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The Study Of The Application Of Noise Mapping Using Golden Surfer Software To Control Noise

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ABSTRACT
Machines and equipment or work processes that make noise. Evaluation of noise intensity is carried out by making a noise map that describes the noise distribution pattern from 278 measurement points and then processed with surfer software, which then becomes basic information to protect workers from the risk of hearing loss. After measuring and analyzing the data, the noise level ranged from the lowest of 41.0 dBA, to the highest of 101.9 dBA. From the noise map, it can be seen that the main sources of noise are in the workshop area, corn intake & dryer area, generator area & bagging off area. Noise control efforts have been carried out by engineering controls, administrative controls in the form of work rotation, Standard Operating Procedures, training, safety signs and the use of ear protective equipment for workers in the form of earplugs and earmuffs.

Keywords: *noisemapping,noisecontrol,surfersoftware*

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1. INTRODUCTION
Industrial noise has long been a problem that until now has not been able to be handled properly, so that if it does not get more attention it can become a serious threat to the hearing health of workers. Therefore, the company must be able to overcome it by carrying out control measures, being able to identify the sources of noise correctly and taking corrective and preventive actions so that workers can be avoided from disturbances due to noise and can improve their optimal health status.

2. LITERATURE REVIEW
2.1. Definisi
According to permenaker no. 5 of 2018 (regulation of the minister of manpower and transmigration of the republic of indonesia no. 5 of 2018 concerning environmental occupational safety and health, 2018) noise is all unwanted sounds originating from production process tools and or work tools that are at a certain level can cause hearing loss.

2.2. Noise Source
Noise caused by the process of production machines (compressor machines, water pump machines, venting, steam drums, etc.) as well as the use of work equipment in the work process is caused by collisions and friction of work equipment, which are generally made of hard objects or metal. . Noise inside the building comes from plumbing, boilers, generators, air conditioners and fans. Noise outside the building comes from emergency vehicles, traffic and refuse collection.

2.3. Noise Type
a. Continuous noise with a wide frequency spectrum (steady state, wide band noise), for example noise from machines, fans, and others.

b. Continuous noise with a narrow frequency spectrum (steady state, narrow band noise), for example noise from circular saws, fan valves, and others.
c. Intermittent noise, for example noise from traffic, airplane noise, and others.
d. Impulsive noise (impact or impulsive noise), for example noise from hammer blows, gun shots, cannon explosions, and so on.
e. Repeated impulsive noise, for example a forging machine in a company.

2.4. Measuring Noise Level

The main tool in measuring noise is a sound level meter. This instrument measures noise between 30 – 130 dB and from frequencies from 20 –20,000 Hz.

2.5. Noise Threshold Value

Table 1 Noise Threshold Value

Exposure Time Per Day	Noise Intensity In dBA
8	85
4	88
2	91
1	94
30	97
15	100
7,5	103
3,75	106
1,88	109
0,94	112
28,12	115
14,06	118
7,03	121
3,52	124
1,76	127
0,88	130
0,44	133
0,22	136
0,11	139

2.6. Noise Effect

a. Disturbance in Health
b. Disturbance in Workability
c. Disruption at Work
d. Community Disturbance

2.7. Impact of Noise on Labor

a. Physiological disorders
b. Psychological disorder
c. Communication disorder
d. Balance disorders
e. deafness

2.8. Noise Control

a. Elimination

b. Substitution
c. Engineering Control
d. Isolation
e. Administration Control
f. Personal protective equipment

3. RESEARCH METHOD

3.1. Factory Layout or Map of PT. XYZ

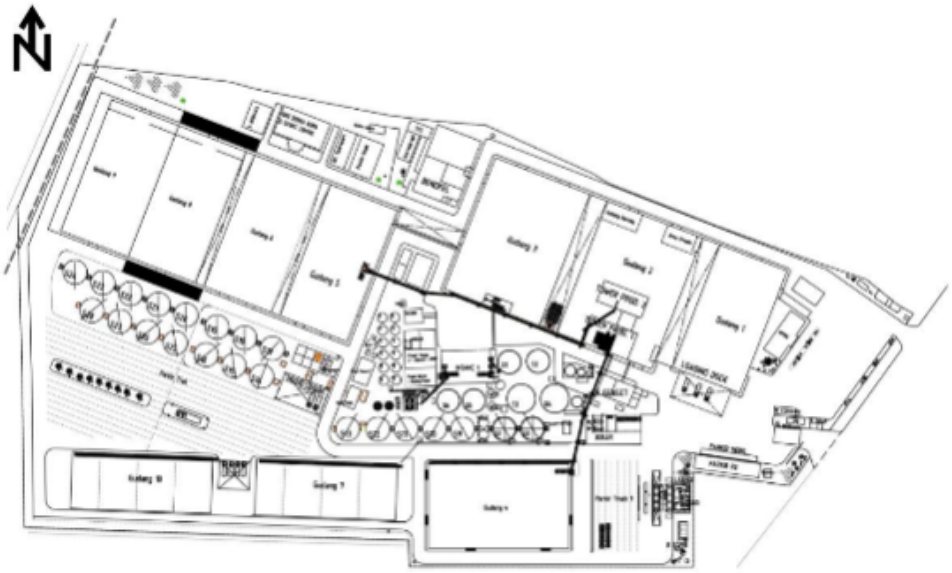

Figure 1. Layout or Map of PT. XYZ

PT. XYZ has a total land area of 13 hectares consisting of office buildings, production areas, raw material warehouses, finished goods warehouses and other supporting buildings. The following is a description of the image from the layout of PT. XYZ, as follows:

a. Office: An office building as a place for company administration
b. Warehouse Area
    1. Warehouse 1: Warehouse (Finished Goods), is a warehouse for storing feed that has been packed in sacks and is ready to be shipped.
    2. Warehouse 2: Consists of Warehouse (Finished Goods), Gudang Sack (a place to store sack materials), and Premix Area (a place for compounding vitamins/animal feed supplements)
    3. Warehouse 3: RAW Material Warehouse
    4. Warehouse 4: RAW Material Warehouse
    5. Warehouse 5: RAW Material Warehouse
    6. Warehouse 6: RAW Material Warehouse
    7. Warehouse 7 : Raw Material Warehouse
    8. Warehouse 8 : RAW Material Warehouse
    9. Warehouse 9 : RAW Material Warehouse
    10. Warehouse 10 : Raw Material Warehouse
c. Production Towers 1 and 2: Places for processing and mixing all feed ingredients until they are ready to be packaged
d. R. (Space) Genset : The location where there are 4 generator sets as back up
e. PLN electricity
f. Boiler: A room where there are 2 boilers each with a capacity of 5 tons and 10 tons
g. Intake 1: A place for unloading corn material to be sent and stored in a silo
h. Dryer: A place to dry corn before sending it to the production tower
i. S1 – S28 (Silo No. 1 to Silo No. 28): Tubular structure/storage used to store corn

j. Workshop: A place used for tool repair, welding, grinding and others to support production activities

3.2. Determination of Measurement Locations

Determination of the location for measuring the noise value is done using the help of the golden surfer software, namely by making a grid area of 20mx20m, and later the intersection of the horizontal (x) and vertical (y) axes will be used as the location of the measurement point.

3.3. Noise Level Measurement

Measurement of noise level using the grid method throughout the factory area with a distance of 20m x 20m, the number of measurement points obtained is 278 points. However, at the time of measuring the noise level, only 255 points can be collected for noise data, this is because the other 23 points are located in inaccessible areas, including in the electrical panel area, above the production machine, the silo area, there are piles of sacks/raw materials for production, etc. The following are the noise measurement points that will be carried out, which can be seen in the image below.

Figure 2. Noise Measurement Location Points

The green measurement point is the point where noise measurement can be carried out, while the red dot indicates the location is inaccessible and cannot be measured. The measurement location is obtained from the intersection of the horizontal line (x) with the vertical line (y).

Noise measurements are carried out at predetermined points and refer to SNI 7231–2009 concerning the Method of Measurement of Noise Intensity in the Workplace using a Sound Level Meter with the Leq (Equivalent Continuous Noise Level) function for 3 minutes at each point.

3.4. Data processing

Based on the data obtained from the measurement of noise intensity, then processing is carried out with the golden surfer program. The steps taken in data processing with the golden surfer program are as follows:

1. Create a noise measurement database in Microsoft Excel

The data needed to create a measurement database are in the form of horizontal line coordinates (x), vertical line (y) and measurement results (z). The measurement data on the Microsoft Excel worksheet can be seen in the image below

Table 1 Noise Measurement Database

Noise Sampling Measurement			
Sampling Point	Coordinate		Leq (dBA)
	X	Y	Z
1	360	90	49,7
2	390	90	49,9
3	420	90	52,4
4	450	90	53,2
5	480	90	54,4
6	510	90	61,2
7	540	90	62,1
8	570	90	58,8
9	600	90	52,3
10	30	120	49,2
11	60	120	49,0
12	90	120	48,6
13	120	120	48,6
14	150	120	50,9
15	180	120	54,0
16	210	120	55,1
17	240	120	54,1
18	270	120	54,9
19	300	120	55,3
21	360	120	64,3
22	390	120	50,8
23	420	120	50,3
24	450	120	50,4
25	480	120	51,6
26	510	120	63,9

The data x, y and z are located sequentially in columns B, C and D. These three data are arranged lengthwise as shown in the figure, then the file is saved under the name "Noise Measurement Database" to be processed later with golden surfer software and used as a measurement database.

2. Process the database and create a measurement data grid

The database that has been created with Microsoft Excel with the name "Noise Measurement Database" with formal .xlsx is mapped again based on the coordinates and measurement results. Steps to create a data grid in the golden surfer software. The following is a layout/map of the factory with the contours that have been merged and have been colored based on the noise intensity.

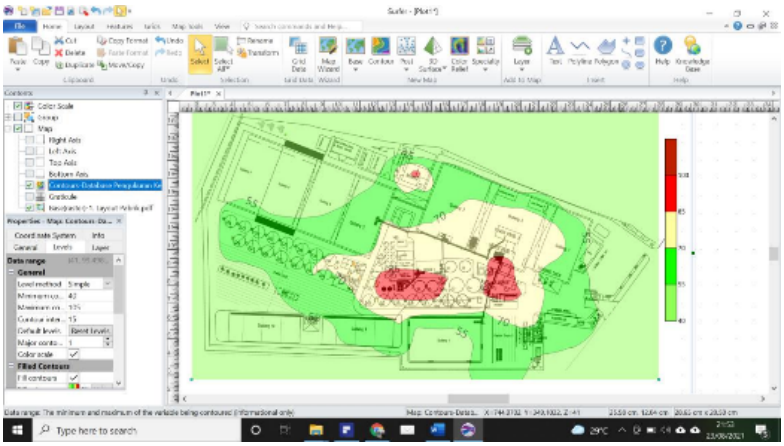

Figure 3. Noise Map Display with Color Based on Noise Intensity

4. RESULT AND ANALYSIST

4.1. Identify the Noise Source

After merging the factory map with the contour, the noise map is obtained which can be seen in the image below.

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Figure 4. Noise Map Display

Based on the results of the noise map above, it can be seen that areas with low to high noise intensity are distinguished by specific colors. Noise intensity between 40 dBA – 55 dBA is shown in light green, 56 dBA – 70 dBA in dark green, 71 dBA – 85 dBA in yellow, 86 dBA – 100 dBA in red and noise intensity over 101 dBA is shown with dark red.

The red area in the image has a noise intensity above 85 dBA, this area is assumed to be a zone where it is safe for workers to work with ear protection equipment including the workshop area, corn intake area & dryer and generator & bagging off area. The yellow and green areas are assumed to be safe zones to work without ear protection because in this area the machines and production equipment do not generate noise that exceeds the noise threshold that has been set based on the Minister of Manpower Regulation No. 5 of 2018 which is the maximum exposure for 8 working hours of 85 dBA.

Table 2. Data Tabulation of Noise Measurement Results at PT. XYZ

Number	Noise Level dBA	Frequency	Percentage (%)	Area Location
1	40 – 45	108	42,35	office, warehouse 10, warehouse 6, warehouse 8, warehouse 9
2	56 – 70	78	30,57	car parking, R2 parking, truck parking 1, warehouse 4, warehouse 7, warehouse 6, premix area, sack warehouse
3	71 – 85	55	21,57	warehouse 1, warehouse 2, warehouse 3, mosque, wet and dry silo, dryer
4	86 – 100	13	5,10	workshop, corn intake, dryer, bagging off
5	101 – 115	1	0,39	generator
sum	255	100		

Based on the data in the table above, it is known that 94.51% of the total area of PT. XYZ is a safe zone to work without PPE from noise hazards, while 5.49% is a safe zone with PPE ear muffs and ear plugs. The safe zones with this noise PPE include:

1. Workshop/workshop area, where welding machines, drilling machines, grinding machines, and so on are often operated in this area.
2. Corn intake area and dryer, in this area is the process where corn unloading is carried out, then corn is inserted into the dryer using a conveyor to be dried by steam from the boiler.
3. Genset area & bagging off area, generator area is an area where 4 diesel generator engines are used as a backup/backup of electricity if the supply from PLN electricity goes out, while the bagging off area is an area where feed is packed into sacks to become finished goods products, this area has a high noise intensity because

above the bagging off area is a production tower that contains machines to mix and print all raw materials into finished products.

4.2. Noise Control Effort

Noise hazard control at PT. XYZ is carried out in the workshop area, corn intake & dryer area and generator & bagging off area because the noise level in these areas exceeds the predetermined threshold value, which is more than 85 dBA. Noise hazard control in the area is carried out by engineering control, administrative control and the use of PPE (Personal Protective Equipment).

Engineering control is carried out to reduce noise exposure directly at the source, administrative control aims to keep noise exposure within safe limits upon acceptance by workers and the use of PPE (Personal Protective Equipment) is the last step taken if all hazard control efforts are carried out. the noise that is done does not reduce the intensity of the noise or it is not possible to do it.

Based on the results of measurements of noise intensity that have been visualized with a noise map, it can be clearly described which areas are unsafe zones to work without using PPE from noise hazards, including the workshop area, corn intake & dryer area, and generator area. & bagging off.

5. CONCLUSION

1. Safe zone with PPE from potential generation, namely in the workshop area, corn intake & dryer area, and generator & bagging off area.
2. The highest level is at point 114 with the highest intensity value of 101.9 dBA which comes from the sound of the diesel generator engine.
3. It appears that 94.51% of the total area of PT. XYZ is a safe zone to work without PPE from the dangers of use, while 5.49% is a safe zone with PPE earmuffs and earplugs.
4. Control efforts that have been carried out by PT. XYZ to reduce something that is a threshold with engineering control in the form of prevention of maintenance and installation of noise/barriers, administrative control of work rotation, manufacture and implementation of Standard Operating Procedures (SOP), conduct training and socialization of potential hazards on a regular basis, placing safety signs in areas with potential potential, and providing personal protective equipment from hazards in the form of earplugs and earmuffs for workers.

REFERENCES

[1] Christy, C.C. (2010). Dampak Faktor Bahaya Kebisingan Terhadap Tenaga Kerjadi Bagian Unit Power Plant Pusat Pendidikan dan Pelatihan Migas Bumi Cepu, Blora, Jawa Tengah.
[2] Departemen Tenaga Kerja. (1970). Undang Undang No.1 Tahun 1970 Tentang : Keselamatan Kerja. Sekretariat Negara : Jakarta.
[3] Fithri, P. (2015). Analisis Intensitas Kebisingan Lingkungan Kerja pada Area Utilities Unit PLTD dan Boiler (Studi Kasus PT. Pertamina RUII Dumai). Jurnal Sains Dan Teknologi Industri, 12 (2), 278–285.
[4] Heru, M.R. (2011). Pemetaan Tingkat Kebisingan Akibat Aktivitas Transportasi di Jalan Kertajaya Indah Timur-Dharma husada Indah Timur-Dharma husada Indah Utara. Jurnal Teknik ITS, 1.
[5] Kementerian Ketenagakerjaan Republik Indonesia. (1999). Keputusan Menteri Tenaga Kerja Republik Indonesia No.51 Tahun 1999 Tentang Nilai Ambang Batas Faktor Fisika Di Tempat Kerja.
[6] Peraturan Menteri Ketenaga kerjaan dan Transmigrasi Republik Indonesia No.5 Tahun 2018 tentang Keselamatan dan Kesehatan Kerja Lingkungan, (2018).
[7] Putra, P. (2009). Dampak Kebisingan Terhadap Kesehatan. http://wordpress.com
[8] Saputra, A., Defrianto, D., & Emrinaldi, T. (2015). Pemetaan Tingkat Kebisingan yang Ditimbulkan oleh Mesin Pengolah Kelapa Sawit di PT. Tasma Puja, Kabupaten Kampar-Riau. Riau University.
[9] Sasmita, A., Elystia,S., & Asmura, J. (2016). Evaluasi Tingkat Kebisingan Sebagai Upaya Pengelolaan Kesehatan dan Keselamatan Kerja (K3) di Unit PLTD/G Teluk Lembu PTPLN Pekan baru dengan Metode NIOSH. Jurnal Sains Dan Teknologi, 15 (2), 34–42.
[10] Setyorini, R. (2010). Gambaran Kebisingan Area Ammonia dan Pengaruhnya Terhadap Tenaga Kerja di PT Pupuk Kujang Cikampek.
[11] SNI, S.N.I. (2009). 7231-2009 tentang Metode Pengukuran Intensitas Kebisingan di Tempat Kerja.
[12] Soeripto. (1993). Penelitian Pembuatan Sumbat Telinga. Majalah Hygene Perusahaan Kesehatan Dan Keselamata Kerja, Ergonomi, Kesehatan Dan Keselamatan Kerja, XXVII.
[13] Sopiana, R. (2012). Pembuatan Peta Bising (Noise Mapping) dengan Software Golden Surfer Sebagai Upaya Pengendalian di PT.Pertamina (persero) Pabrik Aspal Gresik JawaTimur.
[14] Suharja, J., Hurlaela, R., & Tahir, D. (2013). Pemetaan Penyebaran Kebisingan yang dihasilkan oleh Mesin Pabrik PT. Semen Tonasa Pangkep. Universitas Hasanuddin.
[15] Suma'mur, P.K. (2009a). Higiene Perusahaan dan Kesehatan Kerja (HIPERKES). Jakarta : PT. Toko Gunung Agung, 116–132.

[16] Suma'mur,P.K. (2009b). Keselamatan Kerja dan Pencegahan Kecelakaan. Jakarta : CV Haji Masagung.
[17] Tarwaka, K. (2014). Kesehatan Kerja Manajemen dan Implementasi K3 di Tempat Kerja. Harapan Press, Surakarta.