Performance Analysis of the Behavior Based Safety Program in Reducing Occupational Accident Rates

Mitha Qurrota Ayuni, Muhammad Yusuf, Endang Dwiyanti

Department of Occupational Safety and Health, Faculty of Public Health, Universitas Airlangga
Campus C Mulyorejo, Surabaya, East Java 60115, Indonesia

ABSTRACT

Introduction: PT. X is a company that concentrates on the agricultural sector by producing ammonia and urea fertilizers. Occupational accidents at PT.X are reported and recorded by the Department of Occupational Health and Safety, one of which is a form of monitoring the performance of the BBS program at PT. X. The research objective was to determine the performance of the Behavior-Based Safety (BBS) program in reducing occupational accidents due to unsafe actions at PT.X. Methods: This study is an observational study. Determination and sampling in this study used accidental sampling technique for safety officers as many as 5 respondents, while the cluster sampling technique was used for the workforce of 95 respondents. The data analysis method used was descriptive semi-quantitative. Results: The results showed the fulfillment of the criteria and maturity level of behavior-based safety at PT. X, In general, PT X was already at level 4, namely "High Performing" with an average of 3.5. Meanwhile, the work accident rate analysis using the Safe T-score of PT. X was in the category between +2.0 and -2.0, meaning that the number of occupational accidents at PT. X after implementing behavior-based safety did not experience any significant changes. Conclusion: The performance of the behavior-based safety (BBS) program in reducing occupational accidents due to unsafe actions at PT. X in 2019 was effective even though the maturity level of the application of BBS was still not at the high performance level criteria on all criteria, and there was still no significant change in the reduction of the number of occupational accidents.

Keywords: behavior-based safety, occupational accidents, unsafe actions. secure work

Corresponding Author:
Mitha Qurrota Ayuni
Email: mithaqurrotaayuni97@gmail.com
Telephone: +6285790772952

INTRODUCTION

The definition of an accident according to decree of Ministry of Manpower Number 3/ 1998 is an unpredicted or unexpected incident which could have caused human casualties and/ or property. The occupational accidents consist of fire, explosion, hazardous waste disposal, occupational diseases and occupational accidents. Occupational accidents have become a significant problem for the sustainability of a company due to losses they cause (Ministry of Manpower of the Republic of Indonesia, 1998). Meanwhile, according to Gunawan and Waluyo (2015), an accident is an incident that is unplanned and unwanted that can disrupt the production process or operation, damage property or assets, injure humans, or damage the environment. The occupational accident rate in Indonesia is quite high. Based on data from the Institution of Social Security Employment, in 2017 the number of occupational accidents reported was 123,041 cases, while during 2018 it reached 173,415 cases with the nominal compensation paid reaching Rp1,2 trillion (BPJS Ketenagakerjaan, 2019).

In general, occupational accidents possibly occur due to unsafe actions and unsafe conditions. This is supported by the statement of the National Safety Council (2013) which has conducted research and found that the causes of occupational accidents were mostly caused by unsafe actions at 88%, while 10% were due to unsafe conditions, and the remaining 2% had an unknown exact cause. Another researchi conducted by Dupont (2005) also showed that 96% of occupational accidents were caused by unsafe actions and 4% were caused by unsafe conditions. Regardinng the number of occupational accidents, Occupational Health and Safety should have been considered as the first priority, and every industry has to be aware of it. Analysis of the causes of occupational accidents can be determined by applying the theory of occupational accidents.

At present, many occupational accident theories have developed, some of which are the Bird and Germans theory, the International Loss

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Control Institute (ILCI), and the Loss Causation Model (Oostakhan, Mofid and Talab, 2012). The ILCI theory can identify and reduce the damage due to occupational accidents. The theory states that the direct causes of occupational accidents are unsafe actions and unsafe conditions. However, there is a factor behind the direct cause that occurs, namely the weakness of management factors. This can interfere with personal factors or work factors, which will ultimately impact on unsafe actions or unsafe conditions.

According to Ismail *et al*. (2012), modifying behavior that encourages or enhances safe behavior of workers is required as safe behavior of workers is the main key to the realization of a decent safety work. Behavior factor is one of the safety culture and is also part of the culture in the organization. Thus, the safety behavior of the workers can demonstrate safety culture and organizational culture.

Currently, Behavior-Based Safety (BBS) has been widely applied by industries in Indonesia as an alternative safety program. BBS is an approach that aims to hold everyone in every workplace responsible not only for his own safety but also for the safety of others in any work situation. Unsafe actions can be identified and can be eliminated through the application of BBS, so occupational accidents can be prevented by increasing safe behavior at work (Cooper, 2009).

Geller (2005) stated that Behavior-Basedi Safety principles can be applied in many occupational safety domains, including ergonomics, prevention of human error, incident analysis, hazard identification and corrective action, and training. From BBS elements, behavior-based observation and feedback must be seen as one of the many systematic ways to prevent occupational accidents (Jerie and Baldwin, 2017).

There is a study that shows that implementing BBS in a manufacture industry could reduce occupational accident rates up to 75% (Yeow and Goomas, 2014). There are also some data that can be related to the overall implementation of the BBS, including: a decrease in incidents recorded over twenty years by 81%, a reduction in cases of lost time in the 1987-2003 period by 79%, and a reduction in the annual compensation costs of workers in the period from 2002 to 2007 by 97% (Agnew and Ashworth, 2015).

PT. X is a large company located in Bontang, East Kalimantan. PT. X was established in 1979, which concentrates on the agricultural sector by producing ammonia and urea fertilizers in the form of granules and prills. PT. X has a high risk of danger due to the use of raw materials for the majority of chemicals such as ammonia, sulfur, hydrogen, carbon monoxide, nitrogen, and chlorine. Also, the use of tools and machines that have very high temperatures and pressures in the production process also participates in giving the risk of danger.

Based on occupational accident data owned by the Department of Occupational Safety and Health of PT. X, there were 841 reports of unsafe actions and unsafe conditions at work. In addition, from 2009 to 2012, there were 47 cases of occupational accidents which occurred due to unsafe actions. Meanwhile, from 2014 to 2017 there were 20 cases of occupational accidents due to unsafe actions. As a form of commitment from the management to prevent and reduce occupational accidents, PT. X continues to make improvements in all fields, one of which is by implementing a behavior-based safety program in 2013 for all elements of the workers. The purpose of implementing BBS is to prevent and reduce the number of occupational accidents in the company.

PT. X has a BBS-based OHS program which has been implemented since 2013 as an effort to improve safe behavior at work, which includes the BBS Champion team, the safety representative team, the GUPENKAR team, and the We-Care Card. The BBS Champion Team consists of the Occupational Health and Safety (OHS) department and representatives from each work unit of PT. X. The safety representative team has the task of making a work plan on the OHS program, supervising the OHS picket program involving all workers in the workplace, collecting data on OHS issues for further action, and coordinating with the OHS department in all OHS programs. The Fire Management Group (GUPENKAR) is a team formed to carry out training every month on fire management, the use of PPE, activities in a confined space, working at heights, etc. Meanwhile, We-Care or Workplace Environmental Care and Risk Elimination is a reporting system for unsafe conditions, unsafe actions, and near-misses carried out by every worker in order to increase awareness of the workplace and its environment as well as an effort to eliminate hazard risks.

As a chemical-based manufacturing company, work safety assurance is a priority of PT. X. Occupational Health and Safety (OHS) and becomes one of the main elements of the assessment conducted to provide work safety guarantee for

assets owned, including in handling the results of production. Based on the results of several studies described above, this research is needed to determine the performance of the Behavior-Based Safety (BBS) program in reducing occupational accidents due to unsafe actions at PT.X.

METHOD

This research is an observational study with a cross-sectional study design. Meanwhile, based on the data analysis method used, this research is a descriptive study.

The population of this research was the entire workers of PT. X who met the inclusion criteria, as many as 1,800 workers. The number of samples of this study was for safety officers as many as 5, consisting of an OHS manager, a safety inspector, a superintendent, and 95 workers at PT. X. Sampling used the Slovin formula with an error degree of 10% or 0.1. Determination and sampling in this study used accidental sampling techniques for safety officers and cluster sampling techniques for workers.

This research was conducted at PT. X Bontang, East Kalimantan. The time of research and data collection was carried out in February-March 2019. The method of data collection used primary and secondary data. Primary data were obtained by conducting interviews using a modified interview sheet from the interview sheet compiled by Aini (2017) to ask workers about the criteria and level of maturity of each behavior-based safety application; distributing questionnaires to find out knowledge, training and perceptions of workers regarding safe behavior and the implementation of BBS at PT.X; and conducting observations using the Critical Behavior Checklist (CBC) to help observe unsafe actions. Secondary data in this study were the number of occupational accidents due to unsafe behavior and other data that were owned by the company to support this research.

The research data that have been obtained in the field were later collected and processed to determine the performance of the BBS program in reducing occupational accidents due to unsafe behavior, as follows:

Behavioral Safety Maturity Matrix Level

Behavioral Safety Maturity Matrix Level is the maturity level of the BBS program which is analyzed based on the results of interviews using the behavioral maturity matrix level table compiled by Cooper (2009) .

Observation of Safe Behavior

Observation result checklist was used to analyze and identify unsafe actions and safe behavior on workers. The safe behavior calculation is as follows:

$$\%\,Safe\,Act\,Index = \frac{Total\,Observed\,Safe\,Behavior}{Total\,All\,Observed\,Behavior} \times 100\%$$

The results of the percentage of safe act index were categorized into 3 categories, namely, good if the percentage was ≥ 85%, sufficient if the percentage was 60% - 84.9% and bad if the percentage was ≤ 59.9% (Sirait, 2018).

Frequency Rate

The frequency rate shows the number of accidents at work per one million people's working hours. The frequency rate was calculated using the formula:

$$FR = \frac{Total\,Occupational\,Accident\,in\,Year\,X}{Total\,Working\,Hours\,of\,Worker\,in\,Year\,X} \times 10^6$$

Frequency rate shows the level of danger in the workplace. The level of danger in the workplace was high if FR ≥ 10, moderate if 5 < FR < 10, and low if FR ≤ 5 (Silalahi, 1995).

Safe T-Score

The safe T-Score was used to compare the accident rate for the current year with that of the previous year. Safe T-Score was calculated using the formula:

$$STS = \frac{FR\,in\,Year\,X - FR\,in\,Year\,(X-1)}{\sqrt{\frac{FR\,in\,Year\,(X-1) \times 10^6}{Total\,Working\,Hours\,of\,Worker\,in\,Year\,X}}}$$

If the Safe T-Score calculation shows a result of between +2.00 until -2.00, it means that the work accident control program did not show a significant change between year x and year (x-1). If the Safe T-Score ≥ +2.00, it means that the work accident control program decreased in year x compared to year (x-1). If the Safe T-Score ≤ -2.00, it means that the OHS program improved in year x compared to year (x-1) (Silalahi, 1995).

This research has been declared as an ethical study by the Health Research Ethics Committee of the Faculty of Public Health, Universitas Airlangga. This decision is based on a letter of ethical statement Number: 34/ EA / KEPK / 2019.

RESULTS

Fulfillment of Behavior-Based Safety (BBS) criteria at PT.X in 2019 was obtained from the results of interviews conducted with safety officers. Of the nine BBS criteria, there were two criteria that were not completed, namely the definition of use criteria and review criteria. This fulfillment was reflected in the BBS-based OHS program, the formation of the BBS championship team, the existence of training related to the implementation of BBS, the We Care card, and the presence of a safety representative.

The implementation of the maturity level of behavior based-safety (BBS) at PT. X in 2019 in the criteria of ownership, definition of use, training, reinforcement, and goal setting was at level 3 and in the criteria of observation, establishing baseline, feedback, and review was at level 4. The average level of maturity of the BBS was 3.5, which was included in the high-performance category. This category states the level of maturity of safe behavior based on behavioral safety maturity matrix level, which means that the workforce has already had a sense of ownership and awareness of safe behavior, and the workforce has the support of management and co-workers. Behavioral observations carried out have also focused on the involvement or participation of workers in the implementation of BBS, where workers observe each other and remind each other to behave safely while working.

The majority of knowledge of workers at PT.X in 2019 was included in the high knowledge category with a percentage of 48%. Other workers were classified into being in the category of enough knowledge at 47% and low knowledge at 5%. One of the causes of the lack of workers' knowledge are lack of understanding of several aspects, such as the understanding of Occupational Health and Safety, workplace accidents, unsafe behavior, and types of PPE.

Table 1. Fulfillment of Behavior-Based Safety Criteria at PT.X in 2019

Criteria	Fulfillment
Ownership	Fulfilled
Definition of use	Not Fulfilled
Training	Fulfilled
Observation	Fulfilled
Establishing baseline	Fulfilled
Feedback	Fulfilled
Reinforcement	Fulfilled
Goal setting	Fulfilled
Review	Not Fulfilled

Table 2. Behavioral Safety Maturity Matrix Level of PT. X in 2019

Criteria	Level
Ownership	Level 3 (Performing)
Definition of use	Level 3 (Performing)
Training	Level 3 (Performing)
Observation	Level 4 (High Performing)
Establishing Baseline	Level 4 (High Performing)
Feedback	Level 4 (High Performing)
Reinforcement	Level 3 (Performing)
Goal setting	Level 3 (Performing)
Review	Level 4 (High Performing)

Table 3. Distribution of Personal Factors Regarding the BBS-based Occupational Health and Safety Program at PT.X in 2019

Category	Personal Factors					
	Knowledge		Perception		Training	
	n	%	n	%	n	%
High	48	48.00	47	47.00	54	54.00
Enough	47	47.00	52	52.00	46	46.00
Low	5	5.00	1	1.00	-	-
Total	100	100.00	100	100.00	100	100.00

The majority of workers' perceptions at PT.X in 2019 was included in the enough perception category at 52%. Other workers were classified into being in the category of high perception at 47% and low perception at only 1%. This means that the perception that the application of behavior-based safety can encourage workers to behave safely while working was good enough, so work accidents can be prevented. However, there was one respondent who had a bad perception as the respondent still had a lack of understanding of the existing regulations and considered that his workplace environment had no risk of danger, and he still did not fully understand about the observation sheet.

The level of knowledge of the workers was obtained by distributing questionnaires to workers. The majority of training provided to workers at PT.X in 2019 was included in the high category at 54%. Other workers were classified into being in the enough category at 46%. This shows that the training has been carried out well.

The majority of the workers at PT.X in 2019 behaved safely, while the rest of them did not comply with the Occupational Health and Safety policies while working. In addition, the number of respondents who did not behave safely while working was zero.

Table 4. Observation of Safe Behavior at PT. X in 2019

Category	Frequency	Percentage (%)
Good Safe Behavior	98	98.00
Fairly Safe Behavior	2	2.00
Total	100	100.00

Table 5. Total Occupational Accidents at PT. X

Year	Total Occupational Accidents	Working hours (in hour)
2009	12	4,630,329
2010	16	5,618,051
2011	11	6,676,744
2012	8	8,721,745
2013	-	-
2014	8	7,804,477
2015	6	8,411,903
2016	4	6,775,023
2017	2	7,255,632

Table 5 were obtained from the results of the number of occupational accidents that occurred at PT. X along with the total work hours of workers each year. The number of occupational accidents before the implementation of Behavior-Based Safety (BBS) fluctuated. The number of occupational accidents in 2010 increased and in the subsequent period to 2012 the rate decreased. The BBS program at PT.X began to be implemented in 2013, and the number of work accidents after the implementation of Behavior-Based Safety (BBS) continued to decline every year. From 2014 to 2017 the decline was always consistent.

The frequency rate at PT.X wasused to see the frequency of occupational accidents per one million labor hours at PT.X in one year. 2013 is the year of the implementation of BBS and became a transition period between before and after the BBS implementation, so the occupational accident rate was not counted in this study. The frequency rate (FR) value after the BBS decreased every year with a smaller FR value compared to the rate before the BBS was held in which before BBS the FR value fluctuated.

The Safe T-score obtained in years before the implementation of behavior-based safety at PT. X was 0.38, and the lowest value was -1.84. The value of the STS or Safe T-score was in the category between +2.0 and -2.0, and in terms of occupational accident rates at PT. X before the implementation of the Behavior-Based Safety OHS program there was no significant change. Meanwhile, the STS value or Safe T-score obtained in years after the application of behavior-based safety was -1.10 as the lowest value and -0.38 as the highest which was caretgorized in the category between +2.0 and -2.0 in terms of the number of work.

Table 5. Frequency Rate and Safe T-Score of PT.X

Year	Frequency Rate	Safe T-Score
2009	2.59	-
2010	2.85	0.38
2011	1.65	-1.84
2012	0.92	-1.27
2013	-	-
2014	1.03	-
2015	0.71	-0.89
2016	0.59	-0.38
2017	0.28	-1.10

DISCUSSION

Fulfillment of Behavior-Based Safety (BBS) Criteria

PT X in applying the behavior-based safety program has a We-Care card program, which is a system for reporting unsafe conditions, unsafe actions, and nearmiss carried out by each employee in order to increase awareness of the workplace and environment, and as an effort to eliminate the risk of danger. However, it is still confusing or ambiguous to define or categorize (definition of use) between safe or unsafe behavior and unsafe conditions while filling in this card. Not all programs define safe and unsafe behavior in detail (The Keil Centre, 2000).

The results of research on reports from the We-Care card showed that workers still could not distinguish between unsafe actions and unsafe conditions. In addition, interviews with workers showed that workers who wanted to fill out a We-Care card thought that the activity was time-consuming, and ultimately they would not fill out and report OHS problems at work.

Regular review at PT. X was good enough. The review was carried out by the safety representative twice a month in each department unit. According to Cooper (2009), reviews must be conducted periodically by a team of behavior-based safety experts, and there should also be regular monthly meetings to discuss specifically about BBS as well as an issue or an innovation. According to The Keil Centre (2000), to keep behavior safety programs innovative and forward-looking regular program reviews are recommended. Socialization and uniformity of understanding of behavior-based safety must also be carried out frequently so that the goals and objectives of implementing BBS are achieved at PT. X. Unfortunately the topic of discussion was very general, namely the OHS problem in general and was not specific to the BBS-based OHS program.

Behavioral Maturity Matrix Level

Based on the results of the study, behavioral maturity matrix level or the maturnity's level of the behavior-based safety programs at PT. X's application, was basically at the High Performing level. According to Cooper (2009), level 4 or High Performing is a continuous OHS commitment. In this level, OHS is usually prioritized over productivity, labor is involved productively in increasing OHS, monitoring is focused on lagging, and leading indicators and root cause analysis are carried out for all types of accidents. Meanwhile, according to The Keil Centre (2000), level 4 is achieved when the majority of staff believe that from a moral and economic point of view, prioritizing occupational health and safety is important.

According to Cooper (2009), OHS program based on behavior-based safety must be based on the needs of the workers and arranged together by most of the workers and managerial level. It is expected that each level of work units has a high ownership role both in terms of safety and the implementation of the BBS program so that it can reach level 4 or "High Performing".

According to Ningsih and W. Ardyanto, (2013), companies need to equalize the maturity level of the BBS-based OHS program in accordance with the most dominant level to improve the quality of BBS implementation so that it is easier to achieve the goal. In addition, according to Aini (2018), to reach the goal, every reference from BBS needs to be at the same level.

Giving feedback can trigger active participation from behavioral-based safety program targets, so it is not only the managerial level that provides feedback, but also colleagues both in identifying and resolving the causes of accidents. According to Notoatmodjo (2012), giving feedback is very helpful in determining changes in a person's behavior.

Personal Factors in Behavioral-Based Safety (BBS) Program

Personal factors are factors that arise from individuals. Personal factors are one of the basic causes in the Loss Causation Model theory (Tarwaka, 2015). Knowledge is the first important thing in changing or adopting one's new behavior (Notoatmodjo, 2012). According to Ramli (2013), one of the reasons for someone to act or behave unsafely is due to his ignorance of how to behave safely based on existing regulations while working . This makes them not know the dangers that will threaten, so workers make mistakes at work that can cause accidents. According to Osman, Awang and Yusof (2015), the level of knowledge and level of understanding among workers is important to ensure that workers can use their methods for safe work practices because increasing levels of safe work practices can reduce occupational accident rates.

Provision of information or regular socialization is needed to improve the workers' understanding of

unsafe behavior. In accordance with the explanation of feedback in the behavioral maturity matrix level, the provision of information or socialization is not enough to change the behavior of the workers at workplace. Work participation and discussion are also needed in the understanding of unsafe behavior. Knowledge sharing done among fellow colleagues can increase knowledge and participation while working.

Perception is the experience of objects, events, or relationships with those obtained by inferring information and interpreting it (Notoatmodjo, 2012). Perception becomes important because it is one of the factors that exists in each individual in behaving safely (Geller, 2005). Based on the research's results, the perception of the workforce towards the application of behavior-based safety was mostly in a fairly good category of the application of BBS.

However, there were respondents who still had a bad perception about the implementation of BBS, regarding the clear and correct information about BBS, clear regulations related to BBS, and routine socialization and explanation of BBS to all workers. Behaving safely and prioritizing Occupational Health and Safety is very important to be implemented because it can prevent the risk of accidents.

Based on the research's results conducted by distributing questionnaires to respondents, most of the workforces had good training. Ramli (2013) stated that training is a planned effort, which is intended to increase knowledge, soft skills, and attitude and thus training must be designed specifically to be in accordance with the needs of the workforce. In addition, according to Jasiulewicz-Kaczmarek, Szwedzka and Szczuka (2015), improvements in the organizational safety culture and improvement in the quality and frequency of safety feedback within the organization to reduce barriers between employees both within and at all levels of the organization can be pursued by conducting behavior-based safety training.

Unsafe Actions

Unsafe actions are actions that can endanger workers themselves or others and can cause accidents (Suma`mur, 2013). Based on the results of the study, it was found that based on the observations about unsafe behavior at work is most of the respondents behaved safely. However, at the time of the observation, there were still some workers who did not use PPE while working. Workers who are less comfortable using PPE while working should report to the management about it, so that the management can replace the PPE model that is more comfortable to use (Suma`mur, 2013).

There were also respondents who stated that while working using PPE, they rarely used gas masks. Workers felt that they were already used to the smell of ammonia, so they did not need to use a gas mask. In addition, using a gas mask makes their faces uncomfortable while working. This action is called unsafe action which happens due to discomfort when using PPE. According to Septiani (2017), the availability of PPE is one of the important aspects in realizing the application of safety in the workplace even though this is the most recent alternative in the hazard control hierarchy.

According to Sirait and Paskarini (2016), enhancing safe behavior in companies can be done by providing training for all workers, applying SOP consistently, evaluating and monitoring employee behavior, and implementing Behavior-Based Safety programs. In addition, according to Rahmawati, (2017), the results of safe behavior analysis with a behavior-based safety approach to radiographers indicate that safe behavior is created due to behavioral interventions carried out by the management using safety warning activators, SOPs, delivery of TLD results, and the instructions for radiographers to attend training.

Occupational Accidents Due to Unsafe Behavior

The frequency rate is a measurement that is used to calculate the frequency of accidents or injuries resulting in defects, so workers are unable to work at a certain time interval (Tarwaka, 2015). The frequency rate or frequency accident at PT. X has always increased compared to previous years after the behavior-based safety was applied. Safe T-score is an analysis of the frequency or frequency of occupational accidents to determine changes in the frequency of occupational accidents from time to time, which also aims to describe the safety performance in a company (Kumar, Jain and Patel, 2015). Kumar, Jain and Patel (2015) in their research stated that there was an increase in recording after the implementation of Behavior-Based Safety.

Based on the results of the study it was found that the value of the Safe T-score in the year before the implementation of the OHS program based on behavior-based safety (BBS) was between +2.0 and -2.0 with the lowest value of -1.84 and the highest value of 0.38. This means that the number of occupational accidents due to unsafe actions did

not experience significant changes. The Safe T-score obtained in the year after the implementation of the behavior-based safety program also showed no significant changes.

Quantitative monitoring of occupational accident rates can improve safety performance. With this quantitative monitoring, the management can improve the status of safety measures in safety monitoring in various elements such as safety ratings, safety policies, safety organizations, safety committees, planning and implementation, safety audits, safety sampling, safety surveys, etc.

Implementation of Behavior-Based Safety Program against Occupational AAccidents Due to Unsafe Behavior

The implementation of behavior-based safety has been driven by the managerial level where the managerial level sees the number of worker participation involved in the behavior-based safety-based safety program. Behavioral observations were carried out regularly both in groups and individually between managerial and staff levels. Feedback was given verbally both ways after conducting the observation, which was then used to identify and resolve the cause of the accidents. According to Galis *et al*. (2018), behavior-based safety implementation can be influenced by several factors including the level of employee commitment, the level of involvement of leaders and management, the training that has been provided by the company, and the level of compliance and understanding of workers towards behavior-based safety principles.

The Safe T-score at PT. X before the application of behavior-based safety was between +2.0 and -2.0, which means the number of work accidents due to unsafe actions did not experience significant changes. In addition, the Safe T-score after the implementation of behavior-based safety also showed values between +2.0 and -2.0. However, the Safe T-score obtained after monitoring the application of behavior-based safety (BBS) showed a negative value, which means that monitoring the application of behavior-based safety at PT. X based on the record or value obtained indicates an increase or improvement from the previous years. There were also no significant changes in occupational accident rates.

By implementing behavior-based safety, the company has the main goal to determine unsafe actions, unsafe conditions, system errors; and to reduce the number of occupational accidents due to unsafe actions (Cooper, 2009). In addition, according to Skowron-Grabowska and Sobociński (2018), experts agree that among the most important benefits of BBS are the ability to build a culture of safety, increase workers' safety awareness and reduce occupational accident rates.

Based on the results of research that has been obtained, the implementation of behavior-based safety at PT. X has been able to determine unsafe actions, unsafe conditions, and fault systems, and also reduce the number of occupational accidents caused by unsafe actions. The negative Safe T-score (negative value ≤2) on the results of monitoring safety performance showed that the record or recording at that time was better or increased than before, so an improvement has been recorded (Parmar, Choukse and Patel, 2013)

CONCLUSION

Based on the research results, the performance of the behavior-based safety (BBS) program at PT.X in 2019 is said to be effective because the level of maturity or the behavioral safety maturity matrix of PT. X was already at level 4 or High Performing. The safe T-score obtained also showed a negative value (negative value ≤2), although the maturity level of the application of BBS was still not even at the high performing level in all criteria and there was still no significant changes in the number of occupational accidents.

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REFERENCES

Agnew, J. and Ashworth, C. (2015) *Behavior-Based Safety: Setting the Record Straight*. Atlanta: Aubrey Daniels International.

Aini, M. A. (2018) 'Tingkat kematangan Behavior Based Savety (BBS) Pada Program peka (Pengamatan Keselamatan Kerja) di PT X', *Jurnal Ilmiah Kesehatan Media Husada*, 6(2), pp. 227–234.

BPJS Ketenagakerjaan (2019) Laporan Keberlanjutan 2018. Jakarta: BPJS Ketenagakerjaan.

Cooper, D. (2009) *Behavioral Safety A Framework for Success*. USA: BSMS Inc.

Dupont (2005) Not Walking to Talk : DuPont ' s Untold Safety Failures. Pittsburgh: United Steelworkers International Union.

Galis, A. A. *et al*. (2018) 'The Factors Affecting Behaviour Based Safety (BBS) Implementation in Oil and Gas Industry', *International Journal of Engineering and Technology*, 7(3), pp. 157–161.

Geller, E. S. (2005) 'Behavior-Based Safety and Occupational Risk Management', *Behavior Modification*, 29(3), pp. 539–561.

Gunawan and Waluyo (2015) *Risk Based Behavioral Safety: Membangun Kebersamaan Untuk Mewujudkan Keunggulan Operasi*. Jakarta: PT. Gramedia Pustaka Utama.

Ismail, F. *et al*. (2012) 'Behaviour Based Approach for Quality and Safety Environment Improvement: Malaysian Experience in the Oil and Gas Industry', *Procedia - Social and Behavioral Sciences*, 35(December), pp. 586–594.

Jasiulewicz-Kaczmarek, M., Szwedzka, K. and Szczuka, M. (2015) 'Behaviour Based Intervention for Occupational Safety – Case Study', i*n Procedia Manufacturing*, pp. 4876–4883.

Jerie, S. and Baldwin, J. (2017) 'The Effectiveness of Behaviour Based Safety (BBS) in Accident Prevention at a Pine Timber Processing Plant in Nyanga District, Zimbabwe', *Review of Social Sciences*, 2(6), pp. 1–10.

Kumar, A., Jain, N. K. and Patel, P. (2015) 'Analysis of Safety Performance Rating in Thermal Power Plant', *International Journal of Emerging Technology and Advanced Engineering*, 5(1), pp. 120–128.

Mahega Awalatul, A. (2017) *Efektivitas Tingkat Kematangan Behavior Based Safety (BBS) Terhadap Angka Kecelakaan Kerja Akibat Perilaku Tidak Aman (Studi Di PT. Pertamina (Perseo) Refnery Unit IV Balongan, Jawa Barat).* Undergraduate Thesis. Surabaya: Faculty of Public Health, Airlangga University.

Ministry of Manpower Republic of Indonesia (1998) PER.03/MEN/98 Tentang Tatacara Pelaporan dan Pemeriksaan Kecelakaan. Jakarta: Ministry of Manpower Republic of Indonesia

National Safety Council (2013) Injury Facts, 2013 Edition. Itasca: NSC Press.

Ningsih, A. R. and W. Ardyanto, Y. D. (2013) 'Evaluasi Pelaksanaan Behavior Based Safety Pada Program Stop Dalam Membentuk Perilaku Aman Tenaga Kerja Di PT X Tahun 2013', *The Indonesian Journal of Occupational Safety and Health*, 2(1), pp. 35–44.

Notoatmodjo (2012) *Promosi Kesehatan dan Perilaku Kesehatan*. Jakarta: PT. Rineka Cipta.

Oostakhan, M., Mofidi, A. and Talab, A. D. (2012) 'Behavior-Based Safety Approach at a Large Constraction Site in Iran', *Iranian Rehabilitation Journal*, 10(February), pp. 21–25.

Osman, R., Awang, N. and Yusof, S. A. H. S. H. N. M. (2015) 'Level of Awareness BBS in Manufacturing Industry towards Reducing Workplace Incidents', *International Journal of Education and Research*, 3(1), pp. 77–88.

Parmar, V., R.M.Choukse and Patel, P. (2013) 'Safety Performance Monitoring in Pump Manufacturing Industries', *International Journal of Engineering Research & Technology (IJERT)*, 2(9), pp. 1947–1951.

Rahmawati, N. (2017) 'Safe Behavior Safety Behavior-Based Analysis of Safe Behavior With Behavior-Based Safety Approach for Radiographer in Dr . Soetomo Hospital Surabaya', *The Indonesian Journal of Occupational Safety and Health*, 6(3), pp. 323–335.

Ramli, S. (2013) *Sistem Manajemen Keselamatan dan Kesehatan Kerja*. Jakarta: Dian Rakyat.

Septiani, N. (2017) 'Beberapa Faktor Yang Berhubungan Dengan Perilaku Pekerja Dalam Penerapan Safe Behavior Di PT Hanil Jaya Steel', *The Indonesian Journal of Occupational Safety and Health*, 6(2), pp. 257–267.

Silalahi, B. R. (1995) *Manajemen Keselamatan dan Kesehatan Kerja*. Jakarta: PT. Pustaka Binaman Pressindo.

Sirait, F. A. (2018) *Pengaruh Preconditions Terhadap Tindakan Tidak Aman Di Divisi Umum PT. PAL Indonesia (Persero)*. Postgraduate Thesis. Surabaya: Faculty of Public Health, Airlangga University.

Sirait, F. A. and Paskarini, I. (2016) 'Pendekatan Behavior-Based Safety (Studi di Workshop PT . X Jawa Barat)', *The Indonesian Journal of Occupational Safety and Health*, 5(1), pp. 91–100.

Skowron-Grabowska, B. and Sobociński, M. D. (2018) 'Behaviour Based Safety (BBS) - Advantages and Criticism', *Production Engineering Archives*, 20(20), pp. 12–15.

Suma`mur (2013) H*igiene Perusahaan dan Kesehatan Kerja*. Jakarta: CV. Agung Seto.

Tarwaka (2015) *Keselamatan, Kesehatan Kerja dan Ergonomi dalam Perspektif Bisnis*. Surakarta: Harapan Press.

The Keil Centre (2000) *Behavior Modification to Improve Safety : Literature Review*. Sudbury: The Health and Safety Executive.

Yeow, P. H. P. and Goomas, D. T. (2014) 'Outcome-and-Behavior-Based Safety Incentive Program to Reduce Accidents: A Case Study of a Fluid Manufacturing Plant'e', *Safety Science*, 70(December), pp. 429–437.