Moving to the 2nd Generation in Behavior-Based Safety

By examining the origins of BBS and its evolution over time, the author examines what needs to be done to move the methodology forward.

By THOMAS R. KRAUSE

Over the past 20 years, a methodology for safety improvement has developed that integrates behavioral science, quality and organization development principles with safety management in order to reduce industrial injuries. Although this approach is commonly called behavior-based safety (BBS), use of that label is somewhat problematic today because the original method has been popularized to the point that it is hardly recognizable. Nevertheless, many companies are achieving improved performance with this methodology; in that sense, it has moved from an idea to a reality (e.g., Krause, et al; Austin, et al; Saari; Alavosius and Sulzer-Azaroff).

Among these companies, the methodology has undergone a series of evolutionary changes. In addition, as the method has attracted more attention, members of various fields have raised questions about it. From the author's perspective, one critical unresolved question concerns the future of the methodology itself. In five sections, this article 1) reviews the origins of BBS; 2) discusses current confusion; 3) sketches the evolution of an integrated BBS model; 4) describes current issues; and 5) offers suggestions for future directions.

ORIGINS OF BBS

BBS came into being as the result of three currents of work being conducted separately with a small degree of overlap. The first was the applied behavior analysis (ABA) work of psychologist Judi Komaki, then at Georgia Institute of Technology. Komaki was among a small group of academic applied behavior analysts studying industrial performance. A student suggested that his family's bakery would be an ideal application for an academic project; bakery management was concerned about safety performance. Under Komaki's guidance, the bakery implemented a behavior-based model for safety performance improvement that

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appeared to produce results (Komaki, et al 434+). Although the time period over which results were measured was short, the results provided reason to be encouraged about the potential of the method.

In 1979, the author (a psychologist) and his associate Dr. John Hidley (a psychiatrist) were asked to consult with an offshore oil-drilling equipment manufacturer in California to examine ways to improve safety performance. Based on preliminary analysis, the consultants suggested use of ABA.

During this same period, Gene Earnest and Jim Palmer at Procter and Gamble were developing a methodology drawn from the behavioral sciences, which they termed "behavior-based safety." To the author's knowledge, they were the first to use this phrase.

At that same time, other behavioral science researchers and safety practitioners were conducting similar work. By that time, Dan Petersen had described the approach based on what had been published at that time, and Frank Bird had used some behavioral models to teach companies to reinforce safe behavior. In addition, E. Scott Geller had completed research on seatbelt use and published several articles on how to increase seatbelt usage (Geller and Hahn 53+). As the field gained popularity, other consultants interested in performance management began to direct their efforts toward safety.

In these early years, the model used was supervisor-driven. Supervisors were taught how to apply the methods of behavior analysis in order to target safety as the improvement area. For the author, this model changed dramatically in 1986 as a growing number of firms adopted total quality management (TQM) methods.

Since 1997, behavior-based methods have experienced tremendous growth and widespread application. This is a mixed blessing. On one hand, it is good that more companies are using the methodology; on the other hand, it has become a fad—"the thing to do." As a result, some companies pursue BBS for the wrong reasons. The "me-too" factor affects practitioners as well, many of whom claim expertise when they have limited understanding of the methodology. Others assume an opposing stance and often, based on limited understanding of the methodology, pronounce misinformed judgments about it.

CURRENT CONFUSION ABOUT BBS

Because of this history, BBS now means many different things to different people. This ambiguity is so widespread that "BBS" has lost its power to describe anything clearly. Even a casual search of recent literature reveals contradictory uses of the term.

For example, some organizations call their programs BBS, yet involve no shopfloor personnel in the effort, and have no operational definitions of critical behaviors and no continuous improvement mechanism. What they actually have is a traditional supervisor audit program focused on disciplinary action. Proponents of this approach often refer to it as "behavior-based safety," even though the only BBS element present is the label. This reflects the current trend in which various techniques, including the use of incident-contingent incentives, are labeled BBS (in an apparent effort to make them popular). This inhibits communication.

At one end of the continuum of confusion is the idea that anything involving behavior, attitude, culture, the worker, etc., is BBS. The next level of confusion is represented by the idea that to implement BBS, one must simply identify behaviors on a checklist; have employees observe others; apply reinforcement (including tangible incentives); then sit back and watch incident rates fall. This drastic oversimplification is troublesome even when the effort is supplemented by standard safety activities. It becomes even more problematic when offered as the primary component of a safety effort.

Also along this continuum are specific menus offered by various consultants. Each method typically has its own unique focus. Some use a traditional behaviorist approach; others use a more-integrated method. Some consultants have limited industrial experience; others are former industrial managers. In the competition for clients, each attempts to convey that his/her particular version is "the best."

Add to this confusing mix the criticism from international union organizations such as the United Auto Workers, and it becomes clear why it is such a challenge to understand exactly what BBS is and how it works. This is unfortunate because, implemented correctly, integrated behavior-based performance improvement methodology represents one of the few safety improvement methods to have solid, scientifically based data to support its effectiveness.

For example, Krause, et al provided a rigorous, comprehensive evaluation of 73 such implementations (1+). They followed a highly representative sample of behavior-based performance improvement implementations for up to five years and found that the average reduction from baseline equaled 26 percent in the first year, increasing to 69 percent by the fifth. The fact that this methodology has become so distorted and misinterpreted suggests a failure on the part of safety leadership (Karr(a) 34+; Karr(b) 1).

As noted, the popularity of the method merely adds to the confusion. Firms implement BBS initiatives simply because it is "the thing to do" rather than because they understand its implications and are willing to commit the resources to do it correctly. This leads to poor-quality initiatives that typically fail and lead to the conclusion, "We tried BBS and it didn't work."

Similar confusion surrounds TQM. In fact, this same basic pattern has happened to virtually all performance improvement methods used by industry in the past 20 years. In the author's experience, TQM has become a bad word in many organizations. Unfortunately, organizations tend to burn up useful methodologies by jumping into them without committing adequate resources. In the wake of such enthusiasm, organizations confuse and distort the method. Then, the tool breaks and all involved wonder why.

An organization that seeks to improve safety via BBS must first understand what the methodology entails; determine whether external expertise is needed; and, if so, which approach to use. However, because of the confusion that exists, companies must take the time to understand what the effective BBS actually is.

EVOLUTION OF THE INTEGRATED MODEL

As noted, from 1980 to 1985, the method used by the author was management-driven—from the top down. Supervisors were trained in the method, then applied it to wage-roll personnel. There was little use of data. Behavioral inventories were large, sometimes up to 100 behaviors. The focus was primarily on individual behavior and how to change it through application of reinforcement.

From 1986 to 1996, this model evolved into one that was employee-driven. This change was influenced strongly by the TQM movement, which was prevalent in the petrochemical industry at that time. Many clients wanted to involve workers in significant ways. Consequently, TQM and organization development principles were integrated with those of applied behavior analysis. In addition, software was developed to capture data generated during behavioral observation; emphasis was placed on feedback as an improvement mechanism and as a type of reinforcement.

Since 1997, the model has evolved to include more completely the engagement of *all employees.* This reflects the need to more directly address the perceived contradiction between an employee-driven process and management accountability. (In the author's opinion, this contradiction does not exist, but failing to address it allows misinterpretations to occur.)

To its advantage, top-down, supervisor-driven BBS is relatively easy to implement; requires a lower level of training; and does not involve addressing cultural issues to the same extent as other methods. But changing to an employee-driven model has a tremendous advantage—it involves employees. In effect, it creates a new culture that offers significant benefits.

Unfortunately, along the way, many companies left out managers and supervisors. In essence, these firms said, "To involve front-line personnel we must exclude supervisors and managers." As a result, change efforts had strong front-line employee involvement and support, but weak managerial support and involvement. These firms quickly learned that to achieve long-term success, all managers and supervisors must be involved in the process.

This led to the present model in which *all employees* are engaged, including managers, supervisors and wage-roll employees. This approach targets both managerial and employee behavior. In addition, observation data is a key element of the problem-solving process. However, it should be noted that simply stating, "Emphasize use of observation data for problem solving" does not convey the intention of these words. The significance of this statement is noteworthy: Through the use of data, the behavioral process becomes a method for continuously improving facilities, equipment, design and management system issues.

During this period, applications outside safety—including quality, customer service and productivity—have grown. Multi-site international implementations have been achieved as well, often accomplished with the organizations' own internal consultants. A major follow-up study on these initiatives has been published (Krause, et al 1+). Emphasis has been placed on *how to implement* rather than *what is implemented,* and critical success factors have been defined.

The current model combines ABA with techniques of quality management and organization development to create a comprehensive safety improvement methodology. However, this is not to suggest that BBS should be seen as the entire safety system. Rather it is one component of many. The method is employee-driven, yet it includes managers and supervisors and their behavior as well.

This approach has produced proven results (Krause, et al 1+). Not only have injury rates improved at the many sites using this approach, but through a multiple baseline design, results have been shown to be attributable to the BBS implementation (Figure 1). It is worth noting that results are seen equally at union and non-union sites; among large and small employers; and at sites with high and low injury rates in a wide variety of industries. Had U.S. industry in general achieved results equivalent to these sites, the author believes incident frequency rates would have improved much more dramatically than they have (Figure 2).

FIGURE 1

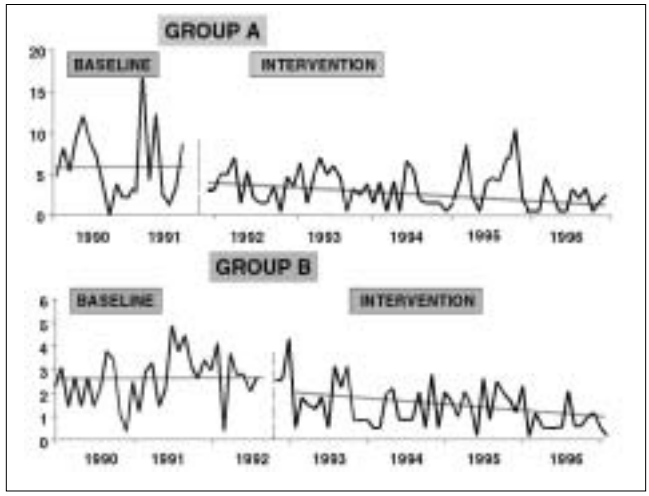
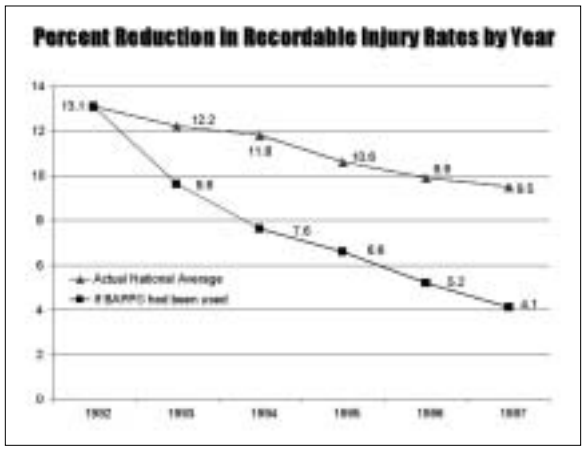


FIGURE 2



CURRENT ISSUES IN BBS

Several issues are presently facing the use of BBS methods.

Reinforcement & Feedback

The use of reinforcement and feedback continues to be a topic of debate. Some practitioners view reinforcement as the primary improvement mechanism in BBS, which is consistent with the strict "behaviorist" position. If the only technology being applied is ABA, then reinforcement will likely be the primary improvement mechanism. A more-effective system is one that integrates ABA with other methods in order to bring other improvement mechanisms into play. In the author's opinion, feedback is, for several reasons, the most-effective and desirable reinforcement available in the workplace.

Reinforcement is a technical term that refers to a consequence (following a behavior) which increases the probability that the behavior it follows will recur in

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the future. Much technical information is available concerning reinforcement, and some controversy exists concerning many of the technical aspects. (ABA textbooks specify the basics of this technology, and the research literature is filled with the current controversies.)

Use of performance-related verbal and visual feedback as the primary reinforcer in safety improvement efforts (the author's preferred approach) has been criticized because it combines often-separate steps in the behavior change procedure ordinarily used in ABA; in that procedure, feedback is separate and distinct from reinforcement. These aspects have been separated based on the assumption that feedback is not *in itself* reinforcing.

While this can be true in certain applications (primarily clinical), such separation is not necessary in safety improvement applications. In fact, using feedback as the primary reinforcement has many significant and highly desirable advantages. For example, feedback is information about performance in relation to a goal. Komaki's original study relied strongly on performance feedback (434+).

Is feedback reinforcing? The answer depends on whether the behavior that it follows tends to increase. That is the definition of reinforcement. In other words, a reinforcer is defined by its effect on behavior. When feedback is applied correctly, it is a reinforcer because it changes behavior (Krause, et al 1+).

The advantage of using feedback as a reinforcer, compared to tangible reinforcement (e.g., prizes, raffle tickets, tokens), is that feedback tends to engage the worker in a significant way, sending the right message and building a positive culture. What is implied when a worker's behavior is changed as a result of performance feedback? Think about this carefully—it is noteworthy. When a person's behavior improves as a result of performance feedback, s/he has been engaged in the improvement process. S/he values good performance and is rewarded by knowing that his/her performance is improving.

Compare this to changing behavior through the use of tangible prizes. The difference is significant. In the former case, the employee recognizes that his/her performance is important and has some significance in the workplace. In the latter case, the employee is motivated to get something. As both Herzberg (109+) and Deming (59, 62, 73-85, 102) demonstrate, it is clear which method works best and in what ways (Krause).

Use of Observation Data

Use of observation data is a significant element of an integrated BBS process. By using behavioral data to develop action plans for improvement, the focus shifts from the worker to systems—including facilities, equipment, design, maintenance, and other, more-subtle mechanisms such as purchasing and decision making. To achieve this, one must analyze behavioral observation data and identify the barriers to safe work—those factors that prevent workers from performing safely. The next step is to formulate action plans to remove barriers.

As this discussion has shown, in a true BBS approach, critical safety-related behaviors are identified based on previous exposure of workers, then measured systematically through observation; feedback is provided, which increases the likelihood that those behaviors which are enabled will occur in a safe manner.

At this point, it must be recognized that not all behaviors are within the employee's control. Three categories of at-risk behavior can be identified: enabled, non-enabled and difficult. *Enabled* behaviors are those within the employee's control. For example, when descending a staircase with a handrail, holding the handrail is an enabled behavior. The employee has the ability to hold the handrail if s/he so chooses. This behavior would be *non-enabled* if no handrail were present—that is, it is not within the employee's ability to perform the safe behavior. The behavior is *difficult* if it can be executed safely only with extra effort (e.g., going to find a ladder, obtaining protective equipment not readily available).

When at-risk behaviors are examined in these terms and the frequency with which such behavior occurs is categorized, it has been found that both non-enabled and difficult behaviors occur frequently in many facilities more frequently than enabled ones. Figure 3 presents the distribution of barriers across these behaviors.

Based on observations at a number of sites, the data provide the basis for developing action plans to remove barriers so that workers will be able to perform in a safe manner. This is a highly significant aspect of the integrated approach. It effectively crosses the bridge from a worker-focused strategy to a system-focused approach—it addresses facility, maintenance and design issues present in the workplace, using behavioral data based on actual exposure as the starting point.

It is ironic that using a behavioral system leads to a focus on facility issues. Many managers look to address behavior only when facility issues have already been addressed. As these data show, however, the behavioral component and facilities component interact in such a way that one must accomplish both in order to reach the desired outcome. The advantage of beginning with identified critical behavior is that it represents exposure—not in the sense that the worker is at fault or to blame—but in the sense that worker interaction with the technology constitutes exposure to injury.

Union Responses to Behavior-Based Methods

Reactions of labor organizations to improvement efforts labeled BBS is another concern. These responses have been mixed—from categorical rejection to collaboration within guidelines established at the site level with local union leadership. Figure 4 shows the outcome of efforts implemented at various represented sites.

Although local unions have been involved in successful BBS initiatives, some international unions continue to oppose BBS (many with no consideration of the critical distinctions detailed in this

article). Others are critical of some versions of BBS and supportive of others, while others have created guidelines for use of BBS and, thus, take a more-neutral position toward its use.

Labor's criticism has provided a useful service to the safety community. It has called attention to methods that are not truly BBS. For example, when consultants claim, "BBS is all you need" or, "Worker behavior is the sole target for improvement," they invite legitimate criticism.

However, categorical resistance is more difficult to understand, as are some arguments made against the methodology. Often, these stances have been tainted by the confusion about what BBS truly is and tend to lump anything dealing with "behavior" into one category.

It's The Thing To Do

As noted, BBS has become "the thing to do." As a result, companies begin initiatives for the wrong reason, and expect the benefits without committing the resources needed for success. In the end, this is a detriment to all involved.

THE FUTURE OF BBS

So, what is the next step in safety process improvement? The usefulness of any technology depends (in part) on its ability to adapt to changing needs. Accordingly, based on input from clients, the comprehensive BBS methodology—and its implementation—have been improved.

To reach the next step, safety practitioners must:

1) Maintain the strengths of the comprehensive BBS strategy and address its weaknesses.

2) Integrate the methodology with existing safety systems from the outset.

3) Increase efficiency.

Strengths that must be maintained include the method's ability to reach the behavioral level. This does not mean "blame the employee." Getting to the behavioral level refers to the fact that the ultimate objective of any improvement methodology is to enhance how work is accomplished. Training, managerial systems, safety meetings, safety programs and improvements are all designed to influence how work is performed.

In the author's opinion, most improvement initiatives simply do not reach the behavioral level. For example, people often say, "The training was good, but it probably won't make any difference." A great value of a behavior-based approach is that it extends to the level of actual behaviors. Note that this is not limited to front-line worker behavior, but also includes all levels of managers and supervisors.

A second strength is the fact that correctly implemented behavioral approaches are systematic. They do not suffer "program of the month" problems typical of many safety initiatives. A third strength is that employees drive the basic mechanics of the process themselves. This does not mean "in the absence of supervision," but does distinguish itself from other initiatives due to the great extent to which employees are involved—and motivated by that involvement. A fourth strength is the fact that the methodology described is data-based—it proceeds with the use of objective, quantifiable data.

What about weaknesses—or perceived weaknesses? First, many believe BBS systems focus solely on the worker. Second, some assert that BBS initiatives distract attention from facilities, maintenance, design and engineering safety improvements. Third, the perceived inflexibility of BBS systems must be addressed. (While this is not actually true in the author's experience, it has occurred in some cases.) Finally, some companies believe implementing BBS causes a disproportionate drain on their resources. Again, this is a valid criticism in some cases, an exaggeration in others.

Another key is understanding the concept of the working interface. Hundreds of data sets containing barriers to safe behavior have been analyzed by the author's firm. To do this for a single data set, the site must categorize data it collects and specify the particular barrier that exists to safe performance.

These data are gathered by the person performing observations, who discussing at-risk behavior with the person who was observed. Essentially, the observer asks, "What stands in the way of performing behavior X safely?" The person who has been observed shares his/her perception of the barrier and explains why an at-risk behavior is performed. Barriers are grouped into categories and observers note the applicable category for each at-risk behavior observed.

FIGURE 3

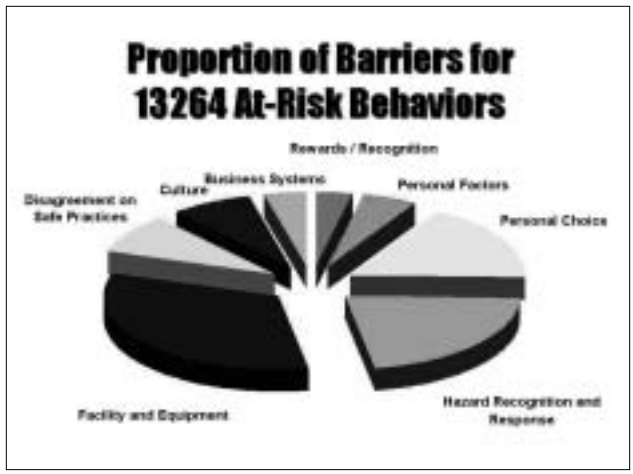

FIGURE 4

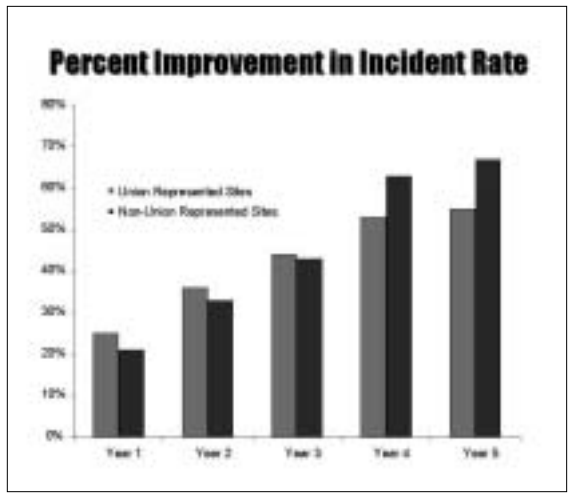

Figure 3 provides an analysis of 13,264 at-risk behaviors observed at several sites. The pattern of distribution across barriers is similar to many other sites. Facilities and equipment, and hazard recognition make up the largest categories, comprising the majority of barriers to safe behavior. It should be noted that such data would not be available had a behavior-based methodology not been used. Examining these data leads one to think freshly about the relationship between causal factors that contribute to injury.

These data show that barriers to safe behavior are primarily related to hardware and management systems (which include facilities, equipment, design and maintenance) rather than personal choice. This changes the focus of improvement efforts from the worker to systems that enable safe behavior. This is called the working interface.

Injury causation has been the topic of many discussions. Some people attribute injury causes to the worker: "Eighty to 90 percent of injuries are caused by unsafe acts." Others argue, "Eighty percent of the

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cause of variation is management systems," or, "Design flaws comprise the great majority of injury causation." These statements suggest that to understand injury causes, it makes sense to divide causes into one of two primary categories: 1) worker-related, meaning the individual, the individual's behavior, human error, things coming from the person; and 2) facilities-related, which includes maintenance, equipment and design.

This basic dichotomy has pervaded thinking within the safety community for the past 50 years. Although modern safety management techniques acknowledge multiple causation, this either/or thinking is still pervasive. Is the problem contained within the individual or within the hardware, facilities and equipment?

The underlying thought in this dichotomy is pervasive throughout society as well. For example, airplane crashes are categorized as those that stem from human error and those due to mechanical failure. Conversations on the floor between supervisors and front-line employees—and in the boardroom among executives—continue to perpetuate this dichotomy. In fact, objections by some union organizations to BBS as well as the response of many BBS practitioners also include an implicit assumption of the validity of this split.

In actuality, this is a false dichotomy. Rarely is an injury caused by the worker. Consider the driver who crosses the white line on a two-lane road and crashes into an oncoming car. Investigation determines that the cause for crossing over the white line was solely within the driver's control. On the other side, an injury can be caused solely by a mechanical system failure. Suppose a person is driving safely in a well-maintained car that suddenly experiences a brake failure and crashes.

The frequency of such incidents is rare—so rare that they do not justify the either/or dichotomy. Furthermore, such thinking sets up serious problems in the way people think about causation.

An exhaustive analysis of injuries—looking at various organizations across industries over a period of several years—coupled with cause-tree analysis on each injury reveals that in most cases, the actual cause of injury is an interaction between the worker and the facility—the working interface. Improvement in safety consists of systematically defining and improving this critically important interface.

CONCLUSION

Despite the confusion about its essence and applications, BBS remains an effective tool for performance improvement, and it is growing stronger and more flexible as more companies adapt it to their unique needs. For companies to succeed, they must look beyond the BBS label and understand what constitutes an effective system. For the methodology to continue to thrive, it must continue to evolve. In this evolution, retaining those characteristics that are effective while addressing perceived weaknesses must be the goal. ■

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