The Analysis of Hearing Threshold Level of Noise Exposed Workers in Circulator Loom Unit

Analisis Nilai Ambang Dengar pada Pekerja Terpapar Kebisingan di Unit Circulator Loom

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ABSTRACT

Introduction: One of the hazards caused by the process of producing plastic sacks is noise. Noise is unwanted sound judged to be unpleasant, loud or disruptive to hearing. Noise is produced by machines used in the production process. Noise that exceeds the threshold limit value (TLV) at workplace can cause hearing loss. The purpose of this study was to analyze the hearing threshold level of workers who were exposed to noise in circulator loom unit at PT. Kerta Rajasa Raya Sidoarjo. **Method:** This was an observational study with a cross sectional approach. The population of this study was 47 workers, while the sample was the total population. The independent variable was noise, while the dependent variable was the hearing threshold level. Contingency coefficient was used to detemine the strength of correlation between variables. Noise intensity measurement at three points revealed that the value exceeded the time limit value. **Result:** Most of the workers were > 40 years old (72.3%), had work period of 15-20 years (51.07%) and never consumed ototoxic medication (80.85%). **Conclusion:** A moderate correlation between the noise intensity and hearing threshold level of right ear. However, the correlation between noise intensity and hearing threshold level of left ear is weak.

Keywords: hearing threshold level, noise, work characteristic

ABSTRAK

Pendahuluan: *Salah satu bahaya yang disebabkan dari proses pembuatan karung plastik adalah kebisingan. Kebisingan yang dihasilkan berasal dari mesin yang digunakan dalam melakukan proses produksi. Kebisingan adalah suara yang tidak diinginkan yang dinilai tidak menyenangkan, keras dan menganggu pendengaran. Kebisingan yang melebihi nilai ambang batas (NAB) ditempat kerja dapat menyebabkan gangguan pada pendengaran. Tujuan dari penelitian ini adalah menganalisis nilai ambang dengar pekerja yang terpapar kebisingan di unit circulator loom PT. Kerta Rajasa Raya Sidoarjo.* ***Metode:*** *Penelitian ini adalah penelitian observasional dengan pendekatan cross sectional. Populasi penelitian sebesar 47 pekerja dan sampel pada penelitian ini merupakan total populasi. Variabel independen penelitian adalah kebisingan Variabel dependen dalam penelitian ini adalah nilai ambang dengar (NAD). Analisa data untuk mengetahui kuat hubungan menggunakan Contingency Coefficient.* ***Hasil:*** *Pengukuran intensitas kebisingan di tiga titik menunjukkan nilai melebihi nilai NAB. Sebagian besar (72,3%) pekerja berumur >40 tahun. (51,07%) pekerja memiliki masa kerja 15-20 tahun dan sebagian besar (80,85%) tidak menggunakan obat-obatan ototoksik.* ***Simpulan:*** *Hubungan yang sedang antara intensitas bising dengan NAD telinga kanan, namun hubungan antara intensitas kebisingan dan NAD telingan kiri lemah.*

Kata kunci: *nilai ambang dengar, kebisingan dan karakteristik pekerjan*

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INTRODUCTION

According to the regulation of the Minister of Manpower concerning Occupational Health and Safety, Work Environment No. 5 of 2018 noise is all unwanted sounds come from the tools of production process and/or work, which at certain level can lead to hearing loss. It is always found in almost every company since all companies use tools and machines in production process. The main influence

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of noise towards workers' health at workplace is hearing damage. Hearing is one of five senses which has functions in communication and interaction. Progressive deafness is hearing loss that can be encountered by workers who were exposed to noise (Suma'mur, 2009).

Noise is a cause that can lead some influences on workers, one of them is physiological influences, namely internal body system, sleep patterns and hearing threshold. Threshold is the minimum sound intensity that is possible to hear by someone. Among many disturbances that can be caused by noise, the most dangerous interference is that it can cause hearing loss or deafness. This deafness can be progressive or initially temporary but if workers work continuously in a place that has high noise, the hearing power will disappear permanently or become Noise Induce Hearing Loss (NIHL) (Buchari, 2007). Noise can influence hearing threshold level, including two influences, namely temporary (physiological) and persistent (pathological) influences (Soeripto, 2008). One of noise influences at workplace is the decrease in threshold value until it leads to deafness. It can occur if someone is exposed to noise which exceeds threshold value of 85 dB during a period of time that exceeds the predetermined limit of 8 hours per day and 40 hours per week.

The World Health Organization (WHO) stated that in 2000, there were 250 million people in the world who had hearing loss and among 75-140 million people were in Southeast Asia. In Indonesia, it is estimated that there will be at least one million workers who are threatened to noise and it will continue to increase. In consultation meeting of WHO-SEARO (Southeast Asia Region al Office) Intercountry Meeting, it was stated that hearing loss caused by noise became the third most causes of hearing loss in Indonesia. According to Warou in 2016 who conducted study at PT. Maju Jaya Sejahtera Plywood, from 28 workers exposed to intensity of 88 dB and conducted measurement of hearing threshold level using audiometric tests, it revealed that 13 people (46.43%) had abnormal hearing threshold level on the left ear and 11 people (39.29%) were on the right ear at a low frequencies (250, 500, 1000 Hz). Therefore, it can be concluded that noise which occurs at workplace is a cause of the increase in hearing threshold level of workers.

PT. Kerta Rajasa Raya is a company that produces plastic bags. It is located on Raya Tropodo street No. 1 Waru, Sidoarjo District, East Java. Plastic bags produced by PT. Kerta Rajasa Raya consists of two types, woven bags with a capacity of 25-50 kg and jumbo bags with a capacity of 500 kg. This company uses machines in its work process which makes quite loud sound where they are operated by workers. Therefore, they will always be exposed by noise at workplace every day. The production process at PT. Kerta Rajasa Raya consists of several units, including extruder unit (smelting), circulator loom unit (yarn knitting), laminating unit, automatic bag machine unit, packing unit (sewing machines), warehouse unit, workshop unit (assembling and making machines), and maintenance unit contained in each section. The number of workers in the production department is 1500 and 200 are in the office. Most of machines involved in the production process of PT. Kerta Rajasa Raya can make noise. The circulator loom unit is a unit that has a high level of complexity, which is around 96 dBA. The noise in circulator unit comes from machines used to conduct the production process, where the number of machines in this unit are 116 and they can make sound with a high sound intensity. Every worker exposed to noise has the risk of hearing loss. A higher intensity of noise and the longer period of the workers exposure to noise make workers encounter higher hearing loss risk. In manufacturing and mining companies, 40% of workers are exposed to the high noise levels for more than a half of work time, construction sectors are 35%, and other sectors such as agriculture, transportation and communication are 20% (Ibrahim et al, 2016).

PT Kerta Rajasa Raya is one of companies in manufacturing sector whose production process produces sound that has noise intensity above NAB. It has never conducted periodic health examination for workers, such as medical examination. It is in accordance with the biggest potential danger that occurred to workers, where there is a condition of workers in circulator unit of PT Kerta Rajasa Raya Sidoarjo. They are not given hearing protectors even the noise intensity in the workplace is above noise threshold value at 85 dB. Therefore, it can be one of triggers which related to hearing loss. If this noisy condition continues to occur, it can lead to hearing damage that caused by workplace noise. It is necessary to measure the noise exposure level, so that it will not be dangerous to the workers' health including loss of hearing function since they exposed to workplace noise. From the description above, there was a case of the decrease in hearing

power of workers from noise intensity that exceeded specified TLV.

In accordance with the Minister of Manpower regulation number 5 of 2018 concerning transmigration on Occupational Safety and Health, Work Environment which states that the NAB noise is 85 dB with the length of exposure time of 8 hours per day and 40 hours a week. The effect of continuous exposure to noise can cause the decrease in hearing threshold level to workers. This study was conducted to analyze the correlation between noise intensity and hearing threshold level of workers at PT. Kerta Rajasa Raya Sidoarjo

According to the preliminary studies that have been conducted, PT. Kerta Rajasa Raya Sidoarjo has a low awareness towards the provision of hearing protection equipment for workers as personal control tool. In addition, they often complain of communication disruptions during work and never have medical examination which related to hearing thresholds at this company. Therefore, it is necessary to conduct study on factors related to hearing threshold level of circulator loom unit workers at PT Kerta Rajasa Raya Sidoarjo.

METHOD

This was an observational study with cross sectional design, where researchers conducted study directly in the work environment and without any treatment of objects of study or variables to be investigated according to dimensions of time by descriptive research design. It analyzed the correlation between noise intensity and hearing threshold level. This study aimed to analyze the factors related to hearing threshold level of workers exposed to noise in circulator loom unit at PT Kerta Rajasa Raya Sidoarjo. The independent variable in this study was noise intensity, while the dependent variable was hearing threshold level. This study was conducted from April to November 2018 in the circulator loom unit at PT Kerta Rajasa Raya Sidoarjo. The population was morning shift workers in the circulator loom unit. It was chosen because the quantity of work was mostly carried out on the morning shift. Therefore, the production machine produces more and the noise intensity is higher. The population in this study was 47 workers in the circulator loom unit at PT Kerta Rajasa Raya Sidoarjo.

The test used to analyze a strong correlation between the independent variables (noise) and hearing threshold level of workers in the circulator loom unit at PT Kerta Rajasa Raya Sidoarjo as the dependent variable was by using data processing applications with contingency coefficient test. This test was used to discover how strong the correlation between the independent variable which is noise intensity and the dependent variable which is hearing threshold value of workers in the circulator loom unit at PT Kerta Rajasa Raya Sidoarjo.

RESULT

The Result of Noise Intensity Measurement in Circulator Loom Unit at PT Kerta Rajasa Raya Sidoarjo

Noise intensity measurement was conducted in the circulator loom production area during work period when the machines were operating. It was conducted on 10 August 2018 at 09.00-10.00 WIB at 3 points. Measurement of noise intensity data in all three points were sequentially measured in each area, in which there were machines and workers doing their work. The tool used to measure noise intensity was Sound Level Meter (SLM). In noise intensity measurement, it was divided into 3 measurement points. The first point was in the operator's work area, the second was in the expedition area and the third was in the treatment work area. Noise measurement was conducted every 15 seconds for 25 minutes with a distance of 1 meter from sound source and also in the work area.

The result of noise intensity measurement from point 1 to 3 produced noise intensity above threshold limit value set by Minister of Manpower Regulation Number 5 of 2018 concerning Occupational Health and Safety, Work environment at point 1 revealed that noise intensity was 103.2 dB, while point 2 and 3 had 93.1 dB with a working time of 8 hours per day or 40 hours per week. The highest noise intensity was found in operator's work area, while the lowest was in the expedition and maintenance work area. Based on the results of the study, it was known that the noise intensity in PT Kerta Rajasa Raya Circulator Loom Unit was 103.2 dBA in the machine operator area, and 93.1 dBA in the expedition and maintenance area.

The noise intensity was received by workers for 8 hours every day. This indicated that all areas in PT Kerta Rajasa Raya's Circulator Loom Unit had noise intensity that exceeded the Threshold Limit Value (TLV) based on the Regulation of Minister of

Table 1. The Result of Noise Intensity Measurement in Circulator Loom Unit at PT Kerta Rajasa Raya Sidoarjo in August 2018

Unit	Noise Intensity (dBA)	Explanation
Operator	103.2	≥ NAB
Expedition	93.1	≥ NAB
Treatment	93.1	≥ NAB

Table 2. The Distribution Workers' Age of Circulator Loom Unit at PT Kerta Rajasa Raya Sidoarjo in August 2018

Age	Frequency (n)	Percentage (%)
< 40	13	27.2%
> 40	34	72.3%
Total	47	100%

Table 3. The Distribution of Work Period of Circulator Loom Unit Workers at PT Kerta Rajasa Raya Sidoarjo in August 2018

Years of Service	Frequency (n)	Percentage (%)
15-20	24	51.07%
21-26	20	42.55%
27-32	3	6.38%
Total	47	100%

Table 4. The Use of Drugs of Circulator Loom Unit Workers at PT Kerta Rajasa Raya Sidoarjo in August 2018

The use of Drugs	Frequency (n)	Percentage (%)
Yes	19	40.43%
No	28	59.57%
Total	47	100%

Table 5. The Hearing Threshold Level of Right Ear of Circulator Loom Unit Workers at PT Kerta Rajasa Raya Sidoarjo in August 2018

HTL of Right Ear	Frequency (n)	Percentage (%)
Normal	3	6.38%
Abnormal	44	93.62%
Total	47	100%

Manpower Number 5 of 2018 which is equal to 85 dBA for 8 working hours per day. For the intensity of noise in the expedition and maintenance area, which was 93.1 dBA, workers were only allowed to be exposed for 1 hour per day. Meanwhile, the intensity of noise in the machine operator area was 103.2 dBA, workers were only allowed to be exposed for 3.75 minutes per day. The high noise intensity in circulator loom unit at PT Kerta Rajasa Raya Sidoarjo was caused by the production machines that made very loud noises. The functions of machine in this unit is being a tool for knitting yarn into fabric, then the products are circular. It has a speed of 130-160 meters per minute and this unit has 170 machines. The type of noise in the circulator loom unit is intermittent. Someone who is often exposed to noise and exposed NAB is more susceptible to organ of corti damage. In addition, it subsequently leads to permanent deafness (Siswanto, 1991).

The measurement results showed that they were above the threshold limit value, so that workers who worked in noisy workplaces were only allowed to be exposed to the noise intensity with 85 dBA for 8 hours per day or 40 hours per week. Noise exposure with an intensity that exceeds the threshold limit value continuously and for a long period of time can cause workers to experience health problems (Regulation of Minister of Manpower, 2018).

The Characteristics of Workers in Circulator Loom Unit at PT Kerta Rajasa Raya Sidoarjo

The workers' characteristics become one of the factors related to hearing thresholds. There are several characteristics of workers, including age, work period and the use of drugs. The following is the result of the workers' characteristics in circulator loom unit at PT. Kerta Rajasa Raya Sidoarjo.

The Age of Circulator Loom Unit Workers at PT Kerta Rajasa Raya Sidoarjo

The distribution age of circulator loom unit workers at PT Kerta rajasa Raya Sidoarjo covers that most of circulator loom unit workers at PT Kerta Rajasa Raya Sidoarjo in August 2018 was at the age of > 40 years (72.3%). Meanwhile, the remaining workers at circulator loom units in Augusts 2018 would be < 40 years (27.2%).

In accordance with the result of study, it was known that the youngest workers age was 34 years old and the oldest was 60 years old. The age range of them in this study was divided into 2 categories. It was caused by when the workers were more than 40 years old, they were susceptible to hearing loss and increase of hearing threshold level. From 47

Table 6. The Hearing Threshold Level of Left ear of Circulator Loom Unit Workers at PT Kerta Rajasa Raya Sidoarjo in August 2018

HTL of Left Ear	Frequency (n)	Percentage (%)
Normal	2	4.26%
Abnormal	45	95.74%
Total	47	100%

Table 7. The Cross Tabulation of Noise Intensity with Hearing Threshold Level of Right Ear in August 2018

Noise (dB)	Hearing Threshold Level of Right Ear (dB)				Total		c
	Normal		Abnormal				
	n	%	n	%	N	%	
93.1	2	20	8	80	10	100	
103.2	1	2.7	36	97.3	37	100	0.278
Total	3	6.4	44	93.6	47	100	

workers, 13 workers were < 40 years old and 34 workers were > 40 years old. Therefore, there were 34 workers who had risk related to hearing loss.

The Work Period of Circulator Loom Unit Workers at PT Kerta Rajasa Raya Sidoarjo

Most workers had 15-20 of work period (51.07%). According to Table 3, the shortest work period of circulator loom unit workers at PT Kerta Rajasa raya Sidoarjo was 15 years, while the longest was 28 years. The vulnerable work period in this study was divided into 3 categories. There were 24 workers who had 15-20 years, 20 workers who had 21-26 years, and 3 workers who had 27-32 years.

The Use of Drugs of Circulator Loom Unit workers at PT Kerta Rajasa Raya Sidoarjo

Based on the use of drugs of circulator unit workers at PT Kerta Rajasa Raya Sidoarjo, 40.43% workers used them. From 47 workers, 19 of them used drugs which related to hearing threshold level. In accordance with questionnaire, it revealed that drugs used by workers were aspirin as pain killer and hypertension in a month. On the other hands, 28 workers did not use drugs which related to hearing threshold level.

Hearing Threshold Level of Circulator Loom Unit Workers in PT Kerta Rajasa Raya

Thresholds were measured for workers in a low, moderate and high frequencies using

Table 8. The Cross Tabulation of Noise Intensity with Hearing Threshold Level of Left Ear in August 2018

Noise (dB)	Hearing Threshold Level of Left Ear (dB)				Total		c
	Normal		Abnormal				
	n	%	n	%	N	%	
93.1	0	0	10	100	10	100	
103.2	2	5.4	35	94.6	37	100	0.109
Total	2	4.3	45	95.7	47	100	

Audiometry (Rion AA 67). Measurement was conducted in company's canteen since the room used in audiometric inspection process was a room with noise intensity of ≥ 55 dB. The inspection process followed the policies given by company, like measurement was conducted alternately before they began their work. The audiometric data were collected on 1-15 August 2018. Audiometric measurement was conducted by the Occupational Health and Work Safety Laboratory of Public Health Faculty which had competence. The result of hearing threshold level measurement of right and left ears of circulator loom unit workers at PT Kerta Rajasa Raya Sidoarjo can be seen in Table 4 and Table 5.

The hearing threshold level of the right ear of circulator loom unit workers at PT Kerta Rajasa Raya Sidoarjo was abnormal (≥25 dB) for most of the workers (93.62%). From 47 workers, there were 3 workers who had normal HTL of right ear, and 44 workers had abnormal hearing threshold level.

Hearing threshold level of left ear of circulator loom unit workers at PT Kerta Rajasa Raya Sidoarjo was abnormal (≥25 dB) for 45 people (95.74%). From 47 workers, there were 3 workers who had normal NAD of left ear, and 45 workers were not normal.

The results of direct observations made in the circulator loom unit found that there were no workers using ear protectors. Based on the results of interviews, the company has not provided ear protectors for workers as a personal control tool for noise.

The Correlation between Noise and Hearing Threshold Level of Circulator Loom unit workers at PT Kerta Rajasa Raya

Hearing threshold level of circulator loom unit workers at PT Kerta Rajasa Raya Sidoarjo which was tested statistically using data processing applications by chi-square test. From the result of statistical tests using chi-square, it revealed that

there was strong correlation between independent variable (noise intensity) and dependent variable (hearing thresholds level) that occurred in circulator loom unit workers at PT Kerta Rajasa Raya Sidoarjo. A moderate correlation between noise and HTL right ear were obtained from the result of contingency coefficient with a value of 0.278. It means that a strong value of correlation is included in a moderate category between noise intensity and hearing threshold level of circulator loom unit workers at PT Kerta Rajasa Raya Sidoarjo.

The measurement result of the intensity of 93.1 dB found that 8 workers (80%) had abnormal hearing threshold level of right ear, while the remaining (20%) was normal. Furthermore 103.2 dB of noise intensity (97.3%) was the highest abnormal hearing threshold level of right ear. According to the statistical test, the contingency coefficient obtained was 0.278. It revealed that noise had a moderate correlation to hearing threshold level of right ear of Circulator Loom unit workers at PT. Kerta Rajasa Raya Sidoarjo.

In intensity of 93.1 dB, all workers (100%) had abnormal hearing threshold level of the left ear, while the noise intensity of 103.2 dB (94.6%) was the highest abnormal hearing threshold level of left ear. In accordance with the statistical test, the Contingency Coefficient obtained was 0.109. It showed that noise had a weak correlation to hearing threshold level of left ear of Circulator Loom unit workers at PT. Kerta Rajasa Raya Sidoarjo.

DISCUSSION

The characteristics of Circulator Loom unit workers at PT Kerta Rajasa Raya Sidoarjo

In accordance with the result of study, there were 47 circulator loom unit workers at PT Kerta Rajasa Raya Sidoarjo, including 13 workers who were < 40 years old and 34 workers who were > 40 years old. The workers who were more than 40 years old had risk of deaf since the noise exposure exceeded TLV (Siswanto, 1991). Someone's hearing will gradually decrease according to the age. However, it depends on noise pollution or noise received throughout his/her life. According to Putra (2010), the increasing age of a person leads organ degeneration, including the function of auditory/ cochlear organs. In addition, it causes decrease of hearing threshold level if exposed to noise. The increasing age leads to the decrease of certain cells functions in inner ear.

Most of circulator loom unit workers at PT Kerta Rajasa Raya had 15-20 years of work period which was 24 workers, while 20 workers had 21-26 years, and 3 workers had 27-32 years of work period. The average of work period of circulator loom unit workers was classified into a long work period categories. According to Wahyu (2003) years of work can affect occupational diseases. The longer a person works in a place, the more likely the worker is exposed to physical and chemical work environment factors that can cause health problems/ occupational diseases so that it can result in a decrease in the efficiency and work productivity of a worker. According to Siswanto (1991) hearing loss can usually occurred after the workers have work period in a noisy workplace over 10 years. According to the result of study, all workers in the circulator loom unit have worked for more than 10 years and can encountered the risk of temporary and permanent deaf. Many studies have stated that hearing loss encountered by workers, who work in noisy environments for a long period of time, is usually someone who works for 5 years or more. Deaf caused by noise occurs gradually or requires time that depends on the noise received, beside it is based on someone's sensitivity to noise. Therefore, time has an important role in the correlation with hearing threshold level of workers (Putra, 2010).

Workers uses drugs that can cause hearing loss were antibiotics, cancer, pain killer, kidney, and hypertension drugs for a long period of time. Those drug can cause hearing loss or ear disorders for the consumers. From the result of study, there were 19 workers who consumed drugs and 28 workers did not.

According to Soetirto (2001), it was stated that there was decrease of hearing in NIHL at frequency of 3000 with 6000 Hz. Another opinion was also stated by (Soeripto, 2008), that deaf caused by noise occurred was at a frequency of 3000-6000 Hz and the greatest increase in hearing threshold was at a frequency of 4000 Hz. In this study, the highest increase in hearing threshold occurs at a low frequency of 500, indicating that it was caused by all workers had work period of more than 5 years. In addition, they exposed to noise every day for 8 hours per day. The noise exposed from the production room was stated to exceed the NAB. Therefore, it can be seen in the result that most workers have normal hearing threshold level. According to Siswanto (1991), if the increase in threshold occurs at frequency of 500, 1000, 2000 Hz, then communication at this level will become more difficult.

There is a number of activities that can be conducted to prevent and deal with hearing loss, like conducting hearing test which was regularly held, and also the company can conduct training about knowledge related to noise and the influence of noise on workers' health.

The Analysis of the Correlation between Noise Intensity and Hearing Threshold Level of Loom Circulator Unit Workers at PT Kerta Rajasa Raya Sidoarjo

Basically, the higher noise received by workers makes the higher risk of being affected by noise. A high noise intensity has direct influence on workers' health, even it directly can be related to hearing loss. The higher noise intensity in the workplace makes the greater potential danger that can be received by them. The noise intensity that exceeds NAB can cause hearing loss and relates to hearing threshold level. The measurement result using the Contingency Coefficient statistic test showed that there was correlation between noise intensity and hearing threshold level of right and left ear of circulator loom unit workers at PT Kerta Rajasa Raya Sidoarjo. This study is in line with Soeripto opinion (2008) that a high noise intensity can cause temporary or permanent decrease in hearing power.

This study is in line with similar study conducted by several researchers with significant results in study (Marselina, 2012) that there was a significant correlation between noise intensity and hearing loss of workers at PT X. In addition, in Jayanti study (2015) regarding the correlation between noise intensity and hearing threshold level at PT X, it showed that there was correlation between noise and hearing threshold level of the right and left ear, where there were 24 respondents (66.7%) who encountered hearing loss from 36 respondents in exposed group. According to Tjan et al (2013), it was stated that there was significant correlation between hearing loss and noise intensity, while Amalia et al (2012), said that there were influences between noise intensity in hearing loss degree and the influence of length of stay in hearing loss degree. Therefore, it was concluded that there was correlation between hearing threshold level of right and left ear of workers and noise in circulator loom unit at PT Kerta Rajasa Raya Sidoarjo.

A high noise intensity can lead direct influence on workers' health, it can even directly damage the hearing of workers. If some workers were exposed to longer noise and greater intensity, then it will cause deaf that cannot back to normal. This situation is called noise induced hearing loss. The higher the intensity received by workers, the higher risk received by the workers. According to Suma'mur (2009), noise intensity can be reduced by the use of ear protectors, like earplugs and earmuffs according to standardization. It is conducted as a personal control for workers to control noise received, so that it can reduce the risk of health problems encountered by them. After the APT distribution is evenly distributed, the K3 team of company should supervise the use of the APT since the work area has noise above the NAB. Beside the use of ear protection devices, the companies can also conduct training and education activities about dangerous and disruption programs conducted by the K3 team of company as an effort to prevent hearing loss as workers.

The efforts to conduct prevention and mitigation are required since all parts of unit have noise intensity in circulator loom unit at PT Kerta Rajasa Raya that exceeds the threshold value. It was set by the Regulation of Minister of Manpower No. 05 of 2018 concerning occupational health and safety, work environment that the recommended noise threshold for 8 working hours is not more than 85 dBA.

CONCLUSION

Noise intensity in circulator loom unit exceeded TLV which was in the operator area of 103.2 dBA, in the expedition area and maintenance of 93.1 dBA. Most of workers (72.3%) were > 40 years old. The workers (51.07%) had work period of 15-20 years and (59.57%) did not use drugs. There is a moderate correlation between noise intensity and hearing threshold level of right ear. In addition, there a weak correlation between noise intensity and hearing threshold level of workers left ear in the circulator loom unit at PT Kerta Rajasa Raya Sidoarjo.

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