Journal Homepage: -www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI:10.21474/IJAR01/ 9398
DOI URL: http://dx.doi.org/10.21474/IJAR01/9398
ISSN NO. 2320-5407

RESEARCH ARTICLE

WORK ENVIRONMENT FACTORS IN POLE AND LINE TYPE OF FISHING VESSELS THAT POTENTIALLY REDUCING THE HEALTH OF THE CREWS.

Monalisa Manuputty[1], Z. Fanani[2], Sri Andarini[3] and Harsuko Riniwati[4].

1. Faculty of engineering lecturer of pattimura university, ambon.
2. Postgraduate lecturer of brawijaya university, malang.
3. Faculty of medicine lecturer of brawijaya university, malang.
4. Faculty of fisheries and marine sciences lecturer of brawijaya university, malang.

Manuscript Info

Manuscript History
Received: 17 May 2019
Final Accepted: 19 June 2019
Published: July 2019

Key words:-
Private Profit, Competitiveness, Ministerial Regulation.

Abstract

The working environment in pole and line fishing vessels is influenced by physical factors such as vibration, noise and temperature and chemical factors in forms of dust particles and carbon monoxide (CO). The exposure of these work environment factors on the crews can affect and potentially reduce their health. The purpose of this study is to descriptively analyze the effect of work environment variables with the indicators of vibration, noise, temperature, dust particles and CO in the work environment on the health of the crew. The data collection was based on the measurements of vibration, noise, temperature, dust particles and CO on the ships that were the object of the research. In addition, the data of the health checks of the crew as respondents were also collected. The number of respondents were 127 people and the indicators of occupational health were the blood pressure, pulse and lung functions. The study was conducted on pole and line type of fishing vessels in Tulehu, Ambon Island. The result of vibration measurements on the vessels studied were 0.6 m/s^2 to 4.7 m/s^2. In the fishing section, the vibration level is in the range of Threshold Limit Value (TLV), which is 0.866 m/s^2, however the engine room and the crew's room is not in the TLV. The noise level on the work deck is in the range of 54 dB to 83 dB and still is below the TLV of 85 dB. In the crew's room there are 5 ships with the noise level below the TLV with a noise level between 54 dB to 85 dB and 6 ships with the noise level above the TLV of 86 dB and 87 dB. The limit value of temperature that is safe for work environment is between 27.5°C to 32.5°C, while the temperature measurement result on the ship found that the lowest temperature of the ship is 19°C and the highest is 38°C. The lowest temperature was measured at night and the highest temperature was measured during a day. The levels of dust particles in the crew's room and engine room are still within the threshold limit value of 230 $\mu g/m^3$. The CO level in the engine room with the highest value was 30,000 $\mu g/Nm^3$ still fulfills the required threshold limit value of 30,000 µg/Nm3 as well as in the crew's room is below the threshold limit value. The result of the blood pressure examination on 127 respondents, it is known that 63.99% of respondents experienced a

Corresponding Author:-Monalisa Manuputty.
Address:-Faculty of engineering lecturer of pattimura university, ambon.

health decline, in this case suffering from hypertension blood pressure disorder. Based on the results of pulmonary function examinations on 127 respondents, it was found that 36 respondents (28.35%) had normal pulmonary function while 91 respondents (71.65%) experienced a health decline in their lung function. The health decline suffered by them are a restrictive and obstructive pulmonary function disorder.

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Introduction:-

Based on the Regulation of Minister of Manpower Number 5 of 2018 concerning Occupational and Health at Work Environment, a workplace is any closed or open, movable or fixed room or field, where labor works or is often entered by workers for the purpose of a business and where there are sources or sources of danger including the room, field, yard and surroundings which are parts or related to the workplace. Fishing vessel is one of the moving workplace, and working as the crews in this vessel is a different job of land work. As the crews of a ship they must stay on the ship in the middle of the ocean for a long time with irregular working hours.

Unlike the work environment in general, the condition on fishing vessels are influenced by factors, such as, physics, chemistry, biology, ergonomics and psychosocial which can affect the safety and health of the crew. Physical factors in fishing vessels consist of vibrations, noise and high temperatures from the operation of the main engine as the propulsive force of the ship and auxiliary machines and other equipment in the engine room (HSA, 2014). The vibration and the noise from the engine room would transmit up to the decks and the crew room, thus made the crew members who assigned to work in the engine room are not the only one exposed to the vibration and the noise, but obviously the entire crews of those pole and line fishing vessels. The temperature exposed to the crews is the heat from the sun and the cold temperatures of the night, while the crews in the engine room would feel the temperature hotter because the temperature in the engine room is affected also by the actively operating engine.

The chemical exposure received by the crews who work in the engine room came from the fuel that was used to operate the engine and also from what remain from the combustion, like dust and carbon monoxide. Because the location of the crew room is quite adjacent to the engine room, therefore other crew members were exposed to the chemical while they were in the resting room.

According to Archer (2015) and OHSReps (2015) exposure to vibrations felt by crew members has risk in the cardiovascular system due to prolonged contact with the vibration of the entire body at frequencies below 20Hz, this can cause hyperventilation, increased heart rate, increased oxygen intake and respiratory rate. Lintong (2009) states that noise can cause various health problems such as increased blood pressure, impaired balance and hearing loss.

Hot environment and low level of humidity can cause hyperthermia, vasodilation, activation of sweat glands, increased blood circulation and changes in electrolyte sweat due to the loss of salt content. Increased room temperature also causes psychic disorders that occur suddenly such as concentration difficulty. This can also cause physiological disorders such as increased work of the heart and circulatory system.

The gas from the engine combustion contains various chemicals including carbon monoxide and dust which will be easily inhaled in human respiratory system. Subconsciously, the gas enter the respiratory and circulatory systems and surely it can cause damage even if it takes a long period of time. The dust that comes from the gases may interferes lung function such as respiration and ventilation disorders (Novitasari & Wijayanti, 2018).

Research Purpose:-

The purpose of this study was to determine the effect of the exposure of vibration, noise, temperature, dust and carbon monoxide on the health of the crews of pole and line type fishing vessels. The health conditions studied were blood pressure, pulse and lung function disorders.

Research Methods:-

This study uses a cross-sectional design that is examining respondents at one time and once to see the correlation between the variables. The analysis used is descriptive analysis which is part of the statistics and is used to describe data without intending to generalize or create conclusion but only explain the group of data.

The populations in this study were all crew members from 11 pole and line type of fishing vessels which were the object of the research with 127 samples of respondents or crew members. Because there are 11 pieces of ships studied with a total of 229 crew members so that the determination of the number of respondents from each vessel is calculated based on the proportional random sampling formula (Sugiyono, 2015).

$$n_1 = \frac{N_1}{N} \times n$$

Where:

n = total sample number
n_1 = desired number of samples
N_1 = population in a ship
N = total population

This research was conducted on pole and line type fishing vessels based in Tulehu Village, Ambon Island, Maluku Province. Measurements of vibration, noise, temperature and dust and carbon monoxide from the engine exhaust in the air workspace are carried out on the ships that are the objects of the research. Examination of blood pressure, pulse and lung function is carried out on the crew of the ships.

The variables in this study are work environment variables with the indicators such as vibration, noise, temperature, levels of dust and carbon monoxide and health variables with indicators of blood pressure, pulse and lung function. Based on the variables and indicators that have been determined, the data analysis scheme is made as in Figure 1.

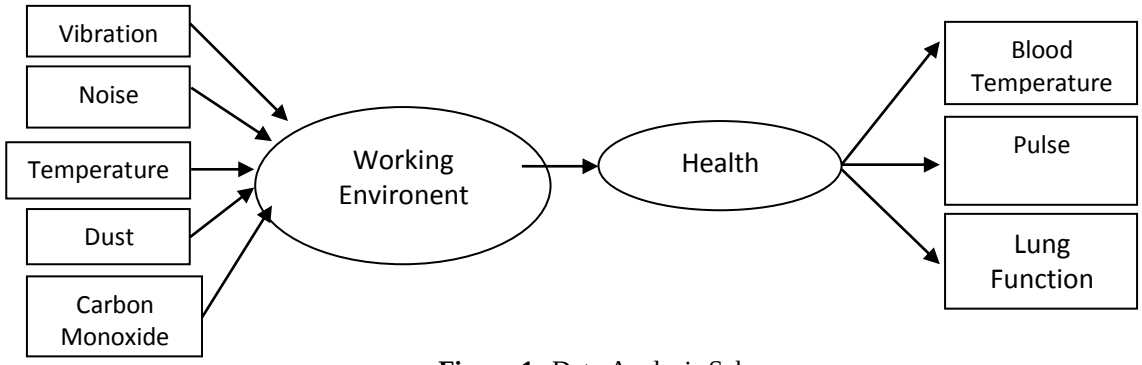

Figure 1:-Data Analysis Scheme

Measuring instruments used are Vibration Meter brand Smart Sensor AR 63B to measure vibration on the ship, Digital Sound Level Meter brand Smart Sensor AR214 to measure noise, Smart Sensor AR 867 to measure room temperature and workplace, Gas Sampler Type HTECH 05 of HAS brands for measuring the levels of dust and carbon monoxide, digital sphygmomano-meter of Omron brands to measure blood pressure and pulse and spirometry of Spirolab III brands and Color LCD of MIR Brands to measure lung function of respondents.

The data in this study are primary data obtained directly by measuring vibration, noise, temperature, levels of dust and carbon monoxide on the ship as well as the results of examination or measurement of blood pressure, pulse and pulmonary function performed on respondents.

Research Result And Discussion:-

Respondents in this study were 127 people who were crew members from pole and line type fishing boats based in Tulehu village, Ambon. All respondents are male. Based on their work specification on board, the respondents

consist of 5 skippers, 6 engine rooms heads (KKM), 2 steering officer, 2 KKM assistants, 8 bouy-bouy or feeders, 3 cooks and 101 anglers.

The results of the measurement of the work environment can be seen in table 1.

Table 1:-Results of Measurement of Work Environment Factors on Fishing Vessels Pole and Line Type

Measurement	Location					
	Work Deck		Engine Rooms		Crew's Room	
	Lowest	Highest	Lowest	Highest	Lowest	Highest
Vibration (m/s^2)	0,6	1,7	2,1	4,7	0,9	3,5
Noise (dB)	54	83	86	97	54	87
Temperaturre (°C)	20	38	32	39	22	37
Dust Particle ($\mu g/m^3$)			10,42	12,54	8,61	10,87
CO / Carbon Monoxide ($\mu g/Nm^3$)			27.000	30.000	19.000	25.000

Based on the measurement, the result shows the vibration on pole and line type fishing vessels that are the object of research is 0.6 m/s^2 which is the lowest vibration level in one particular side of the work deck and the highest was in the engine room, which is 4.7 m/s^2. The value of 0.6 m/s^2 is still below the specified threshold limit value (TLV) of 0.866 m/s^2 based on the Regulation of the Minister of Manpower Number 5 of 2018 concerning Occupational Safety and Health of the Work Environment. However, the results of measurements at other places from the work deck, vessel sub-rooms and engine rooms have a vibration level above the TLV standard.

The noise level on the work deck is in the range of 54 dB to 83 dB and it still meets the specified threshold value (TLV) of 85 dB. In the crew's room there are 5 ships with a noise level below the TLV with a noise level between 54 dB to 85 dB and 6 ships with a noise level above the TLV of 86 dB and 87 dB.

The threshold temperature in the airspace according to the Regulation of the Minister of Health of the Republic of Indonesia Number 70 of 2016 concerning Health Standards for the Industrial Work Environment is 27.5 ℃ up to 32.5 ℃, while the temperature measurement results in the lowest limit ship are 19 ° C and highest 38 ° C. The lowest temperature is measured at night and the highest temperature is measured during a daylight.

The level of dust particles in the crew's room and engine room is still within the threshold limit set in the Government Regulation of the Republic of Indonesia (PP RI) Number 41 of 1999, which is 230 $\mu g/m^3$. The CO level in the engine room with the highest value of 30,000 $\mu g/Nm^3$ still fulfills the required threshold value of 30,000 $\mu g/Nm^3$ as well as in the crew's room is below the threshold value.

Health checks on the crews as respondents was including examination of blood pressure, pulse, hearing power conditions, lung function and skin health. The results of the examination can be seen in the tables below.

Table 2:-Blood Pressure Check Result

No	**Blood Pressure**	**Respondent (person)**	**Percentage (%)**
1	Normal	47	37,01
2	Prehypertension	57	44,88
3	Level I Hypertension	20	15,73
4	Level II Hypertension	2	1,57
5	Emergency Level of Hypertension	1	0,79
	Amount	127	100

Respondents with normal blood pressure amounted to 47 people or 37.01% while respondents who experienced blood pressure disorders in this case high blood pressure or hypertension amounted to 80 people or 63.99%. Of the

80 people, 1 respondent experienced emergency hypertension with blood pressure 184/100 mmHg and 57 people still in the prehypertension level with blood pressure values ranging from 121 to 139 mmHg.

Table 3:-Pulse Rate Check Results

No	Pulse Rate	Respondent (person)	Percentage (%)
1	Slow	0	0
2	Normal	119	93,70
3	Fast	8	6,30
Amount	Jumlah	127	100

The pulse of most respondents is normal, only 8 people or 6.30% of respondents who experience a rapid pulse.

Table 4:-Results of Lung Function Examination

No	Lung Function	Respondent (person)	Percentage (%)
1	Normal	36	28,34
2	Light Obstructive	16	12,60
3	Medium Obstructive	3	2,36
4	Heavy Obstructive	0	0
5	Light Restrictive	46	36,22
6	Medium Restrictive	21	16,54
7	Heavy Restrictive	0	0
8	Combination	5	3,94
	Amount	**127**	**100**

In table 4, there are 36 (28.35%) respondents who have normal lung function and 91 (71.65%) people experience disruption in their lung function. Of the 91 people, 67 of them suffered mild to moderate restrictive lung function disorders or the difficulty of the lung to inhale and hold some air in the lungs during respiration. 19 respondents experienced a disruption in lung function and had difficulty when exhaling due to narrowing of the airways, namely mild to moderate obstructive pulmonary function. 5 of them experienced both the obstructive and restrictive disorders.

Discussion:-

Humans and the environment are closely related and there is always interaction between humans and the environment both as a place to live and the environment as a place to work. The term work environment is used to describe the condition around humans as operating workers. (Riadi, 2014).

In general, there are 5 (five) hazard factors in the work environment in terms of occupational safety and health aspects, including: physical hazard factors, biological hazard factors, chemical hazard factors, biomechanical hazard factors or ergonomics and psychosocial hazard factors. Workers can relate to the dangers of physics, chemistry, biology, ergonomics and psychosocial when carrying out their duties and responsibilities (ILO, 2000).
Based on Minister of Manpower Regulation Number 5 of 2018, what is meant by:

1. Physical factors are factors that can affect physical labor activities, caused by the use of machinery, equipment, materials and environmental conditions around the workplace that can cause work-related disorders and diseases in the workforce, including work climate, noise and vibration.
2. Chemical Factors are factors that can affect chemical labor activities, caused by the use of chemicals and derivatives in the workplace which can cause disease in the workforce, including chemical contaminants in the air in the form of gases, vapors and particulates.
3. Biological factors are factors that can affect labor activities that are biological in nature, caused by living things including animals, plants and their products and microorganisms that can cause occupational diseases.
4. Ergonomics Factors are factors that can affect labor activities, caused by mismatches between work facilities which include work methods, work positions, work tools, and lifting loads on labor.
5. Psychological Factors are factors that influence labor activities, caused by relationships between personal in the workplace, roles and responsibilities for work

6. Threshold Limit Value, hereinafter abbreviated as TLV (NAB, Nilai Ambang Batas), is the standard hazard factor in the Workplace as a time weighted average level that can be received by the workers without causing illness or health problems, in daily work for no time exceed 8 hours a day or 40 hours a week

Vibration is periodic motion or alternating motion of particles which causes almost all systems to be removed from equilibrium conditions and follow a force response which forces them to return to equilibrium conditions (The Editors, 2016). The vibrations felt on the ship are caused by rotating propellers, main engines and auxiliary engines. Vessel vibrations are also influenced by sea conditions when bumpy which causes vibrations in the entire ship and vibrations in the supporting beam (Carter & Schreiner, 2014).

Vibration measurements on the vessels studied showed results of 0.6 m/s^2 to 4.7 m/s^2. Based on the Regulation of the Manpower Minister Number 5 of 2018 concerning Occupational Safety and Health of the Work Environment the threshold limit value (TLV) for the whole body vibration is 0.866 m/s^2. In the engine room and crew's room, the vibration level is above the threshold limit value of 0.9 m/s^2 to 4.7 m/s^2. On the work deck there is one section that has a vibration below the threshold limit value of 0.6 m/s^2, which is in the fishing ground while in other parts such as the work floor above the bait and fish storage the catch is above the threshold of 0.9 m/s^2 to 1.7 m/s^2.

Sound is something that can be heard by the human ear. Undesirable sounds are called noise. Noise is one of the most common occupational health hazards. Noise can occur continuously, vary, intermittent or impulsive depend on how it is changing over time. Continuous sound is a noise that remains constant and stable for a certain period of time. The sound of the engine in a ship's engine room is relatively constant and can therefore be classified as continuous noise (OSHAnswers, 2017).

Most ships use diesel engines for their driving force. Based on engine speed, slow speeds cause relatively low noise levels and high speeds to produce maximum driving power and produce loud noise. The noise also generated from the rotation of the gears and the sound from the combustion process. Apart from the noise generated by the main engine, noise is also generated by auxiliary engines such as electric generators and the engines to drive the crane. The rotation of the propeller and the use of a ventilation system also cause noise on the ship. Noise levels on fishing vessel can reach up to 105 dB in some parts of the engine room (Carter et al. 2014)

It is known that based on the measurement results the noise level in engine rooms exceeds the TLV with a magnitude of 86 dB up to 97 dB, while the work deck still meets the TLV of 57 dB and 83 dB. In the vessels of 11 ships studied, 5 ships have noise levels below the TLV of 54 dB to 84 dB and 6 ships have a noise level above the TLV of 86 dB and 87 dB. The Government through the Minister of Manpower Regulation No. 5 of 2018 concerning Occupational Safety and Health of the Work Environment regulates the threshold limit value for noise is 85 dB.

Temperature is a quantity of physics that expresses subjective perceptions of heat and cold. The temperature of the hot or cold environment felt by workers is influenced by several factors, namely humidity, radiation heat, air velocity and physical activity. Humidity is the amount of water content in the air. In hot situations, high humidity makes people feel hotter than low humidity. If the air has high water content, sweat will not evaporate quickly to cool our body temperature. Cold air has low water content. Radiant heat is emitted by something warm around the workers such as sunlight, furnaces or heaters or work processes that emit heat. Wind speed or air speed in most situations can cool someone and will provide comfort in hot environments but not for cold conditions. The term ‘thermal comfort’ describes a person's sense of heat towards hot or cold temperatures (OSHA, 1998, ILO, 2013).

Although there are many ships that use air conditioning, but the engine room crew still exposed to the hot temperatures in their work space. Hot temperatures in engine rooms are produced, among others, by the operation of main engines and auxiliary engines, waste from the gas pipes, generators, steam pipes, and fuel heating tanks (Serbanescu, 2016).

The results of the temperature measurements on the ship on the work deck, engine room and crew's room are in the range of 19 ° C to 38 ° C. The lowest temperature is measured at night and the highest temperature is measured during the day. The threshold temperature in the airspace according to the Regulation of the Minister of Health of the Republic of Indonesia No. 70 of 2016 concerning Health Standards for the Industrial Work Environment is 27.5 ° C to 32.5 ° C. Especially for engine rooms, although there are many ships that use air conditioning or blowers, the

engine room crew still feels the exposure to hot temperatures in their work space. The crews on fishing boats are exposed to hot temperatures because they work in open workplaces exposed to direct sunlight.

According to Arifin and Sukoco (2009) the results of combustion due to the operation of the machine, commonly referred to as exhaust gas, contain several chemicals, including:

1. Carbon Monoxide (CO)
2. Sulfur Dioxide (SO_2)
3. The liquid gas in the form of liquid will seep into the solid phase, this gas is called Particulate Matter / PM.

These particles range in size from 100 microns to less than 0.01 microns. Particulates measuring less than 10 microns have an impact on air visibility because the particulates will fade the light. Based on their size, the particles are grouped into three, as follows:

1. 0.01-10 mm called smog / fog / smoke particles;
2. 10-50 μm called dust;
3. 50-100 μm is called dust.

In this study, the levels of dust particles and carbon monoxide (CO) were measured. The results of the measurement of the levels of dust particles in the crew's rooms and engine rooms were 8.61 μg / m3 to 12.54 μg / m3 still far below the threshold values stipulated in PP RI No.41 of 1999 namely 230 μg/m3. The CO level in the engine room with the highest value of 30,000 μg/Nm3 still meets the required threshold value of 30,000 μg / Nm3 while in the crew room the value of CO 25,000 μg / m3 is still below the threshold limit value.

Even though the job provides many economic benefits, there are hazards in the work environment that affect the performance, health and safety of the workers. Physical factors such as vibration, noise and temperature in the work environment can cause harm and affect the health of workers with or without contact. Chemical hazards are a type of occupational risk caused by exposure to chemicals in the workplace. Exposure to chemicals in the workplace can affect health acutely in the long term. There are many types of hazardous chemicals, including those that are neurotoxic, affect the body's immunity, affect the skin, carcinogens, reproductive poisons, systemic poisons, affect breathing, pneumoconiosis agents, and allergic reactions. This danger can cause physical and/or health risks. Depending on the type of chemical, the hazards involved can vary, so it is very important to know and apply the correct personal protective equipment while working (OSHA, 1998). Pollution of chemicals in the work environment is caused by a production process that produces chemicals or the use of chemicals in the production process. If chemicals in the work environment exceed the regulated threshold limit values can endanger workers and cause disease (Education Queensland, 2014).

The mechanical vibration felt by the crew is the whole body vibration delivered through the body parts that support the entire body such as the feet when standing on a vibrating floor. Vibration can occur in three translational directions and three-way rotation i.e. horizontally radiating from front to back (x axis), lateral radiating from right to left (y axis) and vertical (z axis) from top to bottom. Each axis together generally responds to vibration acceleration between 0.006 m/s^2 to 0.6 m/s^2 and vary depending on sea conditions, wind direction and worker position on the source of vibration (Jegaden, 2013 & ILO, 2013).

Vibration throughout the body can cause fatigue, insomnia, stomach/digestive problems, headache and unsteady feeling after or during the exposure. The symptoms are similar to those who travel by car or ship. After being exposed to several years, the vibration of the entire body can affect the body and cause a number of health problems. Research on bus and truck drivers exposed to vibration throughout the body found that whole body vibration exposure can contribute to a number of blood, intestinal, respiratory, muscular and spinal disorders. The combined effects of body posture, postural fatigue, dietary habits and vibration of the whole body are possible causes of this disorder. Other studies have shown that vibrations throughout the body can increase heart rate, oxygen uptake and respiratory rate, and can produce changes in blood and urine. Eastern European researchers have noted that exposure to vibrations throughout the body can produce overall pain feelings called "vibration disease." Many studies have reported a decline in performance that also occurs in workers exposed to vibration (OSH Answer, 2015)

Based on HSE (2015) workplace noise affects the human body in various ways, the most important is hearing loss, but working in a noisy environment can also have other effects. Noise exposure can cause two types of health problems, namely auditory effects and non-auditory effects. Despite hearing loss (auditory effects) is one of the

most common occupational diseases but it is often neglected because the effect is not really visible. It usually develops over a long period of time and does not hurt except in certain cases that are very rare. In the early stages of hearing loss above 2000 Hz which affects the ability to understand speech then affects the ability to hear sounds in general. Finally gradually lose the ability to communicate, socialize and respond to the environment. According to Luxson (2012 in Setiyanto, 2013) noise can affect the health of body functions which are non-hearing disorders including physiological disorders. High-pitched noise is very disturbing especially when it breaks or suddenly arrives. Disorders can include increased blood pressure, increased pulse, construction of peripheral blood vessels, especially on the hands and feet, and can cause paleness and sensory disturbances.

Hot work climate can cause additional burden on blood circulation. When doing heavy physical work in a hot environment, the blood will get an additional burden because it has to carry oxygen to the muscle part that is working. Besides that it must bring heat from the body to the surface of the skin. This is also an additional burden on the heart which must pump more blood. As a result of this, the pulse frequency will be even more increase (Purwaningsih & Aisyah, 2016).

Blood pressure means the power produced by the blood against each unit of blood vessel wall which is almost always measured in a millimeter of mercury. Blood pressure is a very important factor in the circulatory system. An increase or decrease in blood pressure will affect homeostasis in the body. Blood pressure is always needed for the thrust of the flow of blood in the arteries, arterioles, capillaries and venous systems, so that a permanent blood flow is formed (Rakhmawati, 2013).

There are 2 (two) important measurements in blood pressure, there are Systolic Pressure and Diastolic Pressure. Systolic Pressure is blood pressure when the heart beats and pumps blood. Diastolic Pressure is blood pressure when the heart rests between beats. To measure blood pressure, there is a tool called a Sphygmomanometer (Dickson, 2016). In healthy adults, the pressure at the top of each pulse, called systolic pressure, is around 120 mmHg. At the lowest point of each pulse, called diastolic pressure, the value is around 80 mmHg (Rakhmawati, 2013). Normal blood pressure is between 90 mmHg to 119 mmHg for systolic pressure while for diastolic pressure is around 60 mmHg to 79 mmHg. Systolic blood pressure below 90 mmHg is categorized as Hypotension / Hypotension or low blood pressure, 90 - 120 mmHg is normal blood pressure, 121-140 mmHg is categorized as prehypertension, 141 - 159 mmHg is categorized as level 1 high blood pressure or level 1, 160 - 179 mmHg is categorized as level 2 hypertension, whereas above 180 mmHg is categorized as emergency hypertension (Dickson, 2016).

Pulse is a vibration or pulse of blood in the arteries due to contraction of the left ventricle of the heart. The frequency of pulse rhythms or heartbeats can be palpated (palpated) on the surface of the skin in certain places. The place to feel the pulse is: the front of the wrist above the base of the thumb (radial artery), the left / right front of the sterno cleido mastoidues muscle (carolian artery), the left chest in the apex of the heart (Artery temparalis) and in the temple. Normal heart rate when resting in Beats per Minute for adults is 60-100 (Liana, 2012). Changes in pulse are often used as a basis for physical fitness tests, where changes that little or no change indicate good regulation of the circulation system, while a marked decline or increase is a sign of poor adjustment of this system (Astuti, 2016).

Based on the results of blood pressure checks on the crew of pole and line type fishing vessels that were the object of research, it was found that respondents with normal blood pressure were 47 people or 37.01% while respondents who experienced blood pressure disorders in this case high blood pressure or hypertension amounted to 80 people or 63.99%. Of the 80 people, 1 respondent experienced emergency hypertension with blood pressure 184/100 mmHg and 57 people still in the prehypertension level with blood pressure values ranging from 121 to 139 mmHg. The results of the examination of the pulse of 127 respondents, most of the respondents (119 people) had a normal pulse, only 8 people or 6.30% of respondents who experienced a rapid pulse. From the results of an examination of 127 respondents, 63.99% of respondents obtained a decline in health in this case a disturbance in blood pressure.

Some studies state that physical factors in the work environment such as vibration, noise and temperature affect the blood pressure and pulse of workers. Kumar, et al (2014) stated that blood pressure has increased at a noise level above 70 dB while the pulse is in the normal range. Wang, et al (2013) stated that noise exposure in the work environment has a positive relationship with hypertension. Setiyanto (2013) stated that noise exposure significantly influences the increase in the pulse of workers. According to Singhal, et al (2009) and Kalantary, et al (2015) noise exposure provides a significant change in the increase in systolic blood pressure, diastolic blood pressure, arterial pressure, pulse pressure and heart rate. Siagian (2012) examined the effect of vibration on blood pressure and pulse

and stated that vibration exposure increases blood pressure and pulse. The higher the frequency of vibration, the blood pressure and pulse increase. The results of the Parameswarappa & Narayana (2014) study showed that the core temperature of workers exposed to heat in the work environment exceeded the limits determined by ACGIH rules and the correlation between heat temperature in the work environment and body core temperature was significant while blood pressure and pulse were higher workers who work at high temperatures compared to workers who work at lower temperatures. According to Purwaningsih & Aisyah (2016) the temperature of a hot work environment has an effect on changes in the pulse of workers.

The air quality in space greatly affects humans because most humans spend 85-90% of their time in open space. The presence of air pollutant is produced from natural processes and human activities. The contribution of air pollutant due to human activities comes from immovable pollutant sources such as office, industrial, and mobile sources such as motorized vehicles (Oktaviani & Prasasti, 2015).

According to Wardhana (2007 in Oktaviani & Prasasti, 2015) the presence of excessive amounts of dust particles in the air resulted in air pollution. Air pollution is the presence of materials, substances, or other components in the air that cause changes in air composition. Mukono (2003 in Oktaviani & Prasasti, 2015) stated that the impact of air pollution can occur in various aspects of life. Air pollution will cause acid rain and accelerate global warming in the atmosphere. If viewed from an economic point of view, air pollution will increase the cost of maintaining tools and buildings and the cost of treating the disease due to pollutant exposure. The impact of air pollution in terms of health will lead to the emergence of acute and chronic diseases.

In addition to chemicals such as asbestos and PAH, exhaust gases from engine combustion products contain various chemicals such as CO and SO2 and dust that will be easily inhaled. Without realizing it, exposure to the exhaust gas enters the respiratory and circulatory systems so that it can cause damage even if it takes a long time. Dust from exhaust gases can reduce lung function and the symptoms of being exposed to dust could be like cough and heavy breathing (Novitasari & Wijayanti, 2018).

Dust particles have several size variations and are composed of many materials and chemical elements. One of the particles that can enter the respiratory tract is $PM_{2,5}$. Based on its size particles are divided into two categories, namely particles less than or equal to 10 microns and particles less than or equal to 2.5 microns. Based on the aerodynamic diameter of dust particles consisting of PM_{10}, $PM_{2,5}$, dan $PM_{0,1}$. Particle size can be directly related to the potential causes of health problems. Particles contained in air generally have a size of 0.1-50 microns or more. Particles that have a diameter of 2.5 microns or less can cause air pollution and have a significant impact on health. $PM_{2,5}$ is a particle that has a diameter of 2.5 microns or is called a fine air particle. Inhaled $PM_{2,5}$ can affect human health. These particles enter the alveoli and can cause an inflammatory reaction that can cause respiratory complaints to impair lung function. $PM_{2,5}$ is very dangerous for human health because these particles can penetrate the deepest parts of the lungs, cardiovascular diseases and even death (Oktaviani & Prasasti, 2015). Dust particles that are at the work site can potentially enter the respiratory tract through the nose and mouth so that it can cause respiratory complaints. Exposure to excessive amounts of dust particles can have an impact on human pathological damage. However, this damage depends on the nature, intensity, duration of exposure, and individual vulnerability (Ekowati, 2012).

Judging from its effect on human health, pollution in the form of particles such as dust with a size of more than 2.5 microns is relatively lighter because humans have anatomically protective abilities such as nose hair, mucus in the throat and cough reflexes so that only dust with $PM_{2,5}$ only which can reach the lung cavity (alveoli). While pollution in the form of gases, such as CO, SO2, NO, directly reaches the lung cavity and dissolves along with other air components lifted to the blood and spreads widely into the body (Sari, 2013).

Lung function disorder consist of respiratory and ventilator disorders. Ventilation disorders are divided into two groups, namely obstructive and restrictive ventilation disorders. Obstructive ventilation disorders are ventilator disorders due to slowing of expiratory air flow. This decrease in air flow due to narrowing of the airway causes a decrease in the value of the first seconds expiratory volume or VEP1. Spirometer tests in obstructive ventilation disorders are characterized by VEP1 values smaller than 80% prediction and VEP1 / KVP (forced vital capacity) values smaller than 75%. Light weight division of obstructive disorders based on VEP1 / KVP values. Mild obstructive disorders have VEP1 / KVP values between 74% and 60%, moderate obstructive disorders have VEP1 /

KVP values between 59% and 30%, and severe obstructive disorders have a smaller VEP1 / KVP value of 30% (Maryko, et al, 2017)

Restrictive ventilation disorders are impaired ventilation due to disruption of lung development by any cause. This limitation of lung development causes a decrease in KVP. In the test the restrictive ventilation disorder spirometer was characterized by a vital capacity value (KV) smaller than 80% of predictions or KVP smaller than 80%. Light weight division of restrictive disorders based on KV or KVP values. Mild restrictive disorders have a KV or KVP value between 79% and 60%. Moderate restrictive disorders have KV or KVP values between 59% and 30%, and severe restrictive disorders have a KV or KVP value smaller than 30% (Maryko, et al, 2017).

Based on the results of examination of pulmonary function in respondents using spirometer found that 36 (28.35%) of respondents had normal lung function and 91 (71.65%) of people had problems with their lung function. Of the 91 people, 67 of them suffered mild and moderate restrictive lung function disorders or disorders of the lungs that had difficulty inhaling and holding some air in the lungs during respiration. 19 respondents experienced a disruption in lung function that had difficulty when exhaling due to narrowing of the airways, namely mild and moderate obstructive pulmonary function. 5 of them experienced both the obstructive and restrictive disorders.

Although the results of measurements of dust and CO levels in the vessels studied showed values below the TLV but the results of examination of lung function in the crew showed 71.65% of the crew experienced a decline in health due to interference with their lung function. According to Suyono (1995) exposure to 2.5 micron size of dust that is continuously inhaled while working can cause detectable diseases in 5 to 15 years. Whereas, contact with CO at high concentrations can cause death, but contact with CO at relatively low concentrations can interfere with health. The results of the Lippmann (2009) study show that there is an increasing number of complaints by people experiencing heavy breathing by 10% caused by exposure to dust from motorized vehicles. Damri's (2016) study showed that CO caused illness to the parking attendants and as higher the concentration of CO exposure, the stronger the pain of parking attendants during work. Carbon monoxide (CO) is a kind of gas that is colorless, odorless and tasteless. CO gas mostly comes from burning fossil fuels with air in the form of exhaust gases. Motorized vehicle emissions contribute nearly 70.5% of carbon monoxide (CO) which will have a bad effect especially on the respiratory system (Novitasari & Wijayanti, 2018) .

The pathological and clinical consequences of exposure to dust particles vary greatly. The manifestation of the disease can be influenced by several factors such as the nature of dust, intensity, length of exposure, and individual vulnerability. The respiratory organs exposed to these particles will also respond differently depending on the chemical properties of the material, the physical properties, and the toxicity of dust particles found in the work environment (Oktaviani & Prasasti, 2015).

Conclusions And Recommendations:-

Conclusion:

1. Vibration measurements on the vessels studied showed results of 0.6 m/s2 to 4.7 m/s2. In the engine room and crew's room, the vibration level is above the threshold limit value (TLV), which is 0.9 m/sec2 to 4.7 m/s2. On the work deck there is one section that has a vibration below the threshold limit value of 0.6 m/s2, which is in the fishing ground while in other parts such as the work floor above the bait and fish storage the catch is above the TLV of 0, 9 m/s2 - 1.7 m/s2.
2. It is known that based on the measurement results the noise value in the engine room exceeds the TLV with a magnitude of 86 dB up to 97 dB, while the work deck still meets the TLV which is 57 dB and 83 dB. In the vessels of 11 ships studied, 5 ships have noise levels below the TLV of 54 db - 84 db and 6 ships have a noise level above the TLV of 86 dB and 87 dB.
3. The results of temperature measurements on the ship on the work deck, engine room and crew's room are in the range of 19 ° C to 38 ° C. The lowest temperature is measured at night and the highest temperature is measured during a daylight.
4. The results of the measurement of the levels of dust particles in the crew's rooms and engine rooms are 8.61 µg / m3 to 12.54 µg / m3 still far below the threshold limit values stipulated in PP RI Number 41 of 1999 which is 230 µg / m3. The CO level in the engine room with the highest value of 30,000 µg / Nm3 still meets the required threshold limit value of 30,000 µg / Nm3 while in the crew room the value of CO 25,000 µg / m3 is still below the threshold value.

5. The results of blood pressure checks on respondents with the pole and line type fishing boat crew who became the object of research, found respondents with normal blood pressure amounted to 47 people or 37.01% while respondents who experienced blood pressure disorders in this case high blood pressure or hypertension amounting to 80 people or 63.99%. Of the 80 people, 1 respondent suffered from emergency hypertension with blood pressure 184/100 mmHg, 57 people were still in prehypertension level, 20 people suffered from hypertension level one and 2 people suffered from hypertension at the second level.
6. From the results of examination of blood pressure on 127 respondents, it is known that 63.99% of respondents experienced a health decline in this case suffering from hypertension blood pressure disorders.
7. The results of the examination of the pulse of 127 respondents, most of the respondents (119 people) had a normal pulse, only 8 people or 6.30% of respondents who experienced a rapid pulse.
8. Based on the results of pulmonary function checks on 127 respondents using spirometry found 36 (28.35%) respondents had normal lung function and 91 (71.65%) people experienced a decrease in their health in their lung function. The decrease in health suffered is a restrictive and obstructive pulmonary function disorder. Restrictive is a disorder of the lungs that has difficulty developing and holding a certain amount of air in the lungs during respiration, while obstructive is a disorder of lung function which has difficulty when exhaling due to narrowing of the airways. 16 respondents experienced mild obstructions, 3 people had moderate obstructive, 46 people experienced mild restrictions, 21 people had moderate restrictiveness and 5 people experienced a combination of obstructive and restrictive.

Suggestion:

1. Ship owners are advised to improve the working environment on their vessels to reduce vibration and noise levels to match the prescribed Threshold Limit Value (TLV) by adding needed device to reduce the noise and vibration from the ship's engine.
2. Ship owners are advised to provide periodic health checks to the crew so that work-related diseases can be detected and be given appropriate treatment.
3. Ship crews are advised to use personal protective equipment in accordance with the type of work to reduce the impact of exposure to their work environment on their health.

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