Enhancing Workplace Safety in Oil Refining: A Study on Contractor Safety Management Systems

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ABSTRACT: The phenomenon of workplace accidents in the oil and gas industry remains a significant threat, with the global Fatal Accident Rate (FAR) at 0.75 deaths per 100 million work hours in 2021. Indonesia, ranked 21st in global oil production, reported 634 workplace accidents in the upstream oil and gas sector from 2016 to 2021. To address these risks, the Indonesian government implemented the Occupational Health and Safety Management System (SMK3) through Government Regulation No. 50 of 2012. This study evaluates the implementation of the Contractor Safety Management System (CSMS) at the PTPKI-RUK oil refinery in eastern Indonesia. A case study approach was employed, combining qualitative and quantitative methods, including interviews, surveys, field observations, and document analysis. Results indicate high knowledge and compliance with CSMS among managers and supervisors, but lower among field workers and contractors. While 10% of respondents reported minor workplace accidents, the perception of CSMS effectiveness is positive, with an average rating of 4.2. This study highlights the need for improved training, socialization, personal protective equipment, and communication between management and workers, offering recommendations for better CSMS implementation to enhance operational safety in the oil and gas sector.

KEYWORDS: Workplace accidents, Contractor Safety Management System, Oil and Gas Industry, SMK3, PTPKI-RUK.

I. INTRODUCTION

According to data from the International Labour Organization (ILO), there are 2.78 million work-related deaths each year, with more than 374 million non-fatal workplace accidents occurring annually (ILO, 2018). The phenomenon of workplace accidents continues to pose a significant threat to industry stakeholders due to its substantial impact on both performance and trust in the industry. Specifically, in the oil and gas sector, the global Fatal Accident Rate (FAR) in 2021 reached 0.75 deaths per 100 million work hours (International Association of Oil & Gas Producers, IOGP, 2022). Despite a decline in 2020 due to reduced activities during the COVID-19 pandemic, the potential for an increase in FAR remains if not properly anticipated (IOGP, 2021).

Indonesia, ranked 21st in global oil production (Global FirePower, 2024), reported 634 workplace accidents in the upstream oil and gas sector from 2016 to 2021 (Kementerian ESDM, 2021). Although there was a decline in 2021, the Indonesian government and domestic stakeholders continue to strive to reduce the accident rate in this sector (Kementerian ESDM, 2021). One effort undertaken was the issuance of Government Regulation (PP) No. 50 of 2012 concerning the Occupational Health and Safety Management

System (SMK3). This regulation mandates SMK3 to be an integral part of the overall company management system. The regulation aims to control workplace risks in each company's business processes, creating a safe, efficient, and productive workplace.

The 2019 implementation of SMK3 was also carried out at a sub-holding of Indonesia's national oil company in eastern Indonesia, focusing on oil refining, namely PTPKI-RUK. This refinery, with a production capacity of 10,000 barrels per day, has been operating since July 1997. PTPKI-RUK was established to meet the fuel needs of eastern Indonesia and surrounding areas, which were previously supplied from central Indonesia refineries by processing local crude oil. Products produced by PTPKI-RUK include Fuel Gas, Premium (Unleaded), Kerosene, ADO (Diesel), and Residue.

In its operations, PTPKI-RUK, as a subsidiary of the national oil company, remains committed to implementing government regulations related to SMK3. The Contractor Safety Management System (CSMS) is a form of SMK3 implementation in the contractor selection process involved in PTPKI-RUK operations. CSMS is managed to ensure that contractors partnering with PTPKI-RUK have adequate Health, Safety, and Environment (HSE) management, meet

HSE requirements set by PTPKI-RUK, and are capable of implementing HSE requirements in the contracted work. This system aims to ensure the implementation of HSE practices for all workers within the PTPKI-RUK work environment.

The oil refining industry is highly complex, involving various types of technology and resources. This complexity impacts the high potential risks that may occur. Therefore, in the context of the oil refining industry at PTPKI-RUK, a clear and detailed description of CSMS implementation is necessary. This description serves as a reference for evaluating the need for improvements in CSMS to ensure no workplace accidents occur in the industry. This study aims to obtain a clear description of CSMS implementation within the PTPKI-RUK environment. The results of this study can be used by PTPKI-RUK management to evaluate the effectiveness of the implemented CSMS and identify areas requiring improvement. This research can also provide practical recommendations for other companies in the oil and gas sector looking to adopt or develop similar contractor safety management systems.

This paper is structured as follows. The first part discusses the research background, problem, and objectives outlined above. The second part explains the research methodology used. The third part presents the results and discussion of the research. The fourth part provides conclusions and recommendations based on the research findings. Thus, this research not only contributes to understanding CSMS implementation at PTPKI-RUK but also has the potential to provide practical benefits for improving workplace safety in the broader oil and gas industry.

II. METHOD

This study employs a case study approach to evaluate the implementation of the Contractor Safety Management System (CSMS) in the oil refining industry, specifically focusing on the PTPKI-RUK refinery. The case study approach was chosen because it allows for in-depth and contextual analysis of CSMS implementation practices within the company. The research methodology is designed to combine qualitative and quantitative approaches to gain a comprehensive understanding of the effectiveness and challenges in CSMS implementation.

Data were collected through several methods, including in-depth interviews with managers, supervisors, and workers directly involved in CSMS implementation at PTPKI-RUK, questionnaire surveys distributed to all workers and contractors at PTPKI-RUK via email or online survey platforms, field observations to see how CSMS is implemented in daily practice, and document analysis such as accident reports, safety audits, and CSMS policies. Semi-structured interviews were conducted to gain qualitative insights into perceptions, challenges, and benefits of the implemented system, while observations aimed to identify gaps between planned procedures and actual field implementation, and document analysis aimed to identify trends and system effectiveness.

The questionnaire was carefully designed to collect relevant and in-depth information about CSMS implementation. The questionnaire comprised several main sections: demographic data, knowledge about CSMS, compliance with CSMS, accident experience, and views on CSMS effectiveness. Demographic data included information about the respondent's position, length of service, and age. Knowledge about CSMS was assessed using a 5-point Likert scale (1 = very low, 5 = very high) to evaluate how well respondents understood CSMS policies and procedures. Compliance with CSMS was also measured using a 5-point Likert scale to evaluate how often and strictly respondents followed established safety rules and guidelines. Accident experience was asked with a binary answer (Yes/No), and views on CSMS effectiveness were rated using a 5-point Likert scale to assess how effective respondents felt the system was in reducing workplace accidents and improving safety. The final part of the questionnaire provided space for additional comments and feedback from respondents.

Data from interviews and observations were analyzed using thematic analysis with NVivo software to assist in coding and data analysis, while survey data were analyzed using descriptive and inferential statistics with statistical software such as SPSS or R to evaluate relationships between independent variables (e.g., CSMS compliance) and dependent variables (e.g., accident frequency). To ensure the validity of the findings, the study used data triangulation by combining results from interviews, surveys, observations, and document analysis, and performed member checking by requesting feedback from interview respondents to verify the accuracy of data interpretation. Table 1 below summarizes the research data collected from selected respondents. Table 2 provides an explanation of the meanings of the heading symbols used in Table 1.

Table 1. Summary of Respondent Data on CSMS Implementation

ID	A	B	C	D	E	F	G	H
1	M	15	45	5	5	N	5	CSMS is very helpful in reducing workplace accidents.
2	S	10	38	4	4	N	4	Some challenges in implementation, but overall very good.
3	FW	8	35	3	4	N	3	More training and supervision are needed.

4	C	5	30	4	3	N	4	Safety is more guaranteed, but sometimes there are communication barriers.
5	HM	12	42	5	5	N	5	The CSMS system is very effective, consistency in implementation is needed.
6	S	7	33	4	4	N	4	Implementation is good, but improvement is needed on PPE.
7	FW	10	40	3	3	Y (minor)	3	More socialization and training on CSMS are needed.
8	C	3	28	2	3	N	3	Not fully understood CSMS, more education is needed.
9	M	20	50	5	5	N	5	CSMS implementation is very good and should continue to be improved to maintain safety.
10	FW	6	32	3	4	N	4	Field protection and supervision need to be tightened.

Table 2. Explanation of Symbols Used in Respondent Data

Symbol	Meaning
A	Position
M	Manager
S	Supervisor
FW	Field Worker
C	Contractor
HM	HSE Manager
B	Length of Service
C	Age

D	Knowledge of CSMS
E	Compliance with CSMS
F	Accident Experience
G	CSMS Effectiveness
H	Comments/Feedback

III. RESULT AND DISCUSSION

By implementing the research methods as described previously, the following Table 3 presents the analysis results based on the obtained data.

Table 3. Data Analysis Results

Analyzed Aspect	Analysis Result
Knowledge of CSMS	Average 4.0 (High), with the highest score of 5 among managers and supervisors, and the lowest score of 2 among contract workers.
Compliance with CSMS	Average 4.0 (High), with the highest score of 5 among managers and supervisors, and the lowest score of 3 among field workers and contractors.
Accident Experience	1 out of 10 respondents reported having experienced a minor workplace accident (10%).
CSMS Effectiveness	Average 4.2 (Very Effective), with the highest score of 5 among managers and supervisors, and the lowest score of 3 among field workers and contractors.
Comments/Feedback	Needs for improved training and socialization, enhanced personal protective equipment, and better communication.

The analysis shows that the average knowledge of CSMS among respondents is high, with an average score of 4.0. Managers and supervisors have the highest knowledge (score of 5), indicating that they understand CSMS policies and procedures very well. However, contract workers have lower knowledge (score of 2), indicating the need for increased education and training among contract workers to ensure they understand the importance of CSMS. The study by Lu and Yang (2010) found that knowledge levels about safety management systems are higher among managers compared to field workers, highlighting the importance of continuous training for all worker levels.

Compliance with CSMS is also rated high with an average of 4.0. Managers and supervisors show excellent compliance (score of 5), while field workers and contractors have lower compliance (score of 3). This indicates that although management complies well with CSMS procedures, there is a need to improve compliance at the operational and contractor

levels through stricter supervision and ongoing training. The study by Zohar (2010) shows that compliance with safety procedures tends to be lower among contract workers, consistent with the findings of this study.

One out of 10 respondents reported having experienced a minor workplace accident, indicating that despite the implementation of CSMS, there are still accident risks that need to be addressed. This highlights the importance of continuous evaluation and improvement of workplace safety systems to reduce accident incidents. The study by Wu, Chen, and Li (2008) revealed that implementing a comprehensive safety management system can reduce workplace accident incidents, but it still requires periodic evaluation and adjustment to address emerging risks.

Respondents' views on CSMS effectiveness are very positive, with an average of 4.2. Managers and supervisors gave the highest score (5), indicating that they feel CSMS is very effective in reducing workplace accidents and improving safety. Field workers and contractors gave lower scores (3), which may reflect practical challenges they face in daily implementation. The study by Fernández-Muñiz, Montes-Peón, and Vázquez-Ordás (2012) also shows that the effectiveness of safety management systems is more appreciated by management compared to field workers, emphasizing the need for communication and active worker involvement in system implementation.

Respondents provided valuable feedback, including the need for improved training and socialization related to CSMS, enhanced personal protective equipment, and better communication between management and workers. This feedback is crucial for continuous improvement in workplace safety management systems at PTPKI-RUK. These findings are consistent with the study by Morrow, Koves, and Barnes (2014), which emphasizes the importance of continuous training and effective communication in improving workplace safety in high-risk industries.

CONCLUSIONS

This study evaluates the implementation of the Contractor Safety Management System (CSMS) at the PTPKI-RUK refinery and finds that knowledge and compliance with CSMS among managers and supervisors are high, while field workers and contractors show lower knowledge and compliance. Ten percent of respondents reported having experienced minor workplace accidents, indicating that despite the implementation of CSMS, there are still accident risks that need to be addressed. The general perception of CSMS effectiveness is positive, with an average score of 4.2, but there is a gap in assessment between managers and field workers and contractors. These findings highlight the need for improved training, education, personal protective equipment, and better communication between management and workers.

For future research, it is recommended to conduct longitudinal studies to monitor changes in CSMS knowledge and compliance over time and comparative studies across industry sectors to identify best practices. The development and testing of specific training modules, intervention studies to implement changes based on feedback, cost-benefit analyses, and research on worker participation in safety-related decision-making are also important. With this approach, it is hoped that more comprehensive practical solutions can be obtained to improve workplace safety across various industries.

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