

Working-Posture Analysis on Workers at Bagging Sector of Urea Fertilizer I in PT Pupuk Sriwidjaja Palembang

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ABSTRACT

Part of Occupational Safety and Health was the ergonomics aspect. Ergonomics has a strong correlation with work-postures and manual handling activities. Improper work postures and heavy manual handling are risk factors for the development of musculoskeletal disorders. The aims of this research were assessing ergonomic risk with work-posture analysis on workers at the bagging sector of urea fertilizer I in PT Pupuk Sriwidjaja Palembang using Quick Exposure Check (QEC) to describe the risk for musculoskeletal disorders. The method of this research was descriptive and qualitative. Informants in this study amounted to 1 key informant from the bagging sector of urea fertilizer I department and 1 key informant from industrial hygiene and health department then 12 informants from bagging sector workers with 3 people working for > 10 years, 7 people working for 5-10 years and 2 people working for <5 years. Ergonomics risk assessment uses Quick Exposure Check (QEC). Quick Exposure Check (QEC) was designed to assess the exposures of risk factors for musculoskeletal disorders in workers. Work posture of filling the fertilizer bag and cutting the yarn had an average exposure score of 88.5% then tidying up the fertilizer bag and sewing the fertilizer bag got 87% and placing the fertilizer bag to pallet was 91.4%. All of the postures in the bagging sector of urea fertilizer I in PT Pupuk Sriwidjaja Palembang had exposure scores above 70% which are included in action level 4. So based on the result, it needs to be investigated and changed immediately on work posture to reduce ergonomic risks and prevent musculoskeletal disorders.

Keywords: Ergonomics, Musculoskeletal Disorders, Quick Exposure Check, Fertilizer Bagging

1. Introduction

The World Health Organization (WHO, [23]) declares that musculoskeletal disorders are the main cause of disability in 4/6 WHO territory in 2017 (Second rank in Eastern Mediterranean and Third place in Africa). While the prevalence of musculoskeletal disorders is increasing with age, younger people also can be infected and generally occur during their peak productivity years. Based on data from the Bureau of Labour Statistics [2] 30.5% of the 10000 incidents rate happen to workers who work full-time with musculoskeletal disorders problems.

In Indonesia, 11.9% of musculoskeletal disorders were diagnosed through professional medical diagnosis and seen from the symptoms, there were 24.7% who experienced the same problems (Riskseddas, [7]). Regarding data from Riskseddas [7] shown in South Sumatera, There was a prevalence of musculoskeletal disorders from symptoms reaching 15.6% and from job-level classification which are labourers with 31.2%. The other research about ergonomic risk in work results, from Santoso *et al.* [17] stated that All of PT Pupuk Sriwidjaja Operators reached 79-93 based on Nordic Body Map Method which means a high-level risk for the workers, and immediate action is required. Besides that, the REBA method was tested on the workers with the score result being 12 and classified to the very high-level risk and level 4 immediate action is required as soon as possible.

Activities at PT. Pupuk Sriwidjadja is almost processed by the machine but in the bagging sector of urea fertilizer in urea fertilizer bagging unit I, still processed manually by humans. Bagging Sector is a work unit carried out manual handling and carrying out manual activities that involve high energy, long duration, awkward or static postures, or repetitive movements. One of the factors of ergonomic risk for urea fertilizer bagging operators is the risk factors for static posture. Four of the operator activities are standing work posture. This Posture has a risk for raising health complaints based on other studies which research the connection between standing work posture and complaints of leg pain in section welding mechanical activity workers at PT. X. The result of the studies showed most of the workers

have complaints of leg pain which is in the low-level category of risk with 53.3% and medium-level risk category with 46.7% for standing work posture. Analysis of statistical results showed there was a correlation between the work posture of standing ($\text{sig} = 0.029$) and pain caused on the leg of the mechanical workers at PT.X (Anggrianti *et al.*, [1]).

The other risk factors of ergonomics from bagging operator posture of fertilizer urea are disproportionate posture factor, weight factor, and repetitive movements. The risk factor can be seen in arranging urea bag activities to the pallet (palletizing) which show the awkward position when the operator arranges the urea fertilizer bag to pallet, operator needs to bow down and do it repeatedly also lift the weight up to 25 Kg when arranging urea bag. Learnt from Khofiyya *et al.* [8] about awkward posture which bowing and did repetitively also lifting the weight with the title "Study of Relationship between Workload, Work Climate, and Work Posture on Complaints of Musculoskeletal Disorders in Airport Baggage Handling Service Workers. The results of the study show there is a connection between work posture from baggage handling service workers with musculoskeletal disorders complaints ($P\text{-value} = 0.001$). The objectives of the research are to conduct an ergonomic risk assessment for working postures on workers at the bagging sector of urea fertilizer I in PT. Pupuk Sriwidjaja Palembang with Quick Exposure Check (QEC) method to determine the risk of musculoskeletal disorders (MSDs).

2. Literature Review

Ergonomics

Ergonomics comes from the Greek word "ergon" which means human work "nomos" which means rule or law. So that it can be interpreted that ergonomics is a rule of law in the work system. According to the International Ergonomics Association [5], ergonomics is a scientific discipline that is concerned with understanding the relationship between humans and other elements of a system and a profession that applies theories, principles, data, and methods designed to optimize the welfare of workers and the entire work system. Ergonomics helps adjust matters relating to workers with the needs, abilities, and limitations of workers at work.

According to the International Labour Organization [6], ergonomics is the study of the relationship between the human body and work. The principle of ergonomics is an effort to adjust the work to the workers. Adjustments are made by arranging jobs and workplaces according to the needs of workers, that is, not making workers adjust themselves. Ergonomic workplace design by providing comfortable workstations, tools and equipment for workers. Of course, it will create a healthier workplace environment, where workers conform to their environment, work methods and processes.

Ergonomics is defined as the study of work. Ergonomics is the relationship between biological science which is a human being with engineering and technology which focuses on optimizing the adjustment of each other from humans to their work, which gives benefits of efficiency and welfare to workers (Suma'mur, [20]).

Ergonomics is a performance system that focuses on adjusting the design to workers or humans, which is the ability to apply information according to human character, capacity, and limitations on the design of work, machines and the system itself, workspace to the factory-wide environment so that humans can work in a comfortable, healthy manner, safe, and efficient performance (Tarwaka, [22])

Ergonomics are generally known as fitting the job to the human, although this definition is simple, it provides a fundamental purpose for ergonomics following the requirements of the job or job with the ability of workers. Another definition describes the existence of a balance or suitability of human abilities with job demands (Dennerlein, [3]). Ergonomics is a science that deepens the relationship between humans, tools or machines, the workplace environment, organization and implementation of work activities so that work can be completed quickly, efficiently, effectively, comfortably and safe (Sugiono *et al.*, [19]).

Successful application of ergonomics can ensure increased productivity, avoid occupational diseases and injuries and increase worker satisfaction. Failure to apply ergonomics, on the other hand, can lead to work with musculoskeletal disorders. The application of good ergonomics is the design of tools, processes, and furniture that can increase worker comfort, health, morale, productivity, and readiness (Shah, [18]).

Musculoskeletal Disorders

Musculoskeletal disorders are a person's discomfort or dissatisfaction in the form of complaints that are obtained from disorders of the skeletal muscle ranging from complaints that have a mild impact to severe complaints. These things arise due to static loads that are carried out repeatedly and continuously and of course for a long time, causing the bodies of the activity actors or workers to suffer damage to the tendons, ligaments and joints (Tarwaka *et al.*, [21]).

MSDS is also identified as one involving muscle tissue, tendons, blood vessels, ligament structures to the nerve ligaments that start with pain or tenderness, tingling, numbness, shaking until the worst are sleep disturbances and burning (Humantech, [2]). Musculoskeletal disorders have an impact on daily activities, workers' ability to work and quality of life. Untreated musculoskeletal disorders can lead to major injuries and loss of function, contributing to restrictions, economic losses and an increasing burden of disease worldwide (Penkala *et al.*, [15])

Musculoskeletal disorders result from overuse and displacement of the body's joint structures beyond the tissue's ability to return to normal or to recover. The three main risk factors for musculoskeletal disorders are awkward posture, heavy use of force, long duration or high frequency. The combination of two or three of these risks, together with increased exposure to or all of the factors, will increase the likelihood of developing complaints of musculoskeletal disorders (Rostykus *et al.*, [16]).

Another study suggests that activities and approaches to preventing musculoskeletal disorders such as the application of ergonomics can be integrated into a management structure by paying attention to and adopting a management approach. Making musculoskeletal disorders prevention activities using the application of ergonomics will be more effective and sustainable (Yazadni *et al.*, [24]). Patients with musculoskeletal disorders often have disabling symptoms, which may or may not limit the type or length of work they can do. Some occupational cases of patients may contribute to the increase in musculoskeletal disorders that they have or can cause damage to the disorder in them and the need for care in helping patients to maintain function (Madan, I. & Grime, [10]).

Process in Bagging Sector of Urea Fertilizer I in PT Pupuk Sriwidjaja Palembang

The first process was the filling of urea fertilizer into the urea fertilizer bag that was carried out by an operator standing in front of the bagging scale. The urea fertilizer bagging department usually fills 50 kg of fertilizer at one time. The next stage is tidying the mouth of the urea fertilizer bag, the filled fertilizer bag will be carried by the conveyor belt to the operator who is ready to tidy up the urea bag. Then sew the mouth of the urea fertilizer bag. In this stage, one operator stands in front of the conveyor belt who is ready to sew the urea fertilizer bag that has been trimmed before, the urea fertilizer bag will be sewn using a special sewing machine that works continuously followed by cutting the remaining sewing rope for the urea fertilizer bag because the sewing machine used is working continuously, the remaining sewing rope is not automatically cut. The final work step in bagging urea fertilizer is the preparation of urea fertilizer bags into pallets. At this stage, it is carried out by two operators who simultaneously take the packaged urea fertilizer bag from the conveyor belt and then arrange it on a pallet which is finally transported into a truck and ready to be distributed. Operators work continuously in an awkward position and lifting heavy loads. The operator will lift the bag of urea fertilizer about 12 bags of fertilizer in a minute and carried out about 2 – 2.5 hours repetitively. Bagging sector workers had working time 4-7 hours in a day depends on their target with standing posture while working



Figure 1. Process in bagging sector

Quick Exposure Check (QEC)

Effective risk management requires accurately identifying, assessing, and controlling any occupational musculoskeletal disorders risk factor. These risk factors are determined using a participatory approach that uses assessment results and is based on workers' statements in certain activities (Oakman and Chan, [12]). The QEC method is a method that has been developed by ergonomics practitioners to assess risk exposure to musculoskeletal disorders (MSDs). Based on the results of tests that have been carried out, this method was found to be sensitive enough to assess changes in exposure before and after the ergonomic intervention.

The QEC method focuses on assessing risk factors in the workplace that are associated with complaints of musculoskeletal disorders (MSDs), such as repetitive movements, activities that produce excess strength, awkward posture, and duration of work. This method combines the assessors 'and workers' assessments in the results of the assessment and shows the level of risk exposure (score) for body parts, which are the back, shoulders or arms, wrists or hands, and neck. This shows the percentage of ergonomic interventions proven to be effective or not (decrease or increase in exposure scores).

The QEC method can also be used for comparison of exposure by either one or more workers doing the same job or different jobs. The QEC method has also proven to be largely reliable and applicable to a wide variety of jobs. However, the QEC method has a drawback, that it cannot yet suggest whether or not it is necessary to take measures that are following a certain level of exposure or exposure (Li, G. & Buckle, [9]). The QEC method is a medium to a very good method for inter-rater reliability with a sufficiently systematic level so that there is little difference in opinion (Oliv *et al.*, [13]).

3. Methods

This research is descriptive designed with the qualitative method, the subject of the research was prepared by the authors from sampling technique with purposive sampling based on direct observation to urea fertilizer bagging unit (PPU) I PT. Pupuk Sriwidjadja Palembang. Research subjects consist of two key informants who work in the bagging area and health & security unit (HIPERKES), also 12 informants work as an operator of the urea fertilizer bagging unit (PPU). There are 5 processes in the urea fertilizer bagging unit (PPU) I PT. Pupuk Sriwidjadja Palembang, which is fertilizer filling to bag fertilizer, tidy up the bag, sew the bag, cut the yarn and place the bag on the pallet.

Assessment of ergonomic risk is using Quick Exposure Check (QEC) method which is designed to achieve exposure score for a musculoskeletal risk factor in the back part, shoulder/arm, wrist/hand, and neck part with connection to work duration, workload, job difficulties, and stress level of workers (Li, G. & Buckle, [9]). Data processing will be organized to achieve the result of the ergonomic risk category from the daily activities of the bagging unit operator. The level of the category will be defined by exposure level (which are low, medium, high, and very high), exposure score, and action level needed.

The formula of Exposure Score

$$Exposure\ Score = \frac{x}{x_{max}} \times 100\% \quad (1)$$

Note:

X = Score total obtained from carried out risk assessment

Xmax = Maximum score total for exposure which possibly happen to back, shoulder/arm, wrist/hand, and neck (for handling work 176 and the others 162).

Postures that are static scores are added only in points 1 - 4. For postures that lift weights manually, the scores added are points 1 - 3 and 5 - 6.

Exposure Scores Worker's name _____ Date _____

Back		Shoulder/Arm		Wrist/Hand		Neck																																																																					
Back Posture (A) & Weight (H) <table border="1"> <tr><td>A1</td><td>A2</td><td>A3</td></tr> <tr><td>H1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>H2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>H3</td><td>6</td><td>8</td><td>10</td></tr> <tr><td>H4</td><td>8</td><td>10</td><td>12</td></tr> </table> Score 1		A1	A2	A3	H1	2	4	6	H2	4	6	8	H3	6	8	10	H4	8	10	12	Height (C) & Weight (H) <table border="1"> <tr><td>C1</td><td>C2</td><td>C3</td></tr> <tr><td>H1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>H2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>H3</td><td>6</td><td>8</td><td>10</td></tr> <tr><td>H4</td><td>8</td><td>10</td><td>12</td></tr> </table> Score 1		C1	C2	C3	H1	2	4	6	H2	4	6	8	H3	6	8	10	H4	8	10	12	Repeated Motion (F) & Force (K) <table border="1"> <tr><td>F1</td><td>F2</td><td>F3</td></tr> <tr><td>K1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>K2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>K3</td><td>6</td><td>8</td><td>10</td></tr> </table> Score 1		F1	F2	F3	K1	2	4	6	K2	4	6	8	K3	6	8	10	Neck Posture (G) & Duration (J) <table border="1"> <tr><td>G1</td><td>G2</td><td>G3</td></tr> <tr><td>J1</td><td>2</td><td>4</td><td>6</td></tr> <tr><td>J2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td>J3</td><td>6</td><td>8</td><td>10</td></tr> </table> Score 1		G1	G2	G3	J1	2	4	6	J2	4	6	8	J3	6	8	10
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Frequency (B) & Duration (J) <table border="1"> <tr><td>B3</td><td>B4</td><td>B5</td></tr> <tr><td>J1</td><td>6</td></tr> <tr><td>J2</td><td>8</td></tr> <tr><td>J3</td><td>10</td></tr> </table> Score 6		B3	B4	B5	J1	6	J2	8	J3	10	Total score for Back Sum of scores 1 to 4 OR Scores 1 to 3 plus 5 and 6		Total score for Shoulder/Arm Sum of Scores 1 to 5 _____		Total score for Wrist/Hand Sum of Scores 1 to 5 _____																																																												
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Figure 2. QEC form

4. Data Collection

Analysis of work posture is carried out by observation and interviews with workers. The first data collection is to analyze the work posture of workers who observe workers' activities while working from the beginning to the end of work. Then interview with the workers following the guidelines in the Quick Exposure Check (QEC) form. In connection with the existence of a pandemic, the interview was carried out indirectly, passing via telephone. Then the data is processed by the Quick Exposure Check (QEC) form to obtain the level of risk level (exposure level) and exposure score from work posture on workers.

5. Results and Discussion

Numerical and Results

Result for Work Posture of Fertilizer Filling to Fertilizer Bags Operators

Table 1. Result of score total, exposure score, and recommend action of fertilizer filling to fertilizer bags operators

Operator	Score Total	Exposure Score	Action Level	Action
1	144	88.8%	Action Level 4	Investigate and change immediately
2	141	87%	Action Level 4	Investigate and change immediately
3	143	88.2%	Action Level 4	Investigate and change immediately
4	140	86.4%	Action Level 4	Investigate and change immediately
5	140	86.4%	Action Level 4	Investigate and change immediately
6	148	91.3%	Action Level 4	Investigate and change immediately
7	148	91.3%	Action Level 4	Investigate and change immediately
8	141	87%	Action Level 4	Investigate and change immediately
9	146	90%	Action Level 4	Investigate and change immediately
10	153	94%	Action Level 4	Investigate and change immediately
11	143	88.2%	Action Level 4	Investigate and change immediately
12	138	85%	Action Level 4	Investigate and change immediately
Average	88.5%		Action Level 4	Investigate and change immediately

As a result of Quick Exposure Check (QEC) calculation, the average work posture exposure score at urea filling to bagging the urea fertilizer is 88.5% which is categorized to action level 4 which means to investigation and direct transformation to the work process.

Table 2. Analysis of work posture of urea fertilizer filling to fertilizer bags operators recapitulation of exposure level

Part Observed	Total			
	Very High	High	Medium	Low
Back	12	-	-	-
Arm/ Shoulder	12	-	-	-
Wrist	-	12	-	-
Neck	7	5	-	-
Driving Duration	-	-	-	12
Vibration Factor	-	-	11	1
Work Step	-	-	9	3
Stress Factor	-	6	5	1

Result for Work Posture Tidying Up the Fertilizer Bag Operator

Table 3. Result of score total, exposure score, and recommend action of tidying up the fertilizer bags operators

Operator	Score Total	Exposure Score	Action Level	Action
1	140	86%	Action Level 4	Investigate and change immediately
2	139	85.8%	Action Level 4	Investigate and change immediately
3	141	87%	Action Level 4	Investigate and change immediately
4	138	85%	Action Level 4	Investigate and change immediately
5	138	85%	Action Level 4	Investigate and change immediately
6	146	90%	Action Level 4	Investigate and change immediately
7	146	90%	Action Level 4	Investigate and change immediately
8	138	85%	Action Level 4	Investigate and change immediately
9	144	88%	Action Level 4	Investigate and change immediately
10	151	93%	Action Level 4	Investigate and change immediately
11	141	87%	Action Level 4	Investigate and change immediately
12	136	84%	Action Level 4	Investigate and change immediately
Average	87 %		Action Level 4	Investigate and change immediately

As a result of Quick Exposure Check (QEC) calculation, the average work posture exposure score at tidying up the mouth of urea fertilizer bag is 87% which is categorized to action level 4 which means need to investigate and change immediately to the work process.

Table 4. Analysis of work posture tidying up the fertilizer bag operator recapitulation of exposure level

Part Observed	Total			
	Very High	High	Medium	Low
Back	12	-	-	-
Arm/ Shoulder	12	-	-	-
Wrist	11	1	-	-
Neck	-	12	-	-
Driving Duration	-	-	-	12
Vibration Factor	-	-	11	1
Work Step	-	-	9	3
Stress Factor	-	6	5	1

Result of Work Posture Sewing the Fertilizer Bag Operators

Table 5. Result of score total, exposure score, and recommend action of sewing the fertilizer bag operators

Operator	Score Total	Exposure Score	Action Level	Action
1	140	86%	Action Level 4	Investigate and change immediately
2	139	85.8%	Action Level 4	Investigate and change immediately
3	141	87%	Action Level 4	Investigate and change immediately
4	138	85%	Action Level 4	Investigate and change immediately
5	138	85%	Action Level 4	Investigate and change immediately
6	146	90%	Action Level 4	Investigate and change immediately
7	146	90%	Action Level 4	Investigate and change immediately
8	138	85%	Action Level 4	Investigate and change immediately
9	144	88%	Action Level 4	Investigate and change immediately
10	151	93%	Action Level 4	Investigate and change immediately
11	141	87%	Action Level 4	Investigate and change immediately
12	136	84%	Action Level 4	Investigate and change immediately
Average	87 %		Action Level 4	Investigate and change immediately

As a result of Quick Exposure Check (QEC) calculation, the average work posture exposure score at sewing the mouth of urea fertilizer bag is 87% which is categorized to action level 4 which means need to investigate and change immediately to the work process.

Table 6. Analysis of work posture of sewing the fertilizer bag operators recapitulation of exposure level

Part Observed	Total			
	Very High	High	Medium	Low
Back	12	-	-	-
Arm/ Shoulder	12	-	-	-
Wrist	11	1	-	-
Neck	-	12	-	-
Driving Duration	-	-	-	12
Vibration Factor	-	-	11	1
Work Step	-	-	9	3
Stress Factor	-	6	5	1

Result of Work Posture of Cutting the Yarn Operator

Table 7. Result of score total, exposure score, and recommend action of cutting the yarn operator

Operator	Score Total	Exposure Score	Action Level	Action
1	144	88.8%	Action Level 4	Investigate and change immediately
2	141	87%	Action Level 4	Investigate and change immediately
3	143	88.2%	Action Level 4	Investigate and change immediately
4	140	86.4%	Action Level 4	Investigate and change immediately
5	140	86.4%	Action Level 4	Investigate and change immediately
6	148	91.3%	Action Level 4	Investigate and change immediately
7	148	91.3%	Action Level 4	Investigate and change immediately
8	141	87%	Action Level 4	Investigate and change immediately
9	146	90%	Action Level 4	Investigate and change immediately
10	153	94%	Action Level 4	Investigate and change immediately
11	143	88.2%	Action Level 4	Investigate and change immediately
12	138	85%	Action Level 4	Investigate and change immediately
Average	88.5%		Action Level 4	Investigate and change immediately

As a result of Quick Exposure Check (QEC) calculation, the average work posture exposure score at cutting the yarn of the urea fertilizer bag is 88.5% which is categorized to action level 4 which means need to investigate and change immediately to the work process.

Table 8. Analysis of work posture of cutting the yarn operator recapitulation of exposure level

Part Observed	Total			
	Very High	High	Medium	Low
Back	12	-	-	-
Arm/ Shoulder	12	-	-	-
Wrist	-	12	-	-
Neck	7	5	-	-
Driving Duration	-	-	-	12
Vibration Factor	-	-	11	1
Work Step	-	-	9	3
Stress Factor	-	6	5	1

Result of Work Posture of Placing the Fertilizer Bag to Pallet Operator

Table 9. Result of score total, exposure score, and recommend action of placing the fertilizer bag to pallet operator

Operator	Score Total	Exposure Score	Action Level	Action
1	160	90.9%	Action Level 4	Investigate and change immediately
2	159	90%	Action Level 4	Investigate and change immediately
3	161	91%	Action Level 4	Investigate and change immediately
4	158	89.7%	Action Level 4	Investigate and change immediately
5	158	89.7%	Action Level 4	Investigate and change immediately
6	166	94%	Action Level 4	Investigate and change immediately
7	166	94%	Action Level 4	Investigate and change immediately
8	158	89.7%	Action Level 4	Investigate and change immediately
9	164	93%	Action Level 4	Investigate and change immediately
10	171	97%	Action Level 4	Investigate and change immediately
11	161	91%	Action Level 4	Investigate and change immediately
12	156	88.6%	Action Level 4	Investigate and change immediately
Average	91.4%		Action Level 4	Investigate and change immediately

As a result of Quick Exposure Check (QEC) calculation, the average work posture exposure score at stacking unit of the urea fertilizer bag onto pallet is 91.4% which is categorized to action level 4 which means need to investigate and change immediately to the work process.

Table 10. Analysis of work posture of placing the fertilizer bag to pallet operator recapitulation of exposure level

Part Observed	Total			
	Very High	High	Medium	Low
Back	12	-	-	-
Arm/ Shoulder	12	-	-	-
Wrist	11	1	-	-
Neck	12	-	-	-
Driving Duration	-	-	-	12
Vibration Factor	-	-	11	1
Work Step	-	-	9	3
Stress Factor	-	6	5	1

Graphical Results

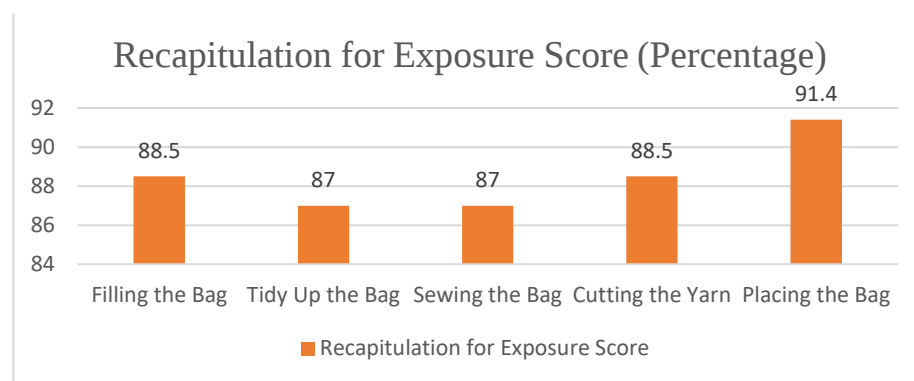


Figure 3. Recapitulation for exposure score

Based on the graphic above, the exposure score for work posture of placing the bag operator has the highest score. Because of that, placing the bag into a pallet is a posture that has a very high risk for musculoskeletal disorders.

Proposed Improvements

1. PT Pupuk Sriwidjaja conducted a further evaluation to find out more about the risk factors for Musculoskeletal Disorders (MSDs) for Urea Fertilizer Packaging (PPU) I operators, especially for placing the bag into pallet process which has a 91,4% exposure score.
2. To reduce exposure to the risk factors for Musculoskeletal Disorders (MSDs), PT Pupuk Sriwidjaja can make efforts in the form of administrative control in the form of stretching schedule that is around 3-5 minutes after 1-2 hours of work and also engineering control in the form of adding chairs with an anthropometric approach.
3. Operators can avoid risk exposure of Musculoskeletal Disorders (MSDs) by using vacuum lifters that make it easier for workers to move large and heavy objects or with Personal Protective Equipment (PPE), and Back Support for Urea Fertilizer Packing (PPU) I operators provided by PT Pupuk Sriwidjaja

Validation

This study used a validity test using three triangulation techniques, which are method triangulation, source triangulation and data triangulation. Method triangulation is a way to obtain the validity of the data under study. Researchers compared the data obtained in different ways or by using more than one technique in collecting the same data. The implementation can be done by checking the existing data again. According to Patton, there are two strategies in implementing this method, by checking the degree of confidence in the results of the research with several data collection techniques. Then second, double-checking the degree of trustworthiness of several data sources with the same method (Patton, [14]).

Source triangulation is checking the validity of data or the correctness of data with various sources. This method can be done in several ways: (1) by comparing data from observations with data from interviews (2) comparing what

someone said in public with what he said privately (3) comparing people's opinions about what happened in the research situation with what he says over time (4) comparing the opinions and perspectives of people from various circles (5) comparing the results of interviews with documents that have a relationship (Moleong, [11]).

Data triangulation is a method that uses two or more data to be combined. This can be carried out and is called an appeal explanation (rival explanation). Thus, the research design, data collection and data analysis must be more complete. The results obtained will certainly be more complete and more comprehensive (Patton, [14])

Conclusion

This research has shown work posture risk for workers at PPU (Urea Fertilizer Bagging Unit) I PT. Pupuk Sriwidjaja Palembang with the Quick Exposure Check (QEC) method is categorised into action level 4, which is indicated as highly recommended for investigation and change immediately. Exposure score from the calculation of Quick Exposure Check (QEC) to workers has results for process filling urea fertilizer into urea fertilizer bag and Cutting the Yarn of Urea Fertilizer Bag were 88.5%. Then, tidying up the urea fertilizer bag and sewing fertilizer bag exposure score were 87% and placing the urea fertilizer bag to the pallet was 91.4%. Category of risk exposure level had the majority for some species of body parts which has musculoskeletal disorders risk, such as the back, arm/shoulder, and wrist with very high level and neck Based on the analysis, work posture that has the most risk for the workers in the process of placing fertilizer bag to the pallet. The reason was the awkward posture for the workers while working, overloading weight, and repetitive movement in the long period. It's shown by the result of QEC, 91.4%.

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