Scientific Research Publishing

Open Journal of Safety Science and Technology, 2024, 14, 40-61
https://www.scirp.org/journal/ojsst
ISSN Online: 2162-6006
ISSN Print: 2162-5999

A Study of Safety Competency for Leadership Change in Companies with ISO 45001 Certification

Shan-Shin Ton[1], Taipau Chia[2], Kai-Yu Huang[1], Cheng-Ming Chang[3], Shu-Chun Tseng[1]

[1]Department of Environmental Engineering and Science, Feng Chia University, Taichung
[2]Department of Safety, Health and Environmental Engineering, Hung Kuang University, Taichung
[3]Institute of Labor, Occupational Safety and Health, Ministry of Labor, New Taipei City
Email: sston5212@gmail.com

How to cite this paper: Ton, S.-S., Chia, T., Huang, K.-Y., Chang, C.-M. and Tseng, S.-C. (2024) A Study of Safety Competency for Leadership Change in Companies with ISO 45001 Certification. *Open Journal of Safety Science and Technology*, **14**, 40-61.
https://doi.org/10.4236/ojsst.2024.143004

Received: May 10, 2024
Accepted: July 6, 2024
Published: July 9, 2024

Abstract

With lessons from the major industrial disasters, we've learned that organizational change (OC) is one of the causes of disasters. The purpose of this study is to investigate the impact of different OCs on the implementation of the Occupational Health and Safety Management Systems (OH&SMS), and gain deeper insights into the safety competency requirements of the leadership personnel. Fifteen professional occupational safety and health (OSH) managers were invited to perform the impact evaluation through questionnaire. The impact levels of eight types of OCs on the implementation of thirty-two clauses in the ISO 45001 OH&SMS were evaluated. The Kruskal-Wallis test was used to analyze the difference of the impact of OCs on the implementation of the clauses. The Mann-Whitney U test was used to compare the impact level of leadership personnel changes for the companies with different duration of implementing OH&SMS. This study showed that the impact level of the OC on the implementation of OH&SMS varies with the types of OC and the implementation years of the ISO 45001 OH&SMS. Most of the clauses with the top five impact levels for leadership personnel change were clauses 5 (Leadership and worker participation), 6 (planning), 8 (operation) and 9 (Performance evaluation). For companies that have implemented the OH&SMS for a longer time (>10 years), the impact level of leadership personnel change was significantly higher on the implementation of clause 6.1.3 ($p = 0.015$) for top management, 5.1 ($r = 0.008$) for OSH manager, and 6.1.4 ($r = 0.046$) for Department manager. When replacing three major OSH leaders, the company must ensure that they meet the requirements of the key clauses. In order to ensure the achievement of the goal of disaster prevention, it should be confirmed that the safety management does not vary from person to person or affect the organization's safety culture when OC is initiated.

Keywords

Organizational Change, ISO 45001, Occupational Health and Safety Management Systems, Leadership, Safety Competency

1. Introduction

Facing rapidly changing world, companies often make changes to equipment, processes or organization in order to improve the efficiency of organizational operations. If the related hazards are not well controlled in the workplace, industrial disasters may occur. Organizational changes such as reducing staffing levels, using contractors or outsourcing, merging departments, or changes to roles and responsibilities are usually not analyzed and controlled as thoroughly as plant or process changes [1]. Even subtle changes to organizations can have significant impacts on the management of hazards. One of the major disasters related to organizational change (OC) is the Bhopal disaster in India [2]. One of the causes for the incident was that the positions of the experienced staffs were replaced by employees who had not received adequate training in operating a methyl isocyanate plant. Neglected necessary measures including risk awareness, education and training, contingency drills and maintenance activities resulted in tragedy. There were 65 errors which were the result of management failures [3]. The Castleford storage tank explosion happened in the UK was also related to OC [2]. The organization structure changed from a linear structure to a matrix in which the role of plant manager was eliminated. Instead, the plant was managed through coordination of senior operatives who were appointed to act as team leaders. Due to overload, the area manager didn't have enough time and attention to process safety issues, which resulted in severe damage [2] [4]. Both catastrophic accidents show the importance of organizational change management.

Regarding the organizational change management, the CCPS (Center for Chemical Process Safety) in the United States had published organizational change management guidelines [2]. The California's process safety management regulations 5189.1 [5] came into force in 2018, which stipulates that refineries must apply more effective methods to prevent major disasters. The HSE (Health and Safety Executive) in UK provided management standards of organizational change, which pointed out the organization should provide employees with timely information to enable them to understand the reasons for proposed changes, probable impact and have access to relevant support during changes [6]. And the key principles of managing OC should ensure that all key tasks and responsibilities are identified and successfully transferred to the new organization [1]. Due to the greater potential consequences of an accident, major accident hazard sites should aim for higher reliability in their planning and decision-making of OC management.

The International Standards Organization officially released the Occupational Health and Safety Management System ISO 45001:2018 in 2018. Karanikas *et al.*

found that the implementation of the new standard could support organizations to move beyond a focus on individual system components and allow a better understanding of the whole socio-technical system [7]. Companies in many countries have established the Occupational Health and Safety Management Systems (OH&SMS) in response to the globally accepted international standard. However, Hastle *et al.* assumed that companies choosing to obtain an ISO 45001 certificate must increase resources and attention to integrate the occupational safety and health (OSH) management and operations management [8]. And it's found that the implementation of safety management system requirements is instrumental to a sustainable continuous improvement in safety performance [9]. Companies need to make effort to improve the effectiveness of the OH&SMS.

Currently, there are ~1824 companies in Taiwan area that have adopted ISO 45001: 2018 [10]. In recent years, Taiwan (China) government revised OSH Law which stipulated that high-risk companies with more than 200 employees must establish an OSH management system. In order to comply with the regulations, companies in science and technology parks or chemical industry have been certified with ISO45001 standards. In Taiwan area, change management in the OSH management has been carried out for many years, but regulations or guidelines related to organizational change management have not yet been established.

It's known that the goal of implementing the OH&SMS in an organization is to provide safe and healthy workplaces and prevent work-related injuries. Also the problem faced by numerous companies with OH&SMS is the poor effectiveness, reflected in the fact that their implementation has contributed little to improving the factory's safety performance, or has not led to any improvement at all [11]. Typically, adequate education and training should be offered when personnel changes. The IChemE Safety Center (ISC) in UK has published the "Process Safety Competency Guidance" on how to establish a process safety competency framework [12]. This guidance anticipates further work in establishing how competency can be achieved. However, there has not yet been a detailed discussion on the requirements of the OH&SMS standards for OC. When the ISO 45001 certified companies face organizational changes, the companies may wonder which requirements of the clauses are important for them. And what are the key safety management competencies for the newly appointed staffs? The purpose of this study is to investigate the impact of different OCs on the implementation of the OH&SMS, and gain deeper insights into the safety competency requirements of the leadership personnel. This study is the first study conducted in Taiwan area to explore the impact of organizational change in the ISO 45001 certified companies. Fifteen safety managers were invited to evaluate the impact of eight types of organizational change on the implementation of the ISO45001 clauses. Based on the investigation, the key safety competencies for three major safety leadership personnel were discussed.

2. Method

This study included an expert panel and a quantitative survey to explore the ex-

periences of the OSH mangers in relation to the OC impact on the implementation of ISO 45001 OH&SMS clauses.

2.1. Subjects

Fifteen OSH practitioners from the manufacturing companies were invited to participate in the questionnaire survey. The fifteen companies included six high-tech companies, four chemical factories, and five small and medium-sized factories that use chemicals. The average number of employees is 6832 (median = 750), and only four companies with less than 300 workers. These companies basically committed "safety as a priority" and have adopted ISO 45001 OH&SMS for many years. The average duration of the OSH management system established in the companies was approximately 13 years. The working experience of the OSH managers ranged from 3 to 35 years, with an average of 17 years.

2.2. Questionnaire Survey

Questionnaire was used to survey the impact levels of eight types of OCs on the implementation of the ISO 45001 OH&SMS. In the questionnaire, there were eight types of organizational change, including the replacement of the top management, OSH manager, Department manager, workers, outsourcing, contractor, work condition change (e.g. control area change) and downsizing. It was assumed that different types of OC have different impacts on the implementation of the 32 clauses in the ISO 45001 OH&SMS (from 4.1 Understanding the organization and its context to 10.3 Continual improvement), as shown in Table 1. Participants of the OSH practitioners were asked to evaluate and grade the impact level based on their experience. A 5-point rating scale was used to evaluate the impact level, level 5 to 1 means catastrophic, major, moderate, minor and insignificant (described in **Appendix 1**). The questionnaire took approximately one to two hours to complete after instruction. There were a total of 3,840 data evaluated in this study. The clauses were directly derived from the ISO 45001 OH&SMS, it is affirmed that they have construct validity. The Cronbach's alpha coefficients of the eight types of organizational changes in this questionnaire were 0.982, 0.984, 0.979, 0.950, 0.977, 0.969, 0.973, and 0.958, respectively. It's indicated that there was a high degree of consistency among the practitioners' responses, suggesting the impact assessment results were consistent.

2.3. Statistics

The data were analyzed using SPSS statistics 24.0. The average value and standard deviation were used to describe the impact level of the OCs on the implementation of ISO 45001 clauses. Non-parametric analyses were performed. The Kruskal-Wallis test was used to analyze the difference in the impact of four types of OCs on the implementation of the clauses. The Mann-Whitney U test was used to compare the impact level of the three types of leadership personnel changes for the companies with different duration of implementing OSH management system (>10 years vs. <10 years). A two-tailed significance level of 5% was adopted.

Table 1. Clauses of the ISO 45001 OH & SMS.

Clause No.	Requirements	Clause No.	Requirements
4	Context of the organization	7.4	Communication
4.1	Understanding the organization and its context	7.5	Documented information
4.2	Understanding the needs and expectations of workers and other interested parties	8	Operation
4.3	Determining the scope of the OH&S management system	8.1.1	General
4.4	OH&S management system	8.1.2	Eliminating hazards and reducing OH&S risks
5	Leadership and worker participation	8.1.3	Management of change
5.1	Leadership and commitment	8.1.4	Procurement
5.2	OH&S policy	8.1.4.2	Contractors
5.3	Organizational roles, responsibilities and authorities	8.1.4.3	Outsourcing
5.4	Consultation and participation of workers	8.2	Emergency preparedness and response
6	Planning	9	Performance evaluation
6.1.1	General	9.1.1	General
6.1.2	Hazard identification and assessment of risks and opportunities	9.1.2	Evaluation of compliance
6.1.3	Determination of legal requirements and other requirements	9.2	Internal audit
6.1.4	Planning action	9.3	Management review
6.2	OH&S objectives and planning to achieve them	10	Improvement
7	Support	10.1	General
7.1	Resources	10.2	Incident, nonconformity and corrective action
7.2	Competence	10.3	Continual improvement
7.3	Awareness		

3. Results

Fifteen OSH managers were invited in this study to evaluate the impact of OCs on the implementation of the clauses in ISO 45001 OH&SMS. The results are shown in Figure 1. The impact level of the eight types of OCs (average ± SD) were 1.46 ± 0.63 (top management), 2.02 ± 0.46 (OSH manager), 1.89 ± 0.46 (Department manager), 1.10 ± 0.42 (worker), 0.87 ± 0.39 (outsourcing), 1.01 ± 0.50 (contractor), 0.68 ± 0.31 (work condition) and 0.88 ± 0.40 (downsizing), respectively. Among them, when the OSH manager is replaced, the average impact level on the implementation of the 32 clauses was the highest.

Regarding the four types of OCs that have a higher impact on the implementation of clauses are the replacement of the top management, OSH managers, Department manager and worker. The average impact level of the 32 clauses for each personnel change is shown in Figure 2 (n = 15). The impact level on the

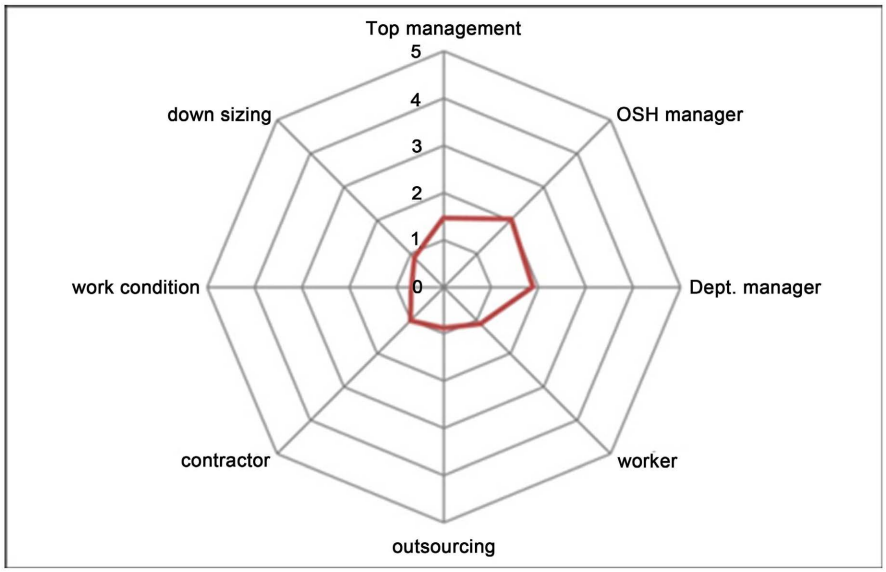

Figure 1. Average impact level of the eight types of OCs on the implementation of the ISO 45001 clauses.

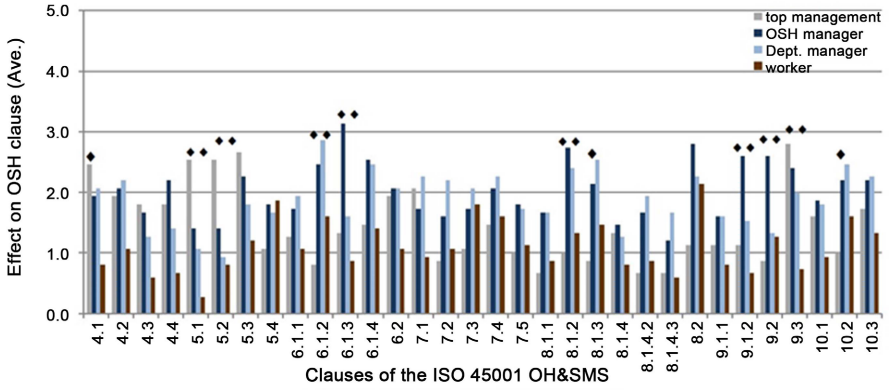

Figure 2. Average impact level of the four types of personnel changes on the implementation of the 32 clauses in ISO 45001 OH&SMS (Kruskal-Wallis test, *: $p < 0.05$; **: $p < 0.01$).

implementation of the clauses varied with the types of personnel change. Those clauses with an average impact level >2.5 included 5.1, 5.2, 5.3 and 9.3 for the replacement of top management; 6.1.3, 6.1.4, 8.1.2, 8.2, 9.1.2 and 9.2 for OSH manager and 6.1.2, 8.1 for Department manager. The replacement of worker only has a higher impact level in 8.2 (the average impact level = 2.13). Using the Kruskal-Wallis test to analyze the impact of the four types of personnel changes on the implementation of clauses, significant differences were found in clause 4.1 ($p = 0.03$), 5.1 ($p = 0.001$), 5.2 ($p = 0.007$), 6.1.2 ($p = 0.004$), 6.1.3 ($p = 0.008$), 8.1.2 ($p = 0.005$), 8.1.3 ($p = 0.041$), 9.1.2 ($p = 0.003$), 9.2 ($p = 0.009$), 9.3 ($p = 0.003$) and 10.2 ($p = 0.033$).

Table 2 summarizes the top five impact levels, that have greater impact on implementation of clauses 4.1 - 10.3 (average ± standard deviation) for the four types of personnel change: top management, OSH manager, Department

Table 2. The top five impact levels on the implementation of the OSH clauses with the four types of OCs.

OC type	Clause (impact level, Ave ± SD)
Top management	4.1 Understanding the organization and its context (2.47 ± 1.73)
	5.1 Leadership and commitment (2.53 ± 1.55)
	5.2 OSH policy (2.53 ± 1.55)
	5.3 Organizational roles, responsibilities and authorities (2.67 ± 1.91)
	9.3 Management review (2.80 ± 1.57)
OSH manager	6.1.3 Determination of legal requirements and other requirements (3.13 ± 1.51)
	8.1.2 Eliminating hazards and reducing OSH risks (2.73 ± 1.28)
	8.2 Emergency preparedness and response (2.80 ± 1.37)
	9.1.2 Evaluation of compliance (2.60 ± 1.40)
	9.2 Internal audit (2.60 ± 1.12)
Department manager	6.1.2 Hazard identification and assessment of risks and opportunities (2.87 ± 1.51)
	6.1.4 Planning action (2.47 ± 1.68)
	8.1.2 Eliminating hazards and reducing OSH risks (2.40 ± 1.50)
	8.1.3 Management of change (2.53 ± 1.64)
	10.2 Incident, nonconformity and corrective action (2.47 ± 1.36)
workers	5.4 Consultation and participation of workers (1.87 ± 1.36)
	6.1.2 Hazard identification and assessment of risks and opportunities (1.60 ± 1.24)
	7.3 Awareness (1.80 ± 1.08)
	8.1.3 Management of change (1.47 ± 1.64)
	8.2 Emergency preparedness and response (2.13 ± 1.19)

manager and worker. It means that the replacement of the personnel had a higher impact level on the implementation of these five clauses. These results provided the information of required safety competency of the newly appointed personnel in this aspect. Therefore, it's necessary to confirm the corresponding checkpoints of safety competency related to the requirements of the clauses. The score of the impact level represents the importance of the requirements.

This study also analyzes the differences of the impact level for different company sizes, work years of the evaluator (OSH managers), or the duration of the company implements the OSH management system. It's found that only the duration of implementing the OSH management system had significant higher impact levels on some of the OH&SMS clauses, as shown in Table 3. For the companies have implemented the OSH system for a longer time, when replacing the top management, the clauses with significantly higher impact levels were 6.1.3, 6.1.4 and 8.1.2; When replacing the OSH manager, the clauses with significantly higher impact levels were 4.4, 5.1 and 7.2; when the Department manager is replaced, the clauses with a significantly higher impact level were 5.2, 6.1.4 and 9.3 (Table 3).

Table 3. Difference analysis of the impact level on the implementation of the OH&SMS clauses with different duration of the OH&SMS (>10 yrs and <10 yrs) and leadership personnel change.

	Duration of implementing the OH&SMS		
OC type OH&SMS clauses	Impact level Ave ± SD <10 years (n = 7)	Impact level Ave ± SD >10 years (n = 8)	p value
Top management			
6.1.3 Determination of legal requirements and other requirements*	0.0 ± 0.0	2.5 ± 2.1	0.015
6.1.4 Planning action*	0.4 ± 1.1	2.4 ± 2.1	0.049
8.1.2 Eliminating hazards and reducing OH&S risks*	0.0 ± 0.0	1.9 ± 2.1	0.037
OSH manager			
4.4 OH&S management system**	0.3 ± 0.5	2.9 ± 1.7	0.007
5.1 Leadership and commitment**	0.9 ± 1.2	3.3 ± 1.5	0.008
7.2 Competence*	0.6 ± 1.1	2.8 ± 1.9	0.032
Dept. manager			
5.2 OH&S policy*	0.1 ± 0.4	2.3 ± 1.8	0.014
6.1.4 Planning action*	1.0 ± 1.3	2.8 ± 1.8	0.046
9.3 Management review*	0.7 ± 1.3	2.4 ± 1.3	0.028

Mann-Whitney U test. *: $p < 0.05$; **: $p < 0.01$.

4. Discussion

This study surveyed fifteen OSH practitioners from small- to large-sized companies that have adopted ISO 45001 OH&SMS. It's found that the impact level of the OC on the implementation of ISO 45001 clauses varies with the types of OC and the implementation years of the ISO 45001 OH&SMS. The replacement of three major safety leaders have higher impact levels on the implementation of ISO 45001 clauses. For companies that have implemented the OH&SMS for a longer time (>10 years), the impact level of personnel change was significantly higher on the implementation of 6.1.3 (Determination of legal requirements and other requirements, $p = 0.015$) for top management, 5.1 (Leadership and commitment, $r = 0.008$) for OSH manager, and 6.1.4 (Planning action, $r = 0.046$) for Department manager.

In recent years, the OSH Law in Taiwan area has been revised that high-risk companies with more than 200 employees have to establish an OSH management system. The fifteen OSH managers who assessed the impact level in this study are the OSH practitioners who have engaged in the implementation of

OSH system for many years (ave. 17 years). Based on their practical experience, which requirements of the ISO 45001 clauses are important for the newly appointed personnel were evaluated (**Figure 1**, **Table 2**). For the four types of personnel change, the impact level was significantly higher on some clauses (**Figure 2**). Organizational changes without thorough consideration, proper planning or supervision may have serious impact on the safety of operations, especially in high-risk factories. Impacts related to OC include worker cooperation, employee morale, workload, time constraints, psychological stress, degradation in the arrangements for managing safety and changes in safety culture [1] [2] [13], which may be the causes of disasters. The effect of replacing safety leadership personnel and the implementation time of the ISO 45001 OH&SMS on the OSH competency of the safety leadership are discussed as follows.

4.1. Three Major Roles in OSH Management

One of the main purposes of implementing an OSH management system is disaster prevention. The results of this study showed that there were three major roles (the top management, OSH manager, and Department manager) play important roles in the governance of OSH management. The average impact levels of these three major roles on the implementation of 32 clauses were relatively higher than others (**Figure 1**). The "Process Safety Competency Guidance" published by the IChemE Safety Centre (ISC) provides an example of a process safety competency model [12]. There are six elements in competency model which are culture, knowledge & competence, engineering and design, human factors, systems & procedures and assurance. The personnel in the guidance cover all organizational members who may be affected by OC, from the front line, engineer, support, management and executive [12]. Conducting gap analysis of OSH competency can find out the capability that each job position should have. As the safety leadership team plays an important role in OSH management and overcoming the difficulties of organizational change during the execution of OC. The key safety competencies of the three major roles in the OSH management are discussed as follows.

4.1.1. Top Management Replacement

Sklad convened experts to evaluate the impact of various elements of the ISO45001 system on safety performance. Comparison of simulation results shows that out of all processes in the OSH management system, improvement of the leadership process contributes most to the system's effectiveness [11]. In order to operate the OH&SMS effectively, first of all, the evaluators in this study believed that the top management should be familiar with issues that affect its ability to achieve the intended outcomes of ISO 45001 OH&SMS (clause 4.1). Generally, the CEO has power to make decisions. He needs to ensure that the resources needed to establish, implement, maintain and improve the OH&SMS are available, etc. (clause 5.1). To develop political support, the leaders need to gain employees' support to implement the change and avoid individuals and groups from block-

ing it [14]. The top management shall ensure that the responsibilities and authorities for relevant roles within the OH&S management system are assigned and communicated (clause 5.3), and be accountable for the functioning of the OH&SMS. These considerations demonstrated the main OSH competencies for the top management.

In order to prevent major disasters, a guideline for high-level framework for process safety management has been published in UK, stating that process safety management requires high standards of leadership (leadership commitment and responsibility, identification and compliance with legislation and industry standards, etc.) [15]. However, it is often assumed that compliance will significantly slow down production or increase costs [16]. This kind of attitude from the top management may negatively impact safety performance of the organization. In our study, the evaluators mentioned that the new top management may have different leadership strategies, safety competency and issues of focus, which may lead to certain OSH problems. Yet, the evaluation result for the replacement of top management did not have the highest average impact level on the implementation of the OSH clauses (**Figure 1**). The reason may be that the corporate compliance covers procedures, standards, specifications or client requirements, so that the replacement of the top management did not cause the highest impact level on OSH management as compared to OSH managers.

However, it is suggested to pay special attention to leadership. Stable, consistent and fair OSH leadership is the foundation of an effective OSH management system [11]. Major change in an organization is usually guided by the top management team, but any member of the organization can initiate change or contribute to its success [17]. If the top managers do not become involved in ensuring safety, it is unlikely that safety would become a priority for the staff. To continuously improve the effectiveness of the OH&SMS, the top management shall review the organization's OSH management whether the OSH objectives have been met, identify areas for improvement and make decisions of adequate resources and effective actions etc. (clause 9.3). It is stipulated in California's PSM regulations that the employer shall develop, implement and maintain an effective "Process Safety Culture Assessment" program [5]. A checklist also listed 39 items for management leadership, commitment, and accountability during organizational change management in the CCPS guideline [2]. The relating check points for top management included establishing a system for operations integrity management, demonstrating commitment, defining individual and team responsibilities, establishing clear goals and objectives of the operations integrity system and measuring/evaluating performance, etc. The Process Safety Competency Guidance in UK also specifically listed the capabilities that Chief Executive Officer (CEO), managing director (MD), and leaders should have [12]. When replacing the top management, the top five clauses that have a higher impact level are 4.1, 5.1, 5.2, 5.3 and 9.3 (**Table 4**), which is in consistent with the importance of safety leadership discussed in aforementioned studies [2] [11] [12] [14]. These top five clauses can be used as the key evaluation criteria

for newly appointed top management. The examples of competency checklist for the "top five clauses" of the top management are listed as follows.

Table 4. Examples of competency checklist for the "top five clauses" of the top management [12] [18].

No	Clause No.	Checking list
1	4.1 Understanding the organization and its context	Ensure the top management team has determined external and internal issues.
2		Take a lead role in the improvement of external and internal issues.
3		Follow the progress of the improvement of external and internal issues during management review.
4	5.1 Leadership and commitment	Ensures leadership team is aware and committed to the provision of adequate levels of financial resources.
5		Ensures the OSH management capability of the leadership team in their area of responsibility.
6		Communicates the importance of visible leadership in developing an effective safety culture.
7	5.2 OSH policy	Top management engages in the development of OSH policy.
8		Confirm the suitability of the developed OSH project according to the OSH policy.
9		Engage in the review of the OSH policy annually.
10	5.3 Organizational roles, responsibilities and authorities	The newly appointed top management understood their own OSH responsibilities (including criminal liability).
11		Exhibit leader behaviors which will increase the likelihood of copied and reciprocated safety behaviors.
12		Identify and clearly articulates behavioral requirements to workforce, contractors and subcontractors.
13	9.3 Management review	Undertakes lead role in monitoring the effectiveness of OSH management system at planned intervals.
14		Provide adequate and appropriate resources for the improvement decision proposed in the management review.
15		Ensure the decisions made in the management review have been implemented.

Since leadership is important to the effectiveness of safety management, evaluating leadership should be mandatory. Sklad's research results showed that great importance should be attached to the leadership process audit, both internal ones and auditors of third parties, including certification bodies. It should be established whether activities undertaken by OSH leaders are carried out regularly and whether they fit into the organization culture and support the achievement of health and safety objectives [11]. Currently, some high-tech companies in Taiwan area have conducted survey on the perceptions of the manager's leadership capabilities, like 360-degree appraisal system [19]. However, most of them have no objections when evaluating leadership team members. It means that it will be difficult to conduct a targeted assessment for the competency of the newly appointed top management, evaluation by a third party may be considered.

4.1.2. OSH Manager Replacement

In Taiwan area, the employer must establish the OSH management plan according to the regulations and authorize managers or related personnel to supervise the implementation of the plan. The OSH managers need to hold Level I or Level II OSH certificates. In small-size companies, OSH supervisors must at least be officially trained to be qualified. Therefore, the main competencies of OSH manager considered by experts in this study include determining how these legal requirements and other requirements apply to the organization and what needs to be communicated (clause 6.1.3). He also needs to know how to use hierarchy of controls to eliminate the hazards (clause 8.1.2) for the purpose of incident prevention in the workplace. Many documents showed that OSH managers need to be familiar with regulations to achieve compliance and understand how to initiate a comprehensive plan for incident prevention [12] [20] [21]. Not only in normal operation, OSH manager should be able to maintain a process needed to prepare for and respond to potential emergency situations and periodically test and exercise the planned response capability (clause 8.2). The capability of the OSH professionals refers to integrating knowledge and skills and adapting them as required to meet future needs [21].

In companies adopting ISO 45001 OH&SMS, the requirements of the standards needs to be comprehensively considered and fulfilled. In order to maintain the OH&SMS, the main competencies of OSH manager considered by experts included maintaining a process for evaluating compliance with legal requirements and other requirements (clause 9.1.2) and take action to address nonconformities and continually improve its OH&S performance (clause 9.2). OSH manager must be well-qualified to detect the nonconformities and perform safety coaching. Workers should be coached to understand the risks resulting from his or her action. Corrective action and coaching, not punishment, are indicated for improving the system [22]. In this study, replacing the OSH manager has the highest impact level on the implementation of the OSH clauses (**Figure 1**). The top five clauses with a higher impact level were 6.1.3, 8.1.2, 8.2, 9.1.2 and 9.2 (**Table 2**), they can be used as the key evaluation criteria for newly appointed OSH manager. Refer to the above information, examples of competency checklist for the "top five clauses" of the OSH manager are listed as follows (**Table 5**).

Hasle indicated that the logics of operations and OSH management have quite different goals, which are not easily reconcilable for the managers in charge of OSH and operations [8]. It leaves OSH management in a sidecar position and operations management troubled with disturbances from both occupational risks and workers lacking commitment. To date, OSH managers still face this challenge on their daily tasks. As Hastle's discussion, OSH managers need to figure out how to make the key performance indicators (KPI) of successful OSH activities move closer to the real-time KPI measurements of operations management. A challenge we have in this though is that the safety professionals need to be able to speak the language of business if they expect to be involved in business decisions [23].

Table 5. Examples of competency checklist for the "top five clauses" of the OSH manager [12] [18] [20].

Clause No.	Checking list
6.1.3 Determination of legal requirements and other requirements	Newly appointed OSH manager recognizes when new legislation necessitates updated risk assessments, plant design, and operations, etc.
	Laws can sometimes be insufficient to meet the demands of the risk profile, so in such cases OSH professionals must consider the spirit and intent of the law and apply good practice and OSH principles to reduce risk.
	Provides feedback to regulators as required.
8.1.2 Eliminating hazards and reducing OH&S risks	Develops mitigation strategies, including the proportionate allocation of resources to control risk adequately.
	Implements new or improved controls for risk reduction.
	Demonstrates understanding and application of reducing public risk as it applies to process safety.
8.2 Emergency preparedness and response	Newly appointed OSH manager understood emergency response procedures, including external support.
	Develop emergency response plan based on major incident scenarios and results of consequence modelling.
	Able to monitor effectiveness of response activities.
9.1.2 Evaluation of compliance	Qualification of professional safety certificate and able to check for regulatory compliance.
	Leverages knowledge and acts as a contributing member of industry bodies, especially in developing industry reference documents that fulfill factory's needs.
	Interfaces with outside contractors in use of, and deviations to, the factory standards.
9.2 Internal audit	Undertakes lead role in assurance activities such as audits and management reviews.
	Knowing how effectively to design and implement safety tours, gap audits, compliance audits, documentation audits and other inspections of various types.
	Demonstrate proficiencies to check for safety compliance of work procedure.

In 2023, International Labour Organization compares and analyses existing typologies across 14 countries for various OSH professional qualification systems [21]. The results may help organizations for further improvement of their national OSH professional qualification system. The emerging core challenges include the changing world of work and job design, emerging technologies and management of psychosocial risk and hazard and increased sources of work-related stress when encounter organizational changes. Facing these specific tasks and duties, the core competence of OSH professionals must meet the requirements of the key clauses.

4.1.3. Department Manager Replacement

In addition to bear statutory OSH responsibilities, the company's Department managers also need to manage and monitor the tasks involved in production to meet the set quality on schedule. The top five clauses selected by the evaluators

when replacing Dept. manager were clauses 6.1.2, 6.1.4, 8.1.2, 8.1.3 and 10.2. As Hughes mentioned, at-risk behavior includes both intention and the violation of rules, policies, and procedures and makes a system vulnerable which increasing risk [22]. The Dept. manager must supervise whether employees comply with the safety requirements. Therefore, the competency of the Dept. manager related to hazard identification and risk control are important (clauses 6.1.2, 6.1.4, 8.1.2). Sklad mentioned that first and foremost, the key evidence confirming real OSH involvement of senior managers is the compliance of what they preach with what they actually do when it comes to making a choice between safety and productivity. Real OSH leaders always put safety first [11].

The Dept. manager also needs to be able to implement and control of planned temporary and permanent changes that impact OSH performance (clause 8.1.3). From the accident statistics, management of change contributes significantly to the occurrence of accidents and its percentage contribution to accident rate is not decreasing over the past 20 years [24]. Organizational change should be planned in a thorough, systematic, and realistic way; similar to the processes for managing plant change [1]. Dept. manager play an important role in the whole management of change. As Cooper mentioned, they supervise the implementation of OSH management matters by addressing management system faults, people's safety related behavior, risk-assessments and decision-making [16] [25].

The fifth key clause relating to the Dept. manager is to determine and manage incidents, nonconformities and corrective actions (clause 10.2). As the California Refining Industry Process Safety Management Regulations (General Industrial Safety Order 5189.1) has included human factors management requirements [5]. Capacities, limitations and demands, such as employee overload and fatigue, may affect human health, work performance and process safety [1] [25]. Organizational changes can, if inadequately conceived or implemented, have a detrimental effect on safety [1]. Even subtle changes to organizations can have significant impacts on the management of hazards. The potential hazards of these human factors during change also need to be supervised by Dept. manager.

In this study, replacing Department managers has the second highest average impact level on the implementation of OSH system clauses (**Figure 1**). The top five clauses discussed above can be used as the key evaluation criteria for newly appointed Department managers. Referring to the above information, the examples of competency checklist for the "top five clauses" of the Dept. managers are listed in **Table 6**.

In this study, the large-size high-tech companies or petrochemical plants have established relevant professional requirements or education and training plans for the qualifications of Dept. managers, and only those with sufficient seniority can be eligible to be supervisors. The participated companies have also conducted the training for supervision of employees' physical and mental health. Besides, the 360˚ peer performance evaluations were conducted in some companies. In the petrochemical industry in China, it's found that the senior managers' safety leadership has a positive impact on safety behavior [27]. From the

Table 6. Examples of competency checklist for the "top five clauses" of the Department manager [12] [18].

Clause No.	Checking list
6.1.2 Hazard identification and assessment of risks and opportunities	Newly appointed Department manager participates in risk assessment processes.
	Able to implement hazards identification, and assess risks/opportunities.
	Understands the way process safety hazards are controlled, what those controls are and how effective they are.
6.1.4 Planning action	Able to design appropriate control measures to reduce risks based on current conditions.
	Reviews maintenance and inspection results and trends.
	Be able to develop safety proposals for OSH opportunity.
8.1.2 Eliminating hazards and reducing OH&S risks	Facilitates the development of safe systems of work.
	Assesses failure effects, determines criticality and reduces work risk.
	Develops protocols for infield performance measurement.
8.1.3 Management of change	Recognises theory of implementing change and how changes will affect risk.
	Actively implements change management procedures.
	Authorises change in their area/competency or is a reviewer on the change.
10.2 Incident, nonconformity and corrective action	Participates in executing assurance activities and audits under supervision.
	Leads basic investigation and identifies potential consequences of incidents.
	Analyses and uses root cause analysis to improve systems performance.

perspective of the dimensions of senior managers' safety leadership and safety behavior, safety concern has the greatest positive effect on safety compliance.

In fact, the root cause of failure always results to some extent from wrong management decisions, including: approval of incomplete and procedure instructions, employment of persons with insufficient qualifications, failure to provide necessary training, etc. [11]. Or workers may engage in risky behavior if they are not familiar with the new procedures. Research by Sandeberg *et al.* pointed out that many skilled workers and team leaders are flexible and choose to correct the situation right there and then rather than to document the occurrence [28]. Occurrences are not reported for fear of being blamed. Although the AI remote/digital identification systems has been used in Taiwan area to detect unsafe behaviors of employees. It deserves to emphasize that strengthening the competency of safety supervision of the Dept. manager should not be ignored.

4.2. Effect of OH&SMS Implementation Time on OSH Competencies of Safety Leaders

The previous paragraph discussed the top five safety competencies of the three OSH leaders (Table 2). The analysis of our results also showed that companies that have implemented the OH&SMS for a longer period of time (>10 yrs, n = 8), the leadership change had a significantly higher impact level on some clauses (Table 3). And most of the clauses in Table 3 were different from the top five

clauses shown in Table 2.

When replacing the top management, companies that have implemented OH&SMS for a longer time paid more attention to 6.1.3 Determination of legal requirements and other requirements, 6.1.4 Planning action and 8.1.2 Eliminating hazards and reducing OSH risks. Senior evaluators believed that the newly appointed top management may not be OSH professionals or familiar with the operation of the OH&SMS. First, in order to follow the ISO 45001 standards, the top management needs to sign the documents of regulation compliance. However, it is a common audit problem in Taiwan area that the identification of the applicability of the OSH regulations are not fully executed in many companies (requirements of 6.1.3). The requirements of 6.1.2 (Hazard identification and assessment of risks and opportunities) and 6.1.3 are the starting point and a crucial step of the OH&SMS. The reason of the evaluation score of 6.1.3 (ave. impact level = 2.5) was higher than 6.1.2 (ave. impact level = 1.5), it may be that if the top management ignores the compliance of regulations, it won't be expected that he or she will support the resources needed for risk assessment. Second, a lack of integrity of regulation identification, the effectiveness of the following OSH planning to eliminate hazards and reduce risks (6.1.4, 8.1.2) will be influenced. When the company operates the OH&SMS for a longer time, the implementation of these three clauses may demonstrate the level of support from the new top management. Syaiful's research results pointed out that there is a strong positive relationship between leadership style and safety climate [29]. And safety culture has a significant positive relationship on safety performance, however, its effect will be more if organizations create and constantly implement a robust safety management system [30]. That means, if the top management insists to implement ISO 45001 OH&SMS robustly, the improvement of safety culture maturity may be expected. Stemn also mentioned, a mature safety culture is regarded as an important means of ensuring good safety performance, particularly in reducing accidents [31]. According to opinion of the senior evaluators, it seemed that the competencies related to regulation compliance, planning and risk reduction were important when replacing the top management.

When replacing the OSH manager, if the company has implemented OSH system for a longer time, the senior experts believed that the new OSH manager is supposed to be familiar with the ISO 45001 PDCA (4.4 OSH management system) and know how to manage OSH risks and ensure compliance with relevant regulations. If the company has implemented the system after a period of time, the top management may authorize the OSH manager performs various tasks. The OSH manager needs to strive for support to achieve the annual OSH goals of the company. And he should lead on the development, function and implementation of operational plans to deliver on the health, safety and welfare requirements across the business and have capabilities of design and implement safety tours, gap audits, compliance audits and documentation audits, etc. [20]. Further, companies that have been operating the OH&SMS for a longer time may have higher level of safety requirements. Meanwhile, the OSH manager

should play a leading role in the financial sustainability of the organization [20]. Besides, the OSH manager needs to communicate with all the stakeholders for OSH consensus, so he must meet the requirements of 5.1 (Leadership and commitment) and 7.2 (Competence). In ILO's recent research, it mentioned that there are four levels of OSH professional tasks and duties [21]. The leader level of the OSH manager includes 1) Engage in and advise on strategic thinking, 2) Show business acumen, 3) Contribute to informed business decision-making about OSH and 4) Influence and persuade others, particularly on OSH matters. In Spain, the "advanced level" corresponds to a lead or senior OSH professional who handles risk assessments requiring advanced monitoring and outcome measurement, as well as delivering specialized training. Thus, when replacing OSH manager, the competency related to these three clauses should also be monitored carefully.

When replacing the Dept. manager, the senior evaluators believed that the new Dept. manager may not be familiar with the OSH policy, may not involve in the prevention of work/related injury or participation in safety improvement before. Therefore, attention must be paid to the compliance with the clause 5.2 (OSH policy, commitment to OSH management) when replace Dept. manager. As conflicting objective between production and safety presents in most companies, it is another task for the Dept. manager to find out the solutions to deal with the conflict. According to clause 6.1.4 (Planning actions), the Dept. manager shall plan actions to address OSH risks and opportunities, legal requirements and prepares for and respond to emergency situations. The new Dept. manager may not be competent in safety management, understand the hierarchy of hazard controls or know how to integrate the actions into the OH&SMS and further evaluate their effectiveness. The requirements in clause 6.1.4 show that organization shall consider best practices, technological options and financial/operational/business when planning actions. The senior evaluators believed that the requirements in 6.1.4 are a task for the new Dept. manager. In addition, the top management shall review the organization's OSH management whether the OSH objectives have been met and make decisions of adequate resources and effective actions (clause 9.3 Management review). As the monitoring/measurement/audit results, incident/nonconformities, change management, and continual improvement will be discussed in the regular review meetings for the OH&SMS. If the new Department manager has not participated in this meeting before or lacks of safety management practices, he cannot provide positive feedback during discussions of various safety issues. The feedback of improvement comes from the practices of work methods, safety behavior observations, tool box meeting and safety review meeting, etc. Additionally, daily inspections and effective equipment maintenance play pivotal roles in preventing accidents and creating a proactive safety culture within organizations [32]. These regular jobs performed in the workplace are supervised by Dept. manager on a daily basis. Thus, when replace Dept. manager, their competency relating to these three clauses should

be monitored cautiously.

This study explores the effect of implementation time on the OSH competencies of three safety leaders. Since Trish mentioned that organizational change is a metaphor for the changes that the organizational culture will undergo [23]. The impact assessment on the clauses in this study leads to the theme that the safety competency of the top management, OSH manager, and Department manager might affect the continuation of safety culture. Cooper mentioned that ineffective safety leadership often stems from confusion about the company safety management systems and associated policies [25]. It would help if companies developed "Leadership Behavioural Competency and Accountability Matrices" by defining its managerial and supervisory roles and responsibilities to ensure leaders are doing the right things at the right time, for the right reasons [25]. To prevent occupational incidents, the influential clauses of the OH&SMS discussed above were suggested to be the essential competencies for the safety leadership personnel.

4.3. Limitation

The limitations of this study included adoption of a cross-sectional design and using convenience sampling. OSH professionals who joined the questionnaire survey were not randomly selected. The assessment results relied on the experts' cognitive ability. The study samples covered small- to large-size companies; however, with insufficient questionnaires. Therefore, generalizing the survey results to all size companies should be done with caution.

5. Conclusions

This is a preliminary study designed to evaluate the impact of organizational change on the implementation of the OSH clauses. The results show that: 1) The impact level of the personnel change on the implementation of the clauses varied with the types of personnel change. It is necessary to confirm the corresponding competency of the newly appointed leadership personnel in a "targeted" manner. 2) The impact level of the leadership change on the implementation of ISO 45001 clauses varies with the implementation years of the ISO 45001 OH&SMS. It's implicated that the safety culture maturity might affect the competency requirements for the safety leadership personnel. 3) On all types of OC, most of the emphasis of impact analysis was on clauses 5 (Leadership and worker participation), 6 (planning), 8 (operation) and 9 (Performance evaluation). When replacing three major OSH leaders, the company must ensure that they meet the requirements of these key clauses.

Further, it's crucial to confirm that safety management does not vary from person to person or affect the organization's safety culture when OC is initiated. The evaluation results of this study can be used as a reference for organizational change management. Further studies are necessary to obtain more empirical evidence on the reduction of emerging risks from OC.

Acknowledgements

This work was granted by the Institute of Labor, Occupational Safety and Health, Ministry of Labor (ILOSH111-S304). The authors are very grateful to the full cooperation of the safety managers to complete the survey.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Health and Safety Executive (2023) Human Factors: Organizational Change Guidance. https://www.hse.gov.uk/humanfactors/topics/orgchange.htm

[2] Center for Chemical Process Safety (2013) Guidelines for Managing Process Safety Risks during Organizational Change. Wiley. https://doi.org/10.1002/9781118530689

[3] Bowonder, B. (1987) An Analysis of the Bhopal Accident. *Project Appraisal*, **2**, 157-168. https://doi.org/10.1080/02688867.1987.9726622

[4] Health and Safety Executive (1992) The Fire at Hickson & Welch LTD, HSE Investigation Report. https://www.icheme.org/media/13704/the-fire-at-hickson-and-welch-ltd.pdf

[5] California Office (2018) California Office of Administrative Law. 5189.1. Process Safety Management for Petroleum Refineries, USA. https://www.dir.ca.gov/title8/5189_1.html

[6] Health and Safety Executive (2021) Management Standards—Change. Guidance. HSE, UK. https://www.hse.gov.uk/stress/standards/change.htm

[7] Karanikas, N., Weber, D., Bruschi, K. and Brown, S. (2022) Identification of Systems Thinking Aspects in ISO 45001:2018 on Occupational Health & Safety Management. *Safety Science*, **148**, Article ID: 105671. https://doi.org/10.1016/j.ssci.2022.105671

[8] Hasle, P., Uhrenholdt Madsen, C. and Hansen, D. (2021) Integrating Operations Management and Occupational Health and Safety: A Necessary Part of Safety Science! *Safety Science*, **139**, Article ID: 105247. https://doi.org/10.1016/j.ssci.2021.105247

[9] Ali, P.O., Wyse, M.E., Odeniyi, K.O., Oludele, O.E., Ejomafuvwe, E., John, A., *et al.* (2022) Evaluation of Safety Management System Effectiveness in a Liquefied Natural Gas Company. *Open Journal of Safety Science and Technology*, **12**, 31-42. https://doi.org/10.4236/ojsst.2022.122003

[10] Occupational Safety and Health Administration (2023) Taiwan Area Internet Information of Occupational Safety and Health Administration. Ministry of Labor. (In Chinese) https://toshms.osha.gov.tw/News/Detail/259

[11] Skład, A. (2019) Assessing the Impact of Processes on the Occupational Safety and Health Management System's Effectiveness Using the Fuzzy Cognitive Maps Approach. *Safety Science*, **117**, 71-80. https://doi.org/10.1016/j.ssci.2019.03.021

[12] IChemE Safety Center. (2018) ISC Process Safety Competency Guidance. IChemE Safety Center. https://www.icheme.org/media/9391/supplementary-guide-march-2019.pdf

[13] Ministry of Defence (2023) Safety and the Management of Change, UK. In JSP 375 Management of Health and Safety in Defence, Directive & Guidance, Vol. 1, Chapter 35, Part 2: Guidance, 10-14. https://assets.publishing.service.gov.uk/media/652527d02548ca000dddf019/2023101

0_Published_JSP375_Vol1_Chapter_35_V1.4_Safety_and_the_management_of_change.pdf

[14] Sætren, G. and Laumann, K. (2017) Organizational Change Management Theories and Safety—A Critical Review. *Safety Science Monitor*, **20**, Article No. 2.

[15] Energy Institute (2010) High-Level Framework for Process Safety Management. Energy Institute. http://www.firstclients.net/UniversityOfHull/EPSM-V2/assets/documents/003_EI_High_Level_Framework_PSM.pdf

[16] Cooper, M.D., Collins, M., Bernard, R., Schwann, S. and Knox, R.J. (2019) Criterion-Related Validity of the Cultural Web When Assessing Safety Culture. *Safety Science*, **111**, 49-66. https://doi.org/10.1016/j.ssci.2018.09.013

[17] Yukl, G. (2010) Leadership in Organizations. 7th Edition, Pearson Education Inc.

[18] Ton, S.S., Chia, T. and Chang, C.M. (2023) Implementation Guideline of the Organizational Change Management. Institute of Labor and Occupational Safety and Health, ILOSH112-T-184, Ministry of Labor. (In Chinese) https://criteria.ilosh.gov.tw/iLosh/wSite/ct?xItem=40171&ctNode=325&mp=3

[19] El Haddad, R., Karkoulian, S. and Nehme, R. (2019) The Impact of 360 Feedback Appraisal System on Organizational Justice and Sustainability. *International Journal of Organizational Analysis*, **27**, 712-728. https://doi.org/10.1108/ijoa-08-2018-1499

[20] Institution of Occupational Safety and Health (2019) Competency Framework-Professional Standards for Safety and Health at Work. Institution of Occupational Safety and Health. https://iosh.com/guidance-and-resources/professionals/competency-framework

[21] International Labour Organization (2023) Occupational Safety and Health Professionals at the Workplace Level: A Review of Qualification Systems and Regulatory Approaches in Selected Countries. International Labour Organization. https://www.ilo.org/publications/occupational-safety-and-health-professionals-workplace-level

[22] Hughes, S. (2022) The Development of a Just Culture in the HSE. https://www.hse.ie/eng/about/who/nqpsd/qps-incident-management/just-culture-overview.pdf

[23] Trish, K. (2018) The Long View on Longford. IChemE Safety Center. https://www.icheme.org/knowledge/safety-centre/news/the-long-view-on-longford/

[24] Han Siong, P., Chin, K.Y., Bakar, H.T.A., Ling, C.H., Kidam, K., Ali, M.W., Hassim, M.H. and Kamarden, H. (2017) The Contribution of Management of Change to Process Safety Accident in the Chemical Process Industry. *Chemical Engineering Transactions*, **56**, 1363-1368.

[25] Cooper, M.D. (2018) The Safety Culture Construct: Theory and Practice. In: Gilbert, G., *et al.*, Eds., *Safety Cultures, Safety Models*, Springer, Berlin, 47-61. https://link.springer.com/chapter/10.1007/978-3-319-95129-4_5

[26] Health and Safety Executive (2003) Organizational Change and Major Accident Hazards. HSE Information Sheet, Health and Safety Executive, UK. https://www.hse.gov.uk/pubns/chis7.pdf

[27] Xue, Y., Fan, Y. and Xie, X. (2020) Relation between Senior Managers' Safety Leadership and Safety Behavior in the Chinese Petrochemical Industry. *Journal of Loss Prevention in the Process Industries*, **65**, Article ID: 104142. https://doi.org/10.1016/j.jlp.2020.104142

[28] Sandberg, E. and Albrechtsen, E. (2018) A Study of Experience Feedback from Re-

ported Unwanted Occurrences in a Construction Company. *Safety Science*, **107**, 46-54. https://doi.org/10.1016/j.ssci.2018.03.028

[29] Syaiful, D.A. and Dwiyanti, E. (2022) The Relationship between Safety Leadership Style and Safety Climate in Phosphoric Acid Industry. *The Indonesian Journal of Occupational Safety and Health*, **11**, 390-401. https://doi.org/10.20473/ijosh.v11i3.2022.390-401

[30] Otitolaiye, V., Abd Aziz, F., Munauwar, M. and Omer, F. (2021) The Relationship between Organizational Safety Culture and Organization Safety Performance. The Mediating Role of Safety Management System. *International Journal of Occupational Safety and Health*, **11**, 148-157. https://doi.org/10.3126/ijosh.v11i3.39766

[31] Stemn, E., Bofinger, C., Cliff, D. and Hassall, M.E. (2019) Examining the Relationship between Safety Culture Maturity and Safety Performance of the Mining Industry. *Safety Science*, **113**, 345-355. https://doi.org/10.1016/j.ssci.2018.12.008

[32] Samarasinghe, H. and Heenatigala, S. (2024) Insights from the Field: A Comprehensive Analysis of Industrial Accidents in Plants and Strategies for Enhanced Workplace Safety. *Open Journal of Safety Science and Technology*, **14**, 1-16. https://doi.org/10.4236/ojsst.2024.141001

Appendix 1

Criteria of evaluation of the impact level of organizational change on the implementation of the clauses in the ISO 45001 Occupational Health and Safety Management System.

Impact level	effect	Evaluation criteria
5	catastrophic	a) Result in the death of one person, more than three persons injured, or the occurrence of occupational diseases that are difficult to recover. b) The specific loss amount is "1 million" or more. (The amount can be customized according to the size of the respondent's company) c) Suspension of all workplaces due to violation of regulations. d) Management system failure.
4	major	a) Result in permanent disability or recoverable occupational disease. b) The specific amount of loss is "1 million" or less. (The amount can be customized according to the size of the respondent's company) c) Some workplaces have been shut down due to violations of regulations. d) Correction Action Request in an audit.
3	moderate	a) Workers need to get medical care or accidents/injuries that result in the loss of working hours. b) Specific amount of loss (below "100,000"). (The amount can be customized according to the size of the respondent's company) c) Company was fined for violating regulations. d) Nonconformance identified in an audit.
2	minor	a) Only emergency treatment or medical treatment is needed, but no loss of working hours or reduction in work efficiency. b) Specific amount of loss (below "10,000"). (The amount can be customized according to the size of the respondent's company) c) Improvements must be completed within a time limit due to violation of regulations. d) Audit observations (show areas for concern or improvement).
1	insignificant	a) No casualties. (near miss accident) b) No property damage. c) No violation of regulations. d) No audit nonconformities identified in an audit.