Human Performance Improvement

Key to sustainable safety excellence

By Richard M. Crossman, Donna Cangelosi Crossman and Julie E. Lovely

SOME IN THE SAFETY INDUSTRY assert that a goal of zero defects, although admirable, is unrealistic because some risks are simply too costly to identify, prevent or eliminate (Behm, Veltri & Kleinsorge, 2004). Constrained by budgets, managers pragmatically target low-hanging fruit—hazards that are most harmful or frequent, may result in costly injuries or are easily controlled. Behm, et al. (2004) maintain "that some risk must be considered acceptable for an organization's financial stability" (p. 24).

In most workplaces, a small measure of human error constitutes "acceptable risk." Although partially mitigated through design, human error is an inherent risk that is considered wholly unavoidable and ultimately inevitable. Unreliability is a fact of life. Oversights occur, information is misdirected, and even the most talented and conscientious employees are occasionally prone to errors in judgment. The risk of human error is amplified in today's highly dynamic work environments. Change is fundamental, rapid and unrelenting. Unexpected circumstances, revised goals, change orders and turnover are just a few of the factors that surreptitiously disrupt safety system equilibrium, resulting in worker inattention, carelessness or negligence.

Organizational Context

Consider an incident that occurred at XYZ Manufacturing Inc. A banner hung at the main entrance proclaimed that the facility was enjoying an extended injury-free period. However, performance was compromised when a worker stair-stepped across a bank of pipes to shut off a valve—instead of using a ladder—and was subsequently hurt. In the follow-up investigation, management faulted the employee for unsafe behavior. Records indicated that the worker had been adequately trained, ladders were conveniently stationed around the plant, the company's safety program was commendable and management at every level was highly committed to protecting workers. What more could have been done to prevent this chance event?

Although it appears that this injury is a factor of faulty worker behavior, the actual cause was deeply rooted in the organizational context. Research indicates that many injuries attributable to human error are traceable to at least one gap in the organizational context (Baysari, McIntosh & Wilson, 2008). Therefore, mitigation of contextual gaps underlying human error can significantly reduce the margin of acceptable risk, thus preventing chance events that compromise sustainability.

In an article intended for the commercial nuclear industry, Coe and Lake (2003) recommend the application of human performance improvement (HPI) practices for addressing acceptable risks and achieving program sustainability. HPI practices are especially appropriate "when quality nears perfection and efficiency efforts have picked all the low-hanging fruit" (Coe & Lake, 2003, p. 40). The goal of HPI is to align the worker with the work-supporting system to produce maximum efficiency (Dean, 1999). HPI management is essentially what Krause (2005)

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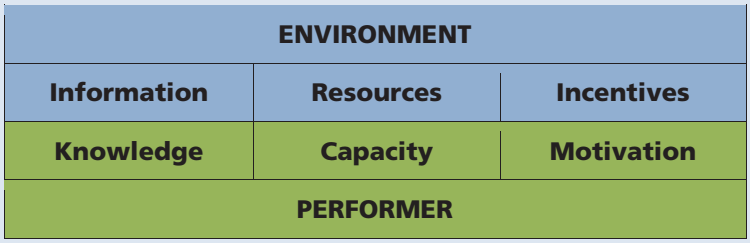
Figure 1

Visual Representation of Gilbert's Behavior Engineering Model



Note. *Adapted from* Human Competence: Engineering Worthy Performance *(Tribute ed.), by T. Gilbert, 1996, Washington, DC: International Society for Performance Improvement.*

Abstract: *Maintaining world-class safety requires implementation of a sustaining safety process. The principles of human performance improvement (HPI) offer a systematic means for identifying, preventing or eliminating deeply embedded, latent and inherent risks that threaten program sustainability. HPI practitioners challenge the notion that such risks are too difficult or costly to mitigate. As HPI is dual focused on people and profits, the attainment of program sustainability and preservation of the bottom line are noncompeting goals.*

refers to as a sustaining safety process (distinguishable from an enabling system), which when integrated with any enabling system, will result in a spiral of continuous improvement and attainment of world-class performance.

Human Performance Improvement: A Sustaining Process

The attractiveness of HPI is three-fold:

1) The methodology is an efficient means for identifying root causes of subtle or latent problems embedded in the system, which may result in injury types that appear random or uncontrollable.

2) The process is results-oriented and, therefore, measurable.

3) Because of the low-cost/high-impact nature of interventions, the average annual rate of return on investment (ROI) for an HPI implementation is 8:1 (Swanson, 1999).

In light of current injury and fatality statistics, opportunities for performance gains through the application of HPI principles and practices exist across a wide range of occupational environments. Skillful applications of HPI principles and practices challenge the notion that efforts to reduce latent and inherent risks are fruitless and costly. Applied consistently as a sustaining process, HPI is a powerful tool that has a potential to help U.S. industry transcend its current injury plateau.

The theoretical underpinnings of HPI are primarily derived from systems theory and behavioral psychology, and prescribed interventions reflect best practices in management, human resource development, human factors, economics, education and sociology. Although similar in philosophy to total quality management, HPI is focused toward developing human capital rather than process enhancement (Talaq & Ahmed, 2004). A relatively new discipline, the practices of HPI are gaining support among executive-level management in many large corporations as a means for gaining a competitive edge in a global economy (Kaufman, 2000; Rummler & Brache, 1995).

American Society for Training and Development (ASTD) and International Society for Performance Improvement (ISPI) both support HPI as a legitimate method of business management, and each organization offers training and certification courses in the discipline. ASTD's certificate program is targeted toward training, human resources and organizational development professionals in either the private or public sectors (ASTD, 2008). ISPI maintains an institute of learning specifically for HPI skill-building and knowledge acquisition.

Understanding Performance Gaps

The practice of HPI is built on Gilbert's (1978) model of behavior engineering (Figure 1). A former colleague of B.F. Skinner and dubbed "father of performance improvement," Gilbert intended for his model to be simplistic and memorable—and easily adaptable to virtually any workplace situation. According to Gilbert, exemplary performance is the result of alignment and interdependence among six system dimensions—three of which are manifestations of the workplace environment (information, resources, incentives) and three are dynamics of worker behavior (knowledge, capacity, motivation).

Closely aligned with the revised paradigm of human error proposed by Reason and Rocklin (Dekker, 2002), Gilbert's theory posits that the root cause of most performance problems lies not with faulty worker behavior but rather in the defective context of the workplace (e.g., information, resources, incentives). Close gaps in the contextual environment and workers—who are properly trained and innately capable—will be motivated to perform well (Gilbert, 1978). What is innovative about Gilbert's model is its systematic nature. The matrix provides a straightforward, organized technique for identifying and eliminating deeply embedded or latent gaps that underpin human error.

Empirical support for Gilbert's model is mounting. A survey by Cox (2006) of M.B.A. candidates in middle management positions indicated that Gilbert's model was considered a value-added strategy for improving performance. Ripley's (cited in Cox, 2006) development of a diagnostic instrument to better understand employee perceptions of the work environment demonstrated high alignment with Gilbert's six-factor model. Frank, Cox and Fodness (cited in Cox, 2006) used Gilbert's model to identify drivers that contributed to employee retention in the supermarket industry.

Dissertation research demonstrated support for Gilbert's model among volunteer firefighters (Crossman, 2008). A path model was built using data collected from 316 firefighters on four variables—firefighter/officer communication (dimension 1), resource availability (dimension 2), psychological incentives (dimension 3) and safety motivation (dimension 6). Results of the path analysis are shown in Figure 2.

Analysis indicated that a work environment marked by effective communication, generous resources and positive psychological incentives significantly influenced firefighter safety behavior and

attitudes. Most interesting was the mediating effect that incentives imposed on motivation in this particular workplace context. Study findings confirm Gilbert's (1978) contentions that system dimensions are interdependently related; and that structuring the contextual environment is a critical management task in improving and maintaining high levels of performance.

Had management known about the embedded contextual gaps in the ladder scenario discussed earlier, the chance injury might have been prevented. Weeks before the injury, an operations manager suspected that subcontractors had stolen several ladders. A unilateral decision was made to chain and lock all ladders. However, secured ladders created problems for workers. Obtaining a ladder involved a convoluted process of locating the one individual (the operations manager) who had the key to unlock the stations. Yet, the supervisor who ordered the worker to immediately turn off the valve was not informed of the ladder situation. Feeling time pressured, the worker chose to risk injury rather than dissatisfy the boss.

Three contextual gaps were actually at the root of the injury that was initially attributed to human error:

1) failure to transmit essential information was identified as a primary cause of the injury (information);

2) lack of ready accessibility to resources was a second root cause (resources);

3) by placing workers under extreme time pressure, the supervisor rewarded production performance over safe behavior, despite the proclamation from management regarding a commitment to safety (incentives).

The synergistic mix of circumstances created an imbalance in the system and opened a multidimensional gap in an otherwise excellent and efficient safety program—a gap in which workers easily fall prey to inherent risk.

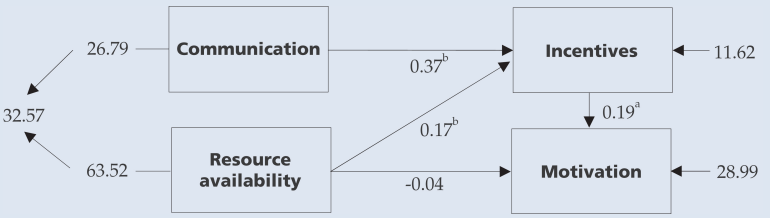
Although employees must be held accountable for their actions, it is only fair to demand strict accountability within the context of a highly supportive system. In this case, the worker was caught in a double bind, forced to choose between safety and productivity. The conflict between safety and production is perennially detrimental to program sustainability.

After some discussion, two ladder-related process changes were instituted. Employees who had a need for ladders received keys and, as a deterrent to theft, conspicuous, permanent and identifying decals were affixed to all company ladders.

A more complex problem, however, involved the communication gap that existed among levels of management and between management and workers. An effort to maximize the potential of the company's safety committee proved to be an ideal strategy for bridging this gap and promoting sustainability. Committee membership was expanded to include representatives from all key organizational stakeholder groups. Over a period of months, the function of the group was transformed from mere committee to "learning organization" (Senge, 2006). The last regularly scheduled committee meeting each month was dedicated to a discussion among a group of cross-organizational stakeholders on the topic of hidden safety gaps.

Figure 2

Proposed Path Model of Firefighter Safety Culture



Note. $^{a}p < .05$; $^{b}p < .01$

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Ongoing discourse accomplished several aims:

1) Cross-organizational input enabled safety management to stay abreast of a changes occurring throughout the overall system.

2) Involvement of safety management in organizational decision making ensured that safety is as essential a priority as production.

3) A collaborative curiosity to continually seek to know what is unknown was a giant step toward building a high reliability organization (Roberts & Bea, 2001).

Becoming a Learning Organization

The transformation to a learning organization is an example of the integrative nature of HPI interventions. Unlike large-scale improvement initiatives, HPI interventions can assimilate into existing program elements and disruptions are minimal. Implementation of learning organization strategies also reflects the strong reliance of HPI on learning for improvement purposes.

HPI interventions assume various forms and are limited only by management's imagination and creativity. Formal and informal learning solutions, process redesigns and team-building activities are typical low-cost/high-impact HPI solutions. Three rules apply when designing interventions: 1) solutions are dictated solely by need, as determined through analysis; 2) interventions must be an extension of existing program elements; and 3) ROI forecasts must illustrate a strong possibility of positive bottom-line impact. Developing solutions according to these criteria prevents implementation of isolated interventions that incur high costs and whose effects are uncertain or dubious.

The general manager of a mid-sized facility recognized the need for sustainability when he asked safety management what its plans were to ensure

continuance of the current accident-free streak. Line management responded to this concern by engaging a safety motivational speaker at a cost of $40,000. Although entertaining and mildly educational, the speaker had little effect on the workforce. When employees were asked a couple of months later what they had learned from the presentation, many were hard-pressed to answer. Knowledge interventions that lack a practical transfer strategy and are unconnected to other program elements waste precious funds (Ford, 2002).

Successful application of HPI practices requires a paradigm shift among management. A company plagued by a series of incidents attributed to worker carelessness issued an order, likely out of frustration, requiring one-on-one safety briefings for any employee planning to work "without two feet planted firmly on the ground." Within a few days, requests for briefings began pouring in from among the plant's 3,000 employees, and soon the safety office was overwhelmed. Undoubtedly, management's objective was not to micromanage but to raise awareness of proper safety protocol and minimize the risk of human error. However, this solution was aimed at fixing the employee rather than restructuring the contextual environment to promote adherence to proper safety practices.

Sustainability, HPI & Safety Culture

Figure 3 presents an expanded representation of Gilbert's (1978) behavior engineering model adapted specifically for the occupational safety environment. Upon close examination, dimensions align with safety culture factors identified in past and present research literature (Zohar, 2000; Griffin & Neal, 2000; Mohamed, 2002; Richter & Koch, 2004; Seo, 2005; Parker, Lawrie & Hudson, 2006; Choudhry, Fang & Mohamed, 2007). Gilbert's strategy succeeds because the model is not only a method of problem solving but also a culture-building tool. Unlike full-scale, complex change initiatives, however, HPI culture transformations are subtle, and, therefore, less costly and complicated—and less likely to fail than major cultural overhauls. Small changes and minor adjustments, intended to tweak a well-functioning system, are ultimately aimed at changing safety attitudes that motivate behavioral decisions workers must make during the course of a typical workday.

HPI & Safety Research

Gilbert's (1978) model also provides a thematic method for organizing safety research, creating a useful bank of inquiry and a valuable resource for identifying possible solutions for mitigating embedded risks. Following is a brief literature review of current safety research organized according to Gilbert's multidimensional model.

Information

Interlevel communication is a hallmark of beyond-compliance programs. However, it is a dynamic most often compromised in a fast-paced work environment. In the field, workers who are uninformed of changes in areas such as job scope, procedures, hazards, rights and obligations are highly vulnerable to risks associated with human error.

In essence, a collaborative pipeline of communication serves as an unwritten psychological contract, resulting in the development of perceived trust and goodwill between management and workers (Walker & Hutton, 2006; Taylor & Thomas, 2003). Contained in this psychological contract are intimations of both employer and employee obligations. Communication in the workplace facilitates sharing of mental models between management and workers, underpinned by positive values and expectations. This meeting of the minds results in an interdependent relationship, empowering the ability to jointly prioritize and work in unison to promote safety (O'Toole, 2002; Prussia, Brown & Willis, 2003). Furthermore, the quality

Figure 3

Gilbert's Model Adapted for Safety

ENVIRONMENT

Information	Resources	Incentives
• Communication of worker rights and responsibilities • Transmission of policies, goals and objectives • Performance feedback • Management example • Accessibility to measurement data, guides, standards, procedures and reference sources	• Hazard ID and abatement • Worksite inspections • JHAs • Safety reviews • Change analyses • Design controls • Near-hit, accident and incident investigations • Exposure assessments • Operating procedures • Evaluation procedures • Production/safety balance • PPE • Access to frontline supervisor • Working conditions	• Promotions • Bonuses • Rewards • Positive peer pressure • Negative reinforcement • Accountability

Knowledge	Capacity	Motivation
• Knowledge management • Compliance training • Content and skill transfer • Informal learning	• Staff qualifications • Hiring procedures • Individual performance reviews	• Attitudes • Self-efficacy

PERFORMER

and delivery style of information is significant (Parker, Axtell & Turner, 2001).

Correlations have also been found between communication quality and safe working, and that the act of informally sharing information is educational, underscoring and emphasizing what has been learned in classroom training. In environments marked by open and honest communication, employees feel confident to raise and discuss safety concerns (Parker, et al., 2001; Mullen, 2005). The establishment and maintenance of an interference-free information pipeline indicates a high level of management commitment to safety, a factor contributing to employee willingness to report even minor mishaps and near hits.

Uninformed workers are frequently prone to error. For example, a plant security guard attempted to enter a newly constructed laser lab while equipment was in use, even though the sign on the door prohibiting entry was illuminated. The guard was operating on the premise that he had access to all plant areas without restrictions—and he never was briefed on laser lab entry procedures. Fortunately, the lab was protected by a failsafe lock, but the lack of information dissemination is indicative of a disturbing communication problem that must be addressed.

Resources

Program excellence and sustainability is dependent on appropriate availability and utilization of resources. Gilbert (1978) defines resources as any equipment, processes and people required for task performance. Most companies allocate a major portion of safety budgets into engineering controls, administrative processes, equipment and PPE. A resource-rich workplace is indicative of high management commitment to safety, an essential underpinning of a shared safety culture.

However, issues embedded within this particular dimension have a high potential to compromise safety. More than any other management position, worker access to frontline supervision is critical to maintaining a high level of safety. According to Zohar (2000) and Zohar and Luria (2003), ineffective supervision exerts a negative impact on both safety climate and injury rate. Pivotally positioned between upper management and workers, the frontline supervisor assumes a unique perspective for identifying potential risks, conveying these risks to upper management and making recommendations for restructuring the worker/workplace interface. Unfortunately, frontline supervisors are often excluded from management development efforts. Studies show, however, that interventions aimed at strengthening the competencies of these supervisors are a wise investment, resulting in positive bottom line returns (Zohar).

Many hidden problems that increase the potential for inherent risk lie within what Rummler and Brache (1995) refer to as the white spaces on the organizational chart—functional interfaces in which work is passed from one department to another. Devoting time to the investigation of interdepartmental processes, which may reveal hidden cumbersome procedures that trigger human error, is a worthwhile investment providing high return.

During the installation of a work trailer, an electrical subcontractor hired by one company required access to property owned and managed by another company. The task required that the subcontractor interface a lockout/tagout procedure with the cooperating company. However, at the last minute, the cooperating company thwarted subcontractor efforts to complete the task in a timely manner because proper management approval was lacking. Additionally, manual procedures for obtaining approval were ambiguously written. Frustration in the workplace contributes to the growth of negative subcultures, as workers attempt to circumvent catch-22-like situations.

Incentives

Gilbert (1978) contends that the use of incentives has a potential for extreme misuse in the workplace. Rewards involving money, especially, have the power to both motivate and demotivate safety behavior (Geller, 1996). Under a behavior-based safety system, for example, incentives are an integral method of reinforcing behavior; however, external rewards (both positive and negative) can discourage workers from reporting incidents and mishaps (Geller).

Haines, Merrheim and Roy's (2001) study involving employee reactions to monetary rewards found such incentives to be most effective when implemented in the presence of positive management-worker relationships and interdependent teams. A follow-up study regarding formal incentive programs demonstrated similar results. Goodrum and Gangwar (2004) quantified the effects of safety incentives on various safety measures, including OSHA recordables, lost-time workdays, restricted workdays and the company's experience modification rate. Findings indicate that formal incentive programs produced a curvilinear effect and were most effective when coupled with a supportive environment and adequate worker training. As the effects of formal incentive programs are not constant or linear, their use in fostering sustainability is questionable.

However, day-to-day recognition, such as simple praise or a pat on the back, is a low-cost/high-impact method of sustaining performance. Workers who feel valued and appreciated will work doggedly to meet management expectations (Gostick & Elton, 2007). It is believed that "positive reinforcements should be a daily affair" (Geller & Daniels, cited in Gangwar and Goodrum, 2004, p. 26). Yet, positive reinforcement is "the weakest and misunderstood link" (Gangwar & Goodrum, 2004, p. 25) among safety management.

A city fire chief routinely commends his firefighters through the media. Nearly every report of fire contains a quote by the chief, publicly praising firefighters, not for bravery or heroism, but for safe performance. In return, city firefighters are highly devoted to their chief and the positive effects of

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deserved praise is one element contributing to the department's accident-free culture. Furthermore, as a no-cost intervention, positive reinforcement has been shown through empirical research to be positively correlated with the bottom line performance (Gostick & Elton, 2007).

Knowledge

The term *knowledge* is often used synonymously with *training*. The focus on and faith in training to increase performance in the workplace is widespread. Within the realm of safety, OSHA standards mandate an array of worker training. Under compliance regulations, training has become a pivotal method for ensuring workplace safety.

Harrington and Walker (2004) and Lingard (2002) found individual training courses to be effective in specific settings, resulting in fewer accidents and injuries. To the contrary, Bell and Grushecky (2006) concluded that training in a high-hazard industry such as logging had little effect on safety performance.

The reasons behind the ineffectiveness of safety training are limitless. However, two causes are notable. Although OSHA standards establish content requirements, methods of delivery are left to the instructor's discretion. Most safety training is delivered via lecture, an instructional method that often falls far short of meeting the needs of most workers—who learn best through other means (e.g. hands-on, visual) (Stolovitch & Keeps, 2002). The failure to match instruction style to learner preferences may be one potential cause of training ineffectiveness. Another is the absence of strategies that ensure transfer of knowledge and skills acquired in the classroom to the actual jobsite (Mager & Pipe, 1997). Behavior-based initiatives are helpful in ensuring transfer of training.

Workers also acquire knowledge and skills through informal channels outside the classroom (Senge, 2006). It is estimated that 75% of all knowledge gained in adulthood is acquired informally (Tennant & Pogson, 2005). Knowledge can be informally gained through teaming efforts, coaching, the Internet or intranet, or by virtue of on the job experience (Sanders & Thiagarajan, 2001; Lick, 2006). Capitalizing on informal learning opportunities in the workplace is an untapped area of study, but some companies that have harnessed the high-impact/low-cost nature of informal learning are seeing significant increases in performance (Senge).

Capacity

As all personnel bring both innate and acquired aptitudes to the job, the establishment of processes that identify high-risk candidates is a practical hiring strategy. Workers who exhibit negative affectivity, job dissatisfaction and risk-taking behavior pose a major safety problem to management and are more likely to be injured on the job, thereby affecting overall productivity (Clarke, 2006). Clarke and Robertson's (2005) meta-analysis of the empirically derived big five personality dimensions found a correlation between low conscientiousness and low agreeableness with accident involvement.

Prospective safety managers should also be assessed and hired for leadership potential. The literature suggests that managers who possess transformational leadership qualities have the best potential to positively impact safety culture and worker attitudes (Paul & Maiti, 2007; Krause, 2005; Barling, Iverson & Kelloway, 2003). Leaders who inspire through appeals to ideals and values elicit higher levels of thinking among followers (Piccolo & Colquitt, 2006), gaining worker commitments to safety.

Motivation

According to Gilbert (1978), maximum motivation results when system dimensions align and function interdependently. In other words, well-trained workers who are informed, who perceive that the organization is concerned and committed to their safety through generous allocation of resources, and who are properly rewarded behave in ways congruent to management goals. The inspiration behind intrinsic motivation is a belief that safety is a possibility in the workplace.

Although the issues discussed and examples provided are by no means exhaustive of the potential applicability of HPI as a safety sustainability process, this brief review of literature illustrates that the systematic nature of Gilbert's model is a primary source of value.

A Field Application of HPI Principles & Practices

To fully understand and appreciate the systematic, systemic, results-oriented nature of HPI, the following example demonstrates the incorporation of HPI principles and practices into an existing and proven safety program.

ABC Demolition, a company with an excellent safety record and a beyond-compliance safety program, experienced several incidents within a short period of time. Management expressed grave concern over the increasing severity of each successive incident, the critical nature of the latest mishap and the expected $30,000 increase in workers' compensation premiums. The first incident, which was rather minor, involved a toe injury. Several weeks later, a second employee sprained an ankle. A third worker then suffered two broken legs. The fourth mishap, the most serious, involved a severed limb. Were these incidents merely a run of bad luck—or were problems occurring that were unrecognized and unacknowledged?

The incorporation of HPI practices into an existing program is most successful when the process is wholly owned by management. Through the guidance of consultants, initial data were collected through the administration of a safety culture survey. Although an imperfect tool, a safety climate survey is an inexpensive, useful tool for measuring worker attitudes, as well as identifying embedded problems impacting the safety system. Various reliable and valid instruments have been developed and are available through the research literature (Guldenmund, 2007), and many consultants have

constructed their own measures of safety climate.

Eliciting worker perceptions is important for many reasons: 1) survey results are indicative of potential problem areas, highlighting latent problem of which management is unaware; 2) data provides management with the ability to organize and address priority problem areas; 3) information obtained indicates areas needing improvement from the worker viewpoint; and 4) surveys immediately raise safety awareness and promote safety buy in.

Areas of concern were identified and additional data were gathered through interviews of relevant stakeholders. A mixed methods research design provided results that were simultaneously broad and deep. Gap and root-cause analyses were then performed. Benchmarking ABC's current system against Gilbert's matrix produced several findings (highlighted in Figure 4).

Figure 4

Needs Assessment Results for ABC Demolition

ENVIRONMENT		
Information	**Resources**	**Incentives**
• Authoritarian style of information delivery	• Production/safety conflict	• Threat of job loss is dominant method of extrinsic motivation
Knowledge	**Capacity**	**Motivation**
• Lack of structured process to ensure transfer of knowledge and skills to jobsite	• Two workers recently hired are illiterate	• Workers wonder who will be the next injury victim
PERFORMER		

Over the past several years, ABC Demolition has earned high praise from OSHA and the company boasts a better-than-average experience modification factor. An interview with management clearly indicated the seriousness with which the organization approaches safety. The senior manager truly cares for the employees.

Following the fourth and most serious incident, this manager immediately enlisted the services of a local trauma intervention team to counsel workers. ABC management should be commended for acting quickly to provide workers with emotional support during a time of crisis. Another favorable point is the company's resource-rich work environment. Provisions for PPE and equipment were generous and the company's truck fleet was updated every 2 years. The frontline supervisor, a longtime employee, was both capable and experienced—and as concerned for employee safety as the senior manager.

Yet, lingering problems were brewing beneath the surface of this system. In his zeal to impress upon workers the seriousness of safety, the senior manager presented a rather gruff facade, creating a subculture of fear that undermined the positive shared culture management believed dominated the system. Although he had never dismissed an employee for a safety violation, tough talk made a deep impression on workers; in a local job market where well-paying jobs are scarce, problems, especially minor issues, tended to be concealed rather than shared.

In the span of time over which the four accidents occurred, the company was also undergoing significant changes. A new recycling plant was under construction and plans to enlarge the nature and direction of the business were underway. It is possible that with this focus on growth, safety had become a neglected facet. Finally, the company had recently hired two illiterate workers. No special procedures were in place to ensure that these workers fully comprehended their safety rights and obligations, and absorbed information adequately enough to engage in work safely.

Intervention Recommendations

Proposed interventions were designed to address and mitigate four site-specific latent and unacknowledged problems embedded in this system:

- the existence of a subversive subculture of fear;
- failure to account for the impact of organizational change on the safety system;
- lack of structured transfer strategies connected to formal training;
- gaps in worker capacity.

Management's short-term goal was to implement a 3-year continuous improvement initiative to eventually restore the company's experience modification rate to its original point. Recommended interventions were designed to be low-cost/high-impact, thereby providing positive bottom-line impact. Prior to implementation, interventions were evaluated against four criteria: time, cost, acceptability and expectations.

The senior manager agreed to participate in a brief series of executive coaching sessions (provided by a consultant) designed to modify his approach toward workers. Because of his caring attitude, it was believed that this manager could become a transformational leader who could inspire safety, rather than motivate from a standpoint of fear.

As Krause (2005) asserts, it is ideal that coaching be more developmental than remedial, thereby "leveraging leaders strengths to a greater advantage" (p. 116). A change in management style will increase trust between management and workers, as well as enhance communication and collaboration within the organization.

Table 1

Formative Evaluation Plan for HPI Implementation, ABC Demolition

Intervention	Current performance	Goal	Measurement method	3-month formative results
Management coaching	Senior manager rarely motivates employees using ad-hoc, day-to-day incentives	Recognize and verbally praise the safety efforts of each individual worker at least once a week	Recognition frequency log (Gostick & Elton, 2007) *(Self-report data)*	Senior manager has incorporated new behavior 50% on average
Worker skill and knowledge on-the-job-training transfer	Baseline observation data indicate that workers use PPE only 50% of the time	Use PPE properly 100% of the time	Individual worker PPE checklist *(Supervisor observation)*	Consistent use of PPE has increased 31%
Management/worker information exchange	Toolbox talks involve daily supervisor lecture	Increase management/ worker exchange at toolbox talks by 25%	Weekly supervisor report	Collaborative feedback has increased 10%
Worker capacity	Two newly hired workers are illiterate	Enroll workers in classes conducted by local literacy volunteers	Number of classes workers have attended	According to agency records, worker 1 has 100% attendance; worker 2 attended only three sessions

Company workers participated in both classroom and on-the-job training. However, the company lacked a structured strategy to ensure that workers applied knowledge and skills consistently. To address this, a regular schedule of behavior observations to assess PPE, equipment usage and worker safety practices was developed.

Information was disseminated to workers primarily through short weekly toolbox talks. Management agreed to increase these meetings to twice weekly. The first session was intended to be a vehicle for informal learning. The second session was designed to encourage workers to articulate and share concerns about observed on-the-job problems about which management may be unaware. In addition, a procedure was implemented to address the worker illiteracy issue.

Evaluation Procedures

Prior to implementation, summative and formative evaluation procedures were designed to gauge effectiveness and impact of proposed interventions. Formative evaluation data are to be collected quarterly; summative data will be analyzed annually. Table 1 contains a summary of the formative plan and displays the initial round of data results after one quarter. A discussion of summative data collection follows.

In the short term, the overarching objective of each intervention is to achieve steady improvement in management and worker target behaviors. In the absence of upward progress, interventions are adjusted to ensure attainment of maximum improvement. All measurement tools used were high intensity instruments, linking management/worker skill and knowledge to actual job results (Barksdale & Lund, 2001).

Of special note is the intervention aimed at the two employees enrolled in a literacy program. Initially, evaluation procedures were targeted solely at assessing worker initiative in addressing their problems. Subsequent assessment will measure improvements in safety awareness and comprehension of protocols. In the event worker #2 fails to return to class, management must weigh the potential liability of retaining a worker who is an extreme safety risk.

HPI & the Bottom Line

The secondary goal of the implementation involves reducing the company's experience modification factor at least to the value held before the series of recent incidents. Evaluation of intervention impact on the double bottom line was accomplished through analyses of two types of data. A record of near-hit and precursor incidents was maintained and, on a monthly basis, events were qualitatively analyzed by management to ensure that interventions were adequately addressing identified gaps, and to determine whether new gaps had developed due to system changes. A forecast of the implementation's annual ROI was calculated using Phillips (2003) methodology. Phillips's framework, which compares the implementation monetary benefits with program costs, is appropriate when interventions are learning-based (Phillips & Phillips, 2005). The following calculation demonstrates the expected ROI at the end of year one.

$$\frac{\text{Total benefits - Program costs}}{\text{Program costs}} \times 100\% = \text{ROI}$$

$$\frac{\$20{,}000 - \$6{,}300}{\$6{,}300} \times 100\% = 217\%$$

Calculation of total benefits was based on direct, indirect and intangible cost savings associated with safety. Program costs included consultants' fee, employee time and any productivity loss. It is conjectured that HPI investments made during year one will yield the lowest ROI of this 3-year implementation. In years two and three, if a trend of zero injuries is sustained, it is expected that ROI will increase, and by the end of year three, total ROI will approach Swanson's (1999) 8:1 estimate.

Conclusion

In the hours immediately following any major safety incident, there is a typical rush to judgment. Media reports broadcast the inevitable finding—many reported incidents are, at least initially, attributed to human error. Hasty judgments promote the

growth of a culture of blame. Placing blame is a superficial—and at best temporary—fix to most safety sustainability problems.

The practice of HPI encompasses an inquiry process that is deep and broad, circular rather than linear, ensuring that true root causes of human error are exposed and solutions are appropriate and permanent.

Several unique facets separate HPI from other problem-solving and change initiatives. Available interventions are wide ranging. While other change initiatives draw from a narrow band of possible solutions, HPI's cross-disciplinary focus provides a unique toolbox of endless options with which to bridge identified gaps. Because sustainability problems are deeply embedded, the ability to problem solve creatively is a management asset.

Unlike other change initiatives, the ultimate focus of HPI is on collaborative learning. Management and workers learn, not just in hindsight, but also through foresight, cultivating sensitivity to predictive patterns that indicate potential crisis or disaster.

Ideally, the goal of HPI is to thwart crisis before it happens. Used as a surveillance tool, HPI is a method for detecting when the system is off-kilter and functions to restore balance. Optimally, HPI is a value-added strategy that is easy and cost-effective to implement, yet provides a high return. The process fulfills both goals of responsible safety management—protection of people and preservation of profits. ■

References

American Society of Training and Development. (2008). Education programs: HPI. Alexandria, VA: Author. Retrieved

Building a Business Case for HPI

Requesting funding to implement a sustainability strategy may be a tough sell to executive management, especially when an existing safety program is commendable. Obtaining even minimal additional funding requires the creation of a strong business case, so as to encourage buy-in from top management. By virtue of the low-cost/high-impact nature of HPI and emphasis on bottom-line outcomes, it is possible to construct a convincing and efficient business case for implementing a systematic sustainability process like HPI.

Rules for Building the Case

Rule #1: Know the Organization

The case must speak to upper management in the language it understands. Before building the case, gather/obtain full knowledge of the particular and unique financial dynamics driving the organization. For example, how does the organization measure return—discounted cash flow and net present value (NPV—which is the most popular metric); internal rate of return (IRR); or return on investment (ROI)? The proposal will only demonstrate value if it meets site-specific criteria. Furthermore, many companies refuse to consider a proposed project unless it meets an established percentage of return. For example, for some organizations, a project that fails to provide at least a 35% annual return is of no value.

Payback period (time required for a project to pay for itself) is another important financial consideration. Be sure to design the case to prove that the proposal can achieve the results that are most valued within the organization. Consult with the finance department to obtain critical information.

Rule #2: Be Creative

The greatest hurdle to overcome when building a business case is in quantifying benefits. Costs are easily quantifiable, but benefits, which are often indirect or intangible, can be difficult to translate into real dollars. Demonstrating the effect of indirect and intangible benefits requires a measure of creativity. Essentially, all businesses strive to meet similar objectives—sales and marketing, production, operational, image enhancement, etc. What differs from one organization to the next is prioritization of objectives. In designing the business case, be certain projected impacts match business priorities. Often, tone can illustrate value by describing the strategy's impact on observable and measurable metrics already in place.

Technology tools can help strengthen the case as well. Software programs such as Monte Carlo and Crystal Ball can generate both sensitivity and risk analyses, offering management a range of scenarios which illustrate that a sustainability strategy is in the organization's best interest under a variety of conditions.

Arguing the case based on other documented HPI case studies is an effective way to capture the attention of executive management. Solid studies of returns associated with HPI implementations can be found through the American Society of Training and Development or the International Society for Performance Improvement.

Rule #3: Enlist the Support of an Advisory Committee

Gathering feedback from a cross-functional group of high-level stakeholders lends credibility and accuracy to the case. Requesting support from stakeholders whose primary interests are unrelated to safety communicates a united front.

Lastly, arguing the need for a sustainability process based on a 360° perspective is strong evidence that such investments are an integral part of the organization's core mission and comprehensively aligned with the company's goals.

Sept. 22, 2008, from http://www.astd.org/content/education/certificateprograms.

Barksdale, S. & Lund, T. (2001). *Rapid evaluation.* Alexandria, VA: ASTD Press.

Barling, J., Iverson, R. & Kelloway, E. (2003). Accidental outcomes: Attitudinal consequences of workplace injuries. *Journal of Occupational Health Psychology, 8*(1), 74-85.

Baysari, M., McIntosh, A. & Wilson, J. (2008). Understanding the human factors contribution to railway accidents and incidents in Australia. *Accident Analysis and Prevention, 40,* 1750-1757.

Behm, M., Veltri, A. & Kleinsorge, I. (2004, April). The cost of safety: Cost analysis model helps build business case for safety. *Professional Safety, 49*(4), 22-29.

Bell, J. & Grushecky, S. (2006). Evaluating the effectiveness of a logger safety training program. *Journal of Safety Research, 37,* 53-61.

Choudhry, R., Fang, D. & Mohamed, S. (2007). The nature of safety culture: A survey of the state-of-the-art. *Safety Science, 45*(10), 993-1012.

Clarke, S. (2006). Contrasting perceptual, attitudinal and dispositional approaches to accident involvement in the workplace. *Safety Science, 44,* 537-550.

Clarke, S. & Robertson, I. (2005). A meta-analytic review of the Big Five personality factors and accident involvement in occupational and nonoccupational settings. *Journal of Occupational and Organizational Psychology, 78,* 355-376.

Coe, R. & Lake, P. (2003). Effectively managing nuclear risk through human performance improvement. *Nuclear Plant Journal, 21*(5), 40.

Cox, J. (2006). Valuing the Gilbert model: An exploratory study. In S. Carliner (Ed.), *ASTD Research-to-Practice conference proceedings* (pp. 37-49). Alexandria, VA: ASTD Press.

Crossman, D. (2008). *The impact of safety culture on worker motivation and the economic bottom line.* Unpublished doctoral dissertation, Capella University, Minneapolis, MN.

Dean, P. (1999). Designing better organizations with human performance technology and organizational development. In H. Stolovitch and E. Keeps (Eds.), *Handbook of human performance technology* (pp. 321-334). San Francisco: John Wiley & Sons.

Dekker, S. (2002). Reconstructing human contributions to accidents: The new view on error and performance. *Journal of Safety Research, 33,* 371-385.

Ford, D. (2002). Knowledge interventions: Training is not always the answer. In G. Piskurich (Ed.), *HPI essentials: A just-the-facts, bottom-line primer on human performance improvement* (pp. 115-131). Alexandria, VA: ASTD Press.

Geller, E. (1996, Oct.). The truth about safety incentives. *Professional Safety, 41*(10), 34-39.

Gilbert, T. (1978). *Human competence: Engineering worthy performance.* New York: McGraw-Hill.

Gilbert, T. (1978). *Human competence: Engineering worthy performance* (ISPI Tribute ed.*).* Washington, DC: International Society for Performance Improvement.

Goodrum, P. & Gangwar, M. (2004). Safety incentives: A study of their effectiveness in construction. *Professional Safety, 49*(7), 24-34.

Gostick, A. & Elton, C. (2007). *The carrot principle.* New York: Simon & Schuster.

Griffin, M. & Neal, A. (2000). Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge and motivation. *Journal of Occupational Health Psychology, 5*(3), 347-358.

Guldenmund, F. (2007). The use of questionnaires in safety culture research: An evaluation. *Safety Science, 45,* 723-743.

Haines, V., Merrheim, G. & Roy, M. (2001). Understanding reactions to safety incentives. *Journal of Safety Research, 32,* 17-30.

Harrington, S. & Walker, B. (2004). The effects of ergonomics training on knowledge, attitudes and practices of teleworkers. *Journal of Safety Research, 35,* 13-22.

International Society for Performance Improvement. HPT education. Silver Spring, MD: Author.

Kaufman, R. (2000). *Mega planning: Practical tools for organizational success.* Thousand Oaks, CA: Sage Publications.

Krause, T. (2005). *Leading with safety.* Hoboken, NJ: John Wiley & Sons.

Lick, D. (2006). A new perspective on organizational learning: Creating learning teams. *Evaluation and Program Planning, 29,* 88-96.

Lingard, H. (2002). The effect of first-aid training on Australian construction workers' occupational health and safety motivation and risk control behavior. *Journal of Safety Research, 33,* 209-230.

Mager, R. & Pipe, P. (1997). *Analyzing performance problems: Or you really oughta wanna.* Atlanta, GA: CEP Press.

Mohamed, S. (2002). Safety climate in construction site environments. *Journal of Construction Engineering and Management, 128*(5), 375-384.

Mullen, J. (2005). Testing a model of employee willingness to raise safety issues. *Canadian Journal of Behavioral Science, 37*(4), 273-282.

O'Toole, M. (2002). The relationship between employees' perceptions of safety and organizational culture. *Journal of Safety Research, 33,* 231-243.

Parker, S., Axtell, C. & Turner, N. (2001). Designing a safer workplace: Importance of job autonomy, communication quality and supportive supervisors. *Journal of Occupational Health Psychology, 6*(3), 211-228.

Parker, D., Lawrie, M. & Hudson, P. (2006). A framework for understanding the development of organizational safety culture. *Safety Science, 44,* 551-562.

Paul, P. & Maiti, J. (2007). The role of behavioral factors on safety management in underground mines. *Safety Science, 45,* 449-471.

Phillips, J. (2003). *Return on investment in training and performance improvement programs* (2nd ed.). New York: Butterworth Heinemann.

Phillips, J. & Phillips P. (2005). *ROI at work: Best practice case studies from the real world.* Alexandria, VA: ASTD Press.

Piccolo, R. & Colquitt, J. (2006). Transformational leadership and job behaviors: The mediating role of core job characteristics. *Academy of Management Journal, 49*(2), 327-340.

Prussia, G., Brown, K. & Willis, P. (2003). Mental models of safety: Do managers and employees see eye to eye? *Journal of Safety Research, 34,* 143-156.

Richter, A. & Koch, C. (2004). Integration, differentiation, and ambiguity in safety cultures. *Safety Science, 42,* 703-722.

Roberts, K. & Bea, R. (2001). Must accidents happen? Lessons from high-reliability organizations. *Academy of Management Executive, 15*(3), 70-78.

Rummler, G. & Brache, A. (1995). *Improving performance: How to manage the white space on the organization chart.* San Francisco: John Wiley & Sons.

Sanders, E. & Thiagarajan, S. (2001). *Performance intervention maps: 36 strategies for solving your organization's problems.* Alexandria, VA: ASTD Press.

Senge, P. (2006). *The fifth discipline: The art and practice of the learning organization.* New York: Currency Doubleday.

Seo, D. (2005). An explicative model of unsafe work behavior. *Safety Science, 43,* 187-211.

Stolovitch, H. & Keeps, E. (2002). *Tellin' ain't training.* Alexandria, VA: ASTD Press.

Swanson, R. (1999). Demonstrating return on investment in performance improvement projects. In H. Stolovitch & E. Keeps (Eds.), *Handbook of human performance technology: Improving individual and organizational performance worldwide* (2nd ed.) (pp. 813-839). San Francisco: John Wiley & Sons.

Talaq, J. & Ahmed, P. (2004). Why HPT, not TQM? An examination of the HPT concept. *The Journal of Management Development, 23*(3/4), 202-218.

Taylor, J., & Thomas, R. (2003). Toward measuring safety culture in aviation maintenance: The structure of trust and professionalism. *The International Journal of Aviation Psychology, 13*(4), 321-343.

Tennant, M. & Pogson, P. (2005). Learning and change in the adult years. In *Theory and methods of educating adults.* Hoboken, NJ: John Wiley & Sons.

W. Edwards Deming Institute. (2000). The Deming system of profound knowledge. Palos Verdes Estates, CA: Author. Retrieved April 23, 2009, from http://deming.org/index.cfm?content=66.

Walker, A. & Hutton, D. (2006). The application of the psychological contract to workplace safety. *Journal of Safety Research, 37,* 433-441.

Zohar, D. (2000). A group-level model of safety climate: Testing the effect of group climate on microaccidents in manufacturing jobs. *Journal of Applied Psychology, 85*(4), 587-596.

Zohar, D. & Luria, G. (2003). The use of supervisory practices as leverage to improve safety behavior: A cross-level intervention model. *Journal of Safety Research, 34,* 567-577.