Conference Paper

Correlation Between Company's Lock Out Tag Out (LOTO) System with LOTO Implementation Behavior of Mechanic in Plant Department

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Abstract

Lock Out Tag Out (LOTO) is a system of locking and labeling on an energy source of isolation equipment. LOTO aims to protect mechanics on maintaining and servicing. Application of Lock Out Tag Out is influenced by behavior. This study aimed to analyze the correlation of LOTO system that has been implemented in the company, involving the LOTO training, supervision, and reward and punishment with the LOTO implementation behavior of mechanics. This research was observational with cross-sectional study. Samples were 50 respondents taken by simple random sampling with a population of 97 mechanics. Data were analyzed statistically using Chi Square test (α <0.05) and continued by observed value of phi coefficient. The results showed that most of the mechanics in the Plant Department of PT. X (mining company) had implemented LOTO in every maintaining and servicing equipment well. Statistical analysis showed the variables have a significant correlation with LOTO application on mechanics was supervision (sig = 0.047; phi value = 0.312). LOTO training, reward, and punishment did not have significant correlation with LOTO application. In conclusion, supervision had significant correlation with LOTO implementation on mechanics. The mining company should increase transfer knowledge to mechanics by putting LOTO signs around workshop area, increasing supervising role of the foreman and OSHE Department, making a LOTO training and refresh training schedule and evaluating it, and also giving rewards to mechanics regularly.

Keywords: Lock Out Tag Out (LOTO), mechanic, mining company

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1. Introduction

The rate of workplace accidents in Indonesia is still high. According to the International Labor Organization (ILO) [1] report of 2011, taken from the fact sheet of the Labor

Inspector of Indonesia, 98.711 workplace accidents occurred during 2010. According to the first half of available data in 2011, there were 48.511 accident cases, with the largest causes being machines, transport plane–a machine, and hand tools.

Accidents happen because of contact with hazardous energy sources, according to Frank Bird's accident approach [2]. The USA estimated that failings in hazardous energy management causes 10 percent of serious incidents in the industry. This further causes a loss of 28.000 work days, as well as 120 deaths every year [3].

Workers need a system to protect them from the release of hazardous energy, as this would prevent accidents. One of the system that can fulfill the need is LOTO. Mechanics have a LOTO procedure when doing maintenance and repair, as an effort to avoid workplace accidents. Ada's research [4] claimed that good LOTO practice by mechanics could avoid or reduce workplace accidents. But, LOTO application procedure is limited by mechanics themselves.

According to Cooper Research [5], 80–95 percent of workplace accidents were caused by unsafe acts. Similarly, DuPont Company Research [6] stated that 96 percent workplace accidents were caused by unsafe acts and the remaining 4 percent by unsafe conditions. Geller [7] described the importance of a behavioral safety approach when improving occupational safety, both reactively or proactively.

PT. X is a leading mining services company in Indonesia. It has a plant department; whose core business process is to maintain and repair the production support equipment. Mechanics in the plant department must execute LOTO in their works. Based on hazard identification, assessment, and risk control in maintenance and repair activity, the department demonstrated the need for LOTO practice by mechanics as a control measure. LOTO is a safety procedure that must be obeyed by mechanics before they work. The department's observation pointed out that 75 percent of mechanics did not apply LOTO according to procedure. For example, they stacked the installation of lock pads on the peer lock pad, were unsure of returning energy cuts, and no LOTOs were used during maintenance work or repairs when working in teams.

PT. X has committed to implementing the LOTO system. IMS (Integrated Management System) indicated that LOTO should be practiced in the form of procedures, standards, work instruction, form, and the availability of LOTO facilities. LOTO procedure within the company must be implemented by mechanics without exception. This is to protect them and the people around them from workplace accidents. This will build productivity and the welfare of mechanics. Based on that issue, research is necessary to find out the related factors, those are official training concerning LOTO for mechanics, supervision by *supervisor*, reward and punishment for the LOTO performance in Plant

Department, so that the implementation of LOTO in PT. X can go well. The purpose of this research is to analyze factors related to implementation of LOTO by mechanics in Plant Department of PT. X.

2. Methods

This is observational research with cross-sectional design. The study was conducted from October 2013 to June 2014, while data was taken from March to April 2013.

The population of this research were all mechanics in Plant Department of PT. X who met the inclusion criteria, for a total of 97 mechanics. Based on the large sample computation and formulas, the minimum sample for this research was 49 mechanics. Sample determination for questionnaires in this research used simple random sampling, because the population was relatively homogenous. Sampling for filling out questionnaire was done by a random system—samples were chosen randomly through lottery. Data collection technique was completed by interview using a questionnaire form to gather data about LOTO implementation by mechanics, LOTO training, supervision, and reward and punishment.

Data collection was not only done by interview using questionnaires to plant management, SCM (*Supply Chain Management/Procurement)*, and the OSHE department of PT. X to discover deeper information about LOTO training, the availability of LOTO tools, supervision, reward and punishment, and LOTO procedure. It was also done by observation using a standardized form to collect data toward LOTO implementation by mechanics. Interviews with managements and observation results were used to support primary data results and the analysis collected from questionnaire form.

Collected data was analyzed by presenting it using a frequency table of each observed variable. This was to see frequency distribution and percentage. It was also to see the level of significance of the relationship of independent variables. The dependent variable was done through a chi square test (because the data type obtained was categorical) with 95 percent confidence level ($\alpha = 0.05$). The strength of a relationship between variables could be seen from the value of Phi contained in chi square results.

If the results displayed a significance level $< \alpha = 0.05$, then Ho was rejected—this meant a relationship between two variables. The next step was to identify the strength of relationship between variables through the value of the Phi coefficient. The Phi coefficient is the measure of an association or relationship between two variables with nominal data types. After the data was analyzed, the conclusion was drawn.

3. Results

3.1. The mechanics characteristics

The mechanics characteristics of PT. X Plant Department showed that most of them were older than 30 years old, high schools graduate or equivalent, had been working for over 46 months.

3.2. LOTO training

This study results showed that most of respondents (58.0%) had attended LOTO training and the rest (42.0%) had not.

3.2.1. Supervision

In accordance with the study result, it was noted that more than half of the respondents (84.0%) said that supervision by *foreman* toward LOTO implementation in workplace had been good already, and only few respondents (8.0%) said that supervision by *foreman* toward LOTO implementation in workplace had been low.

3.2.2. Reward and punishment

Based on the study results, it was noted that almost all respondents had considered the reward, but the rests (10.0%) assumed there was no rewards.

Most respondents (76.0%) had considered the punishments, but the rests assumed there was no punishment still.

3.3. LOTO implementation by mechanic

Based on study results, it was noted that almost all respondents (60.0%) had already implemented LOTO well while doing maintenance and repairing the equipment, while the rests (40.0%) had not implemented well while doing maintenance and repairing the equipment yet.

3.4. Relationship between LOTO training and LOTO implementation by mechanic

Respondents who implemented LOTO well and had attended LOTO training are 62.1 percent, whereas the number of respondents who implemented LOTO well but had never attended LOTO training are 57.1 percent (Table 1). There is statistically no significant relationship between LOTO training and LOTO application because of the significance (0.953) > α (0.05).

3.5. Relationship between supervision and LOTO implementation by mechanic

The respondents who implemented LOTO well and reported good foreman supervision were at 66.7 percent. Respondents who implemented LOTO well but reported that the supervision was not good enough were at 25.0 percent (Table 1). There is a statistically significant relationship between supervision and LOTO implementation because of the significance (0.047) < α (0.05). Knowing that there was a relationship between supervision and the application of LOTO, the value of coefficient phi is then 0.312. Supervision had a weak relationship with the application of LOTO to mechanics because the value of 0.312 approached the value zero, meaning it had a relationship that was getting weaker.

3.6. Relationship between reward and punishment with LOTO implementation by mechanics

The number of respondents who implemented LOTO well and considered rewards in the company were 62.2 percent, whereas the respondents who implemented LOTO well, but had not noticed that there was a reward in the company were 40.0 percent (Table 1).

The respondents who implemented LOTO well and considered punishment in the company were 55.3 percent, while respondents who implemented LOTO well but assumed there was no punishment in the company were 75.0 percent.

There is no statistically significant relationship between rewards and LOTO implementation because of the significance (0.377) > α (0.05). There is no statistically significant relationship between punishment and LOTO implementation because of the significance (0.317) > α (0.05).

Table 1: Relationship between LOTO training, supervision, reward, and punishment in LOTO implementation by mechanics.

Variable		LOTO Implementation						Significance
		Great		Not Good Enough		Total		
		n	%	n	%	n	%	
LOTO Training								
Had attended		18	62.1	11	37.9	29	100.0	0.953
Had not attended		12	57.1	9	42.9	21	100.0	
Supervision								
Good Supervision		28	66.7	14	33.3	42	100.0	**0.047**
Low Supervision		2	25.0	6	75.0	8	100.0	
Value of Phi Coefficient		0.312						
Reward and Punishment								
Reward	Considered	28	62.2	17	37.8	45	100.0	0.377
	Not Considered	2	40.0	3	60.0	5	100.0	
Punishment	Considered	21	55.3	17	44.7	38	100.0	0.317
	Not Considered	9	75.0	3	25.0	12	100.0	

4. Discussion

4.1. Lock Out Tag Out implementation in plant department of PT. X

OSHA Standard 29 CFR Part 1910.147 [9] point (a) about *scope, application, and purpose* explains that *Lock Out Tag Out* (LOTO) system must be applied when there is equipment maintenance and repair activity. LOTO system aims to avoid hazardous energy release as the effect from unexpected start-up of the equipment by automatic or manual control. It can cause critical injury even fatality to the person who does that work.

The plant department authorized management of heavy equipment to support the production process, including maintenance and repair. The plant department has a core business process, which is the maintenance and repair of the production-process support equipment. This supporting equipment is all heavy equipment units and is directly related to the achievement of company production targets.

The OSHA Standard 29 CFR Part 1910.147 [9] point (c) of the General represents that companies should have documented hazardous energy control procedures and provide facilities for the application of the LOTO system. PT. X had already committed to apply hazardous energy control procedures during maintenance and repair work

through the Lock Out Tag Out (LOTO) system in Plant Department. PT. X actualized the commitment in compliance with LOTO facilities and procedures as well as procedures, work instructions, standards, and forms related to the application of the LOTO system.

PT. X provided LOTO tools in accordance with the standards set by all mechanics involved in maintenance and repair activity. SCM is a department that supports the availability of LOTO tools as requested by relevant departments. The plant department will list the names of the mechanics who must have LOTO to the OSHE department. Then, OSHE will provide a list of names to SCM *(Supply Chain Management/ Procurement)* for LOTO procurement process. Following the interview results with SCM, there were no difficulties in providing LOTO tools. SCM can always fulfill a LOTO tools request by related departments. It was evident that all the mechanics in the plant department had LOTO already.

Commitment by PT. X toward the LOTO system implementation was also proven by the existence of procedures, work instructions, standards, and forms that applied LOTO system implementation in the workplace. According to Somad [10], commitment from top management is essential to ensure support for LOTO and OSH (Occupational Safety and Health) implementation in the workplace.

Based on interviews conducted with the head of the plant department, the formulation of procedures, work instructions, standards, and forms regarding the implementation of LOTO system was done by the head office of PT. X. Procedures, work instructions, standards, and forms concerning LOTO implementation ought to be applied throughout the working area of PT. X, which has the core business of maintenance and repair process, without exception.

Somad [10] stated that every production activity will always go through changes in the process, so that existing rules and procedures must be adjusted and updated periodically following those changes. All procedures, work instructions, standards, and forms including those associated with LOTO will always be audited internally and externally. The purpose of this audit is to ensure that the implementation of the LOTO system at work is appropriate with existing regulations and that existing regulations are still in line with current workplace conditions. All workers of PT. X, including mechanics, have the right to review procedures, work instructions, standards, and LOTO forms tailored to the conditions in the field.

LOTO rules and procedures that have been made and issued must be explained to the mechanics, so they understand. The company must communicate all regulations and procedures about the LOTO implementation to mechanics. The purpose of this is to avoid miscommunication of objectives, scope, definitions, responsibilities, work

instructions, and standards regarding LOTO implementation. This is provided through safety briefing, safety talks, safety induction, and board information.

The company's responsibility is not only about communicating LOTO rules and procedures, but also one other important thing. The most important aspect of a procedure or regulation is the company ensuring workers implement them properly. This should be a concern, since the procedures will be useless if not implemented in the workplace. If the mechanic has been able to implement the procedure (one of which is LOTO procedure) in performing maintenance and repair, then safety has been achieved in the workplace.

4.2. Relationship between LOTO Training and Lock Out Tag Out (LOTO) by mechanic

OSHA Standard 29 CFR Part 1910.147 [9] points (c) of the General explained that in the energy control program through the Lock Out Tag Out system, the company has to provide training for the maintenance and repair worker. The standard of OSHA 29 CFR Part 1910.147 [9] points (c-7) on the Training and Communication sub points (i) and (iii) that explains that the company should provide and refresh training to ensure that the objectives and functions of the energy control program are understood by both the repair and maintenance worker. Training also aims to improve knowledge and skills in the safe use of LOTO.

There is no statistically significant relationship between LOTO training that was followed by respondents with LOTO implementation. The results of this study are similar to Halimah's research [11], which states that there is no significant relationship between safety training and a person's working behavior. This is in accordance with the opinion of Notoatmodjo [12], which states that behavior arises from the experience of a person and factors outside the person is known, is believed to cause the intention to act.

According to Bird and Germain [13], training can reduce or even eliminate accidents. In accordance with Somad [10], the concept of accident prevention can be done using the concept of '2E + I', those are E (Engineering), E (Education), and I (Implementation). The training provided by the company is possible through education. The goal is to train mechanics in LOTO procedures and the safe working practices of maintenance and repair work.

According to Somad [10], the training given to the mechanics needs to be evaluated by the foreman and safety officer. In accordance with Industrial Safety and Hygiene

News, Ogungbe [14] states that one of the factors that caused the failure of the LOTO program is ineffective training. Evaluation can be done through observation when the mechanic performs maintenance and repair work, with corrections being made if necessary.

The advantage of evaluation in training outcomes is as a method of training proof, as a tool to see if the mechanic has performed the work according to procedure, as a means of analyzing mechanical performance, and generating cooperation between the mechanic and the foreman and safety officer. It also motivates safe behavior at work and helps to find hidden hazards. Mechanics, as trainees, can also contribute suggestions regarding the training they have acquired.

4.3. Relationship between supervisor and Lock Out Tag Out implementation by mechanic

Supervision is required to enforce applicable OSH regulations. According to Listyandini [15], despite the already mandatory OSH rules, the effect of these regulations will be weak if not combined with good supervision as well. According to Heni [16], supervision should ensure the procedure is obeyed by the worker. Unsafe conditions and behavior that can trigger accidents will be known from the beginning, and the company can immediately take preventive efforts and apply improvements to solve these problems.

This research showed that there is a significant relationship between supervision and LOTO implementation. The role of supervisors was ensuring the application of LOTO procedures to mechanics through the active actions in controlling the work of each mechanic under his supervision. The results of the study are in accordance with the results of Halimah [11], research showing that supervisors are the most dominant factor related to safe behavior when working. In this research, safe behavior was realized in LOTO implementation. The results are similar to the Listyandini [15] study, which states that there is a significant relationship between supervision and person's behavior when working.

According to Suma'mur [17], supervision conducted continuously and perpetually will maintain the quality of safety implementation and accident prevention. According to Heinrich (1930) in Ramli [2], the supervisor is a key element in the implementation of OSH program. Lack of supervision is the biggest source of accidents, according to Bird and Germain [13]. In accordance with Reason (1990) in HaSPA [18], poor supervision

is a latent failure in an organizational system which if left unchecked will trigger an accident.

PT. X enforced a safety accountability program, which consists of three activities: hazard report, inspection, and observation of field assignments. Those activities should be done at least once a week by each supervisor. Hazard reports, inspections, and observations of field assignments should be proven in writing through hazard report forms, inspections, and fieldwork observations. The company will impose strict sanctions if the supervisor does not conduct safety accountability every week. This strict sanction serves as one motivation for supervisors to always conduct OSH supervision. In addition, the responsibility of foreman to ensure mechanics always act safely and complete the work on time makes monitoring the LOTO implementation crucial.

4.4. Relationship between reward and punishment and Lock Out Tag Out implementation by mechanic

There is no statistically significant relationship between the presence of reward and punishment with the application of LOTO. This is because the mechanics had been aware of their responsibilities as equipment repair and maintenance workers who have to apply LOTO due to the working procedure.

Although there is no statistically significant relationship, according to the results of research, most respondents who considered rewards applied LOTO well. This is reinforced by the opinion of Notoatmodjo [12], which states that positive reinforcement factors such as giving awards, praise, and bonuses will change a person's behavior to be more obedient to the procedure. Behavioral changes tend to be easier if the individual gets benefits by changing behavior.

The study results showed that respondents who assumed there was no punishment in most companies actually implemented LOTO well. This is in accordance with the opinion of Notoatmodjo [12], which states that punishment is only suitable to increase the motivation of short-term behavior only. Changes in behavior caused by punishment will not last, because someone will always be afraid of doing something wrong. Notoatmodjo argued that to obtain long-term effects in behavioral change, positive motivation in the form of rewards is more appropriate. Giving rewards will increase the spirits of a person and his co-workers, and thus encourage safe behavior at work.

According to Heni [16], consistency is needed in the implementation of reward and punishment to maintain their impact. Hopefully, with consistent reinforcement of reward and punishment, the rewarded behavior will always be implemented, and the

punished behavior will gradually disappear. These rewards for good work are based on Maslow's Needs Theory. It is a self-actualization requirement for every worker as it is part of the recognition of his work performance.

5. Conclusions

Most of the mechanics are older than 30 years old, with a high school education background, and have worked for more than 46 months. Most of the mechanics in PT. X had already implemented LOTO well in the maintenance and repair activity.

Most of the mechanics had already received LOTO training held by Plant Department, assumed that foreman's monitoring of LOTO implementation had been good already, and had known the presence of reward and punishment system in the company.

The supervision of foreman in the LOTO implementation had a significant relationship with the LOTO implementation by the mechanics, whereas the training and reward and punishment had no significant relationship with LOTO implementation. Supervision has a weak relationship (value of phi = 0.312) with the application of LOTO.

Suggestions that can be given to the company based on this research conclusions are to increase the transfer of knowledge to the mechanics by putting up sign boards about LOTO around the area, providing the LOTO signs around the workshop area, increasing the supervisory role of foreman and OSHE Department, scheduling LOTO training routinely and refresh training combined by evaluation of training results, and being consistent in giving rewards for mechanics.

References

[1] International Labour Organization. (2011) Fact Sheet: Labor Inspection in Indonesia (Lembaran Informasi: Pengawasan Ketenagakerjaan di Indonesia). Retrieved from https://www.google.co.id/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&vedd=oCDUQFjAD&url=http%3A%2F%2Fxa.yimg.com%2Fkq%2Fgroups%2F21823116%2F1266886549%2Fname%2FPengawasan%2BKetenagakerjaan.pdf&ei=w0hTU_3DEIborQfg1IHwAw&usg=AFQjCNFaY8dOn7O1zR4EwEiQKjPJ58VF4w (accessed on 1 January 2013).

[2] Ramli, S. (2010). Occupational Safety and Health Management System (Sistem Manajemen Keselamatan dan Kesehatan Kerja - OHSAS 18001), Seri Manajemen K3. PT. Dian R. Jakarta.

[3] NIOSH. (2011). Using Lockout and Tagout Procedures to Prevent Injury and Death during Machine Maintenance. US Department of Health and Human Services, Centers for Disease Control and Prevention. National Institute for Occupational Safety and Health DHHS Publication No. 2011–156.

[4] Ada', Y. S. B. (2006). Relationship Between Repair and Maintenance of Electric Machines and Implementation of Lock Out Tag Out with Work Accident at PT. GE Lighting Indonesia in Yogyakarta (Hubungan antara Perbaikan dan Perawatan Mesin Listrik dan Penerapan Lock Out Tag Out dengan Kecelakaan Kerja pada PT. GE Lighting Indonesia di Yogyakarta). Thesis, Universitas Gajah Mada.

[5] Cooper, D. (2001). Improving Safety Culture: A Practical Guide. Hull: Applied Behavioural Sciences.

[6] DuPont Company. (2005). Not Walking the Talk: DuPont's Untold Safety Failures. Retrieved from http://assets.usw.org/resources/hse/resources/Walking-the-Talk-Duponts-Untold-Safety-Failures.pdf (accessed on 1 January 2013).

[7] Geller, E. S. (2001). The Psychology of Safety Handbook. Boca Rotan: Lewis Publisher.

[8] Ghozali, I. (2006). Non-parametric Statistics—Theory and Applications with the SPSS Program (Statistik Non-Parametrik – Teori dan Aplikasi dengan Program SPSS). Semarang: Badan Penerbit – Undip.

[9] Occupational Safety and Health Administration (OSHA). 29 CFR 1910.147 – Subpart J Environmental Controls/ Lockout Tagout Standard. Retrieved from http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9804 (accessed 9 April 2014).

[10] Somad, I. (2013). Effective Technique in Implementation Occupational Safety & Health (Teknik Efektif Dalam Membudayakan Keselamatan & Kesehatan Kerja). Jakarta: PT. Dian Rakyat.

[11] Halimah, S. (2010). Factors Affecting Safe Behavior Employees in Production Area PT. SIM Plant Tambun II Year 2010 (Faktor – Faktor yang Mempengaruhi Perilaku Aman Karyawan di Area Produksi PT. SIM Plant Tambun II Tahun 2010). Undergraduate Thesis, FKIK UIN Jakarta.

[12] Notoatmodjo. (2010). Education and Health Behavior (Pendidikan dan Perilaku Kesehatan). Jakarta: Rineka Cipta.

[13] Bird, F. E. and GGL. (1992). Practical Loss Control Leadership. USA: International Loss Control Institute.

[14] Ogungbe, O. O. (2013). The Implementation of Hazardous Energy Control (Lock-out/Tagout) Program at XYZ Inc. Plymouth, Minnesota. Thesis, University of Wisconsin-Stout USA;.

[15] Listyandini, R. (2013). Associated Factors with unsafe action on PT.X Contractor Workers (Faktor yang Berhubungan dengan unsafe action pada Pekerja Kontraktor PT.X). Undergraduate Thesis, Universitas Airlangga.

[16] Heni, Y. (2011). Improving Our Safety Culture. Jakarta: Gramedia.

[17] Suma'mur. (2009). Occupational Safety Hygiene and Accident Prevention (Higiene Perusahaan Keselamatan Kerja dan Pencegahan Kecelakaan). Jakarta: CV. Haji Masagung.

[18] HaSPA (Health and Safety Professionals Alliance). (2012). The Core Body of Knowledge for Generalist OHS Professionals: Model of Causation: Safety. VIC: Safety Institute of Australia.