Predicting and Improving Safety Performance

EXECUTIVE SUMMARY

Organizations interested in improving productivity and quality are increasingly looking to environmental health and safety practices and performance. Studies that examine safety performance show that organizations that perform well in safety tend to perform well across the board. Conversely, evidence points to a predictive relationship between specific organizational health metrics and safety outcomes.

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Safety is a performance leader that many organizations are using as the first line of defense in building a responsible, productive, and effective organization. The difficulty in leveraging this link is learning how to advance safety management into defining a new set of indicators by which to steer safety functioning effectively.

Organizations commonly search for one all-inclusive safety measure that determines success or failure. Many organizations attach a great deal to this single number, whether it is lost-work case rate or total-recordable or medical-case rate (OSHA recordable rates in the United States). But no single measure can reliably tell you whether systems, the culture, and safety leadership practices are aligned and driving performance to a predictable result. Latching onto a single leading indicator is equally problematic.

Rather than tie safety performance to this binary thinking (i.e., we are either going up or down), this article proposes a set of metrics that paint a three-dimensional picture of performance. While not comprehensive, this set provides a foundation for understanding the nature and severity of exposures, the contributing factors in systems and practices (for example, how we select employees or make decisions), and the alignment of organizational culture with stated goals. Properly adapted, these indicators provide a set of tools that allow organizations to predict and improve safety performance systematically.

Indicator One: Exposure

The primary purpose of organizational safety initiatives, whether at the site or corporate level, is to reduce exposure to hazards in the workplace. Hazards refer to the configuration of equipment, facilities, systems, and actions that define the interaction of the worker with the technology. Known as the working interface, the more exposure in this configuration leads to a higher probability of an injury or other undesired event. An organization with 100,000 exposures can expect between zero and four undesired incidents with a magnitude of severity falling anywhere along the continuum of near-miss to fatality.

While there is some debate about the frequency of exposure events to injury events (and it is a serious mistake to assume that exposure events are equal in the severity they represent), it is generally accepted that many small and less severe events precede a single large or serious one. Those smaller or less severe events may be similar in type but lower in severity (small leaks vs. large leaks) or may be precursors in a chain of events leading to the major event (failure to blank a line leading to a major fire).

Exposure data provides a powerful upstream indicator of safety functioning, provided that it is collected in a manner that is statistically valid; that is, that the mechanism assures the right exposures are measured, and a sampling plan is followed that assures adequate, high-quality data is collected in the right situations. Measurements typically take the form of an observation and feedback system, sometimes called a behavior-based safety or employee engagement system that enlists employees in capturing data on exposures at the working interface. The employees are trained to observe their peers openly and conduct two-way feedback to capture the number and nature of exposures in the interface and document the factors creating them.

As opposed to injury data, which is subject to natural variation, exposure measurement provides predictive data that allows organizations to design and justify precise interventions upstream of injuries. The largest study of this approach ever published is based on a sample of 153 locations and shows that the average site achieves a 25 percent improvement in injury rate over baseline in the first year, increasing to 55 percent improvement over baseline in the fifth year. The top 25 percent of users achieve better than 45 percent improvement over baseline in the first year, increasing to 72 percent in the fifth.

Indicator Two: Organizational Culture

Exposure data, though proven, is not sufficient for comprehensive improvement. Even with identical safety systems, technology, and work forces, two sites can report very different incident frequency rates. A study of sites using the same behavior-based safety technology showed that among the strongest indicators of success were the culture of a workplace and the quality of leadership within the organization.

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Culture refers to the unwritten assumptions that influence decision making, attitudes, beliefs, and behavior of those in the culture. In 1999, Behavioral Science Technology Inc. (BST) identified nine factors in the research literature that independently correlate to safety performance and that make up the organizational culture diagnostic instrument (OCDI). Interestingly, only three of the nine dimensions are safety specific. These nine factors can be measured and expressed as percentile scores comparing one organization with many others. Based on the specific profile, the organization can develop interventions that leverage the high-functioning areas to improve lower scoring areas. The nine factors BST identified are:

- ***Procedural justice.*** The extent to which the individual worker perceives fairness in the supervisor's decision-making process.
- ***Leader-member exchange.*** The relationship the employee has with his supervisor. In particular, this scale

measures the employee's level of confidence that the supervisor will look out for the employee's interests.

- ***Management credibility.*** An employee's perception that management's words are consistent with its actions.
- ***Perceived organizational support.*** An employee's perception that the organization cares, values, and supports her.
- ***Workgroup relations.*** The perception the employee has of her relationship with co-workers. How well do they get along? To what degree do they treat each other with respect, listen to each other's ideas, help one another out, and follow through on commitments?
- ***Teamwork.*** The extent to which the employee perceives that working with team members is an effective way to get things done.
- ***Safety climate.*** The extent to which the employee perceives that the organization values safety performance improvement.
- ***Upward communication.*** The extent to which communication about safety flows freely upward through the organization.
- ***Approaching others.*** The extent to which employees feel free to speak to one another about safety concerns.

In a proprietary study published in March 2006, BST sought to demonstrate the practical significance of the extensive evidence on the OCDI's validity. This study included 94 organizations that used the OCDI, and we tracked 12 months of occupational injury rate data. The top third of the organizations that scored consistently high across all OCDI scales averaged an occupational injury rate of 4.3 injuries per 100 employees per year, while the bottom third averaged 8.5. Clients in the middle third averaged 5.8 occupational injuries per 100 employees per year. The difference between the three groups was statistically significant: ($r = -0.33$, $p < 0.01$).

Organizations in this study came from eight countries and from 18 industries. Despite the variety of organizations included — their different businesses, variations in the strengths of their leadership, and safety systems — consistently higher OCDI scores across all scales are far more desirable than low ones.

Individual ratings

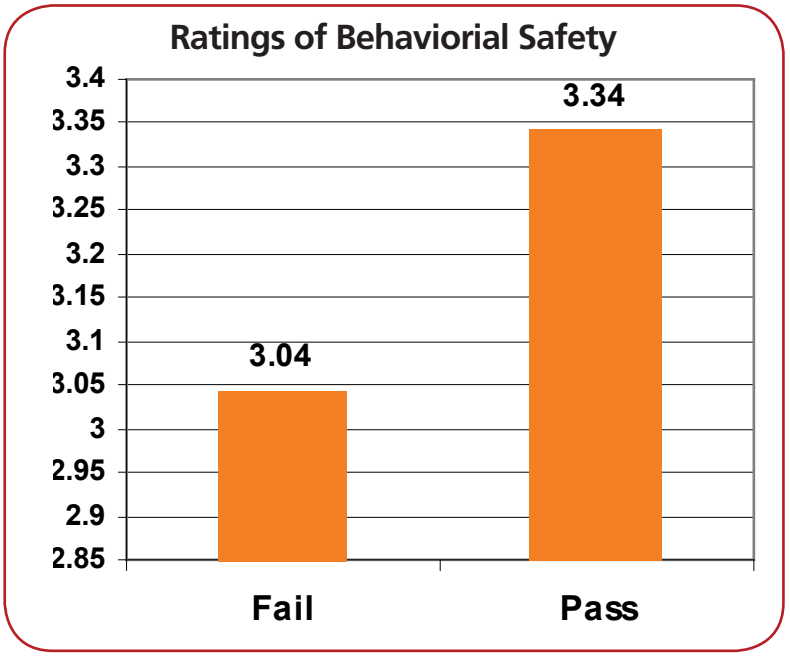

Figure 1. Individuals who passed the Safety Orientation scale were rated significantly higher on behavioral safety by supervisors.

Effective safety leadership starts with the leader's value for people and safety ethic.

Indicator Three: Leadership

Existing literature about leadership influences on safety and organizational culture show that there are definable behavioral practices that recur among effective safety leaders. Research has identified a set of leadership characteristics that predict organizational culture and safety performance — a framework within which the leader influences safety outcomes. This framework comprises three categories of leadership characteristics:

- ***Personal safety ethic.*** Effective safety leadership starts with the leader's value for people and safety ethic. These elements influence safety decision making, interactions with subordinates, the priority the leader places on safety, and how the leader drives success.
- ***How the leader influences.*** Solid research exists on the relationship between leadership style and safety results. A leader's influencing style consists of four dimensions that describe how she motivates and inspires people to go above and beyond the letter of their jobs. The *influencing* dimension establishes the basic credibility and principled action so critical to forming relationships. The *engaging* dimension creates

Supervisor ratings

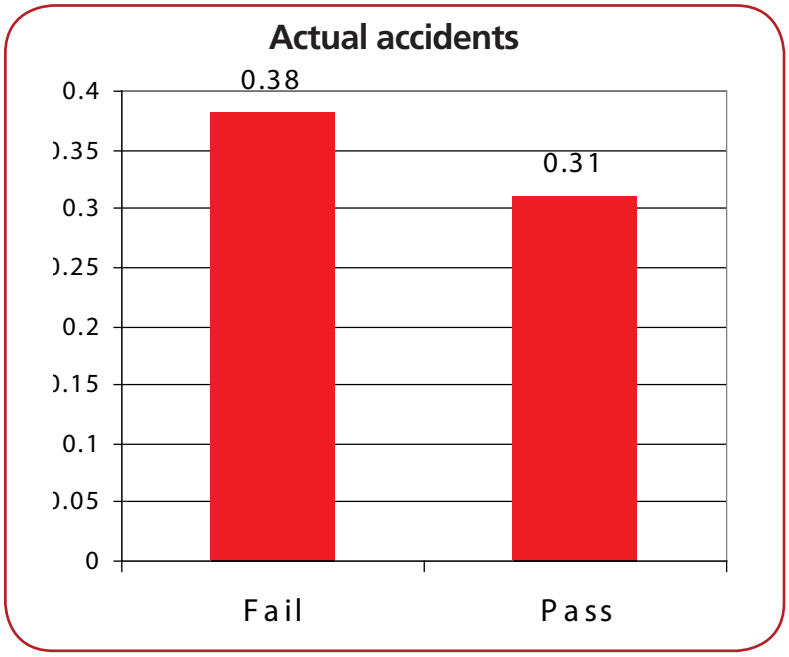

Figure 2. Supervisor ratings of behavioral safety and a measure of accident frequency over the previous year were collected as criterion measures for the Safety Orientation scale.

relationships based on mutual respect and understanding. The inspiring dimension propels these relationships toward an improved future, while the challenging dimension helps break down paradigms that get in the way.

- ***What leaders do.*** Creating the kind of culture where safety is a driving value is something leaders do through their day-to-day actions. In the most effective safety leaders, certain behaviors and qualities are observed including vision, credibility, action-orientation, collaboration, communication, recognition and feedback, and accountability. In a series of studies, BST found that direct report ratings of a leader's influencing style predicts the leader's best practices, which aggregate across leaders to predict the characteristics of organizational culture and safety climate ($r = 0.34$, $p < 0.05$). Culture and climate are the strongest direct predictors of safety outcomes among the entire set of variables studied. Research also provides convincing evidence of the strong impact leadership has on the success of organizational initiatives.

Our experience has shown that these characteristics can be developed among leaders wishing to become more effective safety leaders. In 2005, we compared results of two groups of organizations who implemented BST's employee engagement process (BAPP technology). Results from the first group of 153 clients showed that on average, these organizations reduced their frequency of incidents by 25 percent in the first year. The second group of 16 organizations had us work one-on-one with at least three of the top leaders on safety leadership development concurrently with their BAPP implementations. On average, this group achieved 40 percent improvement in the first year, significantly better than the improvement the clients with BAPP initiatives alone achieved.

Indicator Four: Effect of Selection on Improving Safety

Workplace safety is often attributed to two broad factors: characteristics of the environment and characteristics of the individual. The philosophy of a personnel-selection approach to improving safety is based on identifying individual-difference (ID) characteristics that differentiate applicants who are likely to engage in safe behaviors from those who are not. By finding which variables reliably and consistently predict safe behavior, organizations can screen for such characteristics in their selection process. In this section, we take a look at the existing research on several ID characteristics that have been studied as predictors of workplace safety.

Personality has long been thought to be a relevant characteristic for the prediction of workplace safety. One well-researched conceptualization of personality is the five-factor model (FFM), based on the following traits:

- **Conscientiousness:** Reliability, thoroughness
- **Openness to Experience:** Curiosity, creativity
- **Extraversion:** Talkativeness, assertiveness
- **Agreeableness:** Kindness, trust, selfishness
- **Neuroticism:** Nervousness, moodiness

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A meta-analysis of the extant research connecting the FFM traits with safety outcomes provides several suggestions. First, neuroticism and agreeableness appear to be the most consistent FFM predictors of accidents across settings ($r = 0.28$ and 0.61, respectively). Second, openness to experience and conscientiousness appear to be moderate-to-strong pre-

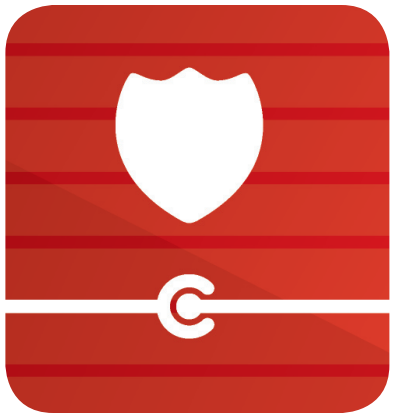
dictors of safety outcomes, but may not be generalized across all positions (r = 0.50 and 0.30, respectively). Finally, extraversion may not be as strong of a predictor of safety outcomes in occupational settings (r = -0.09).

In 2001, Select International developed the Select Safety Orientation scale, a short measure comprising personality statements and scenarios placing candidates into realistic situations where they are instructed to rate the appropriateness of various ways of handling situations. As part of a larger study, the Safety Orientation scale was administered to a group of 384 existing production employees from 14 facilities of a large United States-based manufacturing company. Supervisor ratings of behavioral safety and a measure of accident frequency over the previous year were collected as criterion measures. Scores on the Safety Orientation scale were then correlated with these criteria.

The correlation between the Safety Orientation scale and safety ratings was positive and statistically significant (r = 0.23, $p < 0.001$). Accident data is often not normally distributed and skewed; here, the data fit what is referred to as a Poisson distribution where correlation coefficients do not provide an adequate measure of association. However, we established a cutoff score for use in selecting individuals into production positions. A comparison of those who passed versus failed the Safety Orientation scale is displayed in Figures 1 and 2.

Results show that individuals who passed the Safety Orientation scale were rated significantly higher on behavioral safety by supervisors ($F = 10.52$, df = 1,317, $p < 0.001$) and had fewer accidents (0.31 to 0.38), although this relationship is not statistically significant.

The positive results of this study led us subsequently to include the Safety Orientation scale in the selection process for production employees. In 2005, a follow-up study was conducted to evaluate the performance of the overall selection process and to ascertain the impact on accident occurrence. A comparison of accidents over a one-year period between those hired using the new selection process (including the Safety Orientation scale) and the original baseline sample revealed that accidents had decreased significantly ($t = 218$, df = 328, $p < 0.05$). In fact, as shown in Figure 3, accident rates decreased by slightly more than 70 percent. While it's not possible to determine what percentage of this change is attributable directly to the Safety Orientation scale, it's fair to assume that it did play a meaningful role.



Selection tools help us understand the importance of human factors on safety outcomes and define new ways to engage key stakeholders.

Research has focused on numerous predictors of safety outcomes, primarily in the domains of personality and ability. The reality for most organizations is that achieving safety excellence is a marathon, not a sprint. New ways to measure, predict, and improve safety performance can help organizations rethink old paradigms of what safety means and what constitutes success. For instance, an exposure focus helps us understand whether our outcome indicators are significant or "luck." Selection tools help us understand the importance of human factors on safety outcomes and define new ways to engage key stakeholders.

As with other business systems, the effectiveness of the tools depends on how we use them. Tools must be adapted within the context of a well-defined strategy that articulates what we are seeking to accomplish, the roles and responsibilities of specific individuals and groups in the organization, and an understanding that safety outcomes are created by a complex configuration of business systems and objectives. A well-planned strategy both influences our selection of tools and helps us ensure that the tools we do use are optimized for safety and organizational excellence. ❖

New-hire ratings

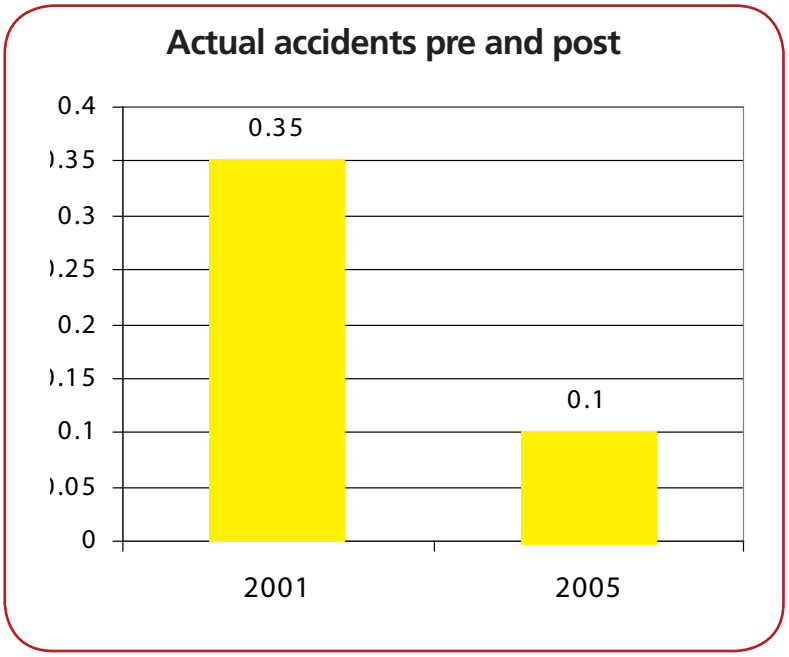


Figure 3. A comparison study of new-hire rates of safety after the creation of Safety Orientation showed a 70 percent decrease in workplace accidents.