ART & SCIENCE OF MINDFULNESS IN THE PRACTICE OF SAFETY

By Linda F. Martin and Jan K. Wachter

MINDFULNESS IS DEFINED AS THE PRACTICE OF MAINTAINING a nonjudgmental state of heightened or complete awareness of one's thoughts, emotions or experiences on a moment-to-moment basis and "paying attention in a particular way: on purpose, in the present moment, nonjudgmentally" (Kabat-Zinn, 1994). Although mindfulness has its origin in Buddhist philosophy and meditation practice, it has been applied as a treatment for a myriad of things, most notably mental and behavioral health issues (Brown, Ryan & Creswell, 2007; Hayes, Luoma, Bond, et al., 2006). Research on mindfulness has increased almost exponentially since the late 1970s and early 1980s with nearly 700 journal publications on mindfulness being recorded in 2017 (AMRA, 2018), giving way to promoting mindfulness and its beneficial results for many different applications including workplace wellness.

A state of mindfulness has been associated with many behavioral conditions, such as conscientiousness (Giluk, 2009; Latzman & Masuda, 2013), engagement, including traits such as commitment, loyalty, productivity and ownership (Wellins & Concelman, 2005), and improved task performance (Dane & Brummel, 2014; Shonin, Van Gordon, Dunn, et al., 2014). Notably, mindfulness has been shown more recently to positively influence worker safety in several limited studies (Betts & Hinsz, 2015; Dierynck, Leroy, Savage, et al., 2017; Huber, Hill & Merritt, 2015; Nolan, 2017; Zhang, Ding, Li, et al., 2013; Zhang & Wu, 2014).

KEY TAKEAWAYS

- **Mindfulness has been applied increasingly to stress and wellness management; however, its importance to the practice of safety is just becoming recognized.**
- **Mindfulness fosters positive attributes linked with enhanced task-specific safety performance.**
- **Meditation training can be provided to line workers by adapting tools such as smartphone apps. Typical exercises include guided meditations, breath control, body scans, self/team focusing activities and examination routines.**

Mindfulness & Working in the Present Moment

Research on mindfulness in the workplace has mostly focused on the objective of trying to improve levels of work-related well-being (Van Gordon, Shonin, Zangeneh, et al., 2014). Companies such as Dow Chemical, Aetna, General Mills, Google, Nike, Ford and Apple have been using mindfulness initiatives such as meditation, yoga, breath control, stretching and the distribution of positive messages via e-mail and slide presentations to help employees reduce stress, improve mental and emotional resiliency, promote creativity, increase productivity and become more engaged with their work and each other (Mindful Spring, 2018; OnlineMBA, 2017; Pinsker, 2015). However, these mindfulness initiatives have been mostly aimed at executive and management level employees. Efforts on increasing mindfulness for line workers have been largely ignored.

According to Hafenbrack (2017), "mindfulness meditation is a practice [that] cultivates mindfulness, a state of consciousness in which people have *present* [emphasis added] awareness and nonjudgmental acceptance of internal and external experience." This idea is sourced from traditional definitions of mindfulness (Brown & Ryan, 2003; Dane, 2011; Kabat-Zinn, 1994) that have its primary focus on attention patterns tied to the present rather than on the past or the future. However, in accomplishing safe work and preventing errors or incidents, workers must exhibit mindfulness relative to the past, present and future simultaneously, and this requires a multipronged approach.

Focus on past and future events is generally accomplished through training, sharing lessons learned and creating job hazard analyses (JHAs) and their review with each task iteration. Because mindfulness techniques have the capability to induce an enhanced awareness of task detail and capacity for action (Joyner & Lardner, 2008; Weick, Sutcliffe & Obstfeld, 1999), incorporating more passive mindfulness techniques, such as anchoring the attention in the present moment, breathing exercises, mindful

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focus exercises and brief daily guided meditations, may positively influence how line workers manage their work in the present moment. Workers manage the present moment by addressing competing internal thoughts, controlling emotions and responding to the external environment during task performance.

Several studies have recently been undertaken to assess the effects of mindfulness in promoting performance-related behaviors (Dane, 2011; Dane & Brummel, 2014; Glomb, Duffy, Bono, et al., 2011; Hulsheger, Feinholdt & Nubold, 2015; Joyner & Lardner, 2008; Reb, Narayanan & Chaturvedi, 2014; van Vugt & Jha, 2011). Joyner and Lardner (2008) found that employing mindfulness training in the workplace has applications in improving task reliability and in promoting the contemplation of immediate dangers prior to the start of work tasks. Glomb, et al. (2011), found that mindfulness is associated with both a focused attention on the present and an increased breadth of awareness that allows employees to better receive signals during task performance, to put these signals into proper context and to make informed decisions on correct ways to proceed. Additionally, full attention to the present moment is directly tied to a mental state that suppresses conceptual elaboration or emotional reactivity (van Vugt & Jha, 2011). This more thoughtful and appropriate reactivity to the present moment and the ability to adapt without internal conflict may result in more confident employees who behave well under stress and uncertainty.

If incorporating mindfulness training can serve to increase workers' mindful uneasiness (see "Mindfulness Definitions" sidebar) and attentional control (e.g., employees maintaining attention to tasks), it is expected that safety rules and procedures can be better identified, recalled and followed under this relaxed yet focused state and overall job performance can be improved. Because reliability is an important factor in the pursuit of quality and safety, it stands to reason that by incorporating mindfulness activities in the workplace, incidents and their associated costs can be reduced. Mindfulness training would then be especially useful in workplaces and industries that are dynamic or demand acute attention to detail in support of preventing errors or incidents.

For example, Leung, Liang and Yu (2016) propose that construction workers are subjected to excessive stress due to the demanding and dynamic nature of the work. This stress results in higher incident rates and lower job performance. Mindfulness techniques can therefore be used as ways to induce adaptive coping and improve both safety and overall job performance. In this respect, the construction industry and its exposure of workers to tasks with high incident and fatality rates (e.g., work at heights, electrical work, operation of heavy equipment, use of power tools) may be a strong beneficiary of mindfulness training techniques.

Further, if mindfulness indeed lowers stress and anxiety, enhances focus and improves attentional performance, tasks that require an instinctual, focused response, such as implementation of an emergency action plan, may also greatly benefit from mindfulness training.

Mindfulness Within a Human Performance Context

Reason's (2016) human performance (HP) model can be used as a theoretical framework to establish and understand the links between mindfulness, reduced human error and improved safety performance. Reason suggests that human errors are of three types: skill-based slips and lapses, rule-based mistakes and knowledge-based mistakes. He describes slips and lapses as unintended actions. Slips arise from attention failures, while lapses arise from memory failures. Mistakes are actions that are executed as planned, but the plan itself is insufficient to achieve its designed outcomes. Mistakes are further categorized as rule-based and knowledge-based mistakes. Rule-based mistakes involve misapplying good rules or applying bad rules when dealing with familiar tasks or problems (Reason, 2016). Knowledge-based mistakes arise when workers must think on their feet in unique situations after running out of ready-made solutions (Nnadede, 2017; Reason, 2016).

The link between mindfulness and safety performance becomes obvious when examining preconditions that promote these errors. Slips and lapses most likely occur when workers are distracted, inattentive, preoccupied, stressed, tired or have forgotten the tasks at hand (Cohen, LaRue & Cohen, 2017; Reason, 1999). Reason (2016) further notes that psychological and situational conditions provoke memory slips. Psychological conditions (such as attention capacity) come into play when workers' minds are so preoccupied with something else that there is little or no attentional capacity left to concentrate on the tasks at hand. Situational conditions that provoke error include change or uncertainty in the task or the situations surrounding the effective performance of the task (Reason, 2016). However, a state of mindfulness helps to ensure focus on the task at hand, the effective switching of attention from one object to the other (Posner, 1980), and identifying and dealing with changes and uncertainty in the work environment (e.g., situational awareness leading to appropriate action). A state of mindfulness is especially critical when operating in a knowledge-based performance mode when workers must be focused and rely on their own understanding and knowledge, perceptions of present circumstances, and discerning similarities and patterns to previous conditions to prevent active error (Nnadede, 2017; Wachter & Yorio, 2013b).

Mindfulness Within a Safety Management System Context

In recent years, organizations have been increasingly using safety management systems (SMS) to more effectively detect and correct hazards, control and reduce risk, and better utilize information for measurement and continuous improvement purposes. Wachter and Yorio (2013a) suggest using a hybrid HP and SMS model as an enhanced approach to SMS. The approach posits that workers should be the center of processes, procedures, facilities, methods and practices (Figure 1, p. 32) and, thus, are the first and perhaps best line of defense in detecting and reacting to errors or flaws in SMS. In this approach, worker mindfulness has a place front and center in implementing an effective defensive SMS strategy and in achieving SMS improvements (e.g., being mindful to improvement opportunities with methods, practices, processes and procedures) (Figure 2, p. 32). A mindful account-

MINDFULNESS DEFINITIONS

Following are several definitions related to the human performance/safety management systems approach to workplace mindfulness.

•Mindfulness: Paying attention in a particular way, on purpose, in the present moment, nonjudgmentally.

•Psychological safety: A shared belief that the worker is safe for interpersonal risk taking.

•Mindful accountability: Acknowledgment by the worker that s/he is the center of the safety management system.

•Mindful adaptivity: Workers are focused and alert and can adapt to unanticipated hazards and changes.

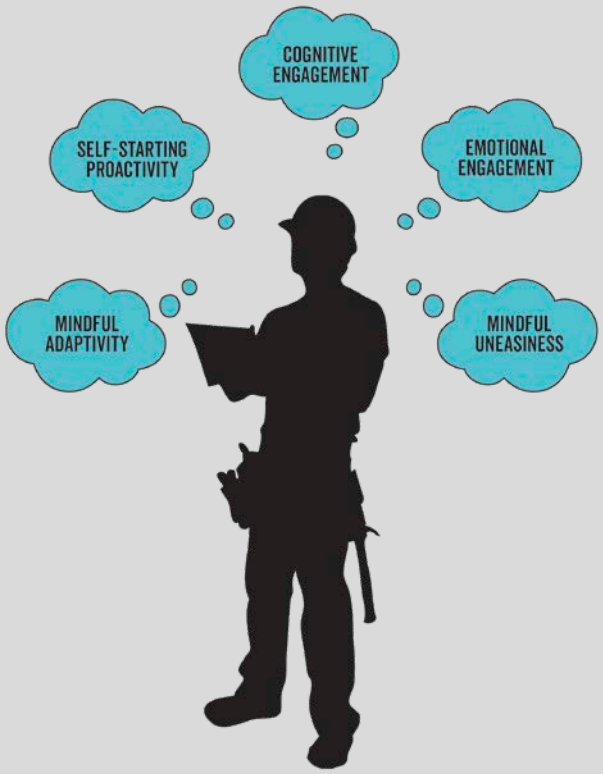
•Mindful uneasiness: Workers approach their work tasks with thoughtful caution.

FIGURE 1
HP/SMS SYSTEM

The worker is the center of the HP/SMS system that can achieve positive mindfulness results.

FIGURE 2
THE POSITIVE ATTRIBUTES OF MINDFULNESS

Mindfulness fosters many positive attributes as to how workers should approach their daily tasks



ability of this fact/duty with workers can prepare a strong base for SMS sustainability and effectiveness.

If workers feel psychologically safe (i.e., empowered to make suggestions for improvement, report and correct hazards, and respond to uncertainty and changes in their work environment by adjusting the SMS without fear of reprisal), then mindfulness initiatives may have a significant place as antecedents in this continual improvement process. Likewise, because there is evidence to support a connection between increased states of mindfulness and self-regulation, resilience, better social relationships and improved task performance (Good, Lyddy, Glomb, et al., 2016), mindfulness training initiatives should have a positive effect on safety performance.

Worker engagement (Figure 2) is a major key for making an HP-centered SMS work. Worker engagement may be influenced by the workers' degree of mindfulness, being in the present moment. Through the conduit of mindfulness, worker engagement in everyday normal work activities may make things (e.g., SMS) go right because workers can be more attuned to overcoming SMS design flaws and operational glitches, adapting their performance to meet changing task demands, correctly interpreting and applying procedures to match conditions, detecting and correcting when things go wrong, and identifying and understanding error prone situations and defend against them (Wachter & Yorio, 2014).

Mindfulness leads to feelings of engagement, which in turn can nurture self-starting proactivity (Figure 2), mindful adaptivity and proficient compliance (Parker, 2011). Self-starting proactivity requires cognitive and emotional engagement on the part of workers and may be one key to making the HP/SMS hybrid approach to safety management a sustaining success. Cognitive engagement reflects workers' active focus on the present moment, which can promote attention to and concentration on the execution of work tasks. This cognitive engagement can result in workers adopting a cautionary mindful uneasiness as they approach their tasks, even during repetitive work. Emotional worker engagement reflects both enthusiasm for and interest in the SMS's programs developed by organizations (Wachter & Yorio, 2014) leading to compliance with SMS requirements. Safety-centered cognitive and emotional employee engagement can be used as a defense against the flaws in the SMS as well as employees' limitations. Thus, it is important to promote in organizations the active engagement of workers in both their work and its safe functioning through mindfulness initiatives, such as offering mindfulness training.

Mindfulness can lead to workers appropriately adapting in real time to changing situations. This mindful adaptivity and flexibility are desirable employee characteristics to have, given that incidents often arise from changes in work, especially in complex, interdependent systems. This mindful adaptivity, involving monitoring and reporting small signals that suggest system breakdown in real time, cannot be easily realized without having worker engagement, worker trust and a state of mindfulness. A part of achieving mindful adaptivity is embracing those employees who disclose errors and mistakes, thus reinforcing a proactive worker engagement within a learning and psychological safe culture (Wachter & Yorio, 2013a).

Self-starting proactivity relies on using employees' initiative to suggest and bring about improvements, including anticipating and taking charge of potential problems, which can be critical in preventing or reducing the impacts from organizational SMS deficiencies (e.g., latent failures often discovered during accident investigations). Motivating proactivity is difficult to achieve without worker engagement (Wachter & Yorio, 2013a) and a state of mindfulness. Organi-

zationally sanctioned, self-starting worker proactivity can increase the self-confidence that workers need to go beyond the technical core and mere compliance by increasing autonomy and participation in decision making related to their own work functions (Parker, 2011). This builds ownership, creates a psychologically safe environment for workers and fosters mindful adaptivity (Wachter & Yorio, 2013a). Engaged and mindful workers can be remarkably adaptive and compensate well for uncertainty and threats in the workplace, and things can go right in light of such uncertainty because of workers' personal defenses and concern for their own well-being fueled by a sense of mindfulness (Wachter & Yorio, 2013b; 2014).

Thus, the application of mindfulness philosophy to worker safety and the HP/SMS approach becomes clear: if workers feel psychologically safe to make on-the-spot decisions that affect the safe accomplishment of work, then their combined states of mindfulness, mindful uneasiness and mindful adaptivity (Figure 2) can impact the quality of their decisions from a safety perspective. Indeed, if psychological safety, self-starting proactivity, mindfulness, mindful uneasiness and mindful adaptivity are cohabiters in workers' minds, quicker and better adaptation to potential hazards, errors or error precursors occurring in the present moment can be realized and corrected (Figure 2). This benefit is supported by the literature which indicates that improved self-regulation of thoughts, emotions, behavior and psychological reactions (Glomb, et al., 2011) and improved working memory (Chiesa, Calati & Serretti, 2011) can be achieved through mindfulness-based practices.

Mindfulness vs. a Behavior-Based Safety Context

Mindfulness initiatives should not be confused with traditional behavior-based safety (BBS) initiatives. Traditional BBS initiatives rely on workers observing other workers' behaviors. In BBS theory, consequences control behaviors and observers' supportive or constructive feedback to those being observed acts as consequences potential reinforcing safe behaviors (supportive feedback) and not reinforcing unsafe behaviors (constructive feedback). In addition, workers use peer pressure on other workers to exhibit safe behaviors to attain organizational or department-level BBS goals and possible recognition and awards.

Mindfulness initiatives, on the other hand, attempt to do several things to reduce human error, such as enhance worker focus, reduce stress, promote caution and hone workers' abilities to identify, acknowledge and deal with uncertainties in the workplace. It is more than using BBS-like psychology to change behaviors as an end result (consequences). Mindfulness changes how behavioral triggers (e.g., organizational and individual error precursors) are handled. Mindfulness attempts to arm workers with strategies to deal with potential error both offensively (e.g., workers approaching tasks with mindful uneasiness, focus and lower stress levels) and defensively (e.g., workers dealing appropriately with error precursor conditions once identified).

Thus, mindfulness training may be more powerful than BBS training since the former potentially changes the characteristics of workers as they deal with uncertainty and the less-than-optimal work environment, while BBS training supports the reflection of a certain inventory of safe behaviors that may not be comprehensive or specific enough to safely accomplish tasks, especially under changing or unique circumstances.

Implementing Workplace Mindfulness Training

The authors propose that mindfulness training must involve three important elements to be effective:

1) attention to the present moment;
2) attention to internal and external influences;
3) attention without judgement.

By paying attention to the present moment, workers can detach themselves from automaticity, disrupt unsafe patterns and create focus on identifying areas for improving task performance.

Use of traditional guided mindfulness techniques (Figure 3) that can be adapted to fit into normal work activities include shortened, informal daily exercises aimed at cultivating an accepting and non-judgmental attitude to the present moment experiences:

- focus on body sensations (called body scan techniques);
- breathing space exercises (breath awareness for prescribed lengths of time);
- focus on daily routine activities with mindful awareness (e.g., eating, walking);

FIGURE 3

DAILY EXERCISES AIMED AT CULTIVATING PRESENT MOMENT EXPERIENCES

	MINDFULNESS ACTIVITY	DESCRIPTION	POTENTIAL WORKER BENEFIT
	GUIDED MEDITATION	3-minute grounding meditations at the beginning or throughout the workday.	Reinforce psychological safety and mindful accountability and set the mind to the task(s).
	BREATH CONTROL	Exercises comprised of counting of breaths and attention to breathing movement.	Lower blood pressure, reduce stress, increase alertness and improve attention span.
	BODY SCAN	Focus the mind from specific body parts to whole systems (and back again).	Train the mind to move agilely between focused attention to a wider awareness from one moment to the next.
	SELF/TEAM FOCUS	Repetitive statements aimed at ingraining compassion for self and others.	Increase self-awareness, empathy and concentration, lower stress and promote positive relationships.
	EXAMINING ROUTINES	Quick task-specific meditations for high risk or repetitive operations.	Promote mindful uneasiness and mindful adaptivity relative to potential hazards and outside influences.

•adapted "loving kindness" exercises (initial focus on the breath/self, then direction of positive feelings toward others including difficult persons);

•specialized guided daily meditation modules at the beginning or throughout the work day.

Traditional mindfulness training techniques are rooted in programs that were first created for improving overall physical and mental health: mindfulness-based stress reduction and mindfulness-based cognitive therapy. However, these programs typically last up to 8 weeks of formal classes with the addition of self-regulated daily practice. Pragmatically, mindfulness training for line workers must be adapted to accommodate the organization's need not to extensively interrupt or have detrimental effects on production, service or accomplishment of work tasks. Mindfulness initiatives, such as meditation, mindfulness classes or yoga in an executive office atmosphere, can be 60 to 90 minutes over a lunch period or before and after work. Mindfulness training for job sites or line workers likely must be even more compressed (e.g., 10 minutes or less, but occurring multiple times each day).

In a working environment where organizations live by metrics (e.g., cost, productivity, safety), the use of mindfulness training and the generation of specific mindfulness programs and apps targeted toward line workers will need to be evaluated. Cost benefits due to the reduction in incidents and errors over time must be compared with costs of mindfulness training and program implementation (e.g., time consumed, training costs, productivity disruptions). However, the real benefits of mindfulness training that should be embraced by senior managers may be reflected in more contented, engaged, happier and less stressed employees, effects that may be difficult to directly quantify with traditional metrics.

As noted, adaption of traditional time-intensive mindfulness training programs to line workers should be performed. Targeted smartphone apps may be the answer. The generation of these apps has advantages of portability and accessibility and can be adapted to integrate key components of mindfulness training (e.g., guided meditations, breathing exercises, body scans) along with company and task-specific objectives and situations.

The use of these mindfulness training components, either pretask or at the beginning of the work day, would promote the following (Figure 1, p. 32):

•affirmation of psychological safety (i.e., workers are supported by the organization when workers manage their SMS to meet task demands, make suggestions to improve the SMS, or challenge assumptions concerning the SMS design and its implementation);

•confirmation of the centrality of workers in the SMS (i.e., SMS depends on focused and psychological safe workers as the center of the system to safely execute work and to adapt work to changing circumstances);

•disruption of automaticity (i.e., workers have acute awareness of the task construct and requirements even for repetitive tasks);

•creation of focus on the specific task or process (i.e., workers effectively deal with distractions);

•awareness and rejection of competing environmental, emotional, psychological and physical factors not conducive to the work (i.e., workers have the ability to notice competing factors but can also deflect and manage them).

The creation of a state of mindfulness is a slow process. Commitment to the underlying behavioral and cognitive changes that must occur takes time and effort on the part of workers and must be reinforced by a company's culture that promotes and supports the mindfulness process. That is, workers must feel that mindfulness initiatives are important parts of their performance expectations and safe work behavior and that time spent on mindfulness activities is considered an integral part of their work day preparation. A few ways that employees can be motivated and more willing to participate in mindfulness training approaches are by tying participation to existing wellness benefits (e.g., discounted medical premiums) or adopting a metrics-based approach that rewards team participation (e.g., outings, catered meals). Whatever approach is chosen to motivate employee participation, the support of management is required as with any safety management system initiative.

By lowering stress, improving focus and enhancing the ability to cope with both outside influences and factors of uncertainty, mindfulness can aid in positively affecting workers' ability to connect with the work, their environment and coworkers. If workers have been indoctrinated into a state of mindful uneasiness, mindful proactivity and mindful adaptivity (Figure 2, p. 32), incidents may be prevented or mitigated. Further, a growing confidence in this state of mindful situational awareness may result in not only a focus on the workers' own task behavior, but in a greater awareness of the behaviors and unsafe conditions and acts occurring around them.

In a group of 140 participants, Hulsheger, et al. (2015), showed that positive effects of mindfulness training were reported after as few as 10 days of self-administered mindfulness exercises lasting an average of 10.5 minutes per day. Study participants included various job types, but notably included many higher stress, dynamic, frontline jobs such as healthcare professionals, police officers, civil servants and teachers. Hulsheger, et al., indicated that additional insights likely could be gained from extending the treatment period to 4 or more weeks, but that the positive effects would eventually plateau.

The limited research conducted to date on mindfulness field interventions has evaluated participation periods ranging from 10 days to 10 weeks (Hafenbrack, 2017). Although it is likely that many transient or temporary workers could benefit from these techniques, due to the limited time these workers are with a company, mindfulness-based training may not be offered to them (as with other types of training). Nonetheless, these workers should be included in any such initiative on the chance that even a limited benefit could be realized.

A major question remains: Can line employee mindfulness training occurring in short, recurring cycles result in positive, repeatable and documentable influences on those factors related to major outcomes that safety professionals seek: reduction in task errors, prevention of incidents and better interpersonal relationships (e.g., better communication, reduction of conflict)? Evidence suggests that it will. As noted, studies conducted by Leung, et al. (2016), show that stress results in higher incident rates and lower job performance. If incorporating mindfulness techniques can lower stress and anxiety and increase focus and attentional awareness, then a reduction in incidents and better job performance seem likely and repeatable end results.

Conclusion

Studies are planned to take place over the next few years at Indiana University of Pennsylvania to test the effectiveness of mindfulness training on line employees in a highly dynamic work environment such as construction where mindfulness-based training does not appear to have yet been tested as an interventional technique for safety performance improvement. These planned empirical studies using the mindfulness training construct with line workers in dynamic work environments may hold the key to understanding how revolutionary this tool can

be to employers, workers and safety professionals from a safety perspective. It is hoped and even likely that the concept of mindfulness and mindfulness training will eventually be as important in the practice of safety as it has been in other disciplines. **PSJ**

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Linda F. Martin, CSP, PG, CHMM, SMS, CIH, is a doctoral student in the Department of Safety Sciences at Indiana University of Pennsylvania. She is corporate safety director at Bay Crane, an adjunct faculty member at Embry-Riddle Aeronautical University and a faculty member at Columbia Southern University. She holds a B.S. in Geology, an M.B.A. and an M.S. in Occupational Safety Management. Martin is the 2018 President of the Board of Directors for the Board of Certified Safety Professionals and a BCSP Ambassador. She is a professional member of ASSP's Granite State Chapter.

Jan K. Wachter, D.Sc., CSP, CIH, CQE, CRE, is a professor and Ph.D. coordinator in the Department of Safety Sciences at Indiana University of Pennsylvania. He holds a B.S. in Biology, an M.S. in Environmental Health, an M.B.A. and a D.Sc. in Hygiene from University of Pittsburgh. Prior to his academic career, Wachter was employed by Fortune 100 companies and the federal government as an environmental safety and health administrator and researcher. He is a professional member of ASSP's Western Pennsylvania Chapter.