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Safety compliance in a highly regulated environment: A case study of workers' knowledge of rules and procedures within the petroleum industry

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ABSTRACT

Violations of rules and procedures are commonly identified as an important causal factor in workplace accidents. Essentially, there are two different types of violations: intentional and unintentional violations. Whereas the former term refers to deliberate violations of rules and procedures that are known and understood by the actor, the latter refers to violations of rules and procedures that the actor has no awareness or knowledge of and therefore operates without any reference to. The vast majority of previous research has been concerned with intentional rather than unintentional violations. This implies that researchers have put a particular focus on the aspects of work that affect workers' safety motivation and their attitudes towards compliant behavior, and that they have been less concerned with the factors that affect workers' knowledge of rules and procedures. On the basis of semi-structured interviews of 24 contract workers within the Norwegian petroleum industry, this research gap is addressed in the present paper. The objective is to identify, categorize and gain a comprehension of the most significant factors that affect workers' knowledge of rules and procedures. Analysis revealed that eight different factors within the workers' organizational context are important. These are sorted into three paramount categories: the safety management system, work characteristics and social interaction. The theoretical and practical implications of the findings are discussed.

1. Introduction

A recurring conclusion of accident investigations across different industries is that a lack of compliance with rules and procedures is an important contributory factor (Dekker, 2005; Hopkins, 2011). The exact proportion of accidents that such non-compliance accounts for varies between industries, but some writers have claimed that violations of rules and procedures within high-risk industries are a significant contributor to as much as 70% of the total number of accidents (Mason, 1997). This demonstrates that adherence to rules and procedures, usually referred to as *safety compliance*, is of critical importance in maintaining safety at work and, further, that there is a need to identify and explain the reasons why workers violate procedures and to address factors that can improve safety compliance.

According to Battmann and Klumb (1993), a broad range of behaviors that deviate from written rules and procedures can be classified as violations. Thus, they argue that violations should be conceived as actions which belong to a dimension, which can vary from the flexible application of rules and procedures to complete ignorance of them. A useful and relatively clear-cut distinction can be made, however, between *intentional* and *unintentional* violations (Reason, 1990, 1997). The former are deliberate violations of procedures that are known and understood by the actor, such as knowingly breaking procedures to get a job done with less effort or because the procedures are considered impractical in a given situation. The latter are violations of procedures that the actor has no awareness or knowledge of and therefore operates without any reference to (Lawton, 1998), such as operating hazardous machinery in breach of regulations because no operating instructions are available. In such instances, a violation has been committed unknowingly. That is without the actor being aware of the relevant rules or procedures, and not for example because non-compliance has been perceived as an easy pathway towards a goal. In addition to this distinction, both intentional and unintentional violations should be distinguished from malevolent acts, such as sabotage, in which both the act and the damaging consequences are intended. Also, they should be distinguished from acts of human error, such as slips, lapses and mistakes that arise from cognitive and perceptual failures (Reason, 1990) where the plan was good (i.e. to follow the known rules), but the execution failed.

The recognized significance of violations in the aetiology of accidents at work has led researchers to increase their efforts to

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detect the antecedents of such unsafe practices, and to identify factors that can improve safety compliance. Some of this research has focused on characteristics related to the individual worker, such as personality (e.g. Salgado, 2002) and demographic attributes (e.g. Chan et al., 2002). During the last two to three decades, however, researchers have become increasingly aware of the importance of the social and organizational context of work and the role that it plays in reducing the frequency of violations and in achieving a high level of safety compliance (Didla et al., 2009). A variety of different contextual factors have been studied, such as job demands and resources (e.g. Hansez and Chmiel, 2010), ethical work climates (e.g. Parboteeah and Kapp, 2008), cooperative relationships (e.g. Simard and Marchand, 1997), job autonomy (e.g. Parker et al., 2001), safety climate (e.g. Cavazza and Serpe, 2009) and leadership (e.g. Lu and Yang, 2010).

The vast majority of this research has been concerned with intentional rather than unintentional violations (Alper and Karsh, 2009). This implies that researchers have been particularly focused on the aspects of work that affect workers' safety motivation and their attitudes towards compliant behavior, and that they have been less concerned with the factors that affect workers' knowledge of the rules and procedures that govern their work (Barber, 2002). Hence, the accumulated insight into the root causes of intentional violations far exceeds the accumulated insight into the root causes of unintentional violations. If the goal is to grasp the full extent of non-compliant behavior, this research gap should be addressed. This is believed to be important, particularly within highly regulated industries, such as the petroleum, aviation and nuclear power industries, where the body of rules and procedures is extensive and complex and where it could be a challenge for workers to have knowledge of these.

The purpose of the present paper is therefore to shed light on this gap in safety compliance research, based on a qualitative case study of contract workers within one such highly regulated industry, the Norwegian petroleum industry. This is done by examining how the contextual aspects of work affect contract workers' knowledge of the rules and procedures that regulate their work. The overall objective is to identify, categorize and gain understanding of the most significant factors that affect such knowledge. Addressing this objective may yield insights into some of the contextual mechanisms that underlie unintentional violations, which would therefore complement research that focuses on the contextual mechanisms that underlie intentional violations.

Such insights should be particularly relevant to the petroleum industry. First, because virtually all work operations in this industry are highly regulated by a relatively extensive and complex set of rules and procedures. Hence, it would be reasonable to assume that knowledge of these rules and procedures depends on more than just common sense. Second, because investigations of accidents within this industry frequently identify non-compliance with rules and procedures as a central contributory factor (Karish and Siokos, 2004; Thunem et al., 2009). It should also be added that contract workers are of particular interest, because they constitute the group of workers that are most frequently involved in and exposed to accidents within the petroleum industry (Hofmann et al., 1995; PSA, 2012; Walker et al., 2012).

2. Background

As already described, previous research on violations and safety compliance in work settings has focused primarily on the causes of intentional violations and has not been particularly concerned with the causes of unintentional violations (Alper and Karsh, 2009). According to Fogarty and Buikstra (2008), intentional and unintentional violations follow different psychological pathways, whereby the former is associated with workers' safety motivation and safety attitudes and the latter with workers' knowledge of rules and procedures. Previous research has been more concerned with identifying the contextual origins of workers' safety motivation and attitudes than with the contextual origins of their knowledge of rules and procedures.

A number of different social and organizational attributes have proved to be of significance within the research on intentional violations. For example, studies of safety climate, defined as the set of perceptions that employees share regarding safety in their work environment (Zohar, 1980), have demonstrated that workers' perception of safety priorities within their organization positively affects safety motivation and attitudes and, further, that positive motivation and attitudes in turn promote safety-compliant behavior (e.g. Biggs and Banks, 2012; Cavazza and Serpe, 2009; Zhou et al., 2008). Studies of leadership point in the same direction. Several leadership studies have found that leaders who emphasize reward and encourage safe performance generate a lower level of deliberate rule-breaking within their work group by positively affecting workers' attitudes and motivation towards safe conduct (e.g. Lu and Yang, 2010; Tomas et al., 1999). Researchers have also found the balance between job demands and job resources to be important. For example, Hansez and Chmiel's (2010) study of non-compliant behavior within the Belgian energy sector demonstrated that imbalances between job demands and resources affect the frequency of intentional violations negatively because of strain and lack of motivation.

The observation that workers' safety attitudes and motivation are important for reducing the number of intentional violations is not new. Neither is it a new observation that contextual factors are important in the formation of both attitudes and motivation. For example, as early as the 1930s, Heinrich (1931) reported from case studies based on 75,000 accident records that poor attitudes were a major obstacle to safe behavior and that supervisors were highly influential in the formation of such attitudes. Later, Slocombe (1941) argued that ignorance of safety rules at work was the result of poor attitudes and motivation caused by improper safety training. Nearly four decades later, Andriessen (1978) claimed that management's prime task with respect to improved safety performance, which is understood as a reduction in deliberate risk-taking and rule-breaking, is to implement measures that aim to enhance safety motivation.

Despite this long-held proposition, other lines of research have indicated that non-compliant behavior should not be analyzed and understood solely in terms of the interplay between the social and organizational context on the one hand, and workers' safety motivation and attitudes on the other. This research also demonstrates the need to expand the research field beyond the scope of intentional violations. An example of this is a study by Elling (1987), cited in Hale (1990), of railway workers' perceptions of the rules governing work on and near railway lines: 85% of the respondents in Elling's study found it hard to find what they were looking for in the rule book, and when they finally found it 70% found the rules too complex and hard to read. Hence, the eventual gap that emerged between work performance as formally described in the rule book and the way work was actually carried out is not always intentional; thus, it cannot be understood exclusively in terms of the interplay between context, motivation and attitudes. Moreover, Elling's study illustrates that safety compliance within highly regulated industries depends to a large degree on an organization's ability to support workers' knowledge of rules and procedures.

A study by Laurence (2005) of the Australian mining industry draws similar conclusions to those that can be drawn from Elling's study. When asked to indicate their reasons for not complying with the rules, 18% of the mine workers reported that there were too many rules for them to remember, 16% reported that the rules