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A system of safety management practices and worker engagement for reducing and preventing accidents: An empirical and theoretical investigation[☆]

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ABSTRACT

Objective: The overall research objective was to theoretically and empirically develop the ideas around a system of safety management practices (ten practices were elaborated), to test their relationship with objective safety statistics (such as accident rates), and to explore how these practices work to achieve positive safety results (accident prevention) through worker engagement.

Method: Data were collected using safety manager, supervisor and employee surveys designed to assess and link safety management system practices, employee perceptions resulting from existing practices, and safety performance outcomes.

Results: Results indicate the following: there is a significant negative relationship between the presence of ten individual safety management practices, as well as the composite of these practices, with accident rates; there is a significant negative relationship between the level of safety-focused worker emotional and cognitive engagement with accident rates; safety management systems and worker engagement levels can be used individually to predict accident rates; safety management systems can be used to predict worker engagement levels; and worker engagement levels act as mediators between the safety management system and safety performance outcomes (such as accident rates).

Implications: Even though the presence of safety management system practices is linked with incident reduction and may represent a necessary first-step in accident prevention, safety performance may also depend on mediation by safety-focused cognitive and emotional engagement by workers. Thus, when organizations invest in a safety management system approach to reducing/preventing accidents and improving safety performance, they should also be concerned about winning over the minds and hearts of their workers through human performance-based safety management systems designed to promote and enhance worker engagement.

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1. Introduction

Organizations often adopt safety management system or behavior-based system approaches to managing their safety functions in an attempt to achieve performance excellence. Organizations typically prefer adopting one system versus the other probably due to both pragmatic (e.g., resource and implementation constraints) and philosophical reasons. Commonly adopted safety management system approaches are described in consensus standards such as OHSAS 18001:2007 ([British Standards Institute](http://www.bsi.com),

2007), ANSI/AIHA Z10-2012 ([American National Standards Institute](http://www.ansi.org), 2012), and the OSHA's Voluntary Protection Program (VPP) ([Occupational Safety and Health Administration](http://www.osha-slc.gov), 2011). These consensus standards do not strongly emphasize the "human element" when developing and implementing the required processes and procedures described in these standards. Conversely, traditional behavior-based systems adopt observational methodologies where workers use a list of defined critical behaviors, observe workers for these behaviors, and provide feedback. However, more advanced behavior-based systems (e.g., antecedent-behavior-consequence systems; DO-IT systems) uncover and correct organizational barriers (i.e., management system deficiencies) that inhibit safe acts (and therefore accidents) from occurring.

The reality is that aspects of both of these systems are probably needed to effectively manage safety performance in organizations. An argument can be made that the two types of systems described above are complementary and that their respective strengths

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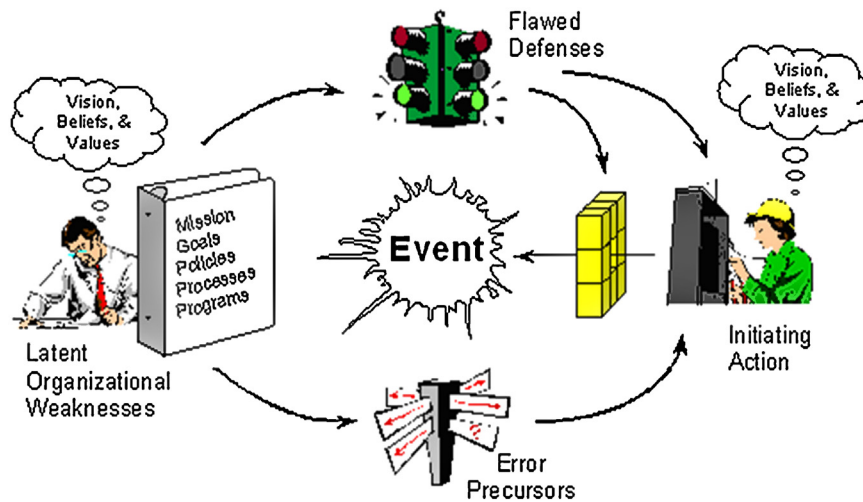


Fig. 1. Human performance approach to accident causation (U.S. Department of Energy, 2009).

can be merged into a more balanced and comprehensive system to managing safety and in preventing accidents from occurring (DeJoy, 2005). Both aspects are prominently featured in the human performance approach to safety management which attempts to understand and eliminate the causes of human error (and thus accidents or events) in the workplace from both safety management and behavioral systems perspectives (see Fig. 1). The human performance approach to safety management in organizations can be viewed as potentially spanning the rational, natural and open system organizational approaches as described by Scott (1981).

In human performance theory, mission, goals, policies, processes and programs (i.e., safety management system components) have latent organizational weaknesses that could give rise to flawed defenses and error precursors within organizations (Reason, 1990, 1997). These error precursors are unfavorable conditions that increase the probability of human errors while performing specific actions. Common error traps include time pressure, mental pressure, fatigue, being new to the task, distractions, and overconfidence (U.S. Department of Energy, 2009). In the human performance system, human error is merely a symptom of some trouble deeper in the system (Dekker, 2006).

It is probably inevitable that latent organizational weaknesses (and resulting flawed defenses and error precursors) will arise within a system of safety management practices for a number of practical reasons. First, safety management systems cannot plan for, control, and defend against all potential error-prone situations because in doing so work would need to be planned and controlled to such a high and constraining degree that it would be time-consuming, unworkable and uneconomical. Second, safety management systems tend to be institutionalized through policies, plans, procedures, and processes and therefore are not easily and readily adaptable to the natural and inevitable variations occurring in work being conducted and the hazards being encountered. Lastly, humans, who are fallible, design and implement safety management systems. Therefore, the lifeblood of a safety management system is shared with the managers and workers who have birthed the system and have given it daily life (and sometimes death).

From a behavioral perspective, workers bring their beliefs, values, and vision to the design and implementation of safety management systems and ultimately in performing work. In particular, the individual worker interfaces with the safety management system by participating or engaging (or by *not* participating or engaging) in the system. Motivation to participate can be affected by workers' beliefs and values, which can impact the workers' degree, quality and consistency of participation. When accidents

occur, the behaviors of workers, who are at the “sharp edge” of accidents and who interface with both the hazards and the safety management system itself, are closely scrutinized during accident investigations. This inquiry focus most likely leads to the often quoted and misapplied statistic that the vast majority of all accidents are caused by unsafe acts (i.e., human behavior) (Seo, 2005).

In the field of human performance improvement, there are a number of human performance tools that can be used to systematically reduce the chance of human error. These tools can be viewed as vehicles for providing mental and social skills that complement a worker's technical skills to promote safe and efficient task performance, such as carving out time to think about work, in particular the critical steps of that work (Muschara, 2012). Some human performance improvement tools commonly used include conducting pre- and post-task briefings, performing peer-checking, and using self-checking approaches such as “take-a-minute,” STAR (Stop-Think-Act-Review), and “stop and seek” for workers who do not believe they have the appropriate knowledge to make decisions (Wachter and Yorio, 2013). These human performance tools are emphatically “worker-centric” in that they engage workers to have more situational awareness concerning their safety, error traps present, tasks to be performed, and conditions/surroundings.

Worker engagement in safety may systematically act to reduce the probability of human errors from occurring by making workers more involved with and aware of their tasks/surroundings and associated risks, as well as error traps that could be present. Thus, increased levels of worker engagement in safety activities could possibly be related to increased safety performance as measured by standard safety outcomes (e.g., accident rates).

The overall goals of the two studies described in this article are two-fold: to theoretically and empirically develop the ideas around a system of safety management practices and to test its relationship with safety performance statistics such as accident rates (i.e., supporting a safety management system approach to managing safety performance) and to theoretically and empirically explore how these practices work (largely using a high performance work practice perspective) to achieve positive safety results through worker engagement (i.e., supporting an approach mediated by worker perceptions). If these goals are achieved, then the human performance approach to preventing accidents (i.e., a system comprised of both safety management and behavior-based system components presented in Fig. 1 and a system which is also represented by the person being the center of the safety management system presented in Fig. 2) is supported.

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