Evaluation of Mining Safety Performance (Safety Maturity Level) at Mining Contractor Company PT. X Lahat, South Sumatra

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Abstract

Background: The implementation of the Mining Safety Management System or Sistem Manajemen Keselamatan Pertambangan (SMKP) is mainly in element 2, namely planning where before starting to develop SMKP the company must conduct an initial review, the results of which are used as a baseline assessment to determine the safety condition of the mine. To conduct the initial review, it is necessary to conduct a study to assess the level of achievement of mining safety performance in the implementation of safe operational management at the mining contractor company PT. X in Lahat, South Sumatra. Method: The study method can be done with a mixed method (semi-qualitative and quantitative). The data is by the Instruments contained in the Technical Guidelines for Assessment of the Level of Achievement of Mining Safety Performance regulated in the KEPDIRJEN MINERBA Number 10. K / MB.01 / DJB. T/2023. The data collection process is carried out using the cross-sectional method. Results: From the assessment of 4 (four) indicators, it was found that for Non-Staff level employees the Safety Maturity Level (SML) achievement was at the Reactive Level, for Group Leader level employees the Safety Maturity Level (SML) achievement was at the Reactive Level and Management level employees the Safety Maturity Level (SML) achievement was at the Planned Level. Conclusion: Achievement of mining safety performance or Safety Maturity Level (SML) at mining contractor company PT. X is the Reactive Level.

***Keyword**: SMKP, Safety Maturity Level, Mining Safety, KP Performance*

1. Introduction

The mining industry is one of the vital industries that has a major role in supplying energy in Indonesia. The process of work in mining has a high potential for danger and risk, for that aspect of Safety, Occupational Health and Environment are requirements that must be met in every work activity (Wardani, 2022).

Regulations in Indonesia require all mining companies and mining service providers to implement the Mining Safety Management System (SMKP Minerba) (Wardani, 2022). This refers to the Regulation of the Minister of Energy and Mineral Resources (ESDM) Number 26 of 2018. SMKP Minerba aims to improve the effectiveness of planned, measurable, structured, and integrated mining safety management. Mining companies and mining services are required to implement SMKP Minerba at least once a year (Kepmen, No 26 Tahun 2018).

The Minister of Energy and Mineral Resources No. 26 of 2018 concerning the implementation of good mining

principles and supervision of mineral and coal mining, where it is explained that SMKP (Mining Safety Management System) is part of the existing system in the company as a whole, assisting companies to implement Mining Occupational Safety and Health (K3) and Implementation of Mining Operational Safety (KO). SMKP Minerba consists of 7 core assessment elements: Policy, Planning, Organization and Personnel, Implementation, Evaluation and Follow-up, Documentation, Management Review, and Work Improvement.

Technical explanations on how to implement good mining rules are explained in the ESDM Decree No. 1827. K / 30 / MEM / 2018 concerning guidelines for the implementation of good mining engineering rules, in Annex IV concerning guidelines for the implementation of the Mineral and Coal Mining Safety Management System (SMKP Minerba) which describes the elements and sub-elements in the application of SMKP MInerba.

In the implementation of SMKP Minerba technically referred to the Kepdirjen Minerba No. 185. K / 37.04 / DJB / 2019 concerning Technical Guidelines for the Implementation of Mining Safety and the Implementation, Assessment, and Reporting of Mineral and Coal Mining Systems, in element 2, namely planning where before starting to develop SMKP the company must conduct an initial review, the results of which are used as a baseline assessment to determine the safety conditions of the mining company. The initial review describes the Level of Mining Safety Performance Achievement based on specific indicators and parameters.

Initial review can be conducted by assessing the level of achievement of mining safety performance through primary data (questionnaires, interviews, observations, FGDs, and tests/simulations) and secondary data (review of documents/records and analysis) so that the level of achievement of mining safety performance (Safety Maturity Level) can be analyzed (Abdul Azis, 2022). This is regulated in the Kepdirjen Minerba No. 10. K / MB.01 / DJB. T/2023 on Technical Guidelines for Assessment of Mining Safety Performance Achievement Levels.

Therefore, it is necessary to conduct a study to assess the level of achievement of mining safety performance in the implementation of safe operational management in the company. So that the Safety Maturity Level Evaluation at the mining contractor PT. X based on KEPDIRJEN Number 10 of 2023 is the topic of this study.

2. Method

The research was conducted in one of the mining companies located in Lahat, South Sumatra Province. Sample determination using the Slovin formula (Rondowunu, 2021), with the following details:

N = 606 employees

e =0.05

$$n = \frac{N}{1 + Ne2}$$

n = 240,95

n = 241

Results based on the calculation of the Slovin formula obtained a sample result of at least 241. Sampling uses the stratification sampling method for the Non-Staff, Group Leader groups, and management groups. With this technique, it is expected that the conditions occurring in each group of respondents can be adequately represented. The formula used is as follows :

$$\text{nh} = \frac{Nh\ x\ n}{N}$$

Nh = Total population of stratum

nh = Number of Sample by Stratum

An in-depth evaluation with qualitative methods is conducted to assess the extent of performance achievement at the planning element level during the initial review. Data processed quantitatively aligns with the instruments outlined in the Technical Guidelines for the Assessment of Mining Safety Performance Achievement, regulated by the Directorate General of Mineral and Coal Director Decree No. 10. K/MB.01/DJB.T/2023. The scale used is from 1 to 5 for each measurement item within each parameter. The following is the calculation method for each indicator according to Directorate General of Mineral and Coal Director Decree No. 10. K/MB.01/DJB.T/2023.

a. The Achievement Value of Parameters is the sum of the total values of all measurement items divided by the number of measurement items, multiplied by 5, and then multiplied by the assigned parameter weight.

$$NP = \frac{Total\ Value\ of\ All\ Measurement\ Items}{5\ x\ Tptal\ Number\ of\ Measurement\ items} X parameter\ weight$$

NP = Achievement Value of the Parameter

b. The Indicator Achievement Value is the sum of all Achievement Values of Parameters within the same indicator.

Indicator Achievement Value = Total of The Achievement of all Parameter within the indicator

c. The Performance Achievement Value is the sum of all Indicator Achievement Values.

Performance Achievement Value = Total Achievement Value of all Indicators

The data collection process is carried out using the cross-sectional method. The qualitative method is carried out by interviews on the research subject and continued with quantitative methods by assessing indicators and parameters calculated according to regulations. The subjects of this study are all X mining contractor workers in Lahat, South Sumatra who are categorized into Non-Staff level (Operator, Helper, Mechanic, Admin, Paramedic, Driver, etc.), Staff (Group Leader level supervisor) and Department Coordinator. Primary data sources (questionnaires, interviews, and field observations) and secondary data (document/recording review and analysis).

3. Result

In accordance with the applicable regulations, mining service companies are required to conduct a reassessment of all or part of the measurement items of the Mining Safety Performance Achievement Level (Gusvita,2023). If the measurement results are obtained the results of the achievement of indicators that are still in the basic level and reactive level categories, then mining service companies must reassess these indicators in the next assessment year (Kepdirjen Minerba No 185 Year of 2018).

The level achievement of mining safety performance as part of the initial review in element II of the Planning has levels described as follows:

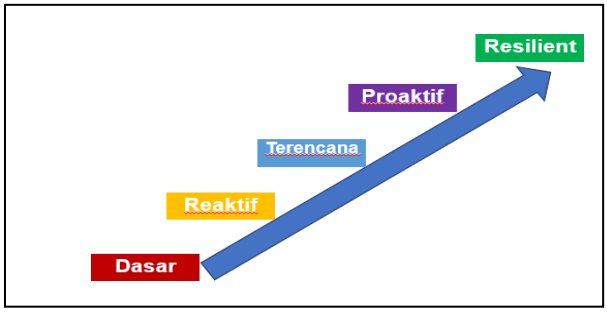

Figure 1. Mining Safety Performance Achievement Level
Source: Warid Nurdiansyah, 2023

The assessment was carried out with 5 indicators from the KEPDIRJEN MINERBA Number 10. K / MB.01 / DJB. T/2023. Each element has a different number of sub-elements which will then be assigned a scale value for the level of application (Sumarno &; Fardan,

2018) (Markkanen, 2004). The following is an assessment of mining safety performance:

a. Achievement Score < 0.50: Elementary Level
b. Achievement Value 0.50 to 0.69: Reactive Level
c. Achievement Value 0.70 to 0.79: Planned Level
d. Achievement Value 0.80 to 0.89: Proactive Level
e. Achievement Value 0.90 to 1: Resilient Level

The measurement results based on indicators of the level of achievement of mining safety performance are as follows:

1) Mine Worker Participation

The calculation of mine worker participation indicators refers to the parameters of individual concern and behavior towards mining safety risks and worker involvement in mining safety management. The calculation refers to the measurement indicator strengthening table specified in the KEPDIRJEN MINERBA Number 10. K / MB.01 / DJB. T/2023.

The level of assessment on the Mine Worker Participation indicator is as follows:

a. Achievement Score < 0.07: Elementary Level
b. Achievement Value 0.07 ≤ x < 0.10 : Reactive Level
c. Achievement Value 0.10 ≤ x < 0.12 : Planned Level
d. Achievement Value 0.12 ≤ x < 0.14 : Proactive Level
e. Achievement Value 0.14 ≤ x < 0.15 : Resilient Level

Based on the review, the results are obtained as illustrated in the figuras follows:

Figure 2. Mine Worker Participation

The calculation results are assessed according to the level of performance achievement criteria for the indicator of participation of mine workers. Based on the graph above, it can be concluded that the level of achievement category of theindicator of participation of mine workers at each subject level is the

Reactive Level. The following is a table assessing the level of achievement of the indicator of mine worker participation.

Table 1. Achievement Level of Mine Worker Participation Indicator

Indicator	Acces Categories		
	Non-staff	Group Leader	Management
Mine Worker Participation	Reactive level	Reactive level	Reactive level

2) Responsibilities of Work Unit Leaders

The calculation of the Responsibility indicator of the Head of the Work Unit refers to the parameters of the implementation of mining safety policies; mining safety leadership and commitment; compliance and enforcement of mining safety regulations; determination of roles, responsibilities, and authorities in mining safety; management of mining safety strategies and operations; information, communication, mentoring, mining safety consulting; quality control of mining safety in operational activities; quality assurance of mining safety through SMKP internal audit. The level of assessment on the Work Unit Leader Responsibility indicator is as follows:

a. Achievement Score < 0.17 : Elementary Level
b. Achievement Value 0.17 ≤ x < 0.24 : Reactive Level
c. Achievement Value 0.24 ≤ x < 0.29 : Planned Level
d. Achievement Value 0.29 ≤ x < 0.33 : Proactive Level
e. Achievement Value 0.33 ≤ x < 0.35 : Resilient Level

Based on the review, the results are obtained as illustrated in the figure as follows:

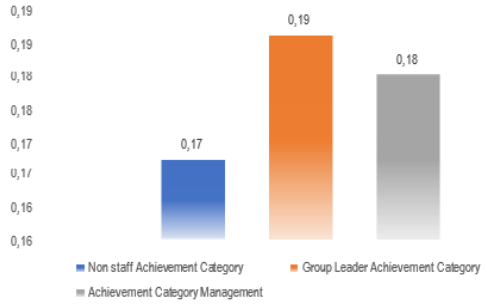

Figure 3. Responsibilities of Work Unit Leaders

The calculation results are assessed at the level by the level of performance achievement criteria for the responsibility indicator of the head of the work unit. Based on the graph above, it can be concluded that the level of achievement category of the responsibility indicator of the head of the work unit has results that vary at each level of the subject. The following is a table assessing the level of achievement of the responsibility indicator of the head of the work unit.

Table 2. Level of Achievement of Work Unit Leader Responsibility Indicator

Indicator	Acces Categories		
	Non-staff	Group Leader	Management
Responsibilities of Work Unit Leaders	Reactive level	Planned tier	Reactive level

3) Analysis and Statistics of Work Accidents, Work-Induced Diseases, Incidents Due to Workforce Diseases, and Dangerous Incidents

Calculation of indicators analysis and statistics of work accidents, and occupational diseases. events due to labor diseases, and hazardous events refer to the analysis parameters of mining safety case data; investigation of mining safety cases; mining safety performance statistics based on lagging indicators; and organizational learning. The level of assessment on indicators of analysis and statistics of work accidents, and occupational diseases. Events due to labor diseases, and hazardous events are as follows:

a. Achievement Score < 0.10: Basic Level
b. Achievement Value 0.10 ≤ x < 0.14 : Reactive Level
c. Achievement Value 0.14 ≤ x < 0.17 : Planned Level
d. Achievement Value 0.17 ≤ x < 0.19 : Proactive Level
e. Achievement Value 0.19 ≤ x < 0.20 : Resilient Level

Based on the review, the results are obtained as illustrated in the figure as follows:

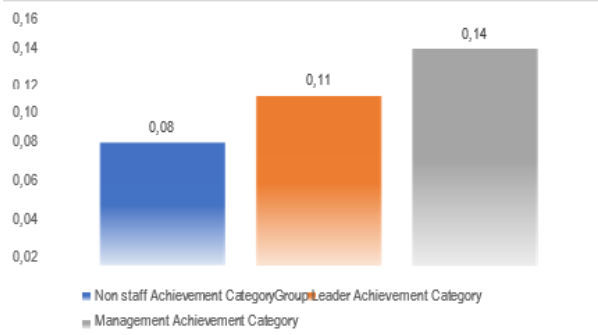

Figure 4. Analysis and Statistics of work accidents, work-induced illnesses, incidents due to labor diseases, and dangerous events

The calculation results are assessed according to the level of performance achievement criteria for analysis indicators and statistics of work accidents, occupational diseases, events due to labor diseases, and hazardous events. Based on the graph above, it can be concluded that the

level of achievement categories of analysis indicators and statistics of work accidents, occupational diseases, events due to labor diseases, and hazardous events at each subject level is the Basic Level. The following is an assessment table of the level of achievement of indicators analysis and statistics of work accidents, occupational diseases, events due to labor diseases, and hazardous events.

Table 3. Achievement Level of Analysis and Statistics of Accidents, Occupational Diseases, Labor Disease Events, and Hazardous Events

Indicator	Acces Categories		
	Non-staff	Group Leader	Management
Analysis and Statistics of Accidents, Work-Induced Diseases, Incidents Due to Workforce Diseases, and Dangerous Incidents	Basic level	Basic level	Basic level

4) Restraint Effort Undertaken

Calculation of indicators analysis and statistics of work accidents, and occupational diseases. events due to labor diseases, and hazardous events refer to having 10 parameters, namely Governance-Based Mining Safety Risk Control; Mining Occupational Health Management; Mining Work Environment Management; Engineering Management &; Process Design; Mining Safety Asset Management; Worker Reliability Management in Mining Safety Management; Change Management; emergency management; Management of Mining Service Companies; Document Management &; Mining Safety Records. The level of assessment on indicators of analysis and statistics of work accidents, and occupational diseases. Events due to labor diseases, and hazardous events are as follows:

a. Achievement Score < 0.15
: Basic Level
b. Achievement Value 0.15 ≤ x < 0.20
: Reactive Level
c. Achievement Value 0.21 ≤ x < 0.25
: Planned Level
d. Achievement Value 0.25 ≤ x < 0.28
: Proactive Level
e. Achievement Value 0.28 ≤ x < 0.30
: Resilient Level

Based on the study, the results are obtained as illustrated in the figure as follows:

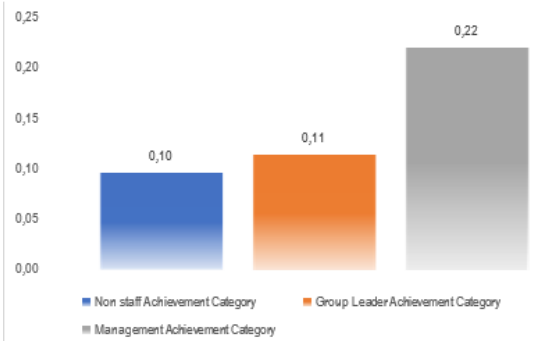

Figure 5. Control Measures Undertaken

The calculation results are assessed by the criteria for the level of performance achievement for indicators of restraint effort undertaken. Based on the graph above, it can be concluded that the level of achievement categories of indicators of restraint effort undertaken has results that vary at each level of the subject. The following is a table assessing the level of achievement of indicators of control efforts carried out.

Table 4. Level of Achievement of Indicators of Restraint Effort Undertaken

Indicator	Acces Categories		
	Non-staff	Group Leader	Management
Restraint effort undertaken	Basic level	Basic level	Planned tier

5) Cumulative Safety Maturity Level (SML) Value

In this study, the results of the analysis based on 4 indicators of achievement level found that research subjects at the management level had the highest achievement category compared to other research subjects. This is illustrated in the figure as follows:

Figure 6. Overall Value of the Indicator

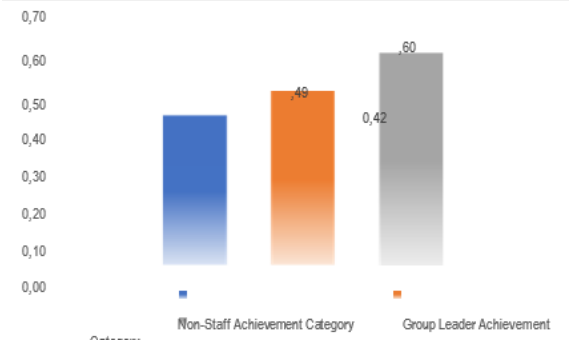

Table 5. Cumulative SML Indicator Achievement Level

Indicator	Acces Categories		
	Non-staff	Group Leader	Management
Total value of overall indicator by research subject	Reactive level	Reactive level	Planned tier

Based on Table 5. Above, cumulatively from the assessment of 4 (four) indicators, it was found that for Non-Staff level employees the Safety Maturity Level (SML) achievement was at the Reactive Level, for Group Leader level employees the Safety Maturity Level (SML) achievement was at the Reactive Level and Management level employees the Safety Maturity Level (SML) achievement was at the Planned Level.

Table 6. SML Achievement Level Mining Contractor PT. X

Information	Acces Categories
Overall Average Rating	0,5 Reactive Level

Refer to Table 6. above, the level of achievement of *the Safety Maturity Level (SML)* of mining contractor PT. X is at the Reactive Level.

4. Discussion

Mining Safety Performance (SMKP Minerba) is one of the integrated parts of the company's system that includes mining occupational safety and health (K3) and the implementation of mining operational safety (KO) (Sakuda, 2019). The level of achievement of mining safety performance is part of the initial review in Element II of the Planning. Based on the results of the above study, in Table 6. Shows the average of the overall value of the measurement Safety Maturity Level (SML) Mining Contractor Company PT. X is 0.5 which means the achievement of mining safety performance in PT. X is the Reactive Level.

According to Kepdirjen No. 10 of 2023, the outcomes derived from the preliminary evaluation of indicators using a reactive level assessment within the Quality Management System (QMS) exhibit management characteristics that remain predominantly centered on:

The system operates based on incidents, meaning the implementation of Occupational Safety and Health Management (SMKP) within the company functions when incidents occur. SMKP has not actively engaged in efforts to identify potential hazards and risks, as well as controls to prevent incidents in mining.

It solely focuses on issues/incidents. In this context, SMKP concentrates on managing incidents that have already occurred. SMKP has not actively endeavored to analyze the causes of incidents or made efforts to implement improvements to prevent similar incidents in the future.

Investigations are solely centered on human errors. Investigations are conducted solely to determine responsibility for the occurrence of incidents. The resolution focuses on

imposing sanctions on employees who have made mistakes. Analysis of the causes and efforts to prevent incidents from occurring have not been optimally executed.

According to the above interpretation, mining contractor company PT. X continues to focus on problems/incidents when it comes to mining safety performance, which means that when there is a problem/incident, the employees and new management evaluate the operation of the mining safety management system (SMKP). Based on a review of accident investigation results documents (LPI), errors due to accidents are focused on unsafe action factors (TTA) and dominant personal factors caused by worker (human) error (Kepdirjen No. 10 of 2023).

Recommendations for improving the safety performance (KP) at mining contractor company PT. X include: enhancing employee competence in their field of work, ensuring all employees are involved in mining safety programs, involving site management in mining safety programs to demonstrate concern for employees, and ensuring supervisors are aware of their operational responsibilities.

5. Conclusion

Mining contractor company PT. X in Lahat, South Sumatra has measured the Safety Maturity Level (SML) or the level of achievement of mining safety performance (KP) and obtained the following cumulative results, the overall achievements of the SML mining contractor company are at the Reactive Level. Based on the results of the review, the suggestions given are by the KEPDIRJEN MINERBA Number 10. K / MB.01 / DJB. T/2023 with the results of the Reactive Level on the results of the Mining Safety Performance Achievement Level, mining service companies must reassess all Mining Safety Performance Achievement Level indicators in the following assessment year.

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