

The Evaluation on the Efficiency of Occupational Safety Training at Thang Long Green Energy JSC Company

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Abstract:

The article assessed the effectiveness of occupational safety training of Thang Long Green Energy Joint Stock Company following the Kirkpatrick model. We conduct surveys in 2 stages. The first evaluated the training results right after the end of the training program to evaluate the training results by level 1 and level 2, and 6 months later, we continue to survey to evaluate the training results by level 3 and 4 of the Kirkpatrick model. The result is a new assessment of the effectiveness of training at level 2 of the model and the effectiveness of labor safety training at an average level

Keywords: Occupational safety training, Thang Long green energy JSC, Kirkpatrick model.

1. Introduction

Vietnam is now in the era of industrialization, modernization, and globalization. Vietnamese enterprises have to cope with many challenges of the technological revolution 4.0. Internal economic integration brings a new market for enterprises; however, it is accompanied by stringent requirements for production standards, including work safety.

Recently, there has been an increase in the number of industrial accidents. According to the Notice No. 1152 / TB-LDTBXH of Ministry of Labor - Invalids and Social Affairs on March 28th, 2017 on industrial accidents: In 2016, there were 7588 industrial accidents, the death toll was 711 people (increase by 6.75% compared to 2015) and the number of victims is 7806 (increase of 0.27% compared to 2015), of which industrial accidents in saturated steam production account for two-sixth of the most serious industrial accidents in 2016.

Thang Long Green Energy JSC Company (TLGE) is the first ranking saturated steam producer in Vietnam. The company's partners are well-known enterprises in Vietnam and in the world, and they appreciate TLGE for production standardization such as product standards, no pollution and meeting the requirements of work safety and hygiene. Currently, TLGE is in the process of being completed in accordance with the standards of ISO and OHSAS.

However, during the period of observing the safety training process at TLGE, the author found that the training process of work safety is only at the level of transferring knowledge; the self-inspection of work safety have not been fully implemented and evaluated. There are no reports evaluating the efficiency of safety training to help managers make sound and timely business decisions.

TLGE is in the process of standardization in accordance with OHSAS 18001 standards (*Occupational Health and Safety Assessment Series*). The board of directors of the company has assigned the Technical Office to train the work safety in the company and the Personnel Office - where I am working - to monitor and evaluate the efficiency of the training.

The studies of local experts on work safety are mostly in terms of legal issues and work safety training curricula, but no authors have evaluated the efficiency of work safety training in enterprises producing saturated steam using a boiler.

According to recent reports by the Department of Work Safety, most of the industrial accidents are caused directly by workers, among which many workers have been trained in work safety.

Labor is the most important input factors for enterprises. In my view, before discussing raising labor productivity or incomes for workers, HR managers should protect their health and lives first.

2. Literature review and theory

2.1. Kirkpatrick model



Figure 1: Model four levels of evaluation by Kirkpatrick

Level 1: Reaction: Are trainees satisfied with the course?

Evaluation at this level mainly examines the response of the trainees to the course. Through polls that are usually delivered at the end of the course, participants express their opinions on various aspects of the course. This level is the most commonly used because it is easy to use and assess. Kirkpatrick recommends that each training program should be evaluated at least at this level

The reaction of the trainees to the training is related to such aspects as the training objectives, the training methods and the teacher's ability to measure, through which the satisfaction of the trainees is measured.

Level 2: Learning: What do trainees learn from the course?

Learning outcomes are determined based on the amount of knowledge, skills, and attitudes that students receive from the course. The evaluation at level 2 determines the extent to which the trainees can improve their knowledge and skills after attending the course. This level can be taken throughout the course and uses a variety of evaluation methods such as questionnaire surveys, observations, theoretical tests, practice tests, group assessment, and self-assessment

Normally, the level of change in knowledge, skills, and attitudes of trainees through training is determined by comparing and contrasting the results of the diagnostic test and the final test. The differences between the two exams show what the trainees have learned from the course.

Level 3: Behavior: Can trainees apply what they learn to their work or after the course, do they improve their work effectiveness?

The possibility and level of application of the knowledge and skills the trainees gained from the course to their work are the main subjects for evaluation at level 3. It answers the question of whether the mentioned skills and knowledge help the trainees improve their work effectiveness and if so, to what extent.

This level is related to what happens after trainees complete the course and returns to work, so this evaluation is best conducted 3 to 6 months after the course ends for the two following reasons: *Firstly*, trainees need time to review what they have learned and apply it to practice. *Secondly*, it is difficult to accurately predict when changes in trainees' performance resulting from training happen.

This level should be implemented many times to determine the effects of these changes fully. Evaluation methods at this level include polls, surveys, interviews, and direct observations. Participants in the evaluation include not only the trainees but also the managers or supervisors, or those in a position to observe the change in performance of the trainees.

Assessment at this level is complex and difficult to implement, requiring much time and effort to collect data and it is difficult to predict when changes in student performance will occur. Moreover, in addition to training, the performance may be affected by many other factors. All of these things make the trainer if not forced not to perform this level of assessment.

Level 4: Result: How does the training affect the organization?

Level 4 evaluates training effectiveness through its impact on business results. Business results include improving quality, improving production effectiveness, reducing production costs, reducing employee retrenchment and dismissal rates. This level does not focus on the impact of individual training but focuses on the overall impact of training on the entire organization, including all individuals within the organization.

Among four levels, this level provides the most valuable and persuasive information. It reflects the ultimate goal of all training programs - that is, the profits organizations can derive from funding for training.

Compared to other levels of evaluation, this level is the most difficult to implement because:

- It takes a lot of time and cost to collect and analyze the data
- It is difficult to separate the effects of training and the effects of other factors (advantageous business environment, an increase in labor scale) on changes in the effectiveness of the organization. These changes can result from training or not.
- It is difficult to convert business results into money and associate it directly with training.

Due to the above reasons, level 4 is hardly implemented by organizations.

The four mentioned levels of evaluation make a systematic and comprehensive evaluation model in which all elements are closely interrelated, although they differ in their degree of difficulty, frequency of implementation, and the value of the information that they provide. Therefore, the evaluation should proceed from level 1, then depending on the time and budget, other levels 2, 3 and 4 will proceed sequentially. The implementation of the whole system of evaluation by Kirkpatrick gives us a comprehensive and formal evaluation of the effectiveness of training programs.

2.2. Factors affecting the effectiveness of occupational safety training

2.2.1. Organizational factors

The strategic objective of the organization

Each organization has its own objectives and strategies for each period of time. These objectives govern all activities of the business including human resource development and training. When businesses expand their production scale, change their organizational structure or technology, trainees need to be trained to have new knowledge and skills in line with those changes.

The management policy and philosophy, the ideas and opinions of the manager of the organization on the human resource management also greatly influence the process of occupational safety training.

Scale and financial capacity of the enterprise

The bigger the scale of the enterprise is, the more complicated the occupational safety training is and vice versa. When the scale of the enterprise is small, and the specialization is not high, more and more occupational safety training needs should be implemented.

The financial capacity directly impacts on occupational safety training activities of enterprises. The organization with abundant financial resources and good business results will invest more in training activities. Organizations with limited financial capacity will reduce occupational safety training activities in terms of size, quantity, and quality.

Enterprise's attitude towards human resource development and training

Each organization or each administrator has his own views on human resource training. Organizations that are led by progressive administrators have a strong interest in the importance of safety training. Simultaneously, At the same time, activities and policies to encourage self-learning and development of employees are also issued to support the training and development of employees.

On the other hand, organizations that set organizational development goals prior to human resource development will face difficulties when the organization grows large. At that time, the quality of human resources will not meet the needs of the rapid development of the organization.

2.2.2. External factors

Economic factors

Economic factors play a leading role and have a decisive influence on the operations of the enterprise. Depending on the development status of the economy: growth, stability or recession, each enterprise chooses its own training and development strategy. As the economy grows, the demand for occupational safety training is higher compared to the recession.

Technological factors

The rapid development of science, technology, and information systems have resulted in tremendous changes in production and business strategies and personnel strategies, in labor productivity as well as in the performance of occupational safety training. Together with the wide and multi-dimensional information resources, enterprises can update their most advanced training programs. The specialization, automation and more robot production also change many steps in the production chain, requiring workers to have the knowledge to adapt to work.

Socio-cultural factors

Socio-cultural factors such as labor practices, life habits, and people's intellectual level, have profound effects on enterprises. It directly influences the formation of corporate culture, group culture as well as work behavior and attitudes of executives and employees in the enterprise. Therefore, in the training strategy on occupational safety and human resources development, special attention should be paid to socio-cultural factors.

Competitor

Competitors have a strong impact on the operations of the enterprise. One of the advantages that can make an enterprise stand out is the promotion of human resources. Enterprises that have good short-term and long-term occupational safety training strategies will increase their competitive advantage in the market.

2.2.3. Labor factors

The motivation of employees: It is the internal factor that drives the activity, directs the behavior and increases the determination to win the goal of the employees. To change the behavior and results in the work, it is necessary to affect this issue. In particular, long-term commitment to work is the most important motive for human resource training and occupational safety training.

Level of employees: Employees at a higher level will absorb and apply the knowledge on occupational safety more quickly and accurately than others.

3. Research Method

3.1. Context

Thang Long Green Energy Joint Stock Company is a subsidiary of Green Energy Corporation of SSG Group. The company was established in June 2011, initially only two steam plants: Phu Tho Steam Plant and Ha Nam Steam Plant. At present, the company has 8 plants and 2 more plants which have been started constructing in Thuong Tin- Ha Noi and Hai Phong.

In the time of international economic integration, with the exploitation of resources from many sides, the company has boldly invested, renovated operation mode, made remarkable changes, brought company growing step by step in both quantity and quality.

The scientific and logic production organization and design of machines is the premise to ensure labor safety. In this section, we would like to describe the production organization as well as the machinery system design at Thang Long Green Energy Joint Stock Company so that readers can decide whether or not such a design is reasonable and is the foundation for ensuring the safety of employees at the company.

Thang Long Green Energy Joint Stock Company operates in saturated steam production, one of the important input factors for the company's partners. At present, the company's partners are big branches such as Sai Gon Sabeco Beer, Ha Noi Sabeco Beer, Vinamilk, URC..., so occupational safety standards are closely monitored according to International Standards. Therefore, Thang Long Green Energy Joint Stock Company focuses mainly on occupational safety insurance in production activities and constantly innovates technology to provide steam efficiently to serve customers to produce the best products, contributing to the development of Vietnamese brands and local budgets.

On account of production characteristics, factories of Thang Long Green Energy Joint Stock Company are built next to or within the partner's that is convenient for steam supply. In the production process, there is a specialized department that is responsible for regularly inspecting steam quality, environmental hygiene, and occupational safety.

3.2. Sample research

We develop questionnaires on the basis of research overview by Lim Guan Chong (2006)- evaluating the training effectiveness of enterprises in Malaysia, Neeraj S.Borate (2014) – evaluating the effectiveness of employee training of enterprises in India, TNO report (2016) – evaluating the effectiveness of employee safety training of enterprises in Netherlands. Together with the features of business and production in Vietnam, we develop 2 types of questionnaires: one is a questionnaire for managers and staffs in charge of occupational safety to evaluate occupational safety training in the company, the other is a questionnaire for employees who participate in occupational safety training to evaluate occupational safety effectiveness. Once the questionnaire is developed, it is sent to HR management specialists from National Economics University and experts in Hanoi for consultation before sending to get data.

We send 255 survey questionnaires to managers and employees who take part in occupational safety training. The results of 235 questionnaires are collected, analyzed and synthesized.

3.3. Evaluation method

With each evaluation level in the model by Kirpatrick, the methods of collecting and analyzing are as follows:

Table 1: Methods of collecting, analyzing data to evaluate training effectiveness

Level of evaluation	Methods of collecting data to evaluate training effectiveness	Methods of analyzing data	Time
Level 1: Reaction	<ul style="list-style-type: none"> - Trainees can write their self-report - Distribute survey on trainees' opinion (5-level scale) - Collect other feedbacks from trainees - Evaluationn by trainees and the coordinator of the training (check sheet or open comment) 	<ul style="list-style-type: none"> - Descriptive statistics - Analyze feedback from trainees - Set the threshold to compare for each course 	<ul style="list-style-type: none"> - Right after the course
Level 2: Learning	<ul style="list-style-type: none"> - Observe the changes of trainees after the training - Organize a test to know the changes of trainees (knowledge, attitudes) - Trainees write reports, distribute survey questionnaires to trainees -Interview (trainees, trainer, coordinator) 	<ul style="list-style-type: none"> - Do pre- post test - Do a pre-post test with the control group - Statistical analysis -Cost-to-benefit analysis 	<ul style="list-style-type: none"> - Right after the course - Before and after training
Level 3: Behavior	<ul style="list-style-type: none"> - The performance of trainees after training in comparison to the previous results - Multiple scale investigation and interview - Trainees write their self-report - Interview (trainees, trainer, coordinator) 	<ul style="list-style-type: none"> - Do pre- post test - Do pre- postatest with the control group - Statistical analysis - Cost-to-benefit analysis 	<ul style="list-style-type: none"> - Right after the course - Before and after training

Pre-post test and pre-post test with a control group have been described in detail in the above part of the paper (Design the evaluation).

At level 4, it is possible to evaluate by analyzing the operation of the enterprise by considering employee mobility, the attractiveness of the business and the performance of employees.

4. Results

Comparing to other production of other products, the process of steam production is quite simple. Water goes into tanks thanks to the water supply system; fuel is taken to furnace by the material excavating system. When materials (choppers, sawdust, peanut shells,) burns, they make water to heat and evaporate. When the pressure reaches a certain level,the steam goes through the steam valve supplying system and moves to partners. Process of steam production is described simply in Figure 2 as follow:

Burning fuels -> Boiling water -> Evaporating water -> Collecting saturated steam.

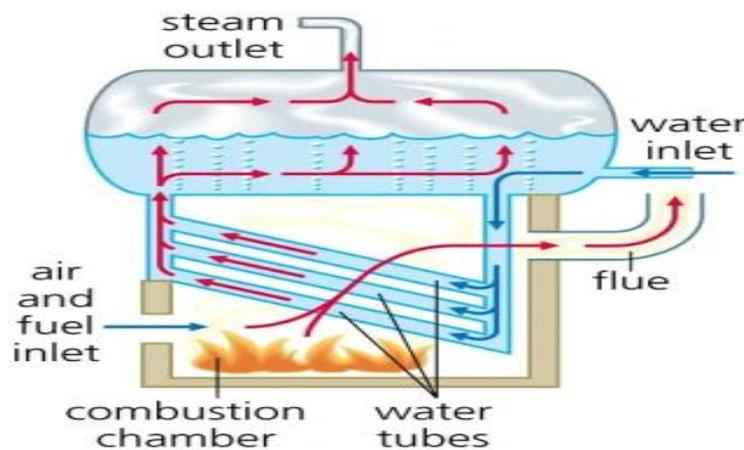


Figure 2: Process of steam production

Once the questionnaire has been consulted by HR management experts, we send questionnaires to all employees who are trained occupational safety in the factory including 38 new employees in recruitment in March 2016. All 220 questionnaires were sent and received 200 questionnaires, of which there were 05 invalid questionnaires, the rest of 195 questionnaires, we imported to excel file and analyzed survey result as follows:

Level 1: Reaction: Most of the trainees are satisfied with the training program

- Reaction: “Do trainee like training program.”
- Evaluation time: After finishing the course, the company evaluates and collects trainee’s feedbacks about the program.
- Comparing with implementing the plan (comparing with the approved plan before the course)

No	Norm	Unit	Results need to be got	Real results
1.	Course quality (through trainee’s feedback)	Score	≥ 3.5	4.5
2.	Percentage of participants/total registrated trainees	%	≥ 80	100

(Source: Self-synthesized by authors)

Trainee’s feedback

Level 1: Reaction- How did the participants react to the training?		Average point
1	This training is beneficial to my work	4.8
2	This training will make the entire operation work better	5.0
3	This training content is easy to integrate into my daily work	4.9
4	The training approach (game) worked fine for me	3.8
5	The training is in conflict with existing procedures or processes	1.6
6	My job performance will improve through the application of the training	4.5
7	Management is engaging with this training	3.2
8	The training made me reflect on my role in ensuring the safety of the operation	3.8
9	The training reflects the operational realities of my job	2.9
10	I like that all employees do the same training	4.3
	AVERAGE	3.88

(Source: Self-synthesized by authors)

- Other trainee’s evaluation:

The most favorite things in the course	The plan will apply in reality
<ul style="list-style-type: none"> - Lecturers interact well with trainees, learning atmosphere is always lively. - Lecturers are young, enthusiastic, humorous, professional manner, knowledgeable deeply and strong. - Trainees will understand more about Green Energy Company and production process of operating machines in the factory and occupational safety knowledge as well - Having a chance to connect and listen to technical, fuel and HR staffs sharing the useful lesson, and learn more experiences from other colleagues. - Modern facilities, attractive, support for trainees during the learning process. - The good learning environment, the training program is good, scientific, reality. 	<ul style="list-style-type: none"> - Applying technical standards of occupational safety, implementing strictly occupational safety requirements while operating and repairing machines. – Always innovating thinking, positive thinking to become fond of job and love more effectively and avoid accidents. - How to handle situations when there are any cases of occupational unsafe.
Things need support in the application process	Suggestion for improvement
<ul style="list-style-type: none"> - Trainees will be supplied with materials to make conferences and storage. 	<ul style="list-style-type: none"> -Teaching contents should be more real and lively. - The course should be longer to train deeply, have practical exercises for preventing occupational unsafe as well as firefighting prevention....

(Source: Self-synthesized by authors)

At Level 1, most employees enjoy training, perhaps because the lecture is tailored to the employees' knowledge. Thanks to the policy of encouraging high scores, the staff active and the rate of absent employees is low. Moreover, after the training, the company asks employees to summarize the training, although the results are not high, some staffs are very serious (maybe because of the reward policy: the best report wins 1 million VND and the two second best gets 500.000 VND).

Level 2: Learning: Most of the trainees get skills as well as knowledge in course

Evaluation time: After training course finishes, they will make a test to know if the trainees have acquired the necessary knowledge or skills.

Examination method: Multiple choices are given after class and answer to questionnaires.

A number of questions: 22 questions.

Timing: 20 minutes

In reality, statistics base on test results, the number of employees have right answer ratio from 70% -85% mainly. As occupational safety training program in March 2016, there were 38 new employees, 35 employees acquired over 70%, the rest of 3 employees acquired 50-70% (HR department)

Level 2: Learning - What information and skills were gained?		Average
1	After trained occupational safety, I have more responsibilities in my activities.	4.8
2	I am increasingly aware of the individual role in ensuring occupational safety	4.9
3	I have learned about the consequences of losing occupational safety when not following occupational safety regulations.	4.6
4	I have improved awareness of my resilience through understanding more how both employees and staffs contribute to safety.	3.9
5	I have learned practical technique which I can use in my working to ensure occupational safety.	4.5
6	I have learned how to react with unexpected situation of losing occupational safety which happens in the production process.	4.6
7	I have more awareness of losing occupational safety impact on production activities.	4.3
8	I have learned to think and evaluate positive and negative experiences that are capable of ensuring occupational safety in reality, contributing to occupational safety improvement.	3.2
Average		4.35

(Source: Self-synthesized by authors)

Survey results show that the majority of trainees have basic knowledge of occupational safety and could apply in reality after training. 4.35/5 of the average point is a positive result. Most trainees learn the role of ensuring occupational safety as well as their responsibilities in ensuring occupational safety. The indicator "I am increasingly aware of the individual role in ensuring occupational safety," reaches 4.9 out of 5. It can be seen that almost 100% of the trainees learn a lot from the safety training — the company. However, learning how to think and evaluate positive and negative experiences that have the potential to ensure occupational safety is in fact not addressed by the staff at the 3.2/5 rating. Thus, at level 2 of the Kirkpatrick model, the analysis finds out that most employees learn the majority of knowledge transmitted during the occupational safety training.

Level 3: Behavior: After the course, most trainees have applied knowledge and skill into practical working.

- Evaluation contents:
- + Have trainees applied knowledge into actual working?
- + Have trainees changed their behaviors, attitudes after training and before training?
- Time of survey: After the training program finishes from 3 to 6 months.
- Form of the survey: questionnaire.
- Content of survey: After 3 to 6 months, when occupational safety training finishes, we make a survey to help employees to look back their changes and applying to practical working. Then, we synthesize, analyzes and evaluates survey results.

Level 3: Behavior		Average point
1	In my daily working, I used what I have learned in the occupational safety training course.	4.5
2	I encouraged my colleagues to follow the company's occupational safety training program.	4.1
3	I have changed my behavior because I applied occupational safety regulations on my daily working.	4.0
4	There was a reduction in the number of actual occupational accidents as members of the team applied occupational safety strategy.	3.5
5	There was a positive participation of members in the team during the training process.	3.9
6	Members of production shifts always follow up with each other's behavior to ensure occupational safety in reality.	4.2
7	Members of production shifts noticed to each other when the unsafe occupational situation happened unexpectedly.	4.5
8	Safety activities have been improved because occupational safety training applied human resource and appropriate strategy.	3.9
9	I feel my colleagues supporting when I propagated the safety rules that I have learned.	3.8
10	I feel superior's supporting when I apply skills that I have been trained.	3.2
11	I feel that I can apply what I have learned during the training process.	4.6
AVERAGE		4.02

(Source: Self-synthesized by authors)

Survey results show that most employees have positive behavior when they are trained occupational safety, reaction level to work is very good with result 4.02/5. When training, most employees are able to apply the trained knowledge to their work. Employees have an awareness of reminding and supervising each other to ensure occupational safety. In particular, survey results show that most employees are able to use what they have learned in the training and the workplace (4.6/5). However, the support of the leaders when the staff applies skills in the workplace is not enough (3.2/5) may be because the company only has one staff member specialized in occupational safety (Mr. Dang Quang Hien). The number of occupational safety staff member is limited, while there are so many factories that the support to workers is not close.

Level 4: Result: The impact of an occupational safety training program on the effectiveness of employee safety.

Duration: 4 months after the training program finishes.

Evaluation method: Depth interview and sending a questionnaire.

Depth interview: Interviewers talk and ask interviewees in the form of depth interview — the list of interviewees and the content of interviewing.

Result of depth interview:

- According to Mr. Hoang Viet, director: “From the establishment of the company, the company always organizes occupational safety training for employees, so it has no occupational accidents unexpectedly. Fire prevention measures are also trained regularly, so there is no fire in the factory. This is really an effective training program”.

- According to Mr. Tran Van Hoan: “After 6 months since training program finishes, I am very satisfied when all employees have many positive behaviors such as: taking occupational safety tools, personal protection tools are always used while working, operating safety procedures properly. According to statistics of the Administration Department, the rate of new employees who are trained and stayed to work is 36/38 employees, means 93%.

- According to Mr Dang Quang Hien- person in charge of occupational safety: “ My job is to communicate, guide and inspect occupational safety ensuring of employees, after the training course finishes, I notice that employees have positive changes in implementing occupational safety regulations, new employees understand more about occupational safety, and old employees assure better.

Level 4: Results		Average point
1	From the perspective of my role, the safety training is implemented correctly	3.2
2	From the perspective of my role I can see an improvement in effectiveness related to this training	3.8
3	From the perspective of my role I can see an improvement in safety related to this training	3.3
4	I have noticed that my colleagues put into practice the things they learned in the training	4.1
5	I have noticed that the number of suggestions for improvement of operational safety increased	2.9
6	I have noticed that there is fewer occupational safety because of not ensuring occupational safety.	4.2
7	I have noticed that the level of safety increased	4.1
8	I have noticed that there is an overall positive impact on (the level of) safety culture	4.2
9	I have noticed that there is increased effectiveness and productivity as a result of increased safety	4.4
	Average	3.8

(Source: Self-synthesized by author)

The result of the survey shows that occupational safety training has brought positive effects for enterprises. Most employees understand the importance of occupational safety and apply to practical working. Thanks to occupational safety training, the number of occupational accidents decrease and the company’s occupational safety culture is increasing. However, analyzing effectiveness between training cost and training effectiveness. This section is for future research. In the paper, we just evaluate training effectiveness on company’s occupational safety effectiveness.

Following the results of the survey on the effectiveness of occupational safety training at Thang Long Green Joint Stock Company, the paper conducts a survey on occupational safety of the company to compare with the effectiveness of occupational safety training in order to analyze and make recommendations in accordance with reality.

5. Conclusion

The research objective is to evaluate the efficiency of safety training at Thang Long Green JSC Company: develop a theoretical framework for evaluating the efficiency of work safety training and analyze the current situation of industrial safety training at Thang Long Green Energy JSC Company, thus recommend solutions to improve the efficiency of safety training at Thang Long Green JSC Company.

We present an overview of the theoretical background on work safety and evaluation of the efficiency of work

safety training. Through the analysis of the situation of safety training efficiency at TLGE, the managers of the company can see the advantages and disadvantages of the work safety training for employees. Thanks to this, it is possible to propose suitable solutions to improve the efficiency of work safety training in order to reduce costs and minimize industrial accidents.

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