



Results of the Finnish national survey investigating safety management, collaboration and work environment in the chemical industry



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ABSTRACT

The aim of this study is to explore the effects of the OSH legislation, collaboration and management. These variables had an effect on the continuous improvement of OSH, the safety training, the safe use of chemicals, the use of personal protective equipments, the monitoring of the work environment and the arrangement of occupational health care. The respondents to the questionnaire survey were OSH managers ($N = 85$) and workers' OSH representatives ($N = 120$) working in the chemical industry. The present results found that workers' OSH representatives believed more strongly than OSH managers in the effects of OSH legislation, collaboration and activities of the management with respect to their practical values for improving OSH. Safety should be considered in the organizational context in which technical controls and work processes are applied. Effects of preventive measures should be followed-up better than is nowadays done. The top-level management in the plants should also promote the activities of middle-management and encourage collaboration in order to improve managers and workers' commitment to the goals of the organizations. Management should define the correct OSH goals and strategies signalling the importance of safety with respect to other organizational goals. With respect to OSH research design this study represents an opportunity for researchers to undertake longitudinal research in the safety in the chemical industry's leadership and process safety.

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1. Introduction

In the chemical industry, considerable research has been conducted into the system dynamics of the behavioral, the management of safety in maintenance activities, the safety climate, the safety management and the design of continuous safety improvement. For example, Bouloiz et al. (2013) developed a system dynamics model in order to formalize causal interdependencies between safety factors (e.g. technical, organizational and human) for a storage unit for chemical products. Hale et al. (1998) established and tested the management of safety in maintenance activities in the chemical process industry and developed an audit checklist to carry out in-depth assessment of their management systems. Vinodkumar and Bhasi (2009) found that safety climate scores had a significant but negative correlation with self-reported accident rates. Reniers et al. (2009) examined the requirements for integrating safety management systems into chemical plants and established comprehensive guidelines for the design, development and installation of continuous safety improvements.

Past research (e.g. Wu et al., 2011) has emphasized the importance of the safety leadership and safety performance in the petrochemical industries highlighting that safety climate mediated the relationship between safety leadership and performance. For example, an understanding of the scenarios and risks in the process hazard analyses can be used to establish highly effective aids to decision making by the management at all levels in the process industries (Myers, 2013). Previous research (e.g. Hu et al., 2012) has also shown that accidents with hazardous chemicals remain a matter of major concern and the quantitative risk assessments are a critical aspect of the chemical industry. Indeed, investigators (e.g. Wu et al., 2008) have provided a conceptual rationale to emphasize that the organizational leaders would do well to develop a strategy, which will improve the safety climate within their organization, since this will then exert a positive impact on safety performance. Furthermore, the work of Schupp et al. (2006) indicated that design for safety in the chemical industry is becoming a more explicit and better organized process and i.e. it now applies existing knowledge about risk control and systematically seeks to learn from this new knowledge.

Reniers (2009) noted that due to the rapid development of chemical technology, in chemical plants there has been is a

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continuous growth of ever more complex installations operating under more extreme and critical process conditions. Furthermore, due to the amounts of highly complex surrounding and dangerous substances handled in such companies and due to the plants' complexity they are characterized as having a high accident potential (Reniers, 2009). Colley et al. (2013) concluded that, in general, organizations working in high risk industries are subject to competing demands. These include balancing concerns for worker well-being with the need for goal attainment and finding an equilibrium between the need for stability and control with the ability to adapt and update. Nonetheless, the results of Colley et al. (2013) suggested that in high risk industries worker well-being and goal attainment are not necessarily competing values, they can and should co-exist.

Grote (2012) indicated that at present in the high-risk industries there is little conceptual and empirical knowledge on how measures aimed at process safety or personal safety achieve their effects and how they interact. Schöbel and Manzey (2011) proposed that future research efforts into high hazard systems should focus more strongly on the development of alternative models of (failed) social system performance since learning from mistakes has the potential to supplement existing methods of functional event analysis. These alternative models may provide interesting insights about the “drivers” of social dynamics, which may then be specifically analyzed with regard to their functional consequences.

Although the research work described above has resulted in a deeper understanding of safety leadership and safety performance in the chemical industry with respect to the roles of managers and workers, there are still a critical gap exists in the literature. By including the organizational relationships and technical measures of OSH into our study it was hoped to clarify their potential effects on the continuous improvement of OSH, the safety training, the safe use of chemicals, the use of personal protective equipments, the monitoring of the work environment and the arrangement of occupational health care.

The responsibilities of OSH managers and workers' OSH representatives are described in the Finnish Act on OSH enforcement and Collaboration on OSH (44/2006) which stipulates that the following issues should be handled in collaboration between the employer and workers (Finnish Legislation, 2006): (1) matters immediately affecting the OSH and changes in those matters; (2) principles for investigating risks and hazards at the workplace, as well as such factors that have emerged in connection with the investigation or a workplace survey carried out by an OHC; (3) development objectives and policies; (4) need and arrangements for training to be given to workers; (5) follow-up of OSH and the effects. Furthermore, the employer shall nominate his representative (OSH manager) to undertake this collaboration. The OSH manager has several duties e.g. to help the employer and the management in tasks relating to acquisition of expertise in OSH and to collaborate with workers and OSH authorities. The OSH manager needs to be adequately qualified regarding the nature of the workplace and the work procedures and to possess sufficient knowledge, of OSH legislation and the conditions in the workplace. The workers' OSH representative is the link with the workers when dealing with OSH matters in collaboration with the employer. Additionally, it is the duty of the workers' OSH representative to become familiar with OSH issues, to participate in OSH inspections, and to ensure that workers pay attention to matters that promote OSH (Finnish Legislation, 2006).

2. The aim and hypotheses of the study

The aim of the present study was to examine the effects of the requirements of OSH legislation, the collaboration in OSH and the

activities of management with respect to organizational relationships and technical measures.

2.1. The requirements of the OSH legislation (issues which will be dealt with in sections below – Hypotheses 1a, 2a, 3a, 4a, 5a, 6a)

EU Directive 98/24/EC (EU Directive, 1998) which is concerned with the protection of the health and safety of workers from the risks related to chemical agents at work. According to Article 5 OSH risks shall be eliminated or reduced to a minimum by the following measures: (1) the design and organization of systems of work, (2) the provision of suitable equipment, (3) reducing to a minimum the duration and intensity of exposure, (4) reducing the quantity of dangerous chemical agents and (5) suitable working procedures. The Finnish Government Decree on Chemical Agents at Work 715/2001 (Finnish Legislation, 2001a) corresponds to the details of the EU Directive 98/24/EC in its various articles. The Finnish OSH Act 738/2002 (Finnish Legislation, 2002) represents the implementation of EU Directive 89/391/EC (EU Directive, 1989). The Finnish Act on OSH Enforcement and Cooperation on OSH at Workplaces 44/2006 (Finnish Legislation, 2006) has regulations aimed at ensuring cooperation to improve the interaction between the employer and the employees, and to make it possible for workers to participate in and influence the handling of matters concerning OSH within the workplace.

Grote (2012) stated that the move towards goal-oriented regulation can also be understood in the context of the general trend towards acknowledging the need to cope with uncertainty instead of trying to manage it away. When the focus is on external regulation, companies have to continuously react to changes in regulations and adapt their safety management accordingly. With respect to the activities of the chemical industry, the so-called Seveso Directive deals with the regulations intended to prevent major accidents where hazardous materials are involved (Vierendeels et al., 2011). A ‘major accident’ in this EU Directive (2012) is defined as follows: “a major accident means an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment covered by this Directive, and leading to serious danger to human health or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances”. In the chemical industry, which has increasing by complex socio-technical systems, the concept that anticipation and perfect prediction can be the basis for legal regulation becomes less feasible. Instead, resilience through rapid adaptation to emerging threats is required.

The actual behavior patterns emerging and which are ultimately repeated with a high degree of regularity have been called routines, or more specifically routines in practice (Grote, 2012). Regulatory agencies define and modify rules and are also in charge of surveying rule compliance and investigating cases of suspected rule violation (Grote, 2012). The recent years have witnessed a tendency to move away from prescriptive regulation which specifies in great detail how an organization has to carry out its operations, towards goal-oriented legislation, which promotes self-regulation (Grote, 2012).

2.2. The collaboration (between the employer and workers) on OSH matters (as it refers to the Hypotheses 1b, 2b, 3b, 4b, 5b, 6b)

Managers and employees within the organization and the interaction between these individuals are critical to this process, since they detect situations and events from which to learn and collect related information (Drupsteen and Wybo, 2014). Furthermore, their experience is captured, processed, transferred and shared throughout the organization. Uhl-Bien et al. (2012, p. 291) reported

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