Systems Thinking for Safety

In his popular books on total quality management, *Out of the Crisis* and *The New Economics*, W. Edwards Deming tells us to focus our efforts on optimizing the system. Peter Senge stresses that systems thinking is the *Fifth Discipline*, and key to continuous improvement. And Stephen Coveys discussions of interdependency, win/win contingencies, and synergy in his best seller, *The Seven Habits of Highly Effective People,* are founded on systems thinking. So what is systems thinking anyway, and how can this concept be applied to industrial safety and health? This article addresses this question from the perspective of behaviors, attitudes, and commitment to safety improvement.

Understanding Systems Thinking

Every time I travel to and from the Roanoke airport on Interstate 81, I am reminded of the interdependency inherent in a transportation system, and of the great number of people whose driving behavior implies an individualistic win/lose attitude rather than the win/win cooperative attitude needed to optimize the system. Consider, for example, the drivers who shift back and forth between lanes, often without signaling, in order to save a few seconds in reaching their destination. These individuals are thinking only of themselves. It doesnt occur to them that their inconsiderate, at-risk behavior could cause a vehicle crash and temporarily shut down the transportation system for themselves and many others. They are thinking only of themselves and short-term individualistic consequences.

Then, there are the slower drivers who think they are entitled to travel in the left lane, perhaps because they will eventually make a left-hand turn several miles ahead. These drivers are also displaying a win/lose perspective, perhaps unconsciously or unintentionally, which results in sub-optimizing the system. In fact, this lack of lane discipline (of staying to the right

except to pass) causes the at-risk lane switching of other win/lose drivers trying to save a few seconds by keeping the pedal to the metal.

Its likely none of these drivers have considered they are part of an interdependent system of numerous other drivers which is optimized when everyone follows the same rules, norms, and courtesies of the road. They have undoubtedly not considered the interdependency between driving behavior and the attitudes and emotions of themselves and other drivers. Consider, for example, how discourteous and risky driving can cause disruptive emotions in other drivers, which in turn can influence these individuals to perform at-risk driving. This could in turn impact negatively on the emotions of more drivers, including those of the drivers who started the chain of disruptive events.

Considering such large-scale interdependency between peoples driving behaviors, attitudes, and emotions is systems thinking. I am reminded of this systems perspective on driving when peering from the window of an airplane as it leaves the ground. The optimal operation of the transportation system I observe depends on the tiny vehicles below following various intricate paths, and of course this is only possible if all of the drivers operate their vehicles according to such interdependency. Thus, leaving the ground in an airplane enables me to see the bigger picture below and appreciate the need for precise interdependency between the behaviors and attitudes of the complex human systems operating each vehicle.

Implications for Industrial Safety

When dealing with safety and health issues its useful to consider my airplane scenario. We need to step back (or up) and get a bigger picture of the situation, and then contemplate the numerous win/win interdependencies required to optimize the various systems needed in a Total Safety Culture. This is systems thinking for safety. It is relevant for various aspects of safety

management and safety improvement. The following principles emanate from such a

perspective, and run counter to some traditional approaches to safety and health management.

     1. There is not one root cause. Systems thinkers do not try to find one root cause of an

incident or injury. Small-scale and independent thinking leads to a search for one single cause of

a mishap. And, some consulting firms market flow charts and computer programs to help us

analyze an incident in order to find *the* root cause.

     At-risk behavior contributes to 95% or more of most injuries, whether intentional or

unintentional. But does this mean a particular individuals at-risk behavior is *the* root cause of

the injury? If you raise your helicopter higher to get a bigger picture of the situation, youll

undoubtedly find a number of other factors contributing to the most relevant at-risk behavior.

     2. Injury is caused by environment, behavior, and person factors. The factors that

cause a near miss or injury can be classified into three domains: environment (including tools,

equipment, and climate of the work setting), person (including attitudes, beliefs, and

personalities of the individuals involved), and behavior (including the safe and at-risk practices

of relevant individuals). Factors within and between these three domains are interactive,

dynamic, and reciprocal. A change in a factor within one domain influences other factors in that

domain, and eventually has impact on factors within the other two domains. For example,

changes in an environmental factor affect peoples behaviors and attitudes; and behavior change

usually results in some change in the environment.

     When people choose to change their behavior, they adjust their attitudes and beliefs

(person factors) to be consistent with their actions. This change in attitude can influence more

behavior change and then more attitude change. This spiraling of behavior influencing attitude,

and then attitude influencing behavior reflects the reciprocal interdependency between our

outward actions and our inward feelings. And, an initial change in behavior or attitude can be sparked by an environmental factor. Thus, systems thinking requires a consideration of interactive variables within two human domains (person and behavior) operating within a particular set of environmental factors.

The management system of an organization is one environmental factor that has dramatic impact on the human factors of person and behavior. But, the true affect of the management system might not be apparent without a comprehensive measurement system. For example, a top-down authoritarian approach to management (as in safety is a condition of employment) might influence certain behavior to occur in certain situations, but the negative person factors affected by such a management style might influence contrary behaviors in situations where people cannot be held accountable to a supervisor for their actions. And, such negative person states might inhibit feelings of personal ownership, commitment, and loyalty needed to facilitate long-term total involvement in a safety process.

3. Assess safety with measures of environment, behavior, and person factors. The systems perspective reflected in the interactive domains of environment, behavior, and person leads logically to the basic principle that a safety measurement system include measures of factors within each of these domains. As Ive described in an earlier *ISHN* article (December, 1992), safety-related factors in the environment and behavior domains can be systematically assessed with periodic audits of environmental conditions and work practices. And, perception and attitude surveys can be useful barometers of person factors. My point here is that systems thinking means our on-going proactive measure of organizational safety must include an evaluation of environment, behavior, and person factors. The traditional reactive measures of safety (such as number of recordable injuries or work compensation costs) have little diagnostic

value with regard to understanding or changing the system variables that are causing the outcomes, whether desirable or undesirable.

Systems thinking for safety enables a clear understanding that outcome measures can be influenced by a number of factors unrelated to safety improvement. For this reason, holding people accountable for numbers of injuries rather than for completing certain proactive procedures for injury prevention can do more harm than good. In such situations, the system puts pressure on people to cover up their injuries, and even their near misses. The result might be a decrease in negative outcome numbers, at least over the short run, but what about the bigger picture? Might such a situation decrease peoples belief that they can truly control safety? Could such system pressure to hide injuries lead to reduced personal motivation to accomplish the proactive activities needed to prevent injuries?

With systems thinking youll answer yes to both of these questions. In this case, youll consider behavior-based and person-based factors potentially influenced by management system factors focused on reducing the numbers. In some environments employees are disciplined (actually punished) for being injured, or at least made to feel embarrassed. Other companies offer rewards if employees avoid injury and keep the numbers down. Some even add peer pressure to the situation with the contingency that all employees lose their reward when one person reports an injury. Systems thinking enables us to understand the problems with these kinds of programs.

4. Injury investigation is fact finding, not fault finding. Systems thinkers see the fallacy in punishment and reward programs based on injuries. They view such reactive attempts to reduce the outcome numbers from a broader perspective. They realize that injury prevention requires a focus on proactive activities upstream from an injury. For example, because its

critical to investigate minor injuries and near misses, system thinkers attempt to remove any aspects of their environment that could inhibit the reporting of safety-related incidents (including penalties for injuries and rewards for not having injuries). They also add factors to facilitate the reporting and investigating of near misses, first-aid cases, and minor injuries -- incidents that are not typically recorded but could be informative regarding the prevention of more serious injuries.

Obviously, injury investigation must be seen as finding facts to prevent more injuries. If factors or contingencies in the system promote a fault-finding perspective toward injury investigation, then information critical to preventing injuries could be stifled. Its been my experience that the fault-finding perspective usually begins with undue focus on outcome rather than process when evaluating safety success.

5. Feedback directs and motivates. The best evaluation numbers provide feedback we can use to improve the relevant process. When feedback follows our actions, it is a consequence that affirms or contradicts our behavior. Positive (supportive) feedback tells us we are correct and motivates us to keep doing what were doing. In contrast, negative (corrective) feedback informs us of a mistake and motivates us to stop a particular behavior and try another approach. Sometimes supportive or corrective feedback follows our behavior naturally, as when we hit a nail with a hammer, drive a golf ball with a five iron, or cook a delicious meal.

Each of these examples is actually a response-consequence system which allows us to adjust our behavior on successive trials according to the built-in feedback. When we change our behavior as a function of natural feedback, the consequence becomes an activator for the next behavior. In this way, feedback both motivates and directs behavior in a spiraling system of behaviors producing consequences that provide information for continuous improvement. Thus,

the ABC model (for activator-behavior-consequence) which Ive discussed in previous *ISHN*

articles (for example, November, 1993 and July, 1996) as a way to analyze ongoing behavior and

develop interventions to change behavior is not a linear cause-effect chain but a spiral of

causality, whereby the motivating consequence of a certain behavior can become the directing

activator for the next behavior.

Rarely if ever does safe behavior have a built-in feedback system to support and direct it.

In other words, when we take the extra time and inconvenience to protect ourselves or others

from a potential injury, we usually do not receive a natural consequence to motivate us to

continue. With systems thinking, however, we see the bigger picture and realize that someday

someone in the work system will gain directly from the protection. Thus, systems thinkers dont

need immediate quick fixes to keep them safe. They understand that cause and effect is not

necessarily immediate nor linear. Taking the time to be safe today, for example, can help

develop a personal habit that could pay off personal dividends in the future, or it could teach

others by example and protect them now or later from injury.

Systems thinkers realize the special need to add extra feedback to motivate and activate

safe behavior. They understand that the natural feedback from convenience, comfort, or a faster

outcome usually competes with the completely safe way to do something. Thus, systems

thinkers look for ways to support safe behavior and correct at-risk behavior. Remembering the

ABC spiral of causality, they use feedback as a consequence to motivate an individual to

continue or stop a particular behavior, and they use feedback as an activator to direct

improvement in particular work practices. (For more information on how to give safety

feedback, please see my *ISHN* article last June, 20 Guidelines for Giving Feedback.)

6. The principle of consistency develops commitment. I have written about the consistency principle in a 1996 *ISHN* article (January). Thus, I wont elaborate here, except to illustrate how this principle supports a systems perspective. Specifically, the consistency principle reflects a spiral of causality and explains how behavior influences attitude and vice versa. When we choose to do something, we experience internal pressure to maintain a personal belief system or attitude consistent with that behavior. And, when we have a certain belief system or attitude toward something, we tend to behave in ways consistent with such beliefs or attitudes. Commitment and total involvement result from a causal spiraling of action feeding attitude, then attitude feeding more action, which strengthens the attitude, and leads to more behavior.

Researchers have found three ways to make an initial commitment to do something lead to the most causal spiraling and total involvement. First, people live up to what they write down, so ask for a signed statement of a commitment. Second, the more public the commitment, the greater the relevant attitude and behavior change, presumably because social pressures are added to the personal pressure to be consistent in word and deed.

Third, and perhaps most importantly, for a public and written commitment to initiate causal spiraling of behavior supporting attitude (and vice versa), the commitment must be viewed as a personal choice. In other words, when people believe their commitment was their idea, the consistency principle is activated. However, when people believe their commitment was unduly influenced by outside factors, they do not feel a need to live up to what they were coerced to write down.

7. Embrace the principle of reciprocity. The systems notion of a spiral of causality is useful for appreciating another basic principle of human relations -- reciprocity. Systems

thinkers for safety embrace this principle because it can be used to increase peoples involvement in a safety-improvement process. Simply put, the reciprocity principle is reflected in the slogan, Do for me and Ill do for you. In other words, if you are nice to someone, they will feel obligated to return the favor. And consistent with a systems perspective, the favor might be returned to someone other than the original source.

A systems thinker sees this principle as powerful rationale for going beyond the call of duty for another persons safety. Such actively caring will provoke reciprocity, and motivate the recipient of active caring to return the favor to someone in the system. And, with a spiral of causality in force, the more you actively care for safety, the more active caring for safety you can expect from others.

Systems thinkers also realize that how they react to people after doing them a favor can either stifle or mobilize a spiral of reciprocity. When a person thanks them for actively caring, systems thinkers do not demean the favor by saying things like No problem, or It was really nothing. Anything that makes the actively caring seem insignificant or trivial will reduce the impetus for reciprocity. On the other hand, adding words to make the actively caring appear more significant or meaningful can be quite awkward and create an uncomfortable or embarrassing situation.

To maintain a comfortable verbal exchange that does not belittle the actively caring and stifle reciprocity, the systems thinker would react to a Thank you for actively caring with something like, Thank you for appreciating my effort to promote health and safety, but I know youd do the same for me. This reaction shows admiration for the thank-you, and thus increases the likelihood that more thanks will be given. Plus, it also activates the reciprocity principle in a way that will be perceived as genuine and valid.

In Conclusion

The gurus of total quality management have told us to think win/win, interdependency, teamwork, synergy, and systems. In other words, to optimize systems we need to foster synergy, and this is facilitated when win/win consequences are achieved through teamwork. And, teamwork is promoted with shifts from independent to interdependent thinking and acting. This article related these buzzwords of total quality management to the human dynamics of occupational health and safety.

A systems approach to achieving a Total Safety Culture implicates a number of paradigm shifts from traditional safety management. Specifically, we need to shift from trying to find one root cause of a near miss or injury to considering a number of potential causes from each of three domains -- environment, behavior, and person.   Additionally, systems thinking requires a shift from outcome-based measures of safety performance to a more proactive and diagnostic evaluation of process variables within the environment, behavior, and person domains.

Systems thinking enables a useful perspective on basic principles of human motivation, attitude formation, and behavior change. We are inclined to consider causation between activators, behaviors, and consequences to be linear, but systems thinking implicates a circular or spiral perspective. Thus, while an event preceding a behavior may direct it and a particular event following a behavior determines whether it will occur again, its instructive to realize that the consequence for one behavior can serve as the activator for the next behavior. With this perspective, behavior-based feedback can serve as a motivating consequence or a directing activator, depending on how it is presented.

The systems perspective of spiral causality and the consistency principle combine to explain how small changes in behavior can result in attitude change, followed by more behavior

change and then more desired attitude change, leading eventually to personal commitment and total involvement in the process. Similarly, the notion of spiral causality and the reciprocity principle explain why initial actively caring from a few individuals can result in more and more actively caring from many individuals. This can lead eventually to interdependent work teams regularly actively caring for the safety of each other with a win/win attitude and a proactive vision. In the end we have safety-focused synergism, and it all started with systems thinking for safety.

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NOTE: Dr. Geller details numerous system-focused strategies for achieving a Total Safety Culture in his 1996 book The Psychology of Safety. For more information please call Safety Performance Solutions at (540) 951-7233 (SAFE).