

## **Estimation of safety performance by MISHA method and the benefits of OHSAS 18001 implementation in Estonian manufacturing industry**

Õ. Paas\*, K. Reinhold and P. Tint

Tallinn University of Technology, Faculty of Economics, Institute of Business Administration, Chair of Work Environment and Safety, Ehitajate 5, EE19086 Tallinn, Estonia; \*Correspondence: onnela.paas@gmail.com

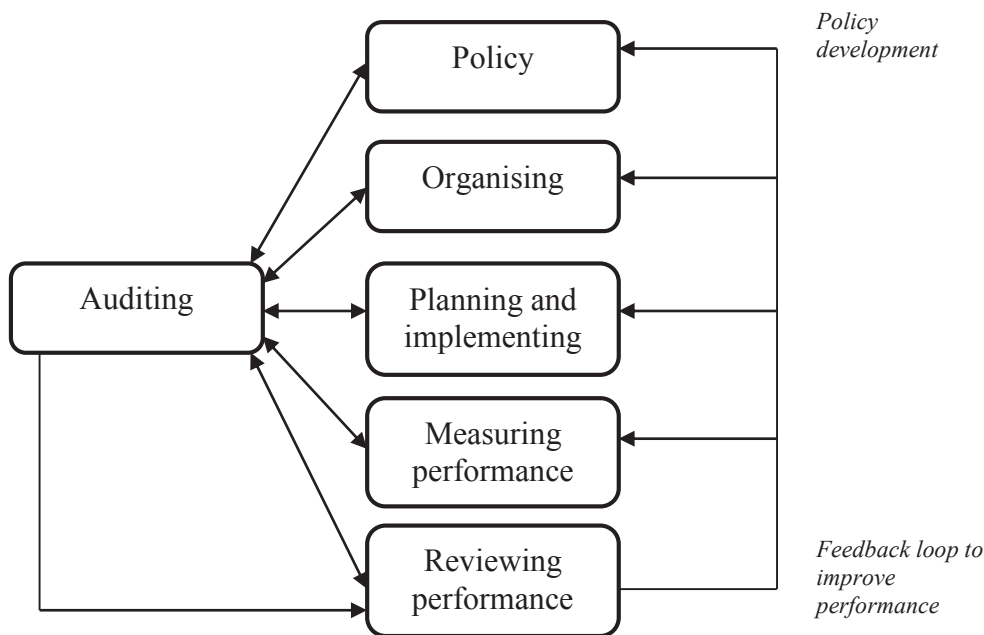
**Abstract.** The paper concentrates on safety auditing as a tool for assessment of safety system and safety management in Estonian manufacturing enterprises. The aim of the research was to estimate the safety performance in Estonian manufacturing industry and explore the benefits of OHSAS 18001. Different available safety auditing methods are described. During 2014, 8 (OHSAS 18001-certified organisations) and 8 (non-certified organisations) Estonian enterprises from different branches of manufacturing were interviewed using MISHA method which is in accordance with the present requirements and is the most comprehensive. The results showed that non-certified organisations could be sub-divided into 2 categories: organisations which belong to a larger corporation or concern and locally established and owned companies. The latter showed the lowest scores as in these firms there are deficiencies in several OHS activity areas. Safety activities in a company depend strongly on consistency. Safety needs commitment and systematic approach. If one of the key elements of safety management system is missing, then it can be seen in the results of other framework elements. Our study demonstrates that OHSAS 18001 certificate automatically will not ensure high safety activities in the company. However, following the OHSAS 18001 standard gives a good incentive for a systematic safety activity in all levels in the company and promotes strong improvement process put in use. MISHA method can be successfully used for evaluating safety management systems in manufacturing industry, but it has to be kept in mind that some modifications may be needed due to national differences in safety activities.

**Key words:** safety audit, safety management system, OHSAS 18001, safety performance, MISHA method.

### **INTRODUCTION**

Safety management system (SMS) is designed in order to deal with occupational health and safety (OHS) in a systematic way by the following activities: setting company's safety targets and objectives; designating roles and responsibilities for safety personnel; planning and performing the hazards mitigation; monitoring, measuring, and improving the on-going system and its effectiveness (Robson & Bigelow, 2010). Measurement is a key step in any management process and forms the basis of continual improvement (HSE, 2001). If measurement is not carried out correctly, the effectiveness of the SMS is undermined and there is no reliable information to inform managers how well the health and safety risks are controlled.

Various evaluation methods can be used for assessing the different aspects of the SMS. The most commonly used methods are: (1) measurement on safety performance through injury and accident statistics, (2) safety audits and (3) management reviews. Safety performance measurement through injury and statistics rates may be problematic due to under-reporting. An emphasis on injury, ill-health and accident rates as a measure, particularly when related to reward systems, can lead to such events not being reported in order to ‘maintain’ performance. Additionally, injury and accident statistics reflect rather the outcomes than the causes. Safety audit, on the other hand, is a means of directly and comprehensively measure the implementation and effectiveness of company’s SMS and covers all the aspects (Karapetrovic & Willborn, 2000). The primary purpose of measuring safety performance is to provide information on the progress and current status of the strategies, processes and activities used by an organisation to control risks to health and safety. The performance measurement system - auditing - must cover each element of the SMS as demonstrated in Fig. 1. For example, the measuring process should establish that a written health and safety policy statement exists, meets legal requirements and best practice, is up to date; and is being implemented effectively.



**Figure 1.** Auditing and performance measurement within the safety management system (adopted from HSE, 2001).

Fernández-Muniz et al. (2007) have significantly expanded the construct in recent years, suggesting an effective SMS should contain six important subfactors: safety policy, incentives for employee participation, training, communication, planning, and control. Fernández-Muniz et al. (2007) included a separate factor of employee involvement. Thus, the additional research in safety management area is needed in the following areas in SMS-s: safety policy, procedures and rules; training; communication;

incident reporting and analysis; safety audits and inspections; rewards and recognition; employee engagement; safety meetings/committees; suggestions/concerns; discipline (Bakker & Schaufeli, 2008; Frazier et al., 2013; Trauman et al., 2013a; Trauman et al., 2013b).

Several safety management related standards, directives, and regulations have been published after 1990's. This progress has been noticeable especially in Europe. The BS 8800 (BSI, 1996) has become the first widely spread general safety management standard. In 1999 the first version of OHSAS 18000 (OHS Assessment Series) was released. The Series consisted of two specifications: 18001 provided requirements for an OHS management system and 18002 gave implementation guidelines. It was intended to help organizations to control OHS risks. Since its publication, OHSAS 18001 has gained considerable acceptance worldwide and has a revised version OHSAS 18001:2007 (OHSAS Project Group, 2007). The fundamental objective of this standard is to support and promote good practice in the area of OHS via a systematic and structured management (Chang and Liang, 2009; Fernández-Muniz et al., 2012b). Another reason for implementation is the need of competitiveness as it enables the organisation to demonstrate to interested parties that the company has an adequate and functioning SMS.

The OHSAS specification is applicable to any organisation that wishes to: (a) establish an SMS to eliminate or minimise risk to employees and other interested parties who may be exposed to OHS risks associated with its activities; (b) implement, maintain and continually improve an SMS; (c) assure itself that the system complies with its stated OHS policy; and (d) demonstrate compliance with this standard to others (OHSAS Project Group, 2007).

Several researchers have demonstrated that OHSAS 18001-certified organisations have an adequate and functioning SMS in order to control occupational hazards (Chang and Liang, 2009; Fernández-Muniz et al., 2012a) and have a stronger management commitment, better organized safety training, higher workers' involvement in safety, more efficient safety communication and feedback, explicit safety rules and procedures, fairer safety behaviour and reasoned safety promotion policies (Vinodkumar & Bhasi, 2011; Fernández-Muniz et al., 2012b). Abad et al. (2013) demonstrates that OHSAS 18001 can be seen as a strategic cost-control tool in order to create and maintain a safe working environment and through it, lower the rate of workplace accidents and interruptions in the production process.

Several instruments have been developed (Diekemper & Spartz, 1970; Eisner & Leger, 1988; Collision & Booth, 1993; SafetyMap, 1995; Dyjac et al., 1998; Redinger & Levine, 1998; Kuusisto, 2000; Bunn et al., 2001; Pearse, 2002; LaMontagne et al., 2004). Authors of the current study started with D&S method (Diekemper & Spartz, 1970; Tint et al., 2010b). However after the analyses of different methods, the MISHA (Method for Industrial Safety and Health Activity Assessment (Kuusisto, 2000)) method was chosen based on its comprehensiveness and compliance with high expectations for health and safety. As the results for the MISHA instrument (Kuusisto, 2000) can be considered preliminary (compared to other methods which do not apply), since they were investigated in only workplace for the final version of the instrument, the authors have decided to test this method.

The aim of this research was to estimate the safety performance in Estonian manufacturing industry and determine the benefits of OHSAS 18001 certification.

The main objectives were: (1) to evaluate the available safety auditing methods and determine the most relevant for manufacturing industry, (2) to conduct safety interviews in 16 industrial companies in order to find the gaps in safety activities and performance and (3) to examine the positive outcomes of OHSAS 18001 for real safety performance.

## **MATERIALS AND METHODS**

On the basis of critical overview of the existing auditing methods, MISHA method (Kuusisto, 2000) as the most innovative was chosen for the current study. The MISHA method considers the following area of industrial activities: A. organization and administration (safety policy and safety activities in practice, personnel management); B. participation, communication, and training; C. work environment (physical work environment, psychological working conditions, hazard analysis procedures); D. follow-up (occupational accidents and illnesses, work ability of the employees, psychological work ability).

To select industrial companies for the research, the database of Estonian Association for Quality (2014) was scanned. By January 2014, 178 Estonian companies owned OHSAS 18001 certification. The scan showed that 32% of certified firms come from manufacturing sector. The authors contacted each of these firms and explained briefly the purpose and the scope of the research. Finally eight companies (representing main manufacturing areas in Estonia such as printing, textile, metal, food industry etc.) agreed to participate which was enough to perform a qualitative study. In order to compare the results with non-certified organizations, eight companies with similar background were selected. The data collection was performed during 2014, when 8 (OHSAS 18001-certified organisations, group I) + 8 (non-certified organisations, group II) Estonian enterprises from different branches of manufacturing participated in 25 interviews with employers, middle-level safety personnel and with safety responsible persons. Altogether 55 questions were asked from each of the person interviewed (MISHA method). Once data collection had ceased, the first author and the interviewer (ÕP) re-heard the records, and checked the coding strategy used for consistency and ensured that all questions had been answered. The second author (KR) then listened to the records and made notes about understanding the answers. After that, the two first authors discussed the answers of each company to come to a good level of agreement about the results (Table 2, 3 and 4). Table 1 presents the characteristics of the examined enterprises – the activity area, lifetime, size, the overall assessment on safety by an expert-interviewer, if OHSAS 18001 is implemented, and the persons interviewed (position and age).

## **RESULTS AND DISCUSSION**

The results described were derived from on-site observations as well as from employee interviews and calculations by MISHA method. According to MISHA method, the total activity scores (Table 2) varied 73.94...93.33 for OHSAS 18001-certified organisations (group I) and 29.10...88.08 for non-certified organisations (group II). This demonstrates that normally, companies who have implemented OHSAS 18001 benefit from it in safety performance as the activity scores are considerably higher than for non-certified companies.

**Table 1.** The characterisation of enterprises investigated (N = 16)\*

Id. of the company	The activity area	Life-time, years	Size, employees	The overall assessment on safety** Likert scale***	OHSAS 18001 implemented	The persons interviewed: position, age
K (Int 1)	Textile industry	11–25	50–249	3	–	Production manager, 38
L (Int 2–4)	Plastic industry	11–25	50–249	4	+	Quality manager, 41 Safety manager, 62 WER, 25
M (Int 5)	Furniture industry	> 50	50–249	4	+	Personnel manager, 64
N (Int 6)	Heat industry	> 50	50–249	5	+	Quality and environment manager, 58
O (Int 7)	Printing industry	1–10	< 50	2	–	Production manager, 36
P (Int 8–9)	Metal industry	> 50	≥ 250	5	–	Safety manager, 35 Trade union representative, 60
Q (Int 10–12)	Elect-ronics industry	11–25	≥ 250	5	–	Quality manager, 36 Safety specialist, 42 WER, 53
R (Int 13–15)	Food industry	> 50	≥ 250	4	–	Safety specialist, 62 WER I, 34 WER II, 39
S (Int 16–18)	Elect-ronics industry	11–25	≥ 250	5	+	Quality manager, 59 Safety manager, 39 WER, 66
T (Int 19)	Metal industry	> 50	≥ 250	5	+	Safety manager, 64
U (Int 20)	Food industry	> 50	≥ 250	5	+	Safety manager, 37
V (Int 21)	Metal industry	1–10	< 50	4	–	Production manager, 36
W (Int 22)	Wood processing industry	1–10	≥ 250	4	+	Quality manager, 47
X (Int 23)	Food industry	> 50	≥ 250	5	+	Safety chief specialist, 68
Y (Int 24)	Glass industry	11–25	< 50	3	–	Production manager, 41
Z (Int 25)	Textile industry	11–25	≥ 250	2	–	Health and safety manager, 67

\*Companies are listed and coded in chronological order; \*\*assessed by expert-interviewer;

\*\*\*Likert scale: 1 – poor, 2 – average, 3 – good, 4 – very good, 5 – excellent;

Abbreviations: Id. – identification; Int – interview, WER – working environment representative.

Table 2 also demonstrates that the activity scores for OHSAS 18001-certified organisations vary slightly while the activity scores of non-certified companies differ considerably more – which means that the safety level depends on ownership, size of the

company, dedication and attitudes of the top management, knowledge and resources availability and the consistency of safety activities in the company. However, the scores also show that some companies with no OHSAS 18001 certification can function as safely as the ones having the certification; mainly due to affiliation to a larger international consolidated company with developed safety systems.

The activity scores of the study showed that non-certified companies can be subdivided – 4 companies (P, Q, R and V) belonging to Nordic or global corporations (scores 79.80...88.08) and 4 companies (K, O, Y and Z) which are locally established and owned (scores 29.10...52.73). It shows that the safety management systems owned and run by local businessmen may lack in several OHS activity areas. The reasons may lay behind lack of resources, knowledge and skills, time while companies belonging to corporations are able to prioritize safety more. Examining results among group I (OHSAS 18001-certified organisations), there is no difference in scores between locally owned businesses (companies L, M) and international corporations (N, S, T, U, W, X).

**Table 2.** Activity rating according to framework elements calculated by MISHA method (grey rows – OHSAS 18001-certified companies; white rows – without certification; total score=100)

Identifi- cation	A: Organisation and administration	B: Training and motivation	C: Work environment	D: Follow up	Total activity score
K	31.88	57.58	60.00	44.44	46.67
L	85.02	68.69	74.07	42.59	73.94
M	85.51	78.79	75.56	61.11	78.79
N	92.75	87.88	80.00	66.67	85.45
O	24.64	33.33	35.56	22.22	29.09
P	86.96	96.97	90.00	69.44	87.88
Q	88.89	97.98	81.48	83.33	88.08
R	85.51	86.87	74.07	59.26	79.80
S	91.30	90.91	79.26	75.93	86.26
T	89.86	87.88	75.56	83.33	84.85
U	84.06	78.79	71.11	72.22	78.18
V	89.86	69.70	84.44	77.78	83.03
W	69.57	81.82	80.00	72.22	75.15
X	97.10	100.00	88.89	77.78	93.33
Y	31.88	54.55	57.78	16.67	41.82
Z	37.68	60.61	73.33	44.44	52.73

Looking at the results according to activity areas (Table 2), the following general conclusions can be drawn:

- The OHSAS 18001-certified organisations gain very high scores for element A (organization and administration) which is mainly establishment of written documents (formal safety). Non-certified companies have low scores for element A when they are locally owned and high scores when they belong to a larger consolidated company.
- The differences for element B (training and motivation) are not as high as for element A as training is strictly regulated by national legislation and therefore, each company, certified or non-certified, has to follow the requirements.

- Scores for element C (work environment) are high; vary slightly for certified companies and are lower and vary more for non-certified companies. The difference comes mainly from lack of dealing with psychological risk factors.
- Scores for element D (follow up) vary both for certified and non-certified companies. It represents the real safety performance, registration and investigation of accidents and absenteeism as well as the measurements of workability of employees. As parts of this is not regulated by legislation, the scores are diverse.

Table 3 and 4 represent the mean scores (0–3 scale) according to the activity area by MISHA method. Each four-category framework element consists of 3 activity areas which are examined by specific 55 items in the form of various interview questions/considerations.

**Table 3.** The mean scores (0–3 scale) according to the activity area (A and B) by MISHA method

Identifi- cation	A1*	A2*	A3*	B1*	B2*	B3*
	Organisation and administration			Training and motivation		
K	0.36 ± 0.67	1.63 ± 0.92	1.50 ± 0.58	1.67 ± 0.58	1.50 ± 1.29	2.00 ± 0.82
L	2.58 ± 0.50	2.67 ± 0.44	2.25 ± 0.88	1.56 ± 0.77	1.75 ± 1.37	2.75 ± 0.50
M	2.91 ± 0.30	2.25 ± 0.46	2.25 ± 0.96	2.33 ± 1.15	2.00 ± 0.82	2.75 ± 0.50
N	3.00 ± 0.00	3.00 ± 0.00	2.50 ± 0.58	2.67 ± 0.58	2.25 ± 0.50	3.00 ± 0.00
O	0.73 ± 0.65	0.75 ± 1.04	0.75 ± 0.50	1.00 ± 0.00	1.00 ± 0.82	1.00 ± 0.82
P	2.68 ± 0.56	2.63 ± 0.58	2.38 ± 0.48	2.83 ± 0.29	2.88 ± 0.25	3.00 ± 0.00
Q	2.76 ± 0.34	2.67 ± 0.36	2.42 ± 0.32	2.78 ± 0.38	3.00 ± 0.00	3.00 ± 0.00
R	2.76 ± 0.34	2.46 ± 0.43	2.25 ± 0.50	2.56 ± 0.51	2.50 ± 0.43	2.75 ± 0.17
S	2.97 ± 0.10	2.58 ± 0.43	2.42 ± 0.57	2.78 ± 0.38	2.67 ± 0.27	2.75 ± 0.50
T	2.82 ± 0.40	2.88 ± 0.35	2.00 ± 0.00	2.67 ± 0.58	2.25 ± 0.96	3.00 ± 0.00
U	2.64 ± 0.50	2.50 ± 0.53	2.25 ± 0.50	1.33 ± 1.15	2.75 ± 0.50	2.75 ± 0.50
V	2.55 ± 0.93	3.00 ± 0.00	2.50 ± 0.58	1.67 ± 1.15	1.75 ± 0.96	2.75 ± 0.50
W	2.36 ± 0.81	1.88 ± 0.83	1.75 ± 0.50	1.67 ± 1.53	2.75 ± 0.50	2.75 ± 0.50
X	3.00 ± 0.00	3.00 ± 0.00	2.50 ± 0.58	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00
Y	0.09 ± 0.30	2.13 ± 0.99	1.00 ± 0.00	2.00 ± 1.00	1.50 ± 1.29	1.50 ± 0.58
Z	0.36 ± 0.92	2.25 ± 1.04	1.25 ± 0.50	1.00 ± 0.00	1.75 ± 0.50	2.50 ± 0.58
Mean	2.16 ± 1.08	2.39 ± 0.59	2.00 ± 0.57	2.10 ± 0.69	2.21 ± 0.62	2.58 ± 0.58

\***A1:** Safety policy; **A2:** Safety activities in practice; **A3:** Personnel management; **B1:** Participation; **B2:** Communication; **B3:** Personnel safety training.

According to Table 3, it can be seen that B3 (personnel safety training) obtained the highest mean score ( $2.58 \pm 0.56$ ) which is not surprising as Estonian legislation specifies the requirements for training and in-service training regarding OHS in detail (Resolution..., 2000). As seen from Table 4, B3 is followed by C1 (physical work environment), by score  $2.52 \pm 0.37$ , which demonstrates that companies generally know how to control occupational hazards such as physical and chemical risk factors; and proves that interviewed companies prioritize workplace risk assessment as one of the main requirement in OSH legislation in Estonia. The third highest score,  $2.39 \pm 0.59$  points, is occupied by activity area A2 (safety activities and practice) where the items are strongly related to OHS legislation (e.g. obligations to elect working environment representatives, formulating duties for safety manager, etc.). The lowest score,  $1.02 \pm 0.44$ , was calculated for D2 (workability employees) which is very likely

connected with Estonian tax system where employer has to give strong evidence of expenses on connectedness of employees' health promotion or otherwise a high fringe benefit tax applies (Income Tax Act, 1999). Therefore, employers are not always eager to invest in health promotion.

**Table 4.** The mean scores (0–3 scale) according to the activity area (C and D) by MISHA method

Identifi- cation	C1*	C2*	C3*	D1*	D2*	D3*
	Work environment			Follow up		
K	2.22 ± 0.97	1.33 ± 0.58	1.00 ± 1.00	1.33 ± 0.15	1.50 ± 0.71	1.00 ± 0.00
L	2.59 ± 0.32	1.78 ± 0.69	1.56 ± 0.96	1.67 ± 0.53	0.33 ± 0.47	2.00 ± 0.00
M	2.44 ± 0.53	2.00 ± 0.00	2.00 ± 1.00	2.33 ± 0.58	1.50 ± 0.71	1.00 ± 0.00
N	2.67 ± 0.50	2.33 ± 0.58	1.67 ± 0.15	2.33 ± 0.58	1.00 ± 0.00	3.00 ± 0.00
O	1.44 ± 0.53	0.67 ± 0.58	0.33 ± 0.58	0.67 ± 0.58	1.00 ± 0.00	0.00 ± 0.00
P	2.94 ± 0.17	2.50 ± 0.50	2.17 ± 0.29	2.33 ± 0.58	1.25 ± 0.34	3.00 ± 0.00
Q	2.70 ± 0.35	2.11 ± 0.69	2.00 ± 1.00	3.00 ± 0.00	1.50 ± 0.24	3.00 ± 0.00
R	2.56 ± 0.60	1.78 ± 0.07	1.67 ± 1.15	2.78 ± 0.38	0.17 ± 0.24	3.00 ± 0.00
S	2.70 ± 0.51	1.67 ± 1.00	2.11 ± 0.77	2.89 ± 0.19	1.00 ± 0.47	3.00 ± 0.00
T	2.67 ± 0.50	1.33 ± 0.53	2.00 ± 1.00	3.00 ± 0.00	1.50 ± 0.71	3.00 ± 0.00
U	2.44 ± 0.73	1.00 ± 1.00	2.33 ± 1.15	3.00 ± 0.00	0.50 ± 0.71	3.00 ± 0.00
V	2.67 ± 0.50	2.33 ± 1.15	2.33 ± 0.58	3.00 ± 0.00	1.00 ± 0.00	3.00 ± 0.00
W	2.78 ± 0.67	1.67 ± 1.53	2.00 ± 1.00	3.00 ± 0.00	0.50 ± 0.71	3.00 ± 0.00
X	3.00 ± 0.00	2.33 ± 0.58	2.00 ± 1.00	3.00 ± 0.00	1.00 ± 0.00	3.00 ± 0.00
Y	2.11 ± 0.93	1.33 ± 0.58	1.00 ± 0.00	0.33 ± 0.58	1.00 ± 0.00	0.00 ± 0.00
Z	2.33 ± 0.87	2.00 ± 1.00	2.00 ± 0.00	1.67 ± 0.58	1.50 ± 0.71	0.00 ± 0.00
Mean	2.52 ± 0.37	1.76 ± 0.52	1.76 ± 0.55	2.27 ± 0.89	1.02 ± 0.44	2.13 ± 1.26

\*C1: Physical work environment; C2: Psychological working conditions; C3: Hazard analysis procedures; D1: Occupational accidents and illnesses; D2: Work ability of the employees; D3: Social work environment.

The next section presents the responses and differences between OHSAS 18001-certified organisations and organisations without it related to specific activity areas given in MISHA method (Kuusisto, 2000) through quantitative and qualitative data (interviews).

### A1 Safety Policy

Interviews revealed that all examined organisations without OHSAS 18001 and local ownership do not hold any kind of written safety policy. Safety and health activities are performed following the current legislation. As the OHS Act of Estonia (1999) does not require a written policy in paper, then in normal conditions, it is not created. These companies which belong to a larger corporation have a written policy with the authority of the concern.

The examined OHSAS 18001-certified organisations, had all a written safety policy; however the implementation of it was different depending on the affiliation to a larger international group/concern. Those companies belonging to an affiliated group, are able to make very few modifications in the safety policy as it is usually a fixed document. Some changes can be made in order to comply the requirements in national legislation. The content and volume of a safety policy depends on policy makers' approach: some have just a few general paragraphs about company's safety commitment



followed by comprehensive implementation guidelines or a more detailed extension (a separate document) where main safety activities and procedures are described. Other OHSAS 18001-certified organisations have one single extensive safety policy document covering all areas (the role and importance of safety, safety goals, main safety activities and their administration, description of safety tasks and responsibilities etc.); while only a part of it is introduced to employees (often being up on the notice-board of manufacturing unit). It came out from the interviews that even when dissemination of safety policy among employees is usually quite well-organized, the companies do not prioritize informing external bodies such as clients, sub-contractors or authorities, although OHSAS 18001 requires it (OHSAS Project Group, 2007). Normally, the policy (or a shorter version of it) is presented on the company's webpage in order to make it available for all external bodies. There is often no clear practice how to inform about the changes in policy document after the revision.

One of the safety managers from the food processing industry summarized: *'When our partners sign or renew a contract and come to our territory, we introduce them the new policy or changes in the policy – usually during the training course'. – Company X, Int 23.*

Normally, the safety policy lists the required documents such as work instructions and instructions for line-managers' and supervisors' safety duties, but how to perform and follow the duties is often unclear and unwritten. For example, the companies have no clear overview or guidelines which tools and knowledge should be used for effective safety training, no evaluation is given about the effectiveness of the training etc. In several cases, it was stated as follows:

*'The supervisors' and line managers' performance how to train our employees, comes with experiences and additional training. There are no guidelines or good tips written in paper for them'. – Company L, Int 3; Company M, Int 5; Company S, Int 18; Company V, Int 21; Company Z, Int 25.*

## **A2 Safety activities in practice**

In both types of companies – group I and group II, safety personnel and their responsibilities are usually designated. In smaller companies, no full-time safety manager is hired; often a production manager or personnel manager fulfils the duties during the working hours. All companies had elected a working environment representative according to the OHS Act (1999). In the larger companies (over 50 employees), the Working Environment Council has to be appointed/selected; the frequency of meetings varies depending on the size of the company and the number of discussions needed – from one up to four times per year.

In both groups of companies, there were deficiencies in safety awareness and knowledge: in most companies no system and clear picture existed how safety and health aspects can be taken into account in the design of new workplaces and processes. The exceptions were 3 OHSAS 18001-certified organisations and 2 non-certified organizations who employ their own engineers in order to find out new solutions for health and safety in the company.

One good example was an enterprise in food industry:  
*'We have a list of health and safety aspects which need to be taken into account when creating new workplaces'. – Company X, Int 23.*

### **A3 Personnel management**

In most of the companies, short-term plans about human resources are made; but no long-term views are generated. The interviewees explained it with the fact that everyday life has shown that market needs change quickly.

The weakest part in several companies was the policy how to ensure elderly personnel's work ability.

A company (in paper industry) argued:

*'We cannot allow ourselves discrimination, so we don't prefer one group of people to another – so therefore, there are no advantages for elderly people'. – Company W, Int 22.*

Another company (in metal industry) answered:

*'We only have young workers, so we don't need to think about the aging workforce yet'. – Company V, Int 21.*

A few companies (Companies S and R) admitted that they would benefit from a document or a guideline where elderly personnel's appreciation is justified. Even when there is no such written document available, the companies applied various activities in order to maintain the employees' health (including aging workforce) for instance providing a masseuse, massage chairs, thermotherapy, a neurologist, exercise equipment on-site etc.

The smaller the company is, the less the individual career planning is done. An example of attitude by production managers (in clothing industry):

*'There are many sewers, but only 4 positions for line managers. There is practically no possibility to make a career if you have chosen to do sewing work in our company'. – Company K, Int 1; Company Z, Int 25.*

A good example is from another small-scale company (Company V) in metal industry where a matrix has been created on a notice-board where workers' abilities and skills are ranked against equipment complexity: the more skills the person has, the more complex work can be performed by him and the more possibility he has for career promotion.

Normally, an evaluation about candidate's health and safety knowledge is not performed during the selection of new personnel. The reason lies mainly on low skilled workforce availability in Estonia.

### **B1 Participation**

In many investigated companies, OHSAS 18001-certified or non-certified organisations, the weak point is the communication between supervisor and employee. The interviews revealed that immediate intervention is not efficiently practiced. Often, the communication is limited to certain times per week; for example:

*'We don't interfere at once. We have a practice to go and gather all the problems and have an audit once a week. Then, we try to find the solutions'. – Company N, Int 6.*

During interviews, only one company out of 16 admitted that they practice immediate intervention also among peers and not only by supervisors:

*'The best practice in our company is, that my colleague will say to me at once if I do something wrong or unsafe'. – Company V, Int 21.*

Concerning employee participation into the workplace design, there are almost no companies (no differences between group I and group II) who involve employees in order to alter workplace safer or healthier. The exceptions are the companies who employ design engineers.

### **B2 Communication**

Companies' communication practices were generally in high level. Interviewees stated that the communication was organized effectively and sufficiently; for instance different communication tools were used: wall-boards, e-mails, internal leaflets, intranet etc. Some companies in the group II do not practice management information meetings for all personnel in regular basis, but in the group I it was predominant. Differences were dedicated in suggestions for improvement between group I and II. OHSAS 18001 states that there should be a procedure for collecting employees' suggestions (OHSAS Project Group, 2007). In the group II companies stated that suggestions for improvements are collected orally (Company O, V and Z) which means that no written procedure exists. Among group I, several company representatives mentioned that it is not common that the person who makes the suggestion can complete it afterwards. In Company X, the interviewee stated:

*'The persons who have made the suggestions, will have the opportunity to complete the proposed improvements (all suggestions that have been evaluated to be suitable for implementation)'. – Company X, Int 23.*

It means that there will be a team assigned to help him/her to complete it. However, several other companies were not convinced that everyone should have this chance as they may not have sufficient knowledge and skills for solving the problem.

In both groups employees were one or another way rewarded for the suggestions made (from verbal gratitude to monetary rewards).

The arrangement of health and safety campaigns in companies is strongly connected to company's practices (no difference between group I and II). For instance, companies U, V, X have strong culture for regular campaigns. The most common campaigns arranged were 'Occupational health days'; lectures on HIV, alcohol, smoking, healthy nutrition, reflectors; sport activities etc.

Another example comes from company in wood processing industry:

*'We have no campaigns, but there are focus areas each year'. – Company W, Int 22.*

### **B3 Personnel safety training**

The need for safety training was evaluated on a regular basis on almost all companies. When preparing work instructions, several companies mentioned that managers and supervisors participate in preparation of the instructions. Employees participate more seldom. All companies stated that employees have seen work instructions, but whether they always act according to them, is questionable. A lot of

companies (M, N, P, Q, R, U, S, T, W, X) stated that they check on regular basis (audit) whether employees follow the instructions or do not.

Several companies (P, Q, R, S, U, V) stated that they involve employees in all levels of the work instruction preparation process. Other companies (K, O, Y, Z) use mainly supervisors when preparing the work instructions. It is widely known among companies that when instructions are updated, they need to be replaced and the old ones removed from the workplaces. As work permits are regulated by Estonian legislation (for example, Machinery Safety Act (2002)), then the companies who need these permits, keep them up-to-date.

Generally, all companies are able to assess working environment hazards, especially physical hazards such as noise, lighting, indoor climate and manual handling of loads. In some level ergonomics assessments are performed as well. It appeared that indoor climate and factors influencing it produce the most diverse opinions and challenges:

*'While designing the new building, everything was taken into account in order to install the most suitable ventilation system. However, our employees complain about draught all the time and have an opinion that the ventilation system isn't built efficiently'. – Company S, Int 17.*

All companies in group I show a very high level of assessment of chemical hazards and risk of major hazards. These factors are explored thoroughly because of the integrated system – all interviewed OHSAS 18001-certified organisations are certified also after ISO 14001 (ISO, 2004) which pays special attention to chemicals used in the enterprise. Some companies in group II, consider chemical exposure essential as well: for instance, in a company in metal industry (Company P), a chemical specialist has been employed.

A very few companies handle off-the-job safety – travelling between home and the workplace:

*'We have drawn instructive lines from the territory to the bus station in order to have a safe lift home'. – Company R, Int 11.*

The interviews indicated that the maintenance of machines and equipment and the cleanliness of the plant area depends rather on the size of the company than the affiliation or owning the OHSAS 18001 certificate. In smaller companies, employees are expected to keep the workplace in order and clean it after the end of the shift as well as do the small daily maintenance. Example from a printing industry:

*'Our employees fix the small problems themselves. We call for outsourced service only when something breaks down and needs a specialist attendance'. – Company O, Int 7.*

Some other companies (R, S, W) answered that they have minimized the off-the-job safety risks by offering a bus to transport the employees home after their shifts.

The difference arising among OHSAS 18001-certified companies compared to non-certified companies is the on-going and continuous improvement activity in order to establish better working conditions (see the section B2).

## **C2 Psychological working conditions**

In examined companies, psychological aspects are not considered while designing new workplaces. During work process, the working load is usually monitored and evaluated – however, psychological factors are often neglected. Some companies ignore the problem:

*'We do not have any stress factors in our company; so we really don't need to deal with it, thankfully'. – Company U, Int 20.*

It turned out that working in isolation is often a privilege and not a psychological hazard because in recent years, people tend to feel that open-plan offices are psychologically more challenging than private offices. However, working alone is a problem in some of the investigated companies (U, W) – working in the nature, on sites.

Some of the physical hazards contribute into psychological hazards as well:

*'My head is ringing as the production line is next to my office and it disturbs my work all the time'. – Company S, Int 16.*

There were no differences between group I and group II companies while dealing with psychosocial hazards. In conclusion, it can be said that the knowledge about psychosocial hazards among managers in Estonia is still low.

## **C3 Hazards and analysis procedures**

Risk assessment has been conducted in all interviewed companies (however, the quality of the assessment was not assessed during the visits to the enterprises). Many companies presented the results of measurements of working conditions, however, many of them were conducted several years ago and the situation may not be the same anymore. In all companies of group I, the risk assessment report lead to the preparation of an action plan. Three companies (K, O and Y) in group II confessed that no action plan has put together after the risk assessment procedure.

All companies except one (O) carry out personnel's health surveillance: they have an activity plan on an annual basis. However, the efficiency and quality of occupational health service varies greatly. It rather depends on a size of the company than whether it is certified by OHSAS 18001 or is not. General trend is the following: the larger the company, the more collaboration between the company and occupational health service provider. In small companies, an occupational health doctor contributes to the maintenance of employees' health through the health inspection and health control decision. Only few companies (P, S, U, X) confirmed that they get a detailed analysis of the results on a regular basis (once or twice per year) by occupational health physician, but many lack it. A company in furniture industry said:

*'It would be essential to have the summary of the results sent to the top management – this way, they would see the employees' problems and understand their responsibility better'. – Company M, Int 5.*

Generally, occupational health service specialists do not participate in employees' training, except in two companies (S, Z, R) who have invited specialists to give some lectures about specific health issue. However, this agreement is signed separately from general health surveillance service. This is the reason why most companies do not deal with it.

Safety organizations participate in safety analysis of the companies through occupational hygiene measurements and performing risk assessment. There is no good practice that the staff of safety organizations represents their results to management and employees. This, again, is usually not a part of the contract. Usually, the results of measurements and risk assessment is introduced by safety manager.

### **D1 Occupational accidents and illnesses**

In group I, all companies keep statistics on accident rates and use it as a reference when new goals for safety improvement are done. In group II, those who belong to a larger affiliation or concern, report on a regular basis which consists the presenting of occupational accidents and illnesses statistics. In group II, companies K, O, Y and Z do not calculate statistics on accident rates. In Company W (less than 50 employees) they act very seriously on accidents and their causes: the root causes are sought, action plan is made, reasons are presented to all employees, information goes to wall-boards. When we look at the investigation of the near-accidents, then in group I it is done 100%. In group II, it is done, too, but not consistently. For example in companies S, W, R the near-accidents reporting is connected with yearly goals. The company decides how many near misses there have to be reported in a year per person as the statistics (Heinrich, 1941) shows that the more accidents the more near-misses exist. In these companies who do not integrate it to yearly goals, the near-accidents reporting rate is very low.

Absenteeism is often followed, but as Estonian legislation (Personal Data Protection Act, 2007) does not allow the separation of reasons of absenteeism, the results are often not analysed and used for goal setting.

### **D2 Work ability of the employees**

As mentioned in section A3, there is generally no policy how to ensure elderly personnel's work ability. None of the companies had a systematic view for the rehabilitation for persons' whose work ability has decreased. However, some companies (P, Q, R, S, U, X, Z) offer various activities in order to maintain the employees' health: providing a masseuse, massage chairs, thermotherapy, a neurologist, exercise, equipment on-site etc.

Most companies answered negatively for the question about redesigning workplace for the persons who have difficulties in coping with the work. The answer was simple: *'Sorry, we can't do it and there is no similar work to offer'*. – Company R, Int 11.

Or the next explanation:

*'Our shifts are 12 hours long. If someone wants to work for 6 hours, we have difficulties to find another person with the same need'*. – Company R, Int 11.

Companies K and S look at each case individually and try to provide the most suitable solutions:

*'We have some workers who work 6 hours instead of 8 because of health reasons. As this is done every day, there is no particular work delays or unexpectancies'*. – Company K, Int 1.

In the several companies, the work satisfaction survey is conducted regularly (usually outsourced), but psychological hazards questionnaires are hardly used. Some companies stated that dealing with this issue depends strongly on the managements' attitudes and knowledge.

A good example of emphasizing the psychological stress factors:  
*'We use occupational psychologists in order to help our supervisors to detect and solve the problems between the team members and how to intervene when stress level becomes too high'. – Company Z, Int 25.*

### **D3 Social work environment**

As mentioned in D2, companies in group I have a clear system how to measure social climate – they conduct regular work satisfaction surveys (except one company) either once or twice a year. Often, these surveys come from the concern they belong to or are outsourced. Interviews revealed that 4 companies (K, O, Y, Z) do not conduct these surveys. Most of them explained that they do not find it necessary in order to improve employees' health.

## **CONCLUSIONS**

In conclusion, following statements can be presented:

1. According to the results, the companies can be divided into 3 different categories: (1) OHSAS 18001-certified organizations, (2) organisations which belong to a larger corporation or concern but are not OHSAS 18001-certified and (3) non-certified, locally established and owned companies. Clearly, OHSAS 18001-certified organizations show the highest scores.

2. The safety activities in a company depend strongly on consistency. The study showed that safety needs commitment and systematic approach. If one of the key elements of safety management systems is missing, then it can be seen in the results of other framework elements. For instance, lack of safety policy may influence the consistency in safety activities, the safety communication and safety knowledge and vice versa. These results are in line with the earlier studies (Tint et al., 2010b; Fernández-Muniz et al., 2012a; Reinhold et al., 2015).

3. Implementation of OHSAS 18001 automatically will not ensure high safety activities in the company. However, holding an OHSAS 18001 certificate, creates a basis for a systematic work in the area of safety management, hazards identification and prevention, and promotes strong improvement process put in use. Other authors (Ma et al., 2001; Fernández-Muniz et al., 2012b) have demonstrated, too, that OHSAS 18001 is only the first step towards the systematic and successful management of safety work. Besides that, companies need to have a favourable safety climate (a strong management commitment with the support of their workforce) (Fernández-Muniz et al., 2012b).

4. Concerning working conditions and occupational hygiene, all companies are able to assess work environment hazards. However, in OHSAS 18001-certified companies the control of chemical hazards and major accident hazards, is in very high level while non-certified organisations show the lower commitment to chemical safety. However, there are 2 good examples in non-certified organisations: a company in metal industry employs a chemical specialist and a company in food industry who outsources

company-specific chemical safety training. Physical hazards like noise and illumination are well managed in all interviewed companies, some challenges are faced with thermal conditions e.g. temperature, airflow and inefficiency of ventilation system. Ergonomics is valued by almost all enterprises; however dealing with it systematically and effectively depend on the size and consistency of the company. The maintenance of machines and equipment and the cleanliness of the plant area depends rather on the size of company than the affiliation or owning the OHSAS 18001 certificate. In smaller companies, employees are expected to keep the workplace in order and clean it after the end of the shift as well as do the small daily maintenance. The knowledge about psychosocial hazards among managers in Estonia is still low and there were no differences between group I and group II while dealing with psychosocial hazards. Our study results indicate that psychosocial work environment is not only difficult to measure, but problematic to detect its dimensions and find suitable solutions and control measures. A study conducted in Denmark (Hohnen & Hasle, 2011) showed a similar result – OHSAS 18001-certified manufacturing company had difficulties in dealing with psychosocial work environment as referred too complex, with multiple causes and too complicated for management to articulate clearly.

5. All interviews were conducted by using the MISHA method questionnaires. MISHA method offers a more comprehensive possibility to evaluate SMS in present-day society: it emphasizes among other activity areas on top management commitment and safety knowledge, psychosocial hazards and integration of personnel management. By reference to previous authors' experiences with other audit methods (Tint et al., 2010a; Tint et al., 2010b), for instance D&S method is a rough and outdated method. Some criteria in it are very easy to meet, too much emphasis is put on fire and industrial hygiene control, less attention is paid to follow-up and auditing. Compared to some other methods, developed in the USA (ISRS-Generic (Collision & Booth, 1993, Goodyear Tire and Rubber Company audits (Dyjack et al., 1998)), MISHA gives less attention to off-the-job safety. Although MISHA method can be successfully used for evaluating safety management systems in manufacturing industry, it has to be kept in mind that some modifications may be needed due to national differences in safety activities. For instance, occupational health service principles and structure vary from country to country.

As the result of the investigation and using the elements of the OHSAS 18001, the model for safety management in the small and medium-sized enterprises will be proposed.

## REFERENCES

- Abad, J., Lafuente, E. & Vilajosana, J. 2013. An assessment of the OHSAS 18001 process: Objective drivers and consequences on safety performance and labour productivity. *Safety Science* **60**, 47–56.
- Bakker, A.B. & Schaufeli, W.B. 2008. Positive organizational behavior: Engaged employees in flourishing organizations. *Journal of Organizational Behavior* **29**, 147–154.
- BSI (British Standard Institution). 1996. BS 8800:1996. *Guide to occupational health and safety management systems*. BSI, London.



- Bunn, W.B., Pikelny, D.B., Slavin, T.J. & Parikar, S. 2001. Health, safety, and productivity in a manufacturing environment. *Journal of Occupational and Environmental Medicine* **43**(1), 47–55.
- Chang, J.I. & Liang, C.L. 2009. Performance evaluation of process safety management systems of paint manufacturing facilities. *Journal of Loss Prevention in the Process Industry* **22**(4), 398–402.
- Collison, J.E. & Booth R.T. 1993. An evaluation of two proprietary health and safety auditing systems. *Journal of Health and Safety* **9**, 31–38.
- Diekemper, R.F. & Spartz, D.A. 1970. A quantitative and qualitative measurement of industrial safety activities. *ASSE Journal* **12**, 12–19.
- Dyjack, D.T., Levine, S.P., Holtshouser, J.L. & Schork, M.A. 1998. Comparison of AIHA ISO 9001-based occupational health and safety management system guidance document with a manufacturer's occupational health and safety assessment instrument. *American Industrial Hygiene Association Journal* **59**(6), 419–429.
- Eisner, H.S. & Leger, J.P. 1988. The international safety rating system in South African mining. *Journal of Occupational Accidents* **10**, 141–160.
- Estonian Association for Quality. 2014. Database of Certificates. <http://eq.ee/sisu/sertifikaatide-andmebaas>. Accessed 05.01.2014 (in Estonian).
- EVS 18001:2007 (OHSAS 18001). *SMSs*. Estonian Centre for Standardization (in Estonian).
- Fernández-Muñiz, B., Montes-Peón, J.M. & Vázquez-Ordás, C.J. 2007. Safety culture: analysis of the causal relationships between its key dimensions. *Journal of Safety Research* **38**, 627–641.
- Fernández-Muniz, B., Montes-Peón, J.M. & Vazques-Ordas, C.J. 2012a. Occupational risk management under the OHSAS 18001 standard: analysis of perceptions and attitudes of certified firms. *Journal of Cleaner Production* **24**, 36–47.
- Fernández-Muniz, B., Montes-Peón, J.M. & Vazques-Ordas, C.J. 2012b. Safety climate in OHSAS 18001-certified organisations: Antecedents and consequences of safety behaviour. *Accident Analysis and Prevention* **45**, 745–758.
- Frazier, B.F., Ludwig, T.D., Whitaker, B. & Roberts, D.S. 2013. A hierarchical factor analysis of a safety culture survey. *Journal of Safety Research* **45**, 15–28
- Heinrich, H.W. 1941. *Industrial accident prevention*. McGraw-Hill, 448 pp.
- Hohnen, P. & Hasle, P. 2011. Making work environment auditable – A ‘critical case’ study of certified SMSs in Denmark. *Safety Science* **49**, 1022–1029.
- HSE. Health and Safety Executive. 2001. A guide to measuring health and safety performance. <http://www.hse.gov.uk/opsunit/perfmeas.pdf> Accessed 30.01.2015.
- Income Tax Act. 1999. RT I 1999, 101, 903. <https://www.riigiteataja.ee/en/eli/ee/Riigikogu/act/520012015019/consolide>. Accessed 02.01.2015.
- ISO. 2004. ISO14001:2004 Environmental management systems – Specification with guidance for use.
- Karapetrovic, S. & Willborn, W. 2000. Generic audit of management systems: Fundamentals. *Managerial Auditing Journal* **15**(6), 279–294.
- Kuusisto, A. 2000. Safety management systems: Audit tools and reliability of auditing. [dissertation] Tampere (Finland): Tampere University of Technology.
- LaMontagne, A.D., Barbeau, E., Youngstrom, R.A., Lewiton, M., Stoddard, A.M. & McLellan, D. 2004. Assessing and intervening on OSH programmes: Effectiveness evaluation of the Wellworks-2 interventions in 15 manufacturing worksites. *Occupational & Environmental Medicine* **8**, 651–660.
- Ma, C.-M., Chen, W.-H., Hung, C.L. 2001. How to Implement the Occupational Health & Safety Management System. Foundation of Taiwan Industrial Service. Taipei.

- Machinery Safety Act. 2002. RT I 2002, 99, 580. <https://www.riigiteataja.ee/akt/129062014040>. Accessed 02.02.2015 (in Estonian).
- Occupational Health and Safety Act. 1999. RT I 1999, 60, 616. <https://www.riigiteataja.ee/akt/108102014007>. Accessed 31.01.2015.
- OHSAS Project Group. 2007. OHSAS 18001:2007. SMSs – requirements.
- Pearse, W. 2002. Club Zero: Implementing OHSMS in small to medium fabricated metal product companies. *Journal of Occupational Health and Safety – Australia New Zealand* **18**(4), 347–356.
- Personal Data Protection Act. 2007. RT I 2007, 24, 127. <https://www.riigiteataja.ee/akt/112072014051>. Accessed 02.02.2015 (in Estonian).
- Redinger, C.F. & Levine, S.P. 1998. Development and evaluation of the Michigan occupational health and safety management system assessment instrument: a universal OHSMS performance measurement tool. *American Industrial Hygiene Association Journal* **59**, 572–581.
- Reinhold, K., Järvis, M. & Tint, P. 2015. Practical tool and procedure for workplace risk assessment: Evidence from SMEs in Estonia. *Safety Science* **71**, Part C, Jan, 282–291.
- Resolution of the Ministry of Social Affairs. 2000. No. 80 of 14 December 2000. Procedure for Training and In-service Training regarding Occupational Health and Safety. State Gazette in Estonia, RTL 2001 35, 469.
- Robson, L.S. & Bigelow, P.L. 2010. Measurement properties of occupational health and safety management audits: A systematic literature search and traditional literature synthesis. *Canadian Journal of Public Health* **101**(Suppl 1), 34–40.
- SafetyMap. 1995. A guide to occupational health and safety management systems 1995. Health and Safety Organization, Victoria, Australia. 52 pp.
- Tint, P., Paas, Ö., Järvis, M. & Tuulik, V. 2010a. Safety Management at Medium- and Small-Scale Enterprises in Estonia. *Journal of International Scientific Publications: Ecology and Safety* **4**(1), 300–310.
- Tint, P., Paas, Ö. & Reinhold, K. 2010b. Cost-effectiveness of safety measurers in enterprises. *Inzinerine Ekonomika-Engineering Economics* **21**(5), 485–492.
- Traumann, A., Reinhold, K. & Tint, P. 2013a. The model for assessment of health risks of dust connected with wood manufacturing in Estonia. *Agronomy Research* **11**, 471–478.
- Traumann, A., Tint, P., Järvik, O. & Oja, V. 2013b. Management of health hazards during shale oil handling. *Agronomy Research* **11**, 479–486.
- Vinodkumar, M.N. & Bhasi, M. 2011. A study on the impact of management system certification on safety management. *Safety Science* **49**, 498–507.