Safety culture as an Essential Part of Prevention of Major Accidents – the Situation within Companies Falling under the Seveso III Directive in the Czech Republic

Filip Berger*, Ivana Slovackova

VSB-Technical University of Ostrava, Faculty of Safety Engineering, Lumirova 13, Ostrava -Vyskovice, 700 30, Czech Republic
filip.berger@vsb.cz

The aim of this paper is to describe the situation concerning implementation of principles and tools of Safety Culture within companies falling under the Seveso III directive (European Commission, 2012) in the Czech Republic. Safety culture is a well-known and popular topic in safety research. The term 'safety culture' was first used by IAEA in INSAG's (1988) 'Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident' and a definition was published in INSAG – 4 (IAEA, 1991): „Safety culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance. "Despite almost 30 years of research there is still not a single definition, concept or model which is fully accepted either by scholars or by safety experts. But there is a consensus – a lot of major accidents have been caused by weak safety culture.

The situation within companies in the Czech Republic under Seveso III is not clear. The Seveso III directive requires that companies implement a Safety Management System. Nevertheless, such a Safety Management System is not sufficient to prevent injuries, accidents, or disasters. To ensure excellence in safety there is a necessity to build strong safety culture. There is an assumption that the topic of safety culture is still not very common in the Czech Republic. There has not been implemented any study program or special course on safety culture for safety experts until 2021. At VSB – Technical University of Ostrava – a course in Safety Culture is going to be held as part of Safety Engineering Master study program. We do not know whether companies have been trying to improve their safety culture systematically, which is the reason for our research into safety culture in the companies covered by the Seveso III directive. The first stage of the research comprised a survey within companies to explore if they implement any activities focused on safety culture.

1. Introduction

The European Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances, also known as the Seveso III directive, aims to promote both prevention and mitigation of consequences of major accidents. Establishments covered by the directive are required to implement safety management system, elaborate safety report, prepare emergency plans and provide information to the public. The Seveso III directive distinguishes 2 types of establishments based on the quantity of present dangerous substances. The establishments with quantity of dangerous substances exceeding lower threshold limits are called lower tier establishments and have to comply with some requirements of the directive. The establishments with quantity of dangerous substances exceeding higher threshold limit are called upper tier establishments and have to comply with all requirements of the directive. According to the Czech law, lower tier establishments are classified as group A, upper tier establishments as group B (Parliament of the Czech Republic, 2015).

2. Materials and methods

A questionnaire survey was conducted in order to find out whether establishments in the Czech Republic covered by the Seveso III directive use the concept of safety culture to improve their safety performance. Prior to the survey, a database of Seveso establishments and contact details was compiled from several sources including the Ministry of the Environment of the Czech Republic, the Occupational Safety Research Institute and regional Fire Rescue Services. The assembled database consisted of 211 enterprises, 97 lower tier establishments and 114 upper tier establishments. Some establishments were part of the portfolio of one parent (holding) company and were managed centrally. For this reason, the number of operators of these establishments was lower, in total 158. In July 2021, these operators were contacted by telephone (if possible) or by e-mail to take part in the survey. A questionnaire was sent to the participating operators with a cover letter explaining the purpose of the survey. In September 2021, the companies were addressed once again by telephone to cooperate. The questionnaires were filled in by occupational health and safety managers or specialists responsible for prevention of major accidents. The goal of the questionnaire was to find answers to these four questions:

I) Do the establishments covered by the Seveso III directive implement activities for safety culture improvement? What activities do they implement?

II) Do Seveso establishments try to regularly assess safety culture? What methods and tools do they use?

III) Is there a connection between the safety management system required by the Seveso III directive and safety culture?

IV) Are there any relations between safety culture and establishment sizes, influence of parent companies or other factors?

The questionnaire divided into 2 parts. The first part of the questionnaire (10 questions) focused on general information about the operator and establishment, for instance, establishment size (number of employees), independent or subsidiary company, influence of a parent company on safety management, safety management system standards. The second part of the questionnaire (11 questions) dealt with safety culture, for example, number and types of activities for improving safety culture, safety culture assessment, relation between safety culture and the Seveso III directive, use of safety culture models and toolkits. The goal of the study was not to assess the level of safety culture or the quality of tools or activities. In its first phase, the research dealt only with the overall situation among the companies covered by the Seveso III directive.

3. Results and discussion

Out of the 158 approached operators of the establishments under the Seveso III directive, 55 filled out the questionnaires. The overall response rate was 35 %.

3.1 Background

20 respondents of the survey were operators of lower tier establishments and 35 respondents were operators of upper tier establishments. 36 out of 55 concerned operators (65 %) and related establishments were part of an international corporation (holding). 30 out of 36 companies (83 %) that were part of an international corporation had their management of occupational safety influenced by that corporation (a parent company). The occupational safety management of the remaining 6 subsidiary companies (17 %) was independent just as the management of the other 19 companies that were not part of an international corporation (25 companies with independent safety management in total). The most represented industry was manufacture of chemicals and chemical products (14 operators), then a petroleum industry (6 operators) and manufacture and processing of metals (5 operators). A brief overview can be found in Table 1.

Table 1: Overview of establishment types and their safety management

Establishments	Number of operators
Lower tier establishments	20
Upper tier establishments	35
Total	55
Holding companies	
Subsidiary companies	36
Independent companies	19
Safety management	
Dependent on parent company	30
Independent	25

3.2 Improvement of safety culture

The majority, i.e. 44 operators stated that they develop safety culture in their establishments by implementing activities dedicated to safety culture. Employing these activities was more common in larger establishments. The percentage of operators who employed activities for safety culture improvement was even bigger amongst operators with safety management influenced by a parent company (dependent safety management). 28 out of 30 operators (93 %) with dependent safety management employed activities for improving safety culture as shown in Figure 1.
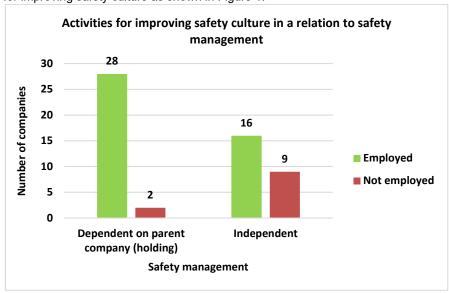

Figure 1: Employment of activities for improving safety culture in relation to safety management

The activities indicated by the operators in the questionnaires were grouped into 10 categories. The most common activities were from categories: on-site safety inspections and interviews, safety committees and boards, special training and education of employees. Complete overview of activities including the number of operators who employ them is given in Table 2.

Table 2: Activities for improving safety culture used by the operators

Activity type	Number of operators
On-site safety inspections and interviews	25
Safety committees and boards	19
Special training and education	13
Safety meetings	11
Safety audits and reports	11
Minutes for safety	10
Reporting of dangerous situations, near-misses	10
Safety days	9
Thematic campaigns and programs	9
Other activities	22

The category "other activities" included, e.g. rewarding employees, promoting safety via leaflets, company journals or notice boards, systems for proposing improvements, etc. All activities in this category did not occur more than twice. It is important to mention that there was a difference between what the operators considered as an activity for improving safety culture. For example, some operators determined annual occupational safety inspections as an activity for safety culture improvement. The annual inspections are required by the Czech law (Parliament of the Czech Republic, 2006) and all employers have to conduct the inspections including the operators of the Seveso establishments. Thus, it is logical to assume that all the approached operators conduct these inspections. However, not every operator filled it in the questionnaire. Consequently, some operators do not consider annual safety inspections to be a tool for a safety culture improvement. The opinion of the operators about what does and what does not improve safety culture caused inaccuracy

while comparing the results. In addition, it was sometimes difficult to put certain activities in one of the ten predefined categories.

The average number of employed activities was 3 per establishment. The highest number of activities employed by a single establishment was 14. The more detailed information about an average number of employed activities based on an establishment size (number of employees) can be found in Figure 2.
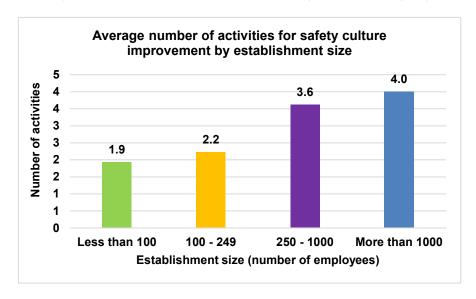

Figure 2: Average number of activities for safety culture improvement by establishment size (number of employees)

Larger establishments employ higher number of activities for safety culture improvement, which is considered as a more efficient strategy (Hale et al., 2010). The number of activities employed by subsidiary companies (establishments) is greatly influenced by parent companies, i.e. establishments with dependent safety management employ 5 activities on average, whereas independent establishments employ 1.4 activities on average. The establishments always employed safety culture improvement activities, if a top management consisted of at least one member from a foreign country or a parent company. Nevertheless, the number of the activities was not necessarily higher than the average of 3. The positive influence of parent companies and their practices is therefore substantial. The main reason for safety culture improvement was an obligatory requirement of a top management (20 cases) or a parent company (17 cases). The third most common reason, although less frequent (5 cases), was a suggestion by a health and safety manager or department. 11 establishments that did not employ any activity for safety culture improvement stated that they were satisfied with their current state of safety culture or did not have necessary means to improve it, e.g. capacity, time, finances.

3.3 Assessment of safety culture

The total number of operators who regularly evaluate safety culture was 46 (84 % of all operators). Safety culture was assessed internally (28 operators), externally (2 operators) or both (16 operators). Safety culture was normally evaluated several times a year or once a year (42 operators in total). Longer periods of evaluation were relatively rare (4 operators).

The methods used for safety culture assessment varied significantly:
- audits and reports (26 cases)
- monitoring of safety performance indicators, e.g. number of accidents, lost time injuries, reported near-misses and dangerous situations (14 cases)
- review of a safety management system (13 cases)
- conducting on-site inspections/observations (9 cases)
- evaluation of previously set goals and plans (both 9 cases)

An efficient and accurate safety culture assessment is a time and resource consuming process. The assessment should ideally combine different methods and tools (Hopkins, 2006). These tools and methods include questionnaire surveys with quantitative results, interviews and on-site observations (EU-OSHA, 2011). It is therefore up for a debate whether methods of assessment indicated by the operators are truly effective and accurate enough.

The establishments always assessed safety culture, if a top management consisted of at least one manager from a foreign country or a parent company. Nevertheless, it is important to mention that there is an overlap with establishments where a safety management is dependent on a parent company, which has been already established to have a major positive influence. The percentage of operators that do not assess safety culture was slightly higher amongst smaller establishments. Subsidiary companies with dependent safety management do not assess safety culture more frequently than companies with independent safety management despite considerable influence of parent companies on activities regarding safety culture.

3.4 Influence of parent companies and use of toolkits

Renowned industrial and consulting companies have elaborated various toolkits for managing safety culture. Some of these toolkits are internationally recognized. The toolkits include tools for assessing and improving safety culture and models consisting of several stages with increasing level of safety culture (Filho and Waterson, 2018). According to the findings of the questionnaire survey, these worldwide approaches are utilized exclusively by establishments with a safety management dependent on a parent company.
Identified safety culture models and associated toolkits were:

- Du-Pont Bradley Curve (6 cases)
- Safety Culture Ladder (2 cases)
- Hearts & Minds (1 case)
- Safety Roadmap (1 case)

30 operators use their own tools, models and approaches. This number includes all the operators with independent safety management (mostly Czech) who actively improve and assess safety culture. Yet again, we can see the positive influence of foreign companies on implementing worldwide approaches. 15 operators employ no systematic approach or do not manage safety culture at all. Only one operator assessed safety culture using one of the toolkits, i.e. used set tools for evaluation and compared results with safety culture model, thus obtaining the organization's level of safety culture.

3.5 Practical issues

The operators were also asked about the difficulties of improving safety culture.
Their needs were the following:

- more resources - time, finances, qualified employees (8 cases)
- effective training and employee development (7 cases)
- better knowledge and methodologies (7 cases)
- examples of good practice, exchange of experience between establishments (6 cases)
- change in employees attitude and attitude of external employees, contractors (10 cases)

The last item of the list is a characteristic of organizations with already strong and developed safety cultures, not a means to achieve it.

3.6 Safety culture and safety management system

Both lower tier and upper tier establishments have an obligation to create and implement safety management system. Requirements for this system are specified in the Seveso III directive. The relationship between safety culture, safety management system and safety performance is a subject of many studies. Strong safety culture is proven to improve safety performance, i.e. reduces the number of accidents, decreases lost time injury rate and encourages employees to be actively involved in safety. Safety management system mediates this relationship and facilitates the process of a safety culture improvement (Otitolaiye et al., 2021). Two questions in the questionnaire focused on the connection between safety culture and safety management system. The Operators participating in the survey indeed confirm that there is a relationship between the safety management system required by the Seveso III directive and safety culture. In 41 cases, established safety management system positively influenced safety culture. On the contrary, 8 operators claimed the opposite. 6 operators could not tell whether this connection exists. More than half of the operators (29) would appreciate it if the Seveso III directive took into consideration this relationship, thus facilitating the improvement of safety culture in their establishments. Moreover, 17 operators see the need for either specific methodology or detailed instructions.

3.7 Other findings

Throughout all the answers given by the Seveso operators, no significant differences were noticed between lower tier and upper tier establishments, apart from one exception. The percentage of establishments which do not assess safety culture is higher for lower tier establishments (30 %) than for upper tier establishments (9 %). Many of the approached operators implement management system standards (MSS), which are

published by the International Organization for Standardization in addition to the safety management system required by the Seveso directive. The establishments with certified MSS were more frequent than establishments without any certification (36 to 19), namely former BS OHSAS 18001 Occupational Health and Safety Assessment Series or current ISO 45001:2018 Occupational health and safety management systems. It is more common among establishments with the certification to employ activities for improving safety culture. Furthermore, activities in establishments with the certification are generally more numerous.

The Czech national authority for regulation of occupational health and safety (the State Labour Inspection Office) and the Ministry of Labour and Social Affairs of the Czech Republic introduced "Safe Enterprise" Scheme which is a national occupational safety and health certification program based on continuous improvement and compliance with law requirements (State Labour Inspection Office, 2012). This certification was held by 8 establishments which participated in the survey. According to the survey results, the certification does not seem to influence organization's interest in safety culture. In other words, establishments with the certification do not employ activities for improving safety culture or assess safety culture more often than organizations without the certification.

4. Conclusions

The concept of safety culture seems to be known and frequently used amongst the establishments covered by the Seveso III directive which participated in the study. The majority of operators, i.e. 44 out of 55 stated that they develop safety culture on the premises by introducing safety culture activities and conduct assessment. Two questions arose from the study: 1) What is the situation in the companies that did not participate in the study? 2) What is the quality of implemented programs, activities and tools? These issues could be the subject of further research. From a practical point of view, some establishments feel the necessity for more knowledge on the subject of safety culture and would welcome further information and methodological help and 17 operators stated that they would like to be involved in the upcoming part of the project, which will focus on practical help in developing safety culture.

Acknowledgments

References

EC, 2012, Council Directive 2012/18/EU of 4 July 2012 on the control of major-accident hazards involving dangerous substances, Official Journal of the European Communities (SEVESO Directive III).

European Agency for Safety and Health at Work (EU-OSHA), 2011, Occupational Safety and Health culture assessment - A review of main approaches and selected tools, Publications Office of the European Union, Luxembourg

Filho A.P.G., Waterson P., 2018, Maturity models and safety culture: A critical review, Safety Science, 105, 192-211.

Hale A.R., Guldenmund F.W., Van Loenhout P.L.C.H., Oh J.I.H., 2010, Evaluating safety management and culture interventions to improve safety: Effective intervention strategies, Safety Science, 48, 1026-1035.

Hopkins A., 2006, Studying organisational cultures and their effects on safety, Safety Science, 44 (10), 875-889.

International Atomic Energy Agency (IAEA), 1991, Safety Culture: A Report by the International Nuclear Safety Advisory Group No.75-INSAG-4, IAEA, Vienna, Austria

Otitolaiye V.O., Abd Aziz F.S., Munauwar M., 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(3), 148-157.

Parliament of the Czech Republic, Law no. 224/2015 of 12 August on the prevention of major accidents caused by chosen dangerous substances or mixtures (law of major accidents prevention [Online]. [Accessed 24 November 2021]. Available from: https://public.psp.cz/en/sqw/sbirka.sqw?cz=224&r=2015 (in Czech)

Parliament of the Czech Republic, Law no. 262/2006 of 7 June code of labour [Online]. [Accessed 25 November 2021]. Available from: https://www.psp.cz/sqw/sbirka.sqw?cz=262&r=2006 (in Czech)

State Labour Inspection Office, 2012, Safe Enterprise [Online]. [Accessed 26 November 2021]. Available from: https://vubp.cz/soubory/produkty/informacni-materialy-bozp/bezpecny_podnik_aj.pdf