Risk Analysis of Musculoskeletal Complaints with Rula Method in Chemical Company

B A Aziz¹, L Handoko² and A I Juniani²

¹Study Program of Safety Engineering, Marine Engineering Department, Shipbuilding Institute of Polytechnic Surabaya, Jl. Teknik Kimia, Kampus ITS, Sukolilo, Surabaya 60111, Indonesia
²Study Program of Design Manufacture, Marine Engineering Department, Ship building Institute of Polytechnic Surabaya, Jl. Teknik Kimia, Kampus ITS, Sukolilo, Surabaya 60111, Indonesia

lukmanhandoko@gmail.com

Abstract. Office workers seem trivial, not many people have aware of occupational diseases risk, office workers who most are computer users in their daily work. Often the symptoms are ignored, most people assume that it is due to ordinary fatigue whereas things it is the beginning of the onset of occupational diseases. Muscle receive static load repeatedly in a long time, will be able to cause complaints of damage to joints, ligaments, and tendons. In this study, the method is RULA that shows a very high and moderate risk level. From the results, such assessments are used as a basis for applying improvements facilities at work. Design through to a table and a chair by analysing anthropometry, it is anticipated that analysis ergonomics and analysis of the redesigning. They used this application for reasonable enough CATIA. That is in pop up based on observation, so it can be an alternative redesigning and possible to reduce the potential of any disease, from behind their backs and purchased operator local control room, publicly listed heavy duty equipment operators affected by the policy and office workers.

1. Introduction
This research was conducted on office workers, where the work looked normal, but it turned out that the impact was huge. In this study using a combination of RULA and CATIA and using the Indonesian population as a sample. Where this theme is rarely discussed because office work looks ordinary and does not have a high level of work risk so that it is considered a job that is free from occupational diseases.

Musculoskeletal Complaints are complaints on the part of the skeletal muscle that is felt by a person from very mild complaints to very painful. If the muscle receives constant static load for a long time, it can cause complaints in the form of damage to the joints, ligaments, and tendons.

Office workers are more comfortable to be exposed to discomfort and pain at work. The occupational risk factors are the most significant factors to this health problem, and it can be found in many industries. MSDs can degrade the health of the workers thus reduces the workers' performance in completing their tasks. Several kinds of literature had suggested that the effect of low performance by the workers can have significant economic and social consequences.

Rapid Upper Limb Assessment (RULA) is a method used to measure musculoskeletal disorders risk factors in the neck and upper body. Mc Atamney and Corlett developed the RULA from the University of New York Institute of Occupational Ergonomics, the United Kingdom in 1993 [1].
RULA itself is used to calculate ergonomic risk factors in jobs where the work is doing much work in a sitting position or standing without any movement. RULA is also used to calculate risk factors in the form of posture, power or load, static work and repetitions carried out at work.

The Nordic Body Map Method (NBM) is different from the RULA method. This method is a method used to assess the severity of the occurrence of a skeletal muscle disorder or injury. In its application, the Nordic Body Map method is done by using a worksheet in the form of a body map that is very simple, easy to understand, inexpensive, and requires a short time for each. The Observer can directly interview or ask the respondent about which skeletal muscles are experiencing dysentery or pain.

Anthropometry comes from "anthro" which has human meanings and "metri" which has a meaning of size. Anthropometry is a study of the measurement of the body of the human dimension of bone, muscle, and adipose or fat tissue. Anthropometric data is used for various purposes, such as designing workstations, work facilities, and product design.

2. Research
The first phase of the study was the initial identification phase with literature study and field study. Then the problem identification stage is carried out and determines the purpose of the research. After that, continue with the data collection stage. Data collection is done by taking data and observing directly. There are two types of data obtained in this study, primary data and secondary data. The primary data collection in this study was obtained from the results of interviews, structured questionnaires, checklists, and sampling and measurement. Whereas, secondary data is data collected from the literature and references relating to the issues discussed, data collected from PT. Chemistry, in the form of company profiles, and data on the number of workers. After the data processing stage is complete, then analyse and draw conclusions and suggestions.

3. Result and Discussion
Observation data was to data were by using RULA worksheet data to measure work posture by dividing observations of administrative body personnel into two groups, A and B. The activity carried out was to determine the RULA score from the results of a combination of A and B scores so that a grand score was found. After that, determine the level of action from the RULA calculation on the work posture. Then continued by assessing the results of the NBM questionnaire which was filled in by the administrative staff. Based on the results of data processing with a calculation that aims to get the RULA worksheet and NBM questionnaire assessment, it will obtain various levels of action against work posture. From the level of action, RULA was identified and analyzed to be associated with the NBM questionnaire. From the results of the analysis, after doing their work activities can be minimised by change work posture.

Figure 1. Office Employee

3.1 Group a posture
- A posture of the upper arm forms an angle > 20 given a score of 2
- Forearm posture forms an angle of 60-100, score 1
• Wrist section <15 is given a score of 2
• Wrist rotation is in the midline with a score of 1 Activity score
• Activities carried out repeatedly, more than four times/minute with a score = 1
• Load score
• Load <2 kg with a score = 0 The total score for group A is 3 + 1 = 4

3.2 Group B posture
• Neck posture (neck) The neck forms an angle of <20 given a score = 2
• Body posture (trunk) The trunk forms an angle of 0-20 given a score = 2
• Group B posture score is = 2 Activity score
• Activity score, Activities are carried out repeatedly, more than four times/minute with a score = 1
• Load Score, Load <2 kg with a score = 0 The total score for group A is 3 + 1 = 4

Table 1. The Calculation Result

| Group A | Rula Score Sheet | Group B |
|---------|------------------|---------|
|         | Right Left       |         |
| Upper Arm | 2 2              | 2       |
| Lower Arms | 1 1 Use Table A | Use Table B |
| Wrist     | 2 2              | 2 2     |
| Wrist Twist | 1 1            | 3 3 3   |
| Muscle Use | 1 1              |         |
| Force/ Load | 0 0            |         |

Score C = 4 4 4 Score D = 4

Grand Score (Score C & D) = 4

R: 4 L: 4

The final score for office staff activities with sitting posture based on Table is = 4. Based on the score, the level of risk of office employee activity with sitting posture is in the medium risk level category, and further investigation is required, there may be a change in the improvement of work attitude. After knowing the level of risk in the form of a score value on the RULA method for office workers at PT. Chemistry, Risk control is needed in the form of improvement of work postures carried out by workers. These improvements are carried out by adding or redesigning work facilities in the workspace. Risk control in the work area is a process to eliminate or reduce risk factors that have been identified and assessed using the RULA method. The improvements that will be made to the work area aim to reduce the risk of injury to the lowest acceptable level without a risk that can cause injury or accident.

The risk control that will be provided refers to the risk control hierarchy, elimination, substitution, design (engineering control), administrative control, and Personal Protective Equipment (PPE). The controls that will be applied by the conditions of the work area are the control of Engineering (engineering Control) and Administrative (Administrative Control).

The application in analysing RULA is used as a tool to carry out an initial analysis that can determine how far the risk of workers to be affected by the factors that cause injury (posture, static
muscle contraction, repetitive movements, and style). The application used is CATIA, in which there is a picture of a visual appearance that can be used to find the best work posture.

From the results of the RULA meeting using simulation Catia on the redesign, calculations can be known that the RULA obtained in number 2 means that it is safe to be used by workers to do their work. For the redesign, results can be seen in the picture below. Previously it can be seen in table 1 that having a RULA 4 can be reduced to 2, by using the redesign that has been applied.
From the results of the redesign, it can be said that the results of RULA can go down from the initial value of 4 to 2, of which value 2 is a safe value for work.

The following is an explanation of the advantages of the new design work facilities in the form of tables and chairs after the application is applied to Local Control Room Operators, Office Workers, and Heavy Equipment Operators:

The advantages of the new design of tables and chairs are re-designed by the standards of the Permenaker, and the mannequin in Catia uses the 95th percentile which is average for Asians. For a workbench, there is an addition to adjusting the height of the table with a height of 58 cm to 68 cm. Moreover, the high change from the work table is beneficial to improve the worker's body position. So with the design, the RULA score is initially valued at 4, now it has been reduced to 2 which means the work posture of the workers has been excellent.

4. Conclusions

The recommended changes to the ergonomic desk and chair design at PT Kimia is to adjust to the anthropometry of the human body, as well as provide a soft upholstery on the back and seat backs and provide additional support for heavy equipment operator seats. The recommendation of the chair and table design in this study is feasible to use because the ergonomics can be tested using posture analysis and RULA test on CATIA applications.

5. References

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