

MANAGEMENT SYSTEM OF HEALTH AND SAFETY WORK (SMK3) WITH JOB SAFETY ANALYSIS (JSA) IN PT NIRA MURNI CONSTRUCTION

by Melliana Melliana

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**MANAGEMENT SYSTEM OF HEALTH AND SAFETY WORK (SMK3) WITH JOB SAFETY ANALYSIS (JSA) IN
PT NIRA MURNI CONSTRUCTION**

Melliana, Armen, Yusrizal, Syarifah Akmal
Department of Industrial Engineering Management
School of Technology Dumai
e-Mail: anamelli@rocketmail.com

ABSTRACT

PT Nira Murni construction is a contractor of PT Chevron Pacific Indonesia which engaged in contractor, fabrication, maintenance construction suppliers, and labor services. The high of accident rate in this company is caused the lack of awareness of workplace safety. Therefore, it requires an effort to reduce the accident rate on the company so that the financial losses can be minimized. In this study, Safe T-Score method is used to analyze the accident rate by measuring the level of frequency. Analysis is continued using risk management methods which identify hazards, risk measurement and risk management. The last analysis uses Job safety analysis (JSA) which will identify the effect of accidents. From the result of this study can be concluded that Job Safety Analysis (JSA) methods has not been implemented properly. Therefore, JSA method needs to follow-up in the next study, so that can be well applied as prevention of occupational accidents.

Keyword: Job safety analysis (JSA), risk management, safe T-core.

I. INTRODUCTION

Background

Dumai city has several industries that indirectly helped to promote, such as PT Chevron Pacific Indonesia that engaged in mining and export of oil and gas. Continued by Pertamina that engaged in processing and distribution of oil and gas, and followed by the processing industry of palm oil (CPO) know as PT.WILMAR. With the establishment of industries in Dumai city, then any company can not be separated from messages of safety and occupational health. In the field work, safety factor is very important to implement. It is caused to have a good production process, so that output produced can be more qualified. However, when obstacles occur in the production process that caused by work accident, It can obstruct some work process such as lost working hours and lost man power hours.

Generally, work accident happened because of two things: the labor is not safe (unsafe act) and unsafe condition. It needs role of all those who are in work environment, so that the goals of company can be achieved.

Work accident occurred due to the careless of employee or errors in equipments used by employee. However, the number of work accident at PT Nira Murni construction from 1st of April 2014 until 30st of July 2016, they were 5 accidents in 2014, 8 cases in 2015, and 7 cases in 2016. The work accident that happened in PT Nira Murni construction was commonly caused by the employee (does not meet work rules and not using protective equipment). Data of work accident in PT Nira Murni construction have indicated some accidents. It can be not allowed without any improvements of work safety system since will loss the company.

Based on the explanation above, in order to minimize the number of accidents, it needs a work safety program for employee or company to avoid the losses, either physical or non-physical losses. Therefore, the authors are interested to research more detail with title "Management system of health and work safety (SMK3) with job safety analysis (JSA) in PT Nira Murni Construction"

Problem statements:

Based on the statement of background, the issues that discussed in this research are:

1. What is level of work accident in PT Nira Murni construction?
2. How is the implementation of Job Safety Analysis (JSA) to prevent work accidents in PT Nira Murni construction?
3. How is work activities in PT Nira Murni construction?

Scope of problems:

1. The improvement of employee work system in PT Nira Murni construction by analyzing potential hazards while doing work activity
2. How the implementation of safety management system and health system by using Job Safety Analysis method

Research purposes:

1. To determine the level of work accident that occurred in PT Nira Murni construction
2. To determine the implementation of Job Safety Analysis (JSA) as an effort to prevent accidents in PT Nira Murni construction
3. To find work activity in PT Nira Murni construction

II. Literature review**Work safety**

Salvation comes from the English word 'safety' and usually always associated with there lease of a person's state of calamity event (accident) or near misses (near-miss). So in essence safety as ascientific approac has well as apractical approach to study the factors thatcan cause accidents and seeks to develop way sand approaches to minimize the risk of accidents (Syaaf, 2007).

Health

Health comes from the English 'health', which to day does not just mean freeing some one from the disease, but has a healthy sense of meaning healthy physically, mentally and socially healthy. Thus the notion of healthy whole show understanding of welfare (well-being). Health as an approach of scientific and practical approach also seeks to study the factors that can cause human illness and at the same time working to develop ways or approaches to preventhum an suffering, and even become healthier (Mily, 2009).

Work accident

According to A.M. Sugeng Budiono (2005:171), work accident is an accident or incidence of unwanted dangerous to humans, property damage or loss to the process.

The measurement of safety operations

The measurement of safety programs can be directed to the measurement of the incidence of work accidents, either heavy or light accident. The measurement of safety operations can be analyzed from humans view (injury disability) and ANSI (American National Standard Institute) to determine the level of accident frequency and the level of severity.

1. Number of working hours
According to Sumakmur in Akbar (2013), the total of working hours can be calculated by using formula below:

Total of working hours = (working hours per day) x (working days per year) x (Total work force per year)

2. Frequency of work accident

The frequency of work accident indicates the number of defect that occurred every one million working hours in the period of employment. According to ANSI, the formula of frequency work accident can be computed as follows:

$$FR = \frac{N \times 1.000.000}{N}$$

Descriptions:

FR: The frequency of work accident

n: Number of defect

N: Number of working hours of employee

3. Level of severity

Level of severity is indicating the number of days lost and death due to work accident for one million working hours from number of working hours of employee. According to ANSI, severity level can be calculated by using formula below:

$$SR = \frac{H \times 1.000.000}{N}$$

Descriptions:

SR: Level of severity

H: Total number of days lost (due to accident)

N: Number of working hours of employee

4. Safe T-Score

Safe T-Score is used to compare the result of frequency accident in the past with the present, so that it can find the number of accident reduction. Testing method used was "T" or "student test" by using formula:

$$\text{Safe T-Score (STS)} = \frac{F2 - F1}{\sqrt{(F2 \times 1.000.000)/N}}$$

Descriptions:

STS: Safe T-Score

F1: The frequency of accident in the past

F2: The frequency of accident at present

N: Number of working hours at present

According to Gunawan in Akbar (2013), the interpretations of STST are:

1. The value of STS between +2 to -2, it means that the frequency of work accident did not indicate a significance change at the present.

2. The value of STS > +2, it means that the achievement level of the present frequency of accident has decreased toward the past achievement.
3. The value of STS < -2, it means that the achievement level of the present frequency of accident has increase toward the past achievement. Based on this measurement, the increasing or decreasing of achievement can be seen, so that it can be analyzed to determine the causes of increase or decrease.

Risk management

According to Rudi Suardi (2007:69), risk management is the core of K3 management system and regulated by *OHSAS* and *permenaker* No.05/Men/1996. An organization can apply any risk management system methods as long as the method can identify, evaluate, choose priority, and do short or long term approach.

However, the categories of risk assessment in the following table:

Table 2.1 Category Risk Assessment

Definition						
Exposure	Scores	Opportunities	Scores	Consequence	Scores	Value Risk
Continuous	10	Very often	1	major disaster	20	E > 20
Frequent	6	periodic	0,6	big	10	H > 10
regular	3	average	0,3	Average specific	5	M 3 – 10
Irregular	2	rarely	0,1	Minor	2	L < 3
Rarely	1	rarely	0,05	insignificant	1	-

Source : Rudi, Management system K3 (2007)

Descriptions:

E: extreme or significant

H: High risk

M: Medium risk

L: Low risk

III. RESEARCH METHODOLOGY

Place and time of research

The research was conducted at PT Nira Murni construction, located in Dumai, Riau province. PT Nira Murni construction was selected by authors because the company has many employees who work in the field and operated high-tech and heavy machinery which automatically requires the implementation of an integrated management system. It makes easier for researchers to conduct the research and collect data which related with the title of the study.

Population and sample

The population in this study was all workers or employee in PT Nira Murni construction. It was 253 employees, either permanent or non-permanent. While the sample were the whole of population.

Type and source of data

The data used in this study is secondary data which obtained from the company known as qualitative data around 1st of April 2014 until 30st of July 2016.

Technique of data collection

In order to obtain the data and information about this study, the authors used data collection techniques as follows:

1. Observation, where research was conducted by visiting the object of research directly to obtain the data required
2. Interview, where the authors obtained the information through oral interview of respondent, or talking face to face with respondent
3. Documentation, where research was conducted by collecting related documents or records regarding health, safety, and performances of employee from 1st of April 2014 until 30st of July 2016.

Technique of data analysis

Risk Management

Steps which were implemented in risk management:

1. Classification of work activities
Classification of work activities is classifying a work activity (A.M. Sugeng Budiono, 2005)
2. Hazards identification
Hazards identification is systematical and continuously steps to find any potential hazards on an element of activity (A.M. Sugeng Budiono, 2005)
3. Risk assessment
The risk assessment is giving an assessment of risk possibility. This step aims to define priorities to follow-up risk, this is because that not all potential hazards can be followed up (A.M. Sugeng Budiono, 2005)

IV Result and discussion

4.1 Data collection

4.4.1 Data of work accident and number of days lost

Research had obtained data of accidents that occurred from April 2014 to July 2016. The data obtained in the following table:

Table 4.1 Work Accident Data recapitulation PT NMK period 2014 until 2016

Year	Month												Total Risk
	1	2	3	4	5	6	7	8	9	10	11	12	
2014				1	2		1	1			2		7
2015	2		2	1			1		2	1	1		10
2016		1	1		2	1	1						6

Source: Data Collection 2016

From Table 4.1. that the workplace accident in 2014 occurred 7 times, in 2015 as many as 10 times, and in 2016 work accidents 6 times.

4.2 Number of employees and work days

The number of workers of PT Nira Murni construction is different for every year. It was caused the increasing of workload so that the number of workers must be added. Where the work days is five working days (Monday to Friday). Table 4.2 shows the amount of workers and work days for every year.

Table 4.2. Number of Labor and Labor Day Period 2014 To 2016

Year	Total Work force	Working day
2014	125	189
2015	181	251
2016	253	126

Source: Data Collection 2016

4.3 Data processing

Working hours of workers of PT Nira Murni construction is 8 hours per day. To determine the total of working hours every year, It can be calculated by using formula as shown in equation 2.1

Total of working hours (N) = (working hours per day) x (working days per year) x (Total work force per year)

Then, the calculation of working hours of employee in 2014 as follows:

Total of working hours (N) = 8 hours/day x 189 days/year x 125 employees
= 189.000 hours. employee per year.

Using the same formula can be found in Appendix 1, where the total working hours for each year can be obtained as shown in the following table.

Table 4.3 Number of Hours of Work Period Until 2014 - 2016

Year	Total hours
2014	189.000
2015	363.448
2016	255.024

Source: Data Processing 2016

Table above explained that in 2014 the number of working hours is 189.000 hours.employees/year. However, in 2015 is 363.448 hours.employees/year, and in 2016 the number of working hours is 255.024 hours.employees/year.

Measurement of result of operations safety

Work accident rate

To determine the frequency of rate of accident, then it can be solved by using formula 2.2, the calculation of the frequency of accidents in the year of 2014 was as follows:

$$FR = \frac{7 \times 1.000.000}{189.000} = 37,04$$

This result means that one million of working hours with the 125 of employees occurred 37.04 times of accident. By using the same formula, the frequency of rate of accident for next year can be calculated and shown in the following table:

Table 4.4 Incidence Rate Calculation Results Work accident

Year	Frequency Rate (FR) of work accident
2014	37,04
2015	27,51
2016	23,53

Source: Data Processing 2016

From the calculation of frequency rate of occupational accidents above, it can be seen that in April 2014 until July 2016, the frequency of occupational accidents in 1 million working hours respectively 37.04, 27.51, and 23.53. However, the smaller results indicate that frequency rate of occupational accidents is small.

Severity level of work accident

The data of severity level of work accident in PT Nira Murni construction can be seen in the following level.

Table 4.5 Work Accident Rate Data Keperhatian PT NNMK

Year	Number of Days Lost (H)	Number of Hours of Work(N)
2014	18	189.000
2015	22	363.448
2016	12	255.024

Source: Data Processing 2015

To determine the severity level of work accident can be computed by using formula in equation 2.3. The results of calculation are:

$$\begin{aligned}
 \text{SR} &= \frac{18 \times 1.000.000}{189.000} \\
 &= 95,24
 \end{aligned}$$

The results indicate that in every one million of productive working hours, there was 95.24 days lost due to the accidents. However, by using the same formula, the severity level of work accident for 2015 and 2016 surely can be calculated as shown in following table

Table 4.6 Calculation Results Severity Work accident

Year	severity of workplace accidents (SR)
2014	95,24
2015	60,53
2016	47,05

Source: Data Processing 2016

From the table above, the severity level of work accident can be seen where from April 2014 until July 2016, respectively 95.24, 60.53, and 47.05.

Safe T-score

In order to compare the severity level of accidents by year to years. So that it can indicate the increasing and decreasing of accident level. The value of FR (1) is obtained from the previous year and value of FR (2) is obtained from the measured year. The formula 2.4 was used to calculate the value of STS. The results for every year were:

$$\text{STS} = \frac{27,51 - 37,04}{\sqrt{(27,51 \times 1.000.00)/363.448}}$$
$$= -659,82$$

By using the same formula, STS value can be calculated completely for each year and shown in appendix 4. Summary of the value of STS in the Year 2014 to the Year 2016 in the following table:

Table 4.7 Safe Value T-Score (STS) in 2014 Until 2016

Year	Number of hours worked (N)	STS
2015	363,448	-659,82
2016	255,024	-209,63

Source: Data Processing 2016

Table 4.8 The recapitulation of STS calculation an its interpretation

Year	Value STS	Interpretation
2015	-659,82	An increase in the frequency of occupational accidents level of achievement in the present, when compared to the frequency of workplace accidents achievements of the past
2016	-209,63	An increase in the frequency of occupational accidents level of achievement in the present, when compared to the frequency of workplace accidents achievements of the past

Source: Data Processing 2016

From the results of STS obtained, the value of STS in 2014 is -659.82. It means that an increasing in the frequency of work accident achievement compared the level of frequency of work accident in 2014. In 2016the value of STS is -209.63. It means that an increasing in the frequency of work accident achievement compared the level of frequency of work accident in 2015.

Risk Management

Risk can identify problems in production process and it can be conducted as the following activities:

1. Conducting the interview by asking the people about problems that regularly occurred when work activities at PT Nira Murni construction and any accident that might occur when performing the process, such as in Annex 5-10.
2. Analyzing the data of accident that occurred in the company and identifying hazards. It can be divided into two parts : unsafe condition and unsafe condition

Risk Assessment

When the identification of risk is done, then the next step is to provide the assessment of possible risks. This step aims to determine the priorities for follow-up risks, this is because not all potential hazards can be followed up. The first step of risk assessment is to define the probability. However, in order to define the probability of working accident, scale based on the level of accident had been used. The next step is to calculate the accident consequences that occurred for each risk. After knowing the probability of accident and consequences of each risk, the next step is to determine the level of each risk where it will be determined by relationship between the value of identification of hazards and consequences. The result of identification, evaluation, weighting, and risk assessment then are listed and ranked to determine the level for each risk. The method used in risk assessment is 3D model as shown in following table. However, with using research data in appendix 6, then the risk assessment on 3d model is obtained as shown in following table. From the measurement of potential risk with 3D modeling methods, it can be seen the level of each risk. For a risk rating which has a value of high (H) and extreme (E) are set as the significant potential hazards or risk priority that requires follow-up.

Table 4.9 Risk Assessment - 3D Model

Danger Identified	Risk Exposure				
	Assessment	Opportunity	Consequence	Valur Risk	Risk Level
Danger welding beam	3	1	5	15	H
The dangers of welding fumes	6	0,6	5	18	H
Danger noise	2	0,6	2	2,4	L
Electrical shock hazards	6	0,1	20	12	H
Hand sandwiched	3	1	5	15	H
Contaminated chemical substances	6	0,1	5	3	M
Danger of hearing	1	0,05	2	0,1	L
Fall / slip	3	0,6	10	18	H
Stings of venomous animals	2	0,1	5	1	L
Danger of gas	3	0,1	2	0,6	L
fall	3	0,3	5	1,5	L
Hand hit the hammer	2	0,3	2	1,2	L
Fell	2	0,3	10	6	M
Danger of gas	6	0,3	10	18	H
Fall	1	0,6	5	3	M

Source: Data Processing 2016

JSA Analysis

To make it easier to analyze the impact of a work accident, it is important to do by using JSA analysis method. Through this method, it can identify the accidents that contribute directly that indicate the top of accident based on the data set in JSA table-picture.

JSA Program

Support of management

From the regulation of PT Nira Murni construction, it can be concluded that management have a commitment to create safe workplace and safe environment healthy for all workers and others who entered around the work place. In application, it is indicated by creation of regulation or work procedure in every working activity and to make sure that all workers can

do their job properly. However, the procedure is possible to be revised if there are conditions that need to be changed. One of the most important considerations is hazard identification activity that will generate inputs for the improvement of the existing working procedures. Therefore, needed a efficient method to analyze faster and based on K3 principle. In this case, PT Nira Murni construction had implemented Job Safety Analysis (JSA), but still there are some activities that have the potential hazards and some of them also have not been implemented for JSA.

Implementation Program

In the implementation of JSA at PT Nira Murni construction, the foreman and operator become implementation team that very related to work activities which will be created for JSA. It is based on that foreman and operator are people who most understand with workplace and work environment and most experienced in performing working activities, so that they play main role in identifying hazard and countering danger conditions to improve work procedure or other actions. The process of analysis will be more effective if done directly by foreman and operator who daily work in the field and very experienced in this field.

PT Nira Murni construction has made various efforts to control risks, but there are still risks that have not been controlled.

Conclusion

From processing of data obtained, it can be concluded:

1. The rate of work accident in PT Nira Murni construction from 1st of April 2014 until 30st of July 2016 were 52 cases and the most occurred accidents were hand squeezed, dropped, and hand accident by hammer. The results of analytical of safety T-score in 2015 was -659.82 and -209.63 in 2016. It means that there was an increasing of the frequency of work accident achievement at present compared the level of frequency of work accident in past year.
2. The implementation of **Job Safety Analysis (JSA) in PT Nira Murni construction** is cooperation between the related various departments. Safety department are only as facilitator for implementations, meanwhile the foreman in any sections is as general guarantor. Where the idea is based on:
 - a. Foreman and operator are assumed as employees that most understand about work activities
 - b. They are assumed the most experienced in work analysis
 - c. They also have sufficient knowledge in their field
3. In the work activities of PT Nira Murni construction, there were risks of potential hazard in every activity. To overcome that problem, the risk controlling had been applied. However, there is still potential hazard that has not been controlled or lees effective controlling

Suggestions:

The advices can be given to company are:

1. The company is expected to develop the method of hazard identifications and risk assessment in more detail for every work process

2. The company is expected to pay more attention about work safety of employee, because the company will get loses once the worker had an accident at work
3. It is important to create and implement Job Safety Analysis (JSA) for all work activities and expected to all of employees to read and understand about the contents of JSA.

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