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# Applying Force to Deliver Desired Safety Results

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Several years ago, when I was speaking to a group of young safety professionals, one individual asked me to comment on what I felt the key responsibilities for the role were in terms of achieving desired safety results. My immediate response was: "Our job as safety leaders is to *force* employees to make the right decisions by removing variables that drive people to make the wrong decisions." The result was immediate silence from everyone in the room. For many, using the word "force" in conjunction with work objectives felt both inappropriate and wrong. Thinking back, that day may have been as much my personal introduction to *political correctness* as to how organizationally sensitive we had become.

In a decade of forward-thinking process improvement strategies, controlling process variation is not a new concept. Many successful safety programs have been built around the simple concept that reducing variables and stabilizing the production process will support the objective of producing world-class quality. In terms of Occupational Safety and Health, and quite aggressively over the last two decades, safety professionals, statisticians and psychologists have studied a similar issue–what one might refer to as *Safety System Control*. In a literal sense, this simply means the ability to identify, evaluate and eliminate those variables that pose the greatest risks—to the process, the product stream and ultimately, to the people who are doing the work. Forty years ago, the job of a safety professional was primarily focused on controlling the physical environment — brought on by the regulatory outcomes of the 1970 OSHA Act. Over the past two decades, we've experienced a shift toward improving worker behavior through better decision making. More recent and, one might say, innovative approaches to safety training and skills development have dominated work plans as we determined that both knowledge and skills are equally valuable components of an effective safety strategy. What is not widely understood is that while some organizations are gaining ground, others are still driving thematic safety plans that *lack* process balance. In quality circles, this points to uncontrolled variability within the work system.

Philip Leather, in his book "Safety and Accidents in the Construction Industry," researched construction safety from a work-design perspective. His research suggests that a multi-factor approach to analysis is necessary to understand safety-system failure. He states, "The study of construction safety revealed a complex array of diverse, yet often closely interrelated, factors and relationships." He also writes, "a recurring obstacle to developing effective strategies for improving the industry's safety record has been its overriding acceptance of single-variable analysis, in particular, its preoccupation with the concept of carelessness as a unifactorial and unqualified explanation of accidents." Leather goes on to say, "What is needed is understanding and explanation, which emphasizes the multiplicity and complexity of accident causation, especially the interrelation of individual, organizational and job variables." What Leather is saying here is that there are certainly more factors to consider in determining why loss occurs in the workplace.

Some years ago, I participated as a third-party investigator where a worker was killed while performing a work task on equipment that was not isolated from its energy sources. The investigation revealed that the worker reached into the equipment to clear a machine jam and while doing so, caused the equipment to move when the jammed product dislodged. He was then crushed in the equipment. As I interviewed employees who witnessed the unfortunate event and analyzed the scene and the equipment involved, my reaction was simply: *Why?* The hazards appeared to be clearly evident, the facility's energy-isolation procedure was complete, and records indicated the employee had been sufficiently trained. Thinking back on the situation now, I feel the worker's decision to work on potentially harmful equipment without it being safely isolated from its energy source is upsetting, but frankly not surprising. In fact, it happens every day in manufacturing facilities throughout the world. But it begs the question, "*What were the* ***uncontrolled variables*** *that drove the worker to make such a poor decision*?" Understanding two key quality management terms may help with understanding variables that reside in the work system:

- **Latent Errors** are errors in design, management decisions, organization, training, or maintenance-related errors that *lead to* operator errors. The negative consequences of these mistakes often lie dormant in the system for long periods of time.
- **Active Errors** occur at the front-line operator level and their effects are felt almost immediately.

My investigation of the fatality revealed latent errors dating back years before the incident. The machine was poorly designed and inadequately guarded. Training had been performed and procedures written, but the capability development plan lacked a *quantifiable method* for measuring success. The preventive and reactive maintenance plan was weak and there was a lack of management leadership, discipline and control. The organization allowed too many variables (or *latent errors*) to reside in the work system, creating a path for catastrophic loss when the worker accepted the deviant errors as the norm and committed an *active error* that cost him his life.

In her book about the Challenger explosion, Diane Vaughan refers to the similar variables leading to the space shuttle disaster as the "normalization of deviance." This happens when small changes in behavior start to occur, expanding the boundaries that allow additional deviations to become acceptable. In essence, when deviant events are tolerated, the potential for error grows and events are overlooked, misinterpreted or simply allowed without question.

With that said, let's not forget that various governmental and research organizations continue to report that more than 90 percent of all injuries are caused by the unsafe acts or the active errors people commit. To understand this, we can look back at the work of Herbert Heinrich, who developed the domino theory of accident causation. In his work, an accident is presented as logical factors (dominoes) in a sequence that results in injury. Simply put, when a domino falls, so do the succeeding dominoes. By removing the domino that represents the unsafe act or conditions, an accident can be prevented. Frank E. Bird, a researcher with the International Loss Control Institute, recognized this issue in the early 1970's when he introduced a revision to Heinrich's domino theory and established a model that added management system error to the sequence of causation.

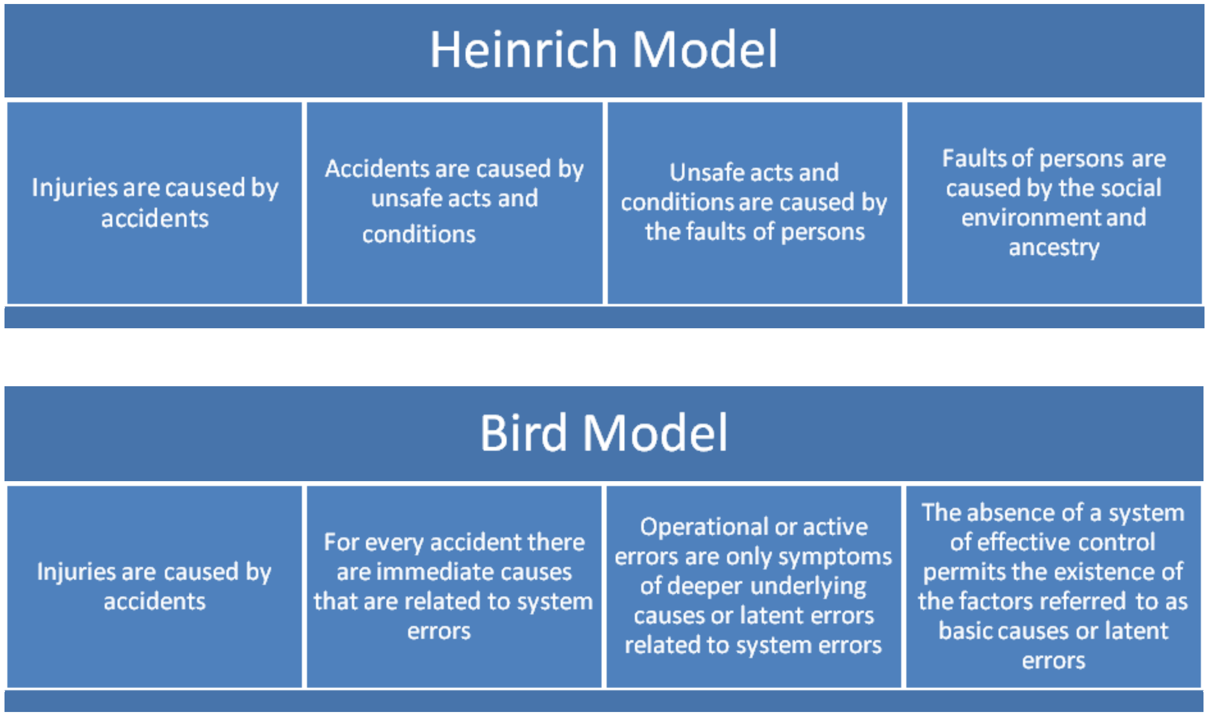


**Figure 1 – Heinrich/Bird Models.**

As my own experience and the data demonstrate, there is ample evidence to suggest that it is critical to view worker error as at-risk behavior, as opposed to unsafe acts. When *decision making* is regarded as at-risk behavior, we're able to recognize that "active errors" are most likely the result of a management system that allows too many variables to exist. The actions of a worker may have been accommodated for so long that they became the common pathway for getting work done.

Thinking about this issue from a systems approach, it is fair to say that safety success does not reside in a single person, how well a machine performs, training plans or the level of management support, but a *combination* of all of these factors. A robust safety system with four key elements is critical to achieving and sustaining safety success.


**Figure 2 - Safety System Factors.**

Reviewing Figure 2, we can now begin to understand that in order to control process variability and reduce loss we must consider the work environment, the workers within that environment, organizational and employee behavior and management leadership, as critical components for success. These factors are interwoven and when change occurs in one, it generally results in change to the others. Using this logic, asking a worker to improve his or her behavior and work safely without providing guarded equipment and the necessary training introduces too much variability in the work system. Each element in the safety system literally hinges on the success of the others. In my years as a safety manager at two large manufacturing facilities, one of the first things to emerge during trend analyses of past incidents was that few workers were actually injured while equipment ran true to its design. However, when operators were forced to intervene, the outcome was only as good as the workers' ability to avert potential accidents. During my time at both facilities, I identified "process upset" as a major variable to successfully controlling incidents and worked aggressively to get equipment manufacturers, engineers and process specialists involved in an effort to increase the reliability and efficiency of the equipment. My motivation was grounded in the belief that once an employee was working outside the safety system, he or she often drew reasonable, though potentially flawed conclusions that, in some cases, would lead to loss.

In safety, just as in quality, variability within the system must be controlled to attain and sustain desired performance results. Though not an exhaustive list, Figure 3 illustrates possible uncontrolled variables within a work system. James Reason, a professor of psychology at the University of Manchester, comments that uncontrolled variables are factors that intervene between the design of a system and the production process, resulting in conditions where errors are more likely to occur.  Although good managerial decisions are required for safe and efficient production, they alone are insufficient. There is an equal need to properly maintain and ensure the reliability of the equipment; maintain a skilled and knowledgeable workforce through continuous training and engagement; and establish reasonable work schedules and well-designed jobs as well as clear guidance on desired performance, to achieve success.

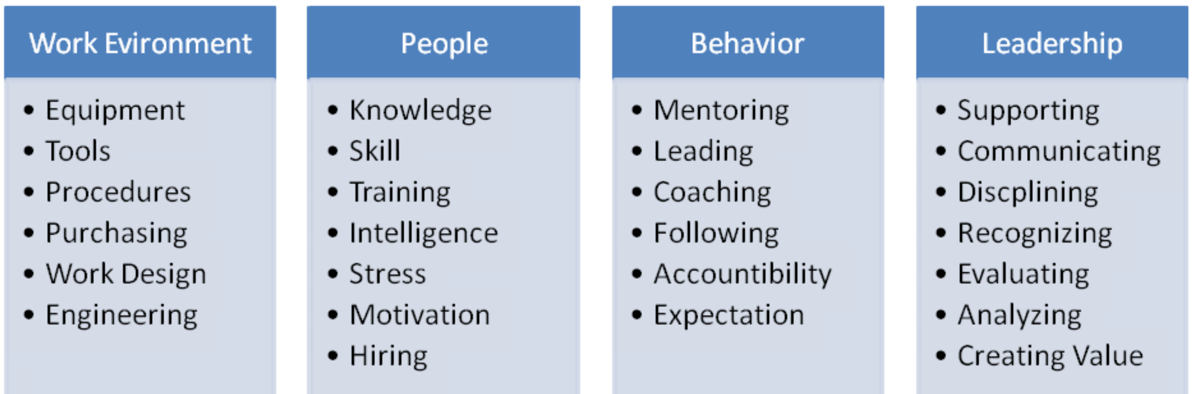


**Figure 3 - Safety System Variables.**

So how do we improve our safety performance?  In the 1980s, Motorola pioneered a management initiative called Six Sigma in an effort to reduce variation in the work process. The strategy sought to define Motorola’s work process from beginning to end and every critical step in-between. The company would collect data and then determine the amount of variation it could tolerate and still be successful.  When you reach the highest level of Six Sigma success, it is said that you have actually reduced variation and defects to such a high degree that even undetected variation has little effect on the value of your process.  In safety circles, it means that you are controlling the variables that pose the greatest threat to your desired outcome.

Applying a Six Sigma approach to safety, the question of how much variation to allow in the system and what important variables to control is clearly warranted.  In this case, success would be based on the fewest number of defects, defined in large part by the customer’s desire. In safety, the customer’s desire is usually no injury, no illness and no loss.

As a starting point:

- Review data from past safety incidents and near-miss reports, planned inspections, and maintenance logs.  Benchmark similar industries to determine the latent errors that have allowed loss to enter the system(s) in the past.  In this scenario, each incident is independent but common errors are most likely identifiable.

- Recognize the problems (errors) that need resolution and determine the level of threat to the system with regard to severity, frequency and the probability of re-occurrence.

- Identify where the problem (error) resides within the safety system to diagnose larger systemic issues. This includes the physical aspects, people, behavior, and leadership factors of the safety system.

- Determine probable solutions and consider the consequences of outcomes related to each proposed alternative.

- Promote solutions to your shareholders and gain endorsement. Implement changes to close variability (gaps) in the work system.

- Monitor for compliance; revise if needed to ensure success.

An example—again from my time as a facility safety manager—I started to notice an increase in the number of hand lacerations occurring in the facility's converting department. In a 12-month period, trend analysis showed that 72 percent of the injuries at the facility were caused by employees using utility razor knives. Further study indicated that employees used razor knives for more than 100 different tasks, wore no protection and had little training in knife use. There was also no uniform policy or guidelines to govern razor knife use. As a result, the facility eliminated 98 percent of tasks requiring knives by tool substitution or process changes, implemented new policies and safety training, established mandatory hand protection requirements and switched to a safer knife design. Removing the uncontrolled variables in this case limited the number of active errors that occurred, resulting in the customer's desire for zero hand injuries. Since implementing this program in the 1990s, the facility has totally eliminated injuries resulting from razor knife use.

So can we as safety professionals, or better yet, as leaders, *force* employees to make good decisions? It's a complex question with no easy answer. The challenge in trying to control error is that there has been, and will continue to be, changes within the work system that influence the way people work. However, leveraging success is possible. By looking at the safety system as a whole, that is *not* examining aspects in isolation but rather as a collective, (importantly, the human element), we gain a clear understanding that while each element may be independent, they impact and are affected by the others. Forcing workers to perform to our desired expectations is simply recognizing that most of the variability in system performance is derived from the response of workers who have to function within a defined system, regardless of whether it's well-designed or not. The safe performance of the worker and his/her relationship to the environment is greatly influenced by design. Forcing workers to make correct choices means removing the variables that allow the employee to make a wrong – and sometimes dangerous – decision.

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