis are presented in Table 7.

**Table 7.** Air Quality in the vicinity of the activity location

Parameter	Location of Settlements	Intake Location	Quality standards	Power House	Unit
SO <sub>2</sub>	32	30	900 <sup>(1 Hour)</sup>	30	µg/m <sup>3</sup>
NO <sub>2</sub>	24	22	400 <sup>(1 Hour)</sup>	22	µg/m <sup>3</sup>
CO	3,208	3,093	30,000 <sup>(1 Hour)</sup>	2,864	µg/m <sup>3</sup>
Dust	70	65	- (1 Hour)	62	µg/m <sup>3</sup>
O <sub>3</sub>	38	34	235 <sup>(1 Hour)</sup>	34	µg/m <sup>3</sup>
HC	62	62	160 <sup>(3 Hour)</sup>	60	µg/m <sup>3</sup>
Pb	<0,08	<0,08	- (1 Hour)	<0,08	µg/m <sup>3</sup>

## VI. Conclusion

Based on the results of research that has been carried out for each category of noise, vibration and air pollution, the following conclusions can be drawn:

1. The noise level around the location before the activity was carried out was still at a safe point. However, when the activity has been carried out, it is predicted that noise will increase so that steps are needed to prevent the impact on the community.
2. The level of vibration is expected to disturb the comfort of the seat during the activity. To reduce the higher level of vibration can use several technologies as a damper or reduce the level of vibration.
3. Air pollution around the activity location is the peak of community unrest.

## VII. Suggestions

To reduce the impact of noise, vibration and air pollution that can cause human health and other living things, a technological approach can be done. Several technologies that can be used to reduce noise, vibration and air pollution include;

1. Use of damper bulkheads (carp or foam) in the construction area.
2. The use of bore pile foundations (dry drilling and wash drilling), which functions to reduce the vibration level during construction.
3. To reduce air pollution, it must be done through cooperation between all parties, both activists, the community and the government as policy makers.

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## Disclosure and Conflicts of Interest

All authors state that they are not known to compete for financial interests or personal relationships that could affect the work reported in this paper.

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