Hazard Identification and Risk Assessment of Health and Safety Approach JSA (Job Safety Analysis) in Plantation Company

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Abstract. Plantation company needed to identify hazard and perform risk assessment as an Identification of Hazard and Risk Assessment Crime and Safety which was approached by using JSA (Job Safety Analysis). The identification was aimed to identify the potential hazards that might be the risk of workplace accidents so that preventive action could be taken to minimize the accidents. The data was collected by direct observation to the workers concerned and the results were recorded on a Job Safety Analysis form. The data were as forklift operator, macerator worker, worker's creeper, shredder worker, workers' workshop, mechanical line worker, trolley cleaning workers and workers' crepe decline. The result showed that shredder worker value was 30 and had the working level with extreme risk with the risk value range was above 20. So to minimize the accidents could provide Personal Protective Equipment (PPE) which were appropriate, information about health and safety, the company should have watched the activities of workers, and rewards for the workers who obey the rules that applied in the plantation.

Keywords: OSH, Health and Safety, JSA,

1. Introduction
In an effort to produce a high quality product and as meeting the needs of consumers, company demanding to use advanced technology in the form of modern tools. The use of advanced tools of course will inevitably bring danger to the operator or to other employees as well as a negative impact on the environment and surrounding communities. This is where the management of occupational safety and health job is expected to minimize the negative impact of a production process, so that the business efficiency maximized and increased productivity of the company can be implemented.

Potential accidents are common in the workplace and working environment resulting in losses from the company, employees and the surrounding community. Efforts should be made to prevent these and to implement a concept of Occupational Health and Safety (OSH). Occupational accidents besides causing direct losses also causing indirect losses which are losses in damage to machinery and work equipment, the stop of the production process, environmental damage and others [1].

In the application management system of OSH one of the steps that must be taken is to identify the risk for accidents that may occur in the work area. Risk identification aims to identify potential hazards that pose a risk of workplace accidents. It can be determined so precautions initiatives will be performed to minimize accidents. Accidents that occur in the workplace largely caused by the carelessness of labour. It can be caused by lack of knowledge of the labour force, inadequate skills in carrying out its work. In addition, especially when faced with new technology or new equipment which is not in accordance with the size of anthropometry of Indonesian workers and also safety was not the focus of workers while
performing their work [2]. To control the work accidents and occupational illness, it is needed the efforts to identify the factors/sources of hazards in the workplace and to evaluate the risks and suggests an adequate control. In the field of OSH there are ways to identify, analyse and evaluate the factors that creates danger in the workplace. One way to identify hazards is the safety analysis, or better known as Job Safety Analysis-JSA [3].

Making Job Safety Analysis, in addition to providing remedial action for potential hazards can also provide other benefits to management. With the implementation of Job Safety Analysis, a supervisor can provide training of safe and efficient procedures for workers, making it easier to give instructions to new workers who will carry out the work and hazards inherent in the work, and can be used to assess or relearn when accidents happen. With the Job Safety Analysis, workers can work in safe and efficient, knowing the dangers inherent in the work and control the action, and to improve the knowledge and awareness of the importance of Occupational Safety and Health [4].

This plantation is one company that produces rubber Low Grade (LG) called SIR 20 and its production processes use a lot of machines that have the potential hazards. On the production process there are many potential hazards and factors that cause workplace accidents or occupational illness. From the data report accidents that previously occurred in the company in 2011 to 2015 there has been a 32 accidents. Therefore, to minimize the risk aspect is committed to protecting the workforce through the implementation of OSH program. This study aims to identify the hazard and risk assessment of health and safety with the approach of Job Safety Analysis (JSA) in order to find the right solutions to minimize workplace accidents on the plantation.

2. Literature

2.1. Occupational Health and Safety (OSH)

Occupational health and safety (OSH) is an instrument that protects workers, the company, the environment and the surrounding community from harm due to workplace accidents. Such protection is a fundamental right that must be met by companies [1]. According to the America Society of Safety and Engineering (ASSE), OSH is defined as the field of activities aimed to prevent all kinds of accidents that are related to the environment and work situation.

In general, work safety can be considered as a science and its application relating to machines, appliances, tools, materials and processing, foundation work and the work environment and how to perform the work to ensure the safety of workers and the company's assets in order to avoid accidents and other losses [1]. Safety also includes the provision of Personal Protective Equipment (PPE), machine maintenance and humane working hours’ arrangements.

In OSH also known terms of Occupational Health, which is a specialization in health sciences as well as practice aimed at keeping workers or community workers obtain health standard as high as both physical, mental, social, with business ventures preventive and curative, against illness or health problems caused by the factors of work and working environment, as well as against common illness [1].

2.2. Work Accident

The main definition describing accident combined form OHSAS 18001:2007 and BS 8800:2400 is the undesired event resulting in injury, sickness or death. [5]. So, accident is defined as an unexpected event, originally undesirable that disrupt the process that has been set up from an activity and can lead to losses for both human and or property. While understanding of occupational accidents according to Ministry Regulation number 03/Men/1994 [6] regarding the program of Jamsostek, is an accident in connection with a work activity, including disorders arising from the employment relationship as well as accidents that happen in the course set out from home to work and back home through road ordinary or reasonable impassable.
Basically, the background of the accident is influenced by two factors, namely:

a. **unsafe condition**
   Where accidents occur due to unsafe working conditions, as a result of the following ways:
   - Machinery, Equipment, Materials, etc.
   - Work Environment
   - Work Process
   - Nature of Work
   - How it Works

b. **Unsafe Action**
   Where accidents occur because the act / acts that are not safe, as a result of the following ways:
   - Lack of knowledge and skills
   - Physical characteristics
   - Work Process
   - Psychological mental characteristics
   - The unsafe attitude and behaviour

2.3. **Risk assessment**
The definition of risk assessment is the process for determining the priority of controlling the level of risk of accidents or occupational diseases [7].

Methods in risk assessment include:
- Determine Opportunity accident
  Determine probability incident that occurred in the workplace, we can use a scale based on the level of potential.
- Determine Accident Consequences
  To determine the consequences, we must make provision for the severity of its potential
- The level of each risk level or levels of risk is determined by the relationship between the value of the identification of hazards and consequences.
  Risk Value (NR) = Value Exposure (E) x Opportunities accident (L) x Consequences of accidents (K)

2.4. **Job Safety Analysis**

JSA often called Job Safety Analysis is one attempt to analyze the tasks and procedures that exist in the industry. JSA is defined as a method of studying a job to identify hazards and potential incidents associated with each step, to develop a solution that can eliminate and control hazards and incidents [4].

When the hazard has been identified, it can be done the control measures in the form of physical changes or repair work procedures to reduce occupational hazards. In practice, the safety analysis procedures require training, supervision and writing job descriptions, known as the JSA to facilitate understanding of the working procedures of employees

3. **Research method**
The research method used in this issue by using primary data through observation, which is direct observation of events happened, and interview methods, which is questioned directly by the parties concerned. In addition, this also uses secondary data, obtained by the method of internal data that is on the books or reports that are available in the company, and external data that is based on the literature and other references that are outside the company.

In identifying the hazards to the job, workers were selected based on the selection of work in the Job Safety Analysis proposed by OSHA 3071 [7], namely:
- Jobs that have a high accident rate
- The work that has the potential hazards, accidents and injury, although there is no record of accidents on the job.
- The work may cause accidents or serious injury as a result of serious human error is simple.
- The new work, the work is not routine, or work experience.
- Works complex / complicated.
Then the selected workers and are analysed as follows:

- Forklift Operator
- Macerator Worker
- Crepe Workers
- Shredder Worker
- Workshop Worker
- Line engineering Worker
- Workers Cleaning Trolley
- Workers decline Crepe in Pre drying

4. Results and discussion

4.1. Results for Job Safety Analysis

Job Safety Analysis in the data collection is performed directly by the direct observation to the workers concerned and the results are recorded on a form Job Safety Analysis. The results from Job Safety Analysis of some of the work that was observed in the plantation.

- Forklift operator

| Job Steps          | Hazards Type                              | Impacts                                           | E  | L  | K  | NR |
|--------------------|-------------------------------------------|---------------------------------------------------|----|----|----|----|
| Running Forklift   | Crashing worker / work area               | Forklift damage, injury to operators, workers and work area damage | 10 | 0.3 | 5  | 15 |
| The process of hiring and laying load | Overload cargo                 | Forklift toppled , operator injury, the fall of the product | 10 | 0.3 | 5  | 15 |
| Altitude removal exceed the limit | Load override Forklift, Forklift Damage, operator injury | 3 | 0.05 | 5  | 0.75 |

- Workers macerator

| Work Steps                  | Hazards Type                              | Impacts                                           | E  | L  | K  | NR |
|-----------------------------|-------------------------------------------|---------------------------------------------------|----|----|----|----|
| Incorporate pieces of rubber into tanks machine | working posture is not good | CTD / MSD                                           | 3  | 0.3 | 1  | 0.9 |
| Strangulated machine        | Fractures, lacerations on fingers or hands | 2 | 0.3 | 10 | 6  |
| Slipping                    | Bruises, sprains, fractures lightweight    | 2 | 0.1 | 5  | 1  |
| engine Noise                | hearing loss                               | 10 | 0.3 | 5  | 15 |
| Exposure to dust comes from rubber | respiratory problems                        | 10 | 0.3 | 5  | 15 |

Based on the results analysis using JSA, it is obtained several risks/hazards that are owned by the macerator worker which has a risk value is 0.9, 6, 1, 15 and 15 where the risk value 15 included in the high risk value so that the necessary risk control to minimize the possibility of accidents needed.

- Crepper Worker

| Work Steps       | Hazards Type | Impacts         | E  | L  | K  | NR |
|------------------|--------------|-----------------|----|----|----|----|
| Strangulated machine | Hands or fingers broke, | 3 | 0.3 | 20 | 18 |
Based on the analysis results using the JSA, it is obtained several risks/hazards that are owned by Crepe worker that have a risk value, as 18, 15, 15 and 0.9 where the risk value 15 included in the high risk value so that it is a necessary risk control to minimize the likelihood of accidents.

- Shredder Workers

**Table 4. Results of Job Safety Analysis shredder worker**

| Work Steps | Hazards Type            | Impacts                      | E | L | K | NR |
|------------|-------------------------|------------------------------|---|---|---|----|
| Incorporate rubber that had dried into the engine | Strangulated machine  | Hands or fingers broke, broken bones, lacerations | 3 | 0.3 | 20 | 18 |
| noise machine  | Hearing loss         | 10 | 0.3 | 10 | 30 |
| Exposure to dust rubber flakes  | respiratory problems, asthma | 10 | 0.3 | 5 | 15 |
| working posture is not good | CTD / MSD             | 3 | 0.3 | 1 | 0.9 |

Based on the analysis results using the JSA obtained several risks / hazards are owned by shredder workers that has a value of risk that is 18, 30, 15, 15 and 0.9 where the risk value 30 entered in the value of the extreme risk that necessary risk control to minimize the possibility of accidents extreme *badly needed*.

- Workshop Worker

**Table 5. Results of Job Safety Analysis workshop worker**

| Job Steps | Hazards Type            | Impacts                      | E | L | K | NR |
|-----------|-------------------------|------------------------------|---|---|---|----|
| Welding  | Eye exposed to sparks  | Damage the vision senses     | 3 | 0.3 | 10 | 9 |
| work posture is not good | CTM / MSD         | 3 | 0.6 | 1 | 1.8 |
| Hand exposed welding sparks | burns, blistering | 2 | 0.6 | 2 | 2.4 |
| Sharpening | Hands affected grinding | scratch wounds, fingers cut off | 2 | 0.3 | 2 | 1.2 |
| Noisy equipment / machinery grinding | damage of auditory | 10 | 0.3 | 5 | 15 |
| working posture is not good | CTD / MSD             | 3 | 0.6 | 1 | 1.8 |

Based on the analysis results using the JSA obtained several risks / hazards to workers workshop that has a value of risk that is 9, 18, 2.4, 1.2, 15 and 1.8 where the risk value 15 included in the high risk value so necessary for risk control minimizing the possibility of accidents *needed*. 
• Line Engineering Worker

**Table 6. Results of Job Safety Analysis** Line Engineering Worker

| Working step   | Hazard Type                  | Impact                          | E  | L  | K  | NR |
|----------------|------------------------------|---------------------------------|----|----|----|----|
| Maintenance Engineering | Exposure to sharp objects | Cut objects hand dropping       | 2  | 0.3| 2  | 1.2|
|                  | Slipped                      | Bruises, sprains, fractures lightweight | 2  | 0.3| 1  | 0.6|
| Dismantling machine | Wedged                      | Bruises, fractures lightweight | 2  | 0.3| 2  | 1.2|
|                  | machinery part fall          | 'Bruises, fractures'           | 2  | 0.3| 2  | 1.2|

Based on the analysis results using the JSA obtained several risks / hazards that are owned by the worker's job line technique that has a risk value is 1.2, 0.6, 1.2 where the risk value of 1.2 included in the value of low risk but remain vigilant in doing any work to prevent work accidents.

• Cleaning Trolley Workers

**Table 7. Results Job Safety Analysis cleaning workers Trolley**

| Working step            | Hazard Type                  | Impact                      | E  | L  | K  | NR |
|-------------------------|------------------------------|-----------------------------|----|----|----|----|
| Submerge Trolley with chemicals | Exposure to chemicals caustic soda | Skin irritation             | 2  | 0.3| 5  | 3  |
| Cleaning Trolley        | Strangulated Trolley         | Cut, scraped                | 1  | 0  | 3  | 0.6|

Based on the analysis results using the JSA obtained several risks / hazards that are owned by the worker's job cleaning trolley that has the risk value is 3 and 0.6 where the risk value 3 included in the value of intermediate risk but remain vigilant in every work order to work accident do not occur.

• Decline Crepe Worker

**Table 8. Results of Job Safety Analysis Decline Crepe Worker**

| Working step        | Hazard Type                  | Impact                          | E  | L  | K  | NR |
|---------------------|------------------------------|---------------------------------|----|----|----|----|
| Decrease crepe      | Falling from height          | injuries, fractures, sprains   | 1  | 0.3| 20 | 6  |
|                     | Crushed crepe               | Bruises, wounds on the skin surface | 2  | 0.3| 2  | 1.2|
|                     | Exposure to dust from crepe  | respiratory problems           | 6  | 0.3| 5  | 9  |
| Crepe Transport     | working posture is not good  | CTD / MSD                      | 3  | 0.6| 1  | 1.8|
|                     | Overload cargo              | falling, injury operator       | 2  | 0.3| 2  | 1.2|

Based on the analysis results using the JSA obtained several risks / hazards to workers decline crepe that has a risk value is 6, 1.2, 9, 1.8 and 1.2 where the risk value 9 included in the value of intermediate risk but remain vigilant in doing any work to prevent work accidents.

4.2. Proposed Risk Management

Following this is the result of the Job Safety Analysis of some of the work that was observed in the company:
• Forklift Operator

**Table 9. Proposed Risk Management on Operator Forklift Operator**

| Department / Working step | Type Hazards | Impact of | Proposed Risk Control |
|---------------------------|-------------|-----------|-----------------------|
| Running Forklift          | Bumping workers / work area | Damage Forklift, injury to operators, workers and damage to the work area | Determination of special lanes for Forklift and transport |
| Processes of appointment and the laying of a charge | Overload charge | Downfall product, Forklift falling, injury operator | Determination of the maximum Forklift load, extension and operator training, use of personal protective equipment such as helmets and boots |
| Altitude removal exceed the limit | Load override Forklift, damage, Forklift injury operator | |

• Macerator Worker

**Table 10. Proposed Risk Management in macerator worker**

| Department / Working step | Type Hazards | Impact of | Proposed Risk Management |
|---------------------------|-------------|-----------|--------------------------|
| Incorporate pieces of rubber into troughs machine | posture work is not good | CTD / MSD | Redesign workstations, using the tools of work |
| Strangulated machine | Fractures, lacerations on fingers or hands | | Running SOP correctly and using tools work |
| Slipping | Bruises, sprains, fractures light | | use of PPE in the form of boots and helmets and cleaning floor |
| Noise machine | hearing loss | | use of PPE in the form of earmuff or earplug |
| Exposure to dust comes from rubber | respiratory problems | | use PPE in the form of masks |

• Crepper Worker

**Table 11. Proposed Risk Management in Crepper Worker**

| Department / Working step | Type Hazards | Impact of | Proposed Risk Control |
|---------------------------|-------------|-----------|-----------------------|
| Incorporate rubber sheets into the machine | Strangulated machine | Hands or fingers broken, broken bones, lacerations | Running SOP correctly and using the tools of labor |
| noise machine | Disorders hearing, deaf | | Use of PPE in the form of earplug or earmuff |
| Flakes Dust rubber | respiratory problems, asthma | | Use of PPE in the form of a mask |
| work posture is not good | CTD / MSD | | Redesign workstations |
- Shredder Workers

**Table 12. Proposed Risk Control at Full Shredder**

| Department / Working step | Type Hazards                        | Impact of                                    | Proposed Risk Control                                                                 |
|----------------------------|-------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------|
| Incorporate rubber that had dried into the machine | Strangulated machine | Hands or fingers broken, broken bones, lacerations | Running SOP correctly, and use work tool                                               |
|                            | engine noise                        | hearing loss                                 | use of PPE in the form of earplug or ear muff, use noise-cancelling machinery            |
|                            | Exposure to Rubber dust flakes      | respiratory problems, asthma                 | use of PPE in the form of a mask                                                       |
|                            | work posture is not good            | CTD / MSD                                   | Redesign workstations                                                                  |

- Full workshop

**Table 13. Proposed Risk Control at Full workshop**

| Department / Working step | Type Hazards                        | Impact of                                    | Proposed Risk Management                                                                 |
|----------------------------|-------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------|
| welding                    | Currency splash fire                | damage vision senses                         | use of PPE in the form of a face shield, goggles                                        |
|                            | posture work is not good            | CTD / MSD                                   | Redesign workstations                                                                  |
|                            | Hand exposed to sparks welding      | Luka burn, scald                            | use of PPE such as gloves heat resistant and scratch resistant                         |
| grinding                   | hands exposed to grinding           | Luka scratch, finger cut                     | use of PPE such as gloves                                                              |
|                            | Noisy equipment / machinery grinding | damage of auditory                          | use of PPE in the form of earplug or earmuff                                          |
|                            | posture work that is not good       | CTM / MSD                                   | Redesign workstation                                                                   |

- Line Engineering Worker

**Table 14. Proposed Risk Management in Line Engineering Worker**

| Ministry / Working step | Type Hazards                        | Impact of                                    | Proposed Risk Control                                                                 |
|-------------------------|-------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------|
| Engine Maintenance      | Exposed sharp objects               | Cut, hand dropping                           | to Use of PPE in the form of gloves anti-scratch, run the SOP with secure              |
|                         | Slipped                             | Bruises, sprains, a mild fracture            | Using of PPE in the form of boots and helmets, carry out the cleaning of floors        |
|                         | Strangulated                        | Bruises, broken bones light                  | SOP Running with secure                                                                 |
| Demolition machine      | machinery part fall                 | Bruises, fractures                           | Running SOP correctly, and use of PPE such as helmets                                  |
• Cleaning Trolley Workers

Table 15. Proposed Risk Control at Cleaning Trolley Workers

| Department / Working step | Type Hazards                      | Impact of        | Proposed Risk Control                        |
|---------------------------|-----------------------------------|------------------|----------------------------------------------|
| Submerge Trolley with chemicals | Exposure to chemicals caustic soda | Skin irritation  | Use of PPE in the form of special gloves     |
| Cleaning Trolley          | Strangulated Trolley              | Cut, scraped     | Running SOP correctly                        |

• Decline Crepe Worker

Table 16. Proposed Risk Control on Decline Crepe Worker

| Department / Working step | Type Hazards                      | Impact of                      | Proposed Risk Control                                      |
|---------------------------|-----------------------------------|--------------------------------|------------------------------------------------------------|
| Lose crepe                | Falling from height injuries, fractures, sprains | Use of PPE in the form of a helmet |
| Crushed crepe             | Bruises, wounds on the skin surface | to Use of PPE in the form of a helmet |
| Affected dust from crepe  | respiratory problems              | use of PPE form of a special mask |
| Crepe Transport           | working posture is not good CTD /MSD | Redesign work stations, Extension of MMH (manual material handling) is good and right. |
| Overload charge           | toppled, operator injury          | Load adjustment of Trolley     |

4.3. Table Value Risk of Overall Results JSA

Table 17. NR overall analysis JSA

| Job Type                     | Value Risk Largest | Category NR |
|------------------------------|--------------------|-------------|
| Been Forklift                | 15                 | High-Risk   |
| Workers macerator            | 15                 | High-Risk   |
| Workers Crepper              | 18                 | High-Risk   |
| Workers Shredder             | 30                 | Risk of Extreme |
| Workers Workshop             | 15                 | High-Risk   |
| Workers Mechanical Line      | 1, 2               | Low risk    |
| Care workers Trolley         | 3                  | Medium risk |
| Decreased workers Crepe      | 9                  | Medium risk |

Risk seen from the table value (NR) the overall results of JSA shredder worker included in the category of the highest NR or an extreme value risk, because it is in the range of NR> 20.

Description [3] Value risk > 20: Extreme, Values risk 10-20: High Risk, Risk Value 3-10: Risk Medium, risk value<3: Low Risk

This model is predicted to be able for implementation in same characteristic plantation.
5. Conclusions and Recommendations

5.1. Conclusion

Based on the result, there are some conclusions as follows:

- Management system for OSH in company has been good. On the other hand, in the implementation of health and safety works were not enough because of his own workers still paid less attention and did not realize the importance of health and safety of their work and therefore there are still accidents were due to the carelessness of workers themselves.

- Based on the analysis using method Job Safety Analysis can be concluded that the worker's job shredder that is worth 30 and has a working level with extreme risk with the risk value range is above 20. Moreover, that can be done to minimize accidents that can use Personal Protective Equipment (PPE) appropriately, counselling on health and safety at work, the company must monitor every activity of employees, and give rewards to workers who obey the rules that apply in the company.

5.2. Suggestions

As for suggestions from the author that if it can help companies to be better are:

- Controlling workplace accidents carefully so that control can run optimally, therefore occupational accidents can be minimized.

- Companies are advised to raise awareness of the employees will be essential and mandatory use of PPE to avoid accidents.

- Companies are expected to conduct regular training to employees about the meaning and importance of an effective OSH program so that compliance with the OSH program become a habit in the workplace.

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