



U.S. Department
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**Federal Highway
Administration**



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THE POTENTIAL APPLICATION OF BEHAVIOR-BASED SAFETY IN THE TRUCKING INDUSTRY

Final Report

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12. Sponsoring Agency Name and Address Federal Highway Administration Office of Motor Carrier and Highway Safety 400 7th Street SW Washington, DC 20590		16. Abstract <p>The purpose of this research is to gain an understand of Behavior-Based Safety (BBS) principals and to determine its applicability to the measurement and management of commercial motor vehicle driver performance and safety. As such, the contractor conducted a series of 3 presentation on BBS in late-August 1998. Two presentations were conducted at the HQ Department of Transportation and one was conducted at HQ American Trucking Associations Foundation, Inc. A question and answer session followed each presentation.</p> <p>As discussed during the presentations, BBS employs "benchmark" behaviors that are identified as safety or productivity-critical. The organization then focuses on these benchmark behaviors for purposes of driver self-management, general management, corrective training and/or rewards. For example, if vehicle highway speed were identified as a safety-critical benchmark behavior, speed would be monitored and both drivers and their managers would receive frequent feedback on the driver's degree of speed compliance. Gas mileage is another example of a benchmark behavior.</p> <p>BBS methods have been implemented with great success in industrial setting and have tremendous potential for improving safety and productivity in the trucking industry. The potential benefits for the trucking community are even more pronounced if BBS principles are used in conjunction with new or soon to be available, in-vehicle technologies (e.g. actigraphs, alertness monitors and electronic on-board recorders) which potentially provide safety-relevant and/or productivity-relevant behavior/performance benchmark information.</p>			
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Final Report

Prepared for the:
Federal Highway Administration
Office of Motor Carrier and Highway Safety
Washington, D.C.

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Behavioral Science Technology, Inc.

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Introduction

Dr. Thomas Krause, CEO, Behavioral Science Technology, Inc. (BST), conducted a series of seminars at the U.S. Department of Transportation (DOT) headquarters on August 20, 1998, and at the American Trucking Associations Foundation (ATA) headquarters on August 21, 1998, on the subject of Behavior-Based Safety (BBS). In attendance were a select group of individuals from the community of researchers, regulators, and trucking company personnel interested in learning about the use of BBS principles and performance monitoring technology to improve driver and other transportation operator performance. Of the two sessions held at the DOT, one was primarily for the Federal Highway Administration (FHWA), Office of Motor Carrier and Highway Safety (OMCHS), and the other had a broader audience from the DOT. At the second session, representatives included staff from the Federal Railroad Administration, Maritime Administration, Office of the Secretary, National Highway Traffic Safety Administration (NHTSA), the United States Coast Guard and FHWA.

These seminars were sponsored by the FHWA, OMCHS as part of its human factors research program on driver performance enhancement. In particular, OMCHS is interested in ensuring the safe, effective use of current and advanced in-vehicle driving performance monitoring devices. Seminar content included BBS foundation concepts, elements of implementation, and results obtained by private companies using BBS methods (see presentation overheads, Attachment A). As discussed during the presentation, BBS principles are applicable to many different industrial work settings and to operators across many transportation modes.

Each session was followed by a discussion of issues related to the integration of BBS and performance monitoring. The focus of most of the discussion was on long-haul truck driving. This paper will summarize the issues discussed and present concepts for the use of performance management to improve driver safety and productivity.

Background

The BBS is a set of methods demonstrated to improve safety performance by engaging workers in the improvement process, teaching them to identify critical safety behaviors, perform observations to gather data, provide feedback to encourage improvement, and use gathered data to target system factors for positive change. Most BBS initiatives have been implemented in industrial environments in which workers are in groups; however, a significant number have been successful with workers who are in remote locations, using the worker as the observer (self observation).

Performance monitoring offers an opportunity to improve driver safety and productivity by measuring and providing feedback to drivers on critical performance variables. Measures for which technology is, or will be available, include alertness, following distance, speed, vehicle control, etc. The practical usefulness of technology to measure performance is dependent on worker acceptance and collaboration of worker and manager.

The use of performance feedback is central to BBS. Performance feedback is a powerful tool, which has been shown to influence behavior effectively in both short and long term settings. In addition, performance feedback accomplishes other objectives:

- * Communicates a standard
- * Increases self-observation
- * Provides accurate information on performance
- * Strengthens safety culture
- * Uncovers hidden barriers

Over 90% of BBS implementation projects conducted by the author and associates have continued within their respective companies, averaging 29% improvement in the first year and growing to 70% by the fifth year (Krause, Seymour & Sloat, 1998). The success of long term BBS initiatives is attributable in large part to their ability to engage workers collaboratively in the improvement process itself. Integrating performance monitoring with BBS methods is a natural way to assure the optimal use of performance monitoring, and avoid potential negative associations and pitfalls.

Objectives for the Use of BBS

The BBS can improve both safety (e.g., vehicle crash rate) and productivity (e.g., on time deliveries). Combining safety and productivity objectives makes BBS more desirable to all concerned, adding to the employer's level of motivation as well as the drivers.

The rationale for improved safety is found in the correlation between monitored performance variables and vehicle crash rates. Potential productivity gains are from the driver's ability to perform more efficiently as a result of better management (e.g., early detection of driver fatigue) facilitating optimal scheduling and rest periods.

Implementation Strategy: *Self-Management or Enforcement?*

Performance data could be used for either enforcement or self-management purposes. Which strategy should be used depends on which is most likely to positively influence the greatest amount of driving behavior most efficiently. Performance monitoring as an *enforcement* tool is likely to engage workers in creating methods to undermine the purpose of the measure. This is a common reason for the failure of technology to produce intended improvements (e.g., early 1970's seatbelt interlocks were widely circumvented by the public and did little to instill the positive value of wearing seatbelts). In contrast, *self-management* requires that the worker be an active and involved participant in the improvement effort. When this is accomplished, the effect of performance feedback is to allow for, and facilitate, positive change. This is a natural outcome with many types of performance monitoring; when workers are given feedback they attempt to improve (Komaki, J., 1978; Krause, T.R. & Sloat, K.C.M., 1993; Killimett, P., 1991, see Attachments B and C).

Accordingly, BBS is best framed as a *self-management* strategy in which the worker has significant involvement and/or control of the monitoring and feedback system. It also provides an opportunity for incorporating new technologies, which enhance safety and/or productivity (e.g., on-board recorders or black boxes) in the everyday work environment.

Results Obtained by Private Companies Using BBS

As of mid-1998, the author and his colleagues have participated in BBS initiatives at over 850 sites in the US and Canada, and in the UK, France, Mexico, Jamaica, Brazil, Venezuela, Argentina, South Africa, Australia, and the Philippines. Although most of these initiatives started in manufacturing settings, the tools of BBS are being used by a number of transportation departments and organizations.

At a Canadian oil and natural gas company, for example, drivers identified a cluster of 16 behaviors common to their history of vehicle-related accident and injuries. These 16 behaviors fell essentially into two categories: behaviors drivers engaged in to ensure the operational integrity of the vehicle prior to taking the wheel (i.e., preventative maintenance), and driving-related behaviors. Examples of operational integrity behaviors included inspecting lights and directional indicators, checking tire pressure and wear patterns, and inspecting and testing brakes. Examples of safe driving behaviors included maintaining an appropriate following distance, using seat belts, scanning parked cars, checking mirrors and avoiding distractions.

Once the behaviors were identified and operationally defined, observations were initiated to gather data, provide feedback, and encourage improvement. The BBS process encouraged self-observation as well as peer-to-peer observation. Observation data were collected and entered into a database. Drivers met monthly to review the data. The data was also used to isolate systemic issues and focus resources on eliminating barriers to continuous improvement. This process is ongoing.

Employees at a glass manufacturing and distribution company gathered hundreds of incident reports from operations throughout Canada and the U.S. These reports were used to develop a list of at-risk behaviors common to this large pool of incidents. The comprehensive list they developed was sent to each of the company's 140 stock and delivery locations. At each of the 140 branch locations, employees were engaged in developing a custom list of behaviors. In addition to selecting relevant behaviors, employees fine-tuned the operational definitions of the behaviors to match the size and configuration of the vehicles operated by employees at the branch.

This BBS process also relied heavily upon self-observation. Drivers met monthly to discuss the data and develop action plans.

The efficacy of BBS is well documented. Hundreds of organizations have used the tools of BBS to make a step change and safety performance toward continuous improvement. In addition to lower incident rates, the data indicate these sites are also experiencing substantial reductions in workers' compensation costs per employee. This point is illustrated in Attachment D.

The author and his colleagues studied workers' compensation reductions at eleven sites. The statistical analysis was based upon comparisons of pre-implementation workers' compensation costs to post-implementation costs. The study compared a 4-year baseline to 3-year follow-up costs. Results revealed consistent and substantial reductions in spending following implementation of behavior-based safety methods. The average reduction from baseline in Year-1 of observations amounted to 39%; in Year-2 the reduction from baseline averaged 46%; in Year-3 it averaged 70% (BST, 1998, see Attachment D). It is reasonable to think that similar results will occur in the trucking industry since the factors underlying incident rates are the same.

Who should receive performance data?

The industry's or company's use of BBS techniques in conjunction with existing or future performance measurement technologies such as alertness monitors, on-board recorders and "black boxes" could generate a substantial quantity of valuable data. Several groups of people have legitimate needs for performance information, for different reasons: the driver, the company management and the government. For the driver, the data needed is continuous safety and performance feedback, to reinforce safe and effective driving performance and increase awareness of improvement opportunities. For the manager and supervisor, the primary purpose of performance data is to inform management of the degree to which the improvement initiative is succeeding. The government is interested in data that demonstrates regulatory compliance and safety enhancement.

A variety of options could be developed for the distribution of performance monitoring data, depending on the objectives of its use. One potential option is:

- Driver (level one). Continuous performance and safety data (e.g., following distance and alertness level) with summaries by day, week, and month, available in real time and at end of performance periods.
- Supervisor and Manager (level two). Summary data by driver group, showing all measures, by all time periods, without drivers individually identified.
- Government Agency (level three). Summary data on safety regulatory compliance improvement or other safety improvements could be provided to cognizant government agencies and could be compiled in such a way to assure individual driver anonymity.

Having information that is too specific available to levels two and three has the potential to undermine the intention of the driver to participate voluntarily and actively, creating fear of reprisal; therefore a tiered system (as referenced above) of data availability should be considered.

Positive Outcomes for Use Of BBS: Incentives and Rewards

All groups as described above (drivers, supervisors, managers, and government agencies) have a stake in driver performance improvement. In addition to the use of performance feedback, other kinds of positive outcomes can be used to motivate the use of BBS. However, the use of incentives to motivate performance is complex and can easily lead to unintended results (Krause, T.R. and McCorquodale, R. J., 1996). It is not uncommon for incentive plans to motivate the subject in ways that are counter-productive (e.g. workers fail to report injuries, or supervisors misclassify injury types). The best strategy is to emphasize positive outcomes that are consistent with the goals of the initiative itself. For example, each level could be encouraged to report performance monitoring data voluntarily to the next level as evidence of proficiency, each receiving appropriate positive response.

Compensatory risk taking?

If drivers improve performance following BBS will they "compensate" by engaging in other types of at-risk behavior? For example, if a driver regulates vehicle speed, will he or she increase some other at-risk behavior, perhaps lower attention? There is no real support for this fear, and in fact there is reason to think that safe behavior *generalizes* from targeted behaviors to other safety related behaviors (Rock, 1993; Ludwig & Geller, 1997). Again, the active involvement and voluntary participation of the driver is of critical importance to the outcome.

Summary

Performance measurement is a critical and essential ingredient in performance enhancement. BBS looks for ways that safety or productivity-critical worker behaviors can be measured and managed systematically. Typically, certain "benchmark" behaviors are identified as safety or productivity critical by organizationally crosscutting teams comprised of workers, supervisors, management, and others. Once established, the organization then employs these benchmark behaviors for purposes of worker self-management, training, general management, information data mining, performance evaluations, and awards or corrective actions. Thus, organizations may use the BBS behavior benchmarks as an additional management tool, as opposed to relying primarily on outcome measures. Outcome measures (e.g., crashes or violations in the case of drivers) are not always as measurable or reliable as behaviors and thus are not a sound basis for effecting behavior changes. However, outcome measures are overwhelmingly used by the trucking industry (and government) today as the principal measure of driver performance measurement and overall measure of safety.

BBS methods have been implemented with great success in industrial settings and have tremendous potential for improving safety and productivity in the trucking industry. For example, if vehicle highway speed were identified as a safety critical benchmark behavior, speed would be monitored and both drivers and their managers would receive frequent feedback on drivers' degree of speed compliance. Drivers demonstrating acceptable behavior/performance would be rewarded so that the overall management atmosphere is positive and facilitative of the desired behavior. Many new in-vehicle technologies are available, or will soon be commercially available (e.g., actigraphs, alertness monitors, electronic on-board recorders, and "black boxes")

to potentially provide accurate safety-relevant and/or productivity-relevant behavior/performance benchmarks.

The potential to improve truck driving safety and performance is enormous, particularly when BBS principles are used in conjunction with these new technologies. Such devices may be viewed negatively as "surveillance" and an unwarranted intrusion into driver privacy. Acceptable implementations of these technologies via BBS will help overcome this potential bias by demonstrating to the drivers the technological benefits of their use and the value of performance feedback as self-management aids and tools for greater autonomy.

Follow-on research could identify optimal driving performance measures (i.e., reliable everyday measures correlating with BBS benchmark behaviors measures). In addition, it could examine the foundations and current practices of BBS and the capabilities of various technologies to extend the range of behaviors/performance factors that may be addressed in a BBS operational environment. An overriding theme would be that in-vehicle technologies can help prevent specific crash types (or provide other safety or productivity benefits, such as greater driver autonomy). In addition, these devices can be viewed and used as important elements in the overall management of fleet safety and productivity, and in some cases, the technological basis for future performance-based safety regulations.

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Can Behavior-Based Safety

Improve

CMV Driver Performance and Safety ?

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Behavior Based Safety



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Behavior-Based Safety

- Foundation concepts
- Implementation steps
- Results - 1986 to 1996
- Discussion

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Behavior-Based Safety

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Behavior-Based Safety

- Applied behavior analysis
- Quality management
- Organizational development

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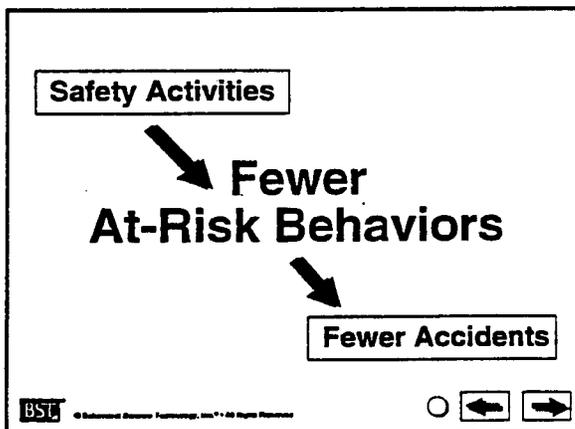
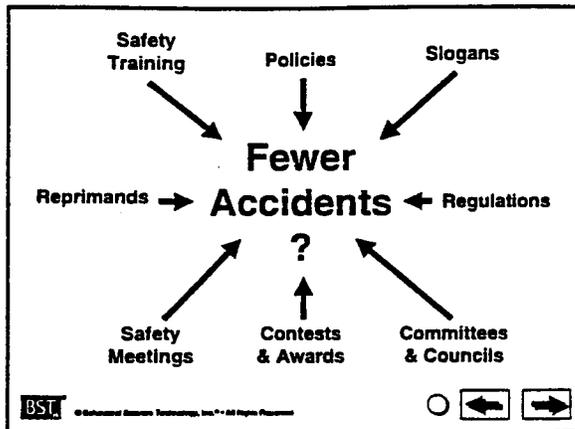


Behavior-Based Safety

- Employee Driven
- Continuous Improvement
- Process
- Focused on Safe Behavior

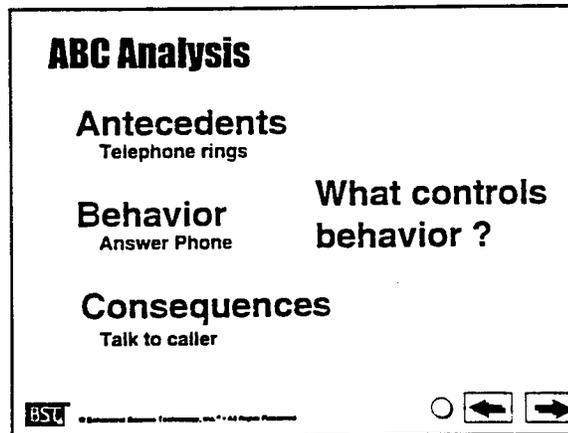
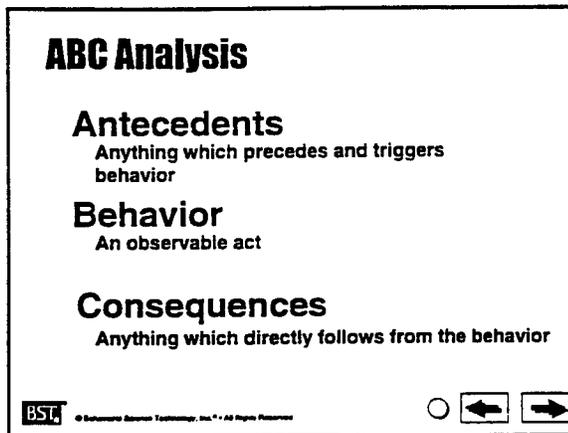
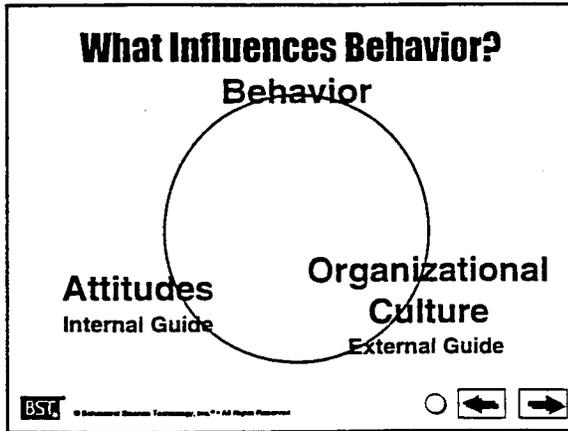
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Behavior
 An Observable Act

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Consequences
Control
Behavior

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Antecedents
Influence
Behavior
Only to the Extent that
They Predict
Consequences

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3 Factors That Affect Consequences

Timing

Sooner / Later

Consistency

Certain / Uncertain

Significance

Positive / Negative

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**Consequences That Are
Most Powerful Are:**

Soon / Certain / Positive

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A

B

C

Failure to drive
within speed limit

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A

B

C

In a hurry
Schedule pressure
No one else does
Time of day
Low risk perception
Lack of awareness

Failure to drive
within speed limit

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A	B	C
In a hurry	Failure to drive within speed limit	Get there faster
Schedule pressure		Feel more comfortable
No one else does		Peer approval
Time of day		Ticket
Low risk perception		Convenience
Lack of awareness		Crash

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A	B	C
In a hurry	Failure to drive within speed limit	Get there faster SC+
Schedule pressure		Feel more comfortable SC+
No one else does		Peer approval SC+
Time of day		Ticket LU-
Low risk perception		Convenience SC+
Lack of awareness		Crash LU-

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One powerful way of influencing behavior is feedback

Feedback is information about performance in relation to a goal

Feedback is a consequence

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Feedback can ...

Communicate a standard
Increase self observation
Provide accurate information
on performance
Strengthen safety culture
Uncover hidden barriers

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Four Elements of Behavior-Based Safety

1. Identify Critical Behaviors



2. Gather Data



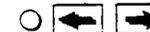
3. Provide Feedback



4. Use Data to Remove Barriers



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1. Identify Critical Behaviors



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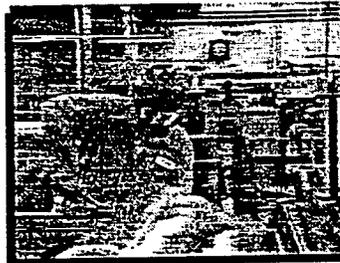
Safe Driving Behavior

- Speed
- Driver Orientation
- Buckle Up
- Space Cushion
- Gauge Traffic Lights
- Intersection
- Scan Parked Cars

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2. Gather Data

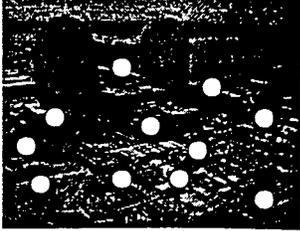


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**Unique Perspective
Based on Gathered Data**

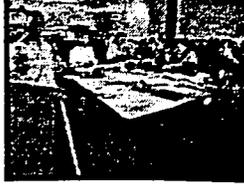
Observations ○



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4. Use Data to Remove Barriers

- Group Meetings
- Cause tree analysis
- Identify Barriers
- Action Planning



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Action Planning Strategies

- Targeted feedback
- Increase observation frequency
- Equipment and Facilities improvement



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Analysis of behavioral data

- View to rear of truck is limited
 - Redesign of trucks for better view to rear
 - Top down mirror for view to rear
 - Cut window into rear of truck
 - Use of “prism” overlay on rear window
 - Side windows in panel truck for blind spots

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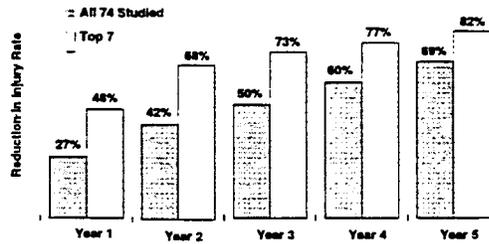
Over 700 Implementations Worldwide



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Results

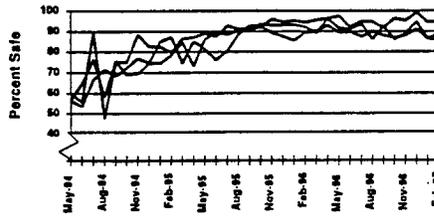


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Increases in Percent Safe for 3 Behaviors

Line of Fire Body Mechanics Walking and Working Surfaces

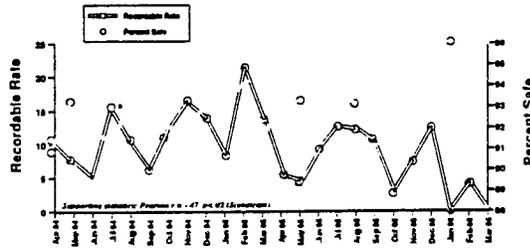


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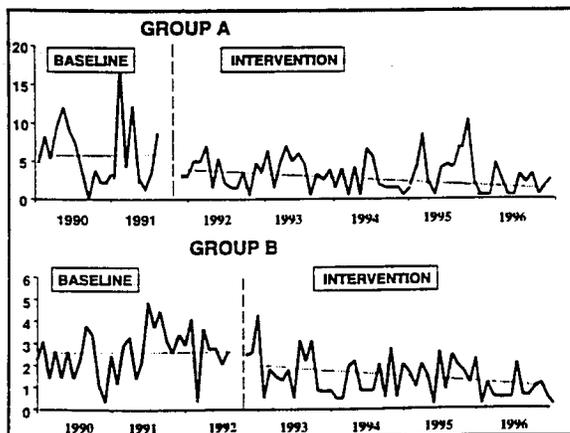
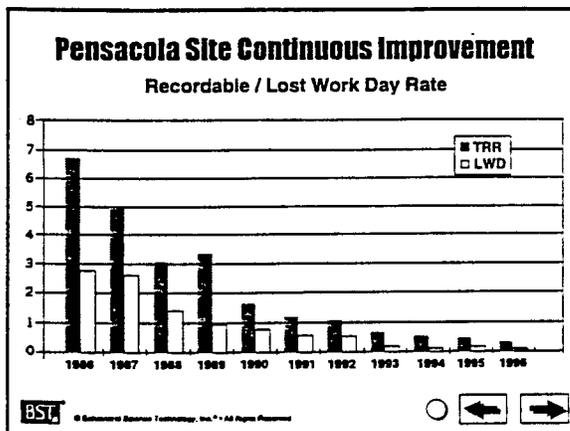
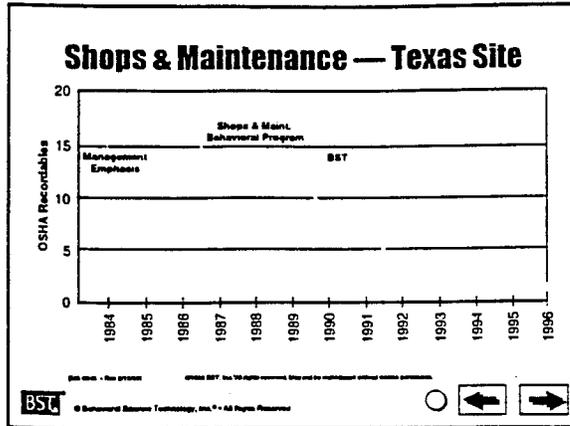
Lumber Mill

As Safe Behavior Increases, Recordable Rates Decrease



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Discussion Questions

1. Objectives
2. Self management vs enforcement
3. Use of performance monitoring information
4. Rewards for excellence
5. Compensatory risk taking



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Driver Orientation

Observable behaviors

Does the driver:

- have full control of the vehicle at all times?
- use defensive driving techniques?
- park and unload so as to not create hazardous situations?
- alter his driving habits to coincide with road conditions?



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The behavior-based approach to safety: a clear picture, an effective plan*

Patrick T. Killimett

Once employees take an interest in safety performance, benefits are felt throughout the workplace.

What is it about safety performance that makes it so difficult to manage? Whether we are considering a paper converting plant, a mill, or any manufacturing environment for that matter, it seems to me that safety is one of the most stubborn problems facing managers today.

Of course, managers face many other challenges: new equipment, new products, new production processes, new government regulations, and the like. However, once familiar with a new process, most people have a pretty clear picture of what they need to do even if the new work is difficult. Safety seems to be difficult in a different way. Where safety performance is concerned, it's hard to get a handle on the real problem. When we use traditional methods for improving safety performance, we rarely develop a clear understanding of the problem, let alone an effective action plan.

This unsatisfactory situation is the result of two things:

1. **Constant change arising from competitive pressure.** To remain competitive in the paper industry, constant change is necessary, and this can distract attention from safety issues.
2. **Reactive vs. proactive safety strategies.** Even with the best of intentions, management safety efforts are often blunted by reactive approaches that rely exclusively on disciplinary action, downstream measures such as accident frequency rates, and off-the-shelf programs with no staying power. Along with this goes the mindset that says, "We don't have a problem because we haven't had an injury yet"—a mindset with many implications for safety performance.

Competitive pressure

At the paper converting plant I managed we were continually changing our equipment or our product to gain

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Killimett worked in the paper industry for 15 years: 5 years with Procter & Gamble, 10 years with Kimberly-Clark. Presently he is a consultant with Behavioral Science Technology, Inc., Ojai, Calif. 93023.

an advantage over the competition—an advertising advantage if nothing else. For instance, in the disposable diaper market equipment innovation and changes in raw material are always in the works. One year we had five major changes of this kind:

1. We added super-absorbent material to the product. This meant a related change in the quality system as well, requiring people to learn new ways to check and adjust for quality. This change also required a complex storage and metering system that workers had to learn to operate, adjust, and repair.
2. An additional elastic component was incorporated into the diaper, which also had the operational ripple effect in quality and storage mentioned above.
3. We upgraded the humidity and dust control system. During the six months it took to install this new system, control of humidity and dust was irregular and caused operational problems. The result was additional pressure not only to increase production rates but to reduce waste and improve quality—both of which had also been adversely impacted during the installation of the new system.
4. The product dimensions were changed to better fit the user and to conserve raw materials. Equipment modification was only the beginning here. Because of the multiple raw materials and numerous in-process control points, the new process required higher levels of skill and alertness.
5. We introduced a new system to apply elastic raw materials. In this case, control of the web became even more critical because of the placement of the elastic materials.

My point in describing these competitive pressures is to say that they go with the territory. The marketplace pressure to innovate will not go away. If anything, it is likely to increase. Now the important question becomes, "Which safety approach is best suited to a constantly changing workplace?" The best answer to continuous change is continuous improvement in safety performance—a safety approach that operates as a system or process, not as a temporary program. Short-term efforts will necessarily fade whenever operational changes bring new priorities. Employee involvement is critical to sustaining continuous improvement in safety performance

no matter what the changes in product and equipment.

This is why the behavior-based approach to safety seems to me to be an idea whose time has come. Among other benefits, the behavior-based safety approach is a long-term process that provides a vehicle for involvement and for workforce problem solving—skills that are very compatible with a leaner, continually changing, more competitive operation.

In fact, without well-focused, sustained attention to safety performance, production pressure usually determines where we place our efforts. The result is that we don't pay attention to safety until it's too late.

Hard lessons about safety performance

Each of the five equipment and product changes I mentioned earlier had an impact on our ability to operate safely. At the minimum, changes of this sort take a great deal of time and attention. The challenge is to make the necessary changes to product and equipment without losing sight of safety. And let's face it, given the many things calling for immediate attention, it's easy to lose sight of safety.

Why is safety so difficult to handle effectively? It's not easy to handle because as managers we tend to rely on methods that do not address the problem: unsafe behavior. Yes, behavior. The facts are in; human behavior is the final common pathway in 85-95% of all safety incidents. The data are there, but in most cases nobody really knows what to do about it. I certainly didn't.

So, in spite of the extra time I devoted to safety-related matters, I never felt that our plant achieved lasting improvements in safety performance. In the face of this kind of frustration it is tempting to blame the employees for their own injuries and accidents. However, since safety-related behavior is a function of management systems, blaming the employee is not only unfair, it is counterproductive. Besides, in statistical process control terms accidents and injuries are downstream, not upstream where we should be managing safety performance.

Though I was aware of these points in a general sense, I was still wrestling with how to apply them. Safety ownership and involvement, motivation, and attitude—these remained areas of concern.

Safety ownership

In the case of safety ownership, for instance, although people generally admitted that they were responsible for their own safety, their willingness to say this did not translate into more safe behavior. I didn't know how to change people's attitudes or motivation about safety. I increased enforcement of the existing rules and added some new rules for safety. I increased my own level of commitment to safety. These attempts were successful only for a short time, then people went back to the old way of thinking and doing things.

Motivation

I could never understand why people were not self-motivated to work safely. I tried to provide an environment that would cause people to be concerned about safety. I did manage to get across to supervisors that safety violations would be disciplined, and I also increased the

I. Behavior-based safety assessment is a two-step process

Analysis

- Describe unsafe behavior
- List current unsafe behavior

Implementation

- Identify unsafe behavior
- Create inventory of critical behavior
- Sample workforce behavior
- Encourage input from everyone
- Continue to sample workforce behavior

level and number of contests and giveaways for crew and department safe man-hours. I personally attended safety meetings and discussed safety and my expectations. Overall, however, accidents continued to happen at the same frequency as before. In other words, although we experienced short-term improvements, we did not achieve long-term, sustained results.

Rules

Another thing I discovered was that the plant had a number of safety rules that did not make sense; they were contradictory, outdated, and they lacked credibility with the workforce. So I got the work groups together to review the rules and make changes. The goal was to draft a set of rules that were consistent and that people could understand. During this effort I also learned that many people did not even know the rules. Among other things I started a contest to encourage people to learn the new rules. This approach had some good effect but not as much as I had hoped. It was temporary in nature and tended to be seen by employees as "another program."

Attitude

Finally, I noticed when I talked to people that they simply did not care much about safety. It seemed to me that no matter what I said or did people thought that safety was merely being given lip service, that it wasn't really important. And in some sense, this perception was probably accurate. Everyone knew what was really important to the organization: production. Everything we did as an organization strengthened that impression. Positive strokes were given for good rates of production. The perception was that people were promoted based on production. Positive, on-the-spot feedback was given for fixing production problems. Safety only got that kind of attention when someone was injured. And then we had a flurry of activity. This is the accident-safety cycle. The negative impact of this cycle on productivity is too often neglected.

I think that my situation was fairly typical. Since I didn't yet know the relatively new behavior-based methodology, I fell back on the familiar, reactive approaches: contests, rules, disciplinary action, meetings, accident investigations, etc. I simply assumed that this was all I could do and that people must be responding to these measures somehow. The real problem for managers is that since the traditional methods do have some effect in the short term, when we use those methods we get the impression that

we have solved our safety problems. So we feel justified in moving on to some other problem area even though we have barely scratched the surface of proactive management and continuous improvement in safety performance.

In fact, I don't know of any other area of operations where we settle for measures that are as temporary or unpredictable as we do in safety. Consider the message that this sends. When I moved on to other problems before new safety measures had a chance to take root in the organization, it told people that safety was not really very important.

I worked hard on new quality assurance measures, not resting until they took root in the organization. It was the same with new production and maintenance procedures. I paid close and sustained attention to them, and I wasn't satisfied with my performance until they took root in the organization. One result was that people throughout the organization got the message: production-related problems are of the highest priority. Supervisors also got the message: there are plenty of rewards for handling production-related problems.

But what about safety? What reasons did supervisors have to pay attention to safety in a consistent, professional manner? The fact is there were almost no incentives for them to put themselves out for safety; it wasn't part of our culture. I did not have a clear enough picture about these matters. I also did not see the ways in which a production-driven organization sets the stage for accidents and injuries by rewarding workers for risky behavior.

Behavior-based safety assessment

Behavior-based safety assessment draws a very clear picture of the forces that are actually driving the safety effort at a given facility (Table I). Very briefly sketched, the steps of the behavior-based analysis are:

1. Draft an objective statement of each unsafe behavior that is at issue.
2. List the variance antecedents (things that trigger the behavior) and consequences (things that reinforce the behavior) that are present within the organization.

In the picture that usually emerges from this analysis, managers see clearly that the most powerful consequences delivered by the organization favor continued unsafe behavior. Such an assessment is often both sobering and stimulating—sobering because it presents an accurate portrait, warts and all, and stimulating because it shows the underlying logic of recurring safety problems and thus points the way to an effective action plan.

Implementing the behavior-based safety process

Implementation of the facility's action plan proceeds in five broad steps:

1. Identify a cluster of unsafe behaviors that account for a significant portion of the facility's injuries or near misses.
2. By formulating these behaviors in objective, observable terms, a site-wide representative committee of personnel arrives at an inventory of critical behaviors that will

serve as leading indicators of the facility's safety performance.

3. Observers are trained to sample workforce behavior using the facility inventory. In this way they take a baseline measure of what percentage of the facility's behavior is safe (%Safe). This baseline measure offers both a key management tool and a powerful way of presenting the behavior-based approach to the workforce at large in the kickoff meetings.
4. At the kickoff meetings the presenters emphasize the input of hourly personnel in developing the inventory of critical behaviors. They also emphasize the nondisciplinary focus of the %Safe observations, emphasizing that the primary aim of the behavior-based approach is preventing injuries—something that benefits everyone.
5. After the kickoff meetings the observers continue to sample the facility's %Safe performance, generating data for charts posted in the workplace and written reports for use in safety meetings as feedback and for problem-solving efforts.

Benefits across the board

As the behavior-based safety process gathers momentum and people see that management is careful not to use the observations for disciplinary purposes, then the individual crews, departments, or shifts become interested in their %Safe performance ratings.

Supervisors notice a change. Where once supervisors had to nag their crews about safety, now the crew members initiate discussions about their own safety performance. When a crew's %Safe rating rises on the chart, they're proud of their record. When their %Safe rates drop off relative to their own past performance or relative to the chart of another crew, they want to know why. They engage the observers in serious discussion about which of the critical behaviors on the facility inventory are responsible for their declining %Safe rating. At safety meetings the crews learn how to solve problems to bring their %Safe ratings back into a rising profile. And these beneficial changes are just the beginning.

Because the behavior-based safety process addresses performance, in short order its effects are felt in many other performance-related areas of the workplace such as: employee involvement, training, responsiveness to change, motivation and ownership, communications, and attitudes. □

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Attitude Alone Is Not Enough

Why do workers who say they support safety fall into unsafe behavior? Safety training must address specific precautions and counter the notion that 'I'm the only one so why bother?'

By Thomas R. Krause, PhD and Kim C.M. Sloat, PhD

Illustration by Mike's Perica

Bob is a model employee, and he just got hurt on the job. The facility had completed almost 2 million work hours without a recordable injury — until Bob's. Bob has successfully completed all facility safety training, and just last month, he led the safety meeting and talked about his personal commitment to safety. He is known to be a good worker. What gives?

How can our best workers have such good safety attitudes on the one hand, and on the other hand tolerate or condone at-risk behavior?

This combination of good attitude and bad practice does not seem to make sense. We justifiably wonder what is going on here.

EXPECTING TOO MUCH FROM ATTITUDES. Conventional wisdom assumes that a good safety attitude is a reliable predictor of safe behavior. Pursuing this unexamined assumption, those who undertake safety training initiatives often spend a significant proportion of available resources on what could be termed attitude adjustment measures — contests, posters, slogans, meetings, training and other efforts to improve attitudes and to increase awareness.

However, this is one of those cases where conventional wisdom is misguided. As it turns out, people's general attitudes about safety do not reliably predict what those same people will do when they face specific safety situations.

A new and more effective theory offered here is the behavior-based approach to managing continuous improvement in safety performance.

By structuring training and other safety efforts around ongoing soon-certain-positive consequences that focus attitudes on identified critical behaviors, management can assure that workforce safety attitudes reliably predict safe behaviors.

A SECONDARY ROLE. For safety training and leadership, three points must be considered about the links between attitude and behavior:

1. The consequences of behavior are significantly more powerful than the antecedents — including attitudes.

2. Behaviors can be measured and therefore managed, whereas trying to change attitudes is a murky business.

3. Furthermore, attitude is only one of the antecedents of behavior.

A behavior-based approach to safety gets all three of the above issues right:

1. Recognizing the power of consequences over antecedents, training and leadership action plans are directed toward developing soon-certain-positive consequences for improved safety performance.

2. The primary focus of improvement is behavior—which can be measured and managed—vs. attitude.

3. Assessments of existing antecedents take into account their full range, giving safety attitude its proper due as one of the antecedents of safety-related behavior.

These ideas show the place of attitudes in the overall scheme of workplace safety and reflect the way that consequences both follow from behaviors and, subsequently, modify attitudes.

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TRUTH OF CONSEQUENCES. An antecedent is anything that precedes and elicits a given behavior. A consequence is anything that follows from a given behavior.

Question: Does the ringing bell cause people to answer the phone?

This is a trick question because it plays into our old, unexamined paradigm about behavior. The scientific and far-reaching answer to the trick question turns out to be:

Yes, people respond to the bell by answering the phone; but, no, the bell does not cause them to answer the phone.

The revolutionary insight of behavioral science is this: people respond (behavior) to the bell (antecedent) because it predicts a consequence — someone to talk to on the phone. It is this predicted consequence that moves people to answer the phone. The bell merely serves to signal the presence of a caller. When a phone malfunctions and rings repeatedly though there is no one on the line, people stop responding to the bell. The bell has not changed. What has changed is that the bell no longer reliably predicts a consequence of interest.

Many well-intended safety efforts fail because they rely too much on antecedents — safety rules, training on attitude, procedures, meetings — that have no effective consequences backing them up.

For sustained performance improvement, the most effective consequence is one that is simultaneously soon, certain and positive.

Many safety efforts are unsuccessful because they rely solely on late-uncertain-negative consequences to make their point. For instance, a hearing-loss prevention effort that depends on warnings of the eventual (late) possibility (uncertain) of hearing loss (negative) is an effort that is going to sustain hearing loss.

The strategy for effectively addressing workplace safety attitudes is two-fold:

- Understand the secondary role of attitudes in the overall scheme of workplace safety performance.

- Implement organizational consequences that focus attitudes into intentions to perform specific, critical safety-related behaviors.

To understand the role of attitudes in workplace safety, this material incorporates elements of a "Theory Planned Behavior" (Fishbein & Ajzen). Guiding the discussion of implementation and training issues, the behavior-

based safety process is offered as a way of assuring that safety attitudes reliably predict safety-related behavior. Special attention is paid to the significance of the ongoing feedback about a facility's inventory of critical behaviors. This inventory is one of the central instruments of the behavior-based process.

GOOD ATTITUDE, BAD PRACTICE.

The model presented by the "Theory of Planned Behavior" explains that just because a worker has and expresses a strong attitude in favor of safety, in no way does it assure that he or she is going to behave in a safe way.

Adapting the model developed by Fishbein and Ajzen, we note that:

- ▲ Attitude becomes more predictive of behavior as...

- ▲ ...the sum of a person's attitudes about something...

- ▲ ...forms an intention to perform a specific behavior.

Furthermore, we analyze this summing of a person's attitudes across three areas: beliefs, subjective norms (peer pressure) and perceived control (support, empowerment).

A subjective norm is based on what we think other people think of us when we are performing some particular behavior.

Perceived behavioral control refers to our perception of whether we are capable of performing the behavior — can we do it, and, if so, may we do it?

The stage is set for failure when safety or training efforts stop short of developing workforce attitudes into the intention to perform specific safety-related behaviors that are followed by soon-certain-positive consequences. Furthermore, this development needs to proceed in all three areas of attitude — beliefs, subjective norms and perceived control.

Successful safety efforts simultaneously address all three of these components of attitude. Effective efforts:

- (1) focus general beliefs on specific identified behaviors;

- (2) assess and correct peer pressure (subjective norms);

- (3) address and remedy issues of skill, support and empowerment (perceived control).

Failure to achieve ongoing success in all three of these areas stalls overall progress on safety performance issues.

For example, consider the following three scenarios in which one out of these three components goes unaddressed:

- No Focus: There is (2) a healthy sense of workforce ownership, and

there is (3) good management support for the effort, but because the pep rally atmosphere is completely unfocused on specific measures and critical safety-related behaviors (no 1), Result = No Go.

- No Involvement: Or perhaps (1) workforce beliefs are properly focused, and (3) management support is obvious in the training, time and other resources provided for the safety effort, but because workforce buy-in remains weak or unengaged altogether (no 2), Result = No Go.

- No Perceived Support: Or (2) peer pressure is marshalled behind the safety effort, and (1) generally favorable beliefs are focused on the facility's identified critical behaviors, but because workers feel that they have neither the capacity nor the resources to carry through (no 3), Result = No Go.

Therefore, the training challenge is to bring all three of these strands of workforce attitude together into an intention to perform identified safety-related behaviors. The behavior-based safety process provides an integrated and interactive answer to this challenge.

BEHAVIOR-BASED INVENTORY.

Among its numerous important benefits for a facility, the behavior-based approach to safety establishes and maintains a mechanism to assure that attitudes reliably predict behaviors. Central to this outcome is the development, review and ongoing feedback concerning the facility's inventory of critical safety-related behaviors.

A facility's behavioral inventory is developed through behavior-based analysis of incidental reports. An inventory of critical behaviors is operationally defined through this analysis. Site-wide input from all levels is involved in this preparatory work. The inventory undergoes peer review to sharpen its categories and to introduce it to the workforce. Trained wage-roll observers then use the behavioral inventory to establish the facility's percent safe baseline, and these figures and charts are then presented to the workforce during kickoff meetings directed to buy-in and ownership of the ongoing safety process.

During the implementation effort, the observers give positive verbal feedback to the workers they observe, and the accumulated observer data are presented as charts to the workforce. As workforce performance undergoes demonstrated improvement, new performance targets are reviewed, added to the facility's behavioral inventory,

Safety training efforts should include developing workforce attitudes into the intention to perform specific safety-related behaviors.

and brought under ownership in a problem-solving mode that establishes continuous improvement.

This ongoing mechanism affords the best way of assuring that safety attitudes reliably predict safe behaviors. The inventory review, buy-in, feedback and problem-solving provisions of the process simultaneously address all three areas of attitude development—beliefs, subjective norms and perceived control. In the course of inventory review and buy-in, generally favorable beliefs are focused into beliefs about specific identified safety behaviors.

SPECIFIC BEHAVIORS. A link between attitudes and behavior needs to be established and maintained actively because although attitudes are often general, behavior is specific.

This fact always offers an important clue to how safety assessment efforts fail. We may ask the right people about their attitudes toward safety, but we ask the wrong questions, and we end up measuring their attitude on a level that is too general to relate to their performance of specific behaviors that are critical to safety at our facility.

Workers may have and express a generally favorable attitude toward safety, and yet they may do things that are clearly hazardous, such as working without the proper protective equipment. Leaders, trainers and fellow workers can find this frustrating. At meetings, when the general subject is safety, the workers are right there, talking up safety. But afterwards, out on the shop floor, there seems to be an inconsistency. The problem may be that the meeting discussion was too general.

The primary point here is that:

In the absence of operational definitions of the specific behaviors at issue, the people at a safety meeting can only fall back on their individual interpretations of how to work safely.

If each participant is agreeing to something different, then such a meet-

ing may achieve agreement in word, but it does nothing to correct extreme variation in practice. This situation holds all the way from the bottom to the top of the organization.

Instead of settling for a general discussion, behavior-based trainers and meeting facilitators aim for agreement on the specific safety-related behaviors that are critical to the safety of the particular crew. Then not only does everyone agree on the general proposition that safety is important, they also agree that operationally defined critical safety-related behaviors are the foundation on which productive work rests.

SPECIFIC SAFETY BEHAVIORS. Workers need to know precisely which safety-related behaviors actually hold the most potential for incident-free performance because conventional wisdom is not always a reliable guide in these matters. Behavior-based assessments show that individual hunches, anecdotes and experiences often are misleading about the kinds of behaviors and number of incidents that truly characterize a work group.

The best source for a reliable work group safety exposure profile is a behavior-based analysis of relevant data. The critical safety behaviors emerge from this examination. Employee involvement at all levels is built into the process from the outset. Site-wide representation is the basis of the implementation effort. Assembled with significant participation from hourly ranks, a steering team develops an inventory of operationally defined behaviors that are critical to safety at the facility.

At this point, the generally favorable safety attitude can find a worthwhile focus—specific behaviors critical to safety. In this way, the individual worker begins to have and express favorable attitudes toward specific safety behaviors—using personal protective equipment, correct tools and safe body placement in relation to task,

and so on.

The behavior-based safety meeting is now to the point that each worker has not only a generally favorable attitude—*1. I believe that safety is important*—but also some more focused attitudes—*2. I believe that the facility's categories of identified critical behaviors are important.*

INTENTION-TO-PERFORM. A worker whose attitudes have been focused on specific safety categories is just a short step from forming an intention. The focused attitude of:

3. I believe that tagging out pumps (identified category) reduces the odds of injury,

is on the threshold of forming the stated intention of:

4. I will tag out No. 7 pump the next time I change the valve.

Each level of generality/specificity has an important role to play in the workplace. As the most general expression of safety attitude, statement No. 1 is the minimum that is expected of facility personnel. And, indeed, most people do think that safety is important. As statements of intention, however, statements 1-3 remain empty or incomplete in some way. Because of their more general form, they do not commit the worker to a specific action or behavior.

PEER PRESSURE. In the real world, it often happens that the preparatory work of focusing beliefs is accomplished quite well, but it falls short of being translated into an intention to perform. The process is arrested at the stage of statements such as, "I believe PPE use is important, and I will pay attention to it." In other words, workers are pro-PPE but PPE use rates remain unacceptably low.

Putting more effort into focusing beliefs about PPE use would be effort misspent. It is time to look to the status of subjective norms and perceived control.

Intention formation also is influenced by subjective norms. A worker

might have strong, positive attitudes in favor of proper tool use, and yet his or her belief about the opinions of co-workers could counter or offset the worker's tendency to form an intention to use proper tools. Thus, the influence of subjective norms is an important second place to look when behaviors are not being performed. This is where the importance of culture and peer group pressure comes in.

Safety Belief: I believe that proper tool use is important, and I will pay attention to it sometime. However,

Subjective Norm: I also want to feel that I am part of the group; and it seems to me that

Existing Assumption: My teammates do not believe that proper tool use is important.

In this case the subjective norm counterbalances and cancels the formation of an intention to use proper tools at the next opportunity.

FIXING SUBJECTIVE NORMS. The best way to strengthen norms toward safety-related behavior is to involve workers in the process of specifying the critical safety-related behaviors of the facility's inventory. This opportunity for involvement allows people to find out whether their subjective norms are accurate. Sometimes all that is needed to moderate the power of subjective norms is to change the perception of what the norms truly are.

If I have a good attitude about tool use, but I haven't yet formed an intention to observe proper tool use because I have the mistaken idea that my co-workers look down on it, it can be a big load off of my mind to discover that I have read my co-workers wrong. They not only don't mind proper tool use; they may think it is a good idea. This correction of my subjective norms can clear the way for me to form an intention to use proper tools the next time I have an occasion to do so.

On the other hand, if the original subjective norms are accurate, and the crew really is negative about the effort to assure proper tool use, then the challenge is to re-set the subjective norms. This is best accomplished through continued focus on the facility's behavioral inventory, and through continued feedback about performance. Observers continue to sample workforce behaviors and to give both verbal and charted feedback.

PERCEIVED CONTROL. Finally, workers' beliefs may be well focused on specific behaviors, and their peer group reinforces their focus, but they still do not form an intention to per-

form the specific safe behaviors critical to continuous improvement in performance. They may be stalled by a third factor that has an impact on intention formation — the factor of perceived control. Perceived control refers to my perception of whether I am capable of performing the behavior.

Perceived control has two facets:

- capacity and resources to perform (can I?) and
- permission or support to perform (may I?).

The first point has to do with the fact that people who do not believe that they can perform the behavior in question are not likely to form the intention to perform it. For instance, it may not be my skill or resources that I doubt, but whether I have the supervisory or management support to match the task. People who think that they will get in trouble for performing a specific behavior also are not likely to form the intention to do it.

These and related developments change the way the workers perceive their control of their overall safety situation. And to the degree that workforce perceived control is accurate about areas where management commitment to safety could improve, there is no better forum for working in improvement than during the ongoing problem-solving meetings of the behavior-based approach. These functions then have the effect of addressing and correcting perceived control.

PREDICTING BEHAVIOR. The behavior-based approach to safety offers the most effective way to assure that safety attitude reliably predicts safe behavior. Companies who are safety leaders have used this approach to achieve an impressive step-change in their performance. The behavior-based approach achieves these results because it does not set the stage for disappointment by expecting more of attitude than attitude alone can deliver.

Instead, by means of proven instruments and procedures, the behavior-based approach brings each component of attitude into focus.

- Free-floating general safety beliefs are directed to specific safe behaviors.
- Peer pressure is checked for accuracy, and is re-set in favor of the intention to perform identified critical behaviors.
- And workforce perceptions of support and empowerment also are checked for accuracy. Whatever issues exist here are addressed in the course

of ongoing problem-solving, and workforce perceptions of control are re-set in favor of performance of critical safety-related behaviors.

Observation and feedback provide ongoing soon-certain-positive consequences for specific identified behaviors that are critical to a facility's continuous performance improvement. By not relying on attitude alone, the behavioral emphasis strengthens safety attitude. **OHS**

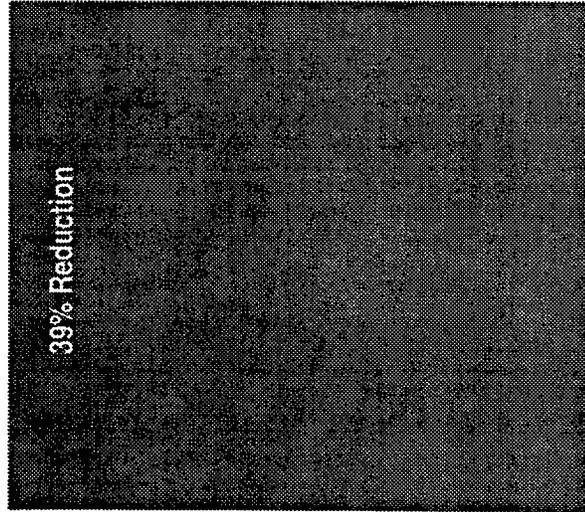
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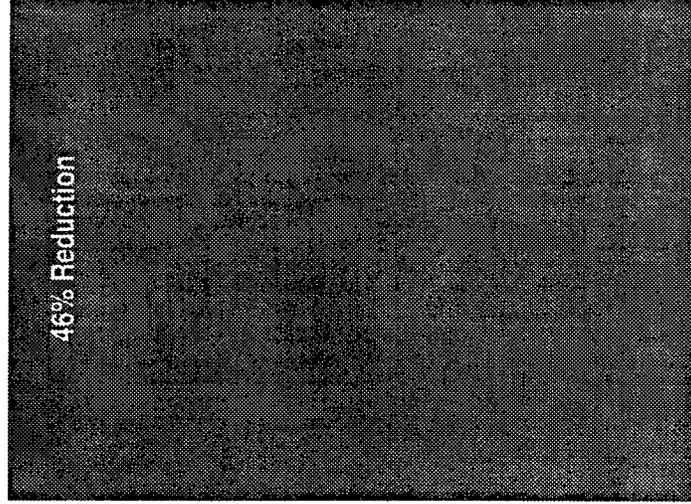
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Workers' Compensation Reductions

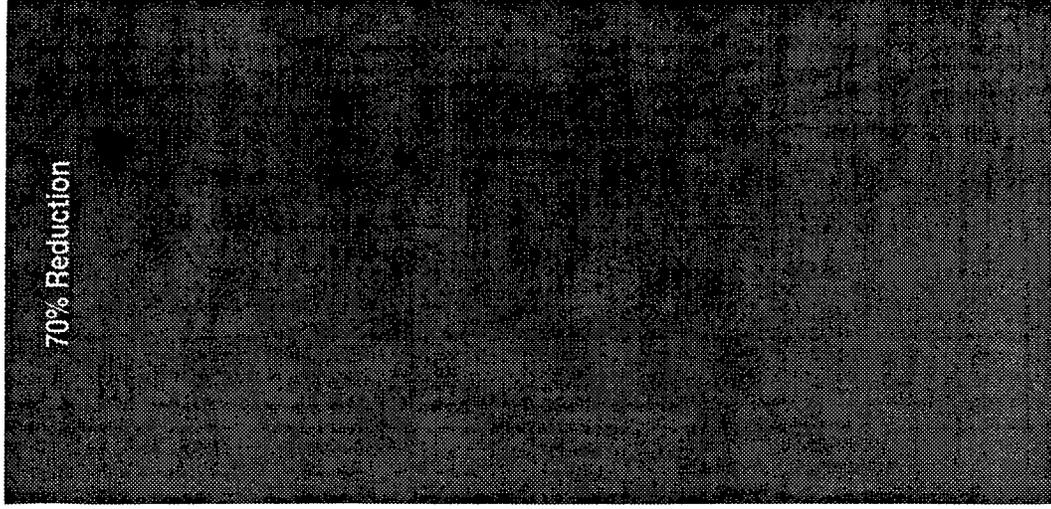
BST Client Results,
Reductions in
Workers' Compensation Cost
Per Employee



Year-1



Year-2



Year-3

Attachment D-1

