Behavior Based Safety

In the Workplace

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1. INTRODUCTION

There are a number of techniques that can be employed when incorporating safety in the work environment. Through the phased systematic concept of Behavior Based Safety (BBS); "at risk" behaviors (any action(s) that has the potential to negatively impact health and safety) that have the potential to lead to injuries are identified/mitigated through observation, documentation/measurement, and feedback (Al-Hemoud et al., 2006). In this research presentation, each of these phases will be explained in detail which will provide a general overview of on how BBS can be integrated in the workplace. Examples of different industries where BBS has been instituted will also be provided.

1.1 BBS History

The methods employed in BBS originate from techniques used by psychologist and have only been used in occupational safety applications for approximately 30-years (Al-Hemoud et al., 2006). Psychologists have identified a comprehensive behavior change program as one that includes the following (Sarafino, 2001):

- Identification of target behavior(s).
- Establishment of criteria in order to determine what consequences will apply to those behaviors that have to be changed.
- Include the target audience as active participants in the process of implementing the program.
- Provide training to all participants that the program will affect.
- Collect data in order to track progress.

- ❖ Provide feedback based on the data.
- ❖ Allow for adjustments to the program when necessary.
- ❖ Exercise a continued commitment to the program.

From a psychological standpoint, design safety engineers do not design with the mindset that all people vary based on behavioral vectors such as: social norms, functional disorders, stress, etc. Psychologist believes that if these things were evaluated during the design of any process, then the potential for human error can be decreased (Peters, 2006). While the above is valid in retrospect, one can make an opposing argument in analyzing human error to conclude that during the design of safety critical systems; the user having the "freedom to choose" can contribute to a human engaging in "at risk" behaviors that can lead to injuries (Pajan, 1997). Both points of view (from the psychologist and safety perspectives) share a common interest and that being human error human error has not been researched enough at the design engineering level.

Other psychological researchers believes that when it comes to eliminating/reducing human errors that result from "at risk" behavior; more than one technique should be administered. These include, but are not limited to (Anca, 2007):

- Training & Development
- Leadership/Management/Supervisors Inclusion

- Distraction Management
- Situational Awareness

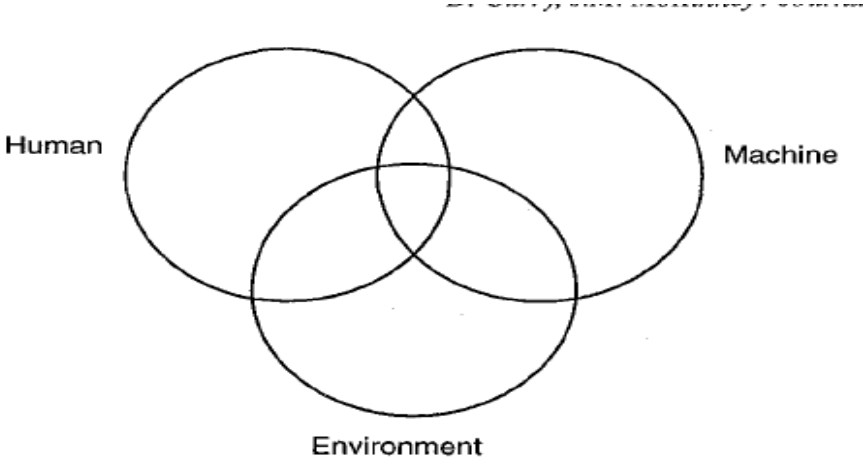
While the core principles of BBS relate to psychological applications, its application in the workplace requires continuous maintenance/participation/support from all levels of employment as opposed to targeting specific groups of interest, similar to implementation of behavior modification in the psychology field. BBS is most effective when applied at all levels of the organization (DePasquale et al., 1999).

1.2 Behavior and Accident Prevention Model

The Bureau of Labor Statistics (BLS) reported that there were approximately 2.8 million non-fatal occupational injuries and 4,609 occupational fatalities in 2011 (BLS, 2012). H. Heinrich performed comprehensive research in 1931 of a database that is used by the insurance industry. As a result, he concluded that approximately 90% safety incidents happen as a result of "unsafe acts" (Al-Hemoud et al., 2006). If further research proved that this number is precise, the amount of occupational injuries that result every year could drastically reduce if the human error element is eliminated.

In prevention, maintenance, and injury investigations the human/machine/environment interaction is often the critical tool used by safety professionals in the evaluation of safety related programs. Incorporating BBS in the work environment provides the opportunity to decrease injuries

because the human contribution to the incident is decreased. Anytime there is an interaction between the human/machine/environment the possibility for injury will always exist and the likelihood of an injury due to human error has the potential to be less substantial.



(Curry et al., 2006)

The human/machine/environment matrix was developed in World War II by United States Army researchers (Curry et al., 2006). These researchers decided to create this investigative matrix because there was a direct correlation between an increase in injuries (due to human error) and the increase in the development of technology being used by the army (Curry et al., 2006). Injury prevention using this model gives an investigator a formal mechanism to analyze processes, predict possible outcomes, and apply the appropriate administrative/engineering controls to prevent incidents. After this tool became a successful matrix by the army, it has become routinely used industry wide by a countless number of government and private industries.

The “human” aspect of this model doesn’t necessarily involve the individual injured during the process. Human error or “at risk” behaviors can also be a potential threat from the injured employee, witnesses, equipment installers, operators, maintenance personnel, management, and engineers (Curry et al., 2006). When determining the magnitude of the role of these involved individuals, it is important to consider the length of their employment, level of training, previously held positions in the organization and observations before/after the incident.

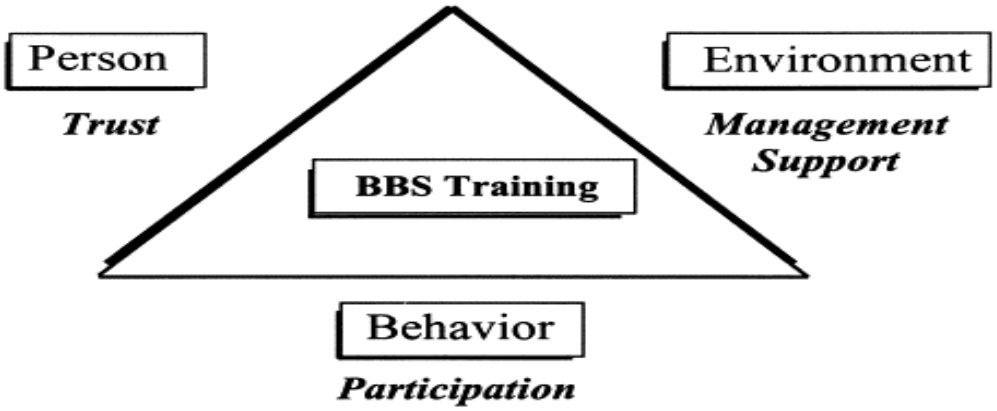
The “environment” element is evaluated at the equipment level and the direct surroundings that the human was performing the work in (Curry et al., 2006). In order to properly evaluate the direct surroundings that the work was performed in, it is important to get an accurate account of witness statements from individuals who were present before and after the incident. It may also be beneficial to gather historical information about the work environment in order to facilitate in drawing a conclusion about normal working conditions.

Evaluation of the “machine” element takes a multitude of factors into consideration (ie machine guarding, corrosion, part recalls, maintenance, design etc.). Additionally, at the time of the incident; it is important to consider if the equipment was used per the manufacturer’s recommendation. It is also pertinent to evaluate how the human operator fits the design of the equipment and the level of comprehension when it comes to operating this piece of machinery. Needless to say, there is a substantial amount of data collection

during the human/machine/environment evaluation; but at every level the human error aspect is pertinent.

2. Implementation of BBS in the Workplace

As previously mentioned, BBS is typically phased into the workplace via a three step systematic process (observation, documentation/measurement, and feedback). While many organizations choose different forms of integration at each phase, the basic methodology remains the same. These include: targeting "at risk" behaviors that have a negative impact on safety, then documenting and measuring those behaviors, set attainable goals, provide feedback (positive and negative) to involved person(s) and reinforcing progress (Al-Hemoud et al., 2006). In this section it will be defined where in each phased of BBS that these methodologies should be applied.



The above BBS model is based on a combination of surveys and focus groups which reflect how the participants perceive BBS in their workplace (DePasquale et al., 1999). In this model, the middle training portion connects

all components of BBS and is critical to a successful BBS program. In this meta-analysis of employee perception of BBS, most of the felt that when their knowledge of BBS was enhanced; they became more inclined to participate in the program (Depasquale et al., 1999).

2.1 Phase 1 – Observation

The most important objective during this initial phase is identifying those "at risk" behaviors that contribute negatively towards safety. While the identification of these types of behaviors is essential in injury prevention in the workplace (Al-Hemoud et al., 2006); there aren't any specific outlines that are established for accurately identifying the correct behaviors for change (Wirth et al., 2008). There are a number of avenues that can be taken to identify these behaviors and trends such as:

- ✓ Past OSHA 300 Injury Logs
- ✓ Employee Complaints
- ✓ Workers Compensation Claims
- ✓ Employee Surveys
- ✓ Interviews
- ✓ Direct Observation with a customized behavioral checklist

The behavioral checklist is the most widely used mechanism in conducting BBS observations. The behavioral checklist should reflect those "at risk" behaviors that hold the most prevalence (in regards to injuries) for the

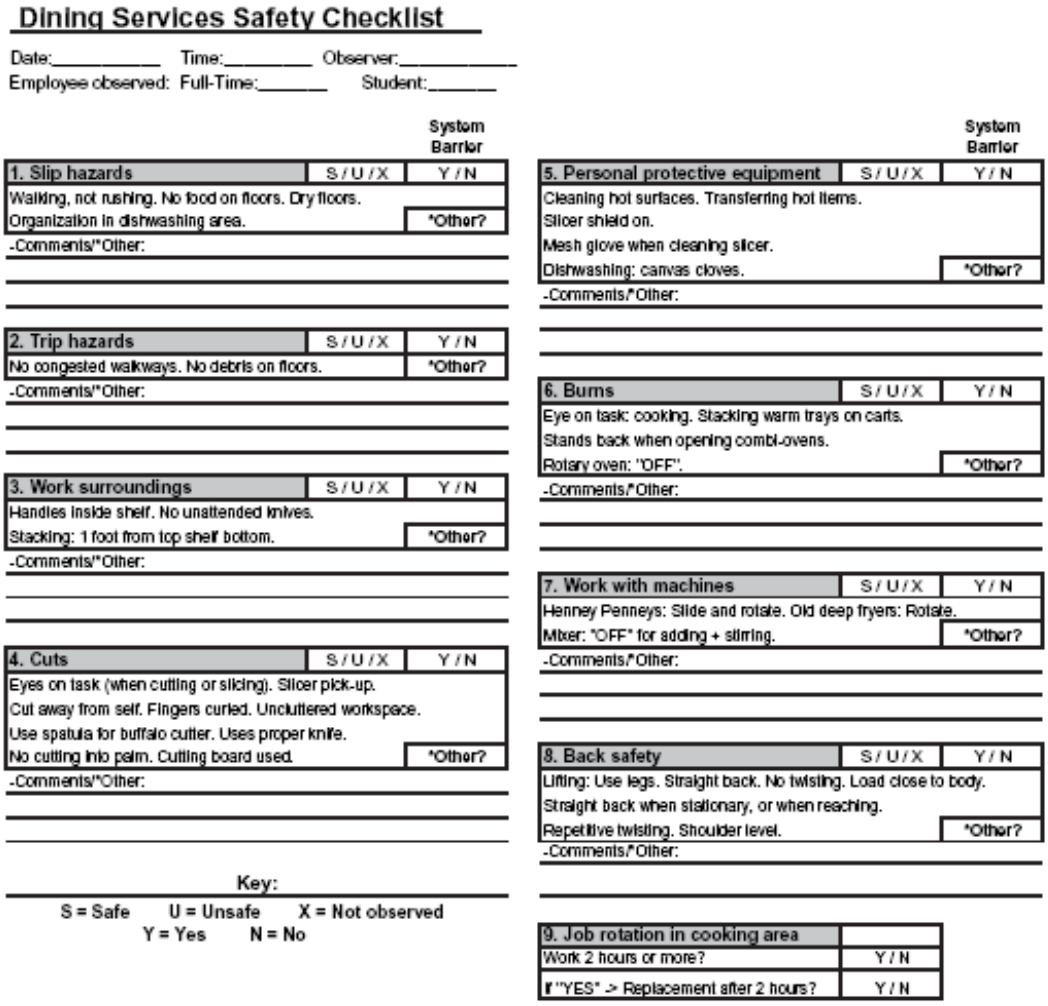
company; additionally, those behaviors that contribute to the potential for fatalities should be evaluated. Researchers suggest starting with a small amount of content on the checklist and as employees get adjusted to the program, add more complex subject matter (DePasquale et al., 1999).

After target behaviors have been identified and critical behavior checklist (CBC) has been created, a baseline measurement must be established. A baseline measurement is an evaluation of the environment prior to instituting BBS techniques. Baseline establishment is important because it give visibility in determining if the program is actually working after measuring the environment after BBS has been permeated in the workplace. There are not any established guidelines as to the recommended duration of baseline measurement.

All employees that are affected by the BBS program must be thoroughly trained on what BBS is and what their roles and responsibilities are during this process. Employees that will be performing peer observations must have specialized training that educated these individuals on how to properly identify/document those behaviors which negatively impact safety.

The “who” and “when” in regards to completion of the CBC is something that must be tailored to fit the organization (DeJoy et al., 2005). There are not any established guidelines that suggest how these individuals must be selected, how long one must observe, and/or how many days per week

observations must be performed. See below examples of critical behavior checklists.



Dining Services Safety Checklist

Date:_____ Time:_____ Observer:_____
Employee observed: Full-Time:_____ Student:_____

	S / U / X	System Barrier Y / N
1. Slip hazards		
Walking, not rushing. No food on floors. Dry floors.		
Organization in dishwashing area.		*Other?
-Comments/*Other:		

	S / U / X	System Barrier Y / N
2. Trip hazards		
No congested walkways. No debris on floors.		*Other?
-Comments/*Other:		

	S / U / X	System Barrier Y / N
3. Work surroundings		
Handles inside shelf. No unattended knives.		
Stacking: 1 foot from top shelf bottom.		*Other?
-Comments/*Other:		

	S / U / X	System Barrier Y / N
4. Cuts		
Eyes on task (when cutting or slicing). Slicer pick-up.		
Cut away from self. Fingers curled. Uncluttered workspace.		
Use spatula for buffalo cutter. Uses proper knife.		
No cutting into palm. Cutting board used.		*Other?
-Comments/*Other:		

	S / U / X	System Barrier Y / N
5. Personal protective equipment		
Cleaning hot surfaces. Transferring hot items.		
Slicer shield on.		
Mesh glove when cleaning slicer.		
Dishwashing: canvas cloves.		*Other?
-Comments/*Other:		

	S / U / X	System Barrier Y / N
6. Burns		
Eye on task: cooking. Stacking warm trays on carts.		
Stands back when opening combi-ovens.		
Rotary oven: "OFF".		*Other?
-Comments/*Other:		

	S / U / X	System Barrier Y / N
7. Work with machines		
Henney Penneys: Slide and rotate. Old deep fryers: Rotate.		
Mixer: "OFF" for adding + stirring.		*Other?
-Comments/*Other:		

	S / U / X	System Barrier Y / N
8. Back safety		
Lifting: Use legs. Straight back. No twisting. Load close to body.		
Straight back when stationary, or when reaching.		
Repetitive twisting. Shoulder level.		*Other?
-Comments/*Other:		

Key:
S = Safe U = Unsafe X = Not observed
Y = Yes N = No

9. Job rotation in cooking area	
Work 2 hours or more?	Y / N
If "YES" -> Replacement after 2 hours?	Y / N

Observation procedure

1. General Observation - Who could get hurt, and how would it happen?
2. Observe Conditions - Categories 1–3
3. Observe Behaviors - Categories 4–8
4. Show Checklist and give Safety Information
5. Discuss performance and System Barriers to Safety

Please put the completed Checklist in an envelope and give to unit secretary
Thank you for your participation!

FIGURE 1 Checklist of at-risk behaviors and conditions used by employees during peer observations.

(Lebbon et al., 2012)

FIGURE 1 The critical behavior checklist (CBC) developed by the employees and used by the researchers (operational definitions for each behavior were printed on the back of the CBC).

Behavior	Safe	At-Risk	Comments
Personal Protective Equipment			
• Eye Protection			
Lifting			
• Bend Knees			
• Hold Load Close			
• Move Feet, Don't Twist			
Forktruck Driving			
• Slow at Intersections			
• Honk at Intersections			
• Back with Load			
General			
• Stacking Pallets			
• Handrail Use			
• Conveyer Avoidance			

(Williams et al., 2000)

Table 1
The critical behavior checklist (CBC) used in the study

Critical Behavior Variables	Safe	At-Risk	Comments
1. Smoking in the premises			
2. Incorrect storage and stacking			
3. Awkward sitting posture			
4. Leaving lights on after work			
5. Poor Housekeeping (floors, aisles, work area)			
6. Electrical cords and outlet circuits improperly used			
7. Horseplay during work			
8. Standing on a chair instead of using a ladder			

(Al-Hemoud et al., 2006)

The frequency of observations should be customized to fit the magnitude of the "at risk" behavior that is being observed. For example, if the target behavior is "slips, trips, & falls" where a high percentage occurs on 3rd shift, then it may be in the best interest to observe this action on 3rd shift in addition to 1st shift, in order to evaluate what these two shifts are doing differently. The best practice that may need to be instituted on 3rd shift could lie on 1st shift. The components of a CBC vary depending on the basis of the company's injury history and it may or may not affect acute and chronic safety performance (Wirth et al., 2008). The following items have been suggested for further research related to the observation phase of BBS (Wirth et al., 2008).

- "Are behavioral checklist and observations the best way to measure safety performance or are there alternative methods"?
- What number of behaviors (pinpoints or targets) is optimal for inclusion on a behavioral checklist"?
- "What is the minimum effective observation frequency"?
- "Are observers more likely to engage in safe behaviors (observer effect)? What conditions or variables influence the observer effect?

Answers to the above unidentified research questions could potentially lead to more established guidelines in the observation component of BBS. It is also important to remember that BBS is a continuous and systematic process; therefore, the observation phase will always be instituted first. Observations that are performed by co-workers have a direct correlation with a decrease in OSHA recordable injuries (Lebbon et al., 2012).

2.2 Phase 2 - Documentation and Measurement

After observations have been created the data usually gathered and analyzed in order to establish attainable safety related goals for the organization. During the establishment of the baseline in the observation phase, a sample of the work environment is measured (usually at its normal state where no spikes in safety incidents are a factor for a specified amount of time). This data is gathered in order to compare and contrast it against measurements taken after BBS has been instituted within the organization. This process gives visibility as to if the BBS program is working and/or if injuries are in fact being reduced. It can also be used to measure specific components of the program (ie observations, employee participation, etc.). The data can be used to generate reports that can be used as a program improvement tool. Data and measurement also gives the BBS participants the opportunity to visually track their individual progress. The data also gives the BBS administrators the opportunity to identify and respond to injury trends in a timely fashion.

Measurement of the data facilitates continuous improvement and the identification of “at risk” behaviors and helps determine what their impact will be in improving safety. A food service provider stationed on a college campus, had a BBS safety program instituted on campus in order to determine of there was a direct correlation between peer observations and OSHA recordable

incidents (Lebbon 2012 et al.,). The data that was collected for this research project is below.

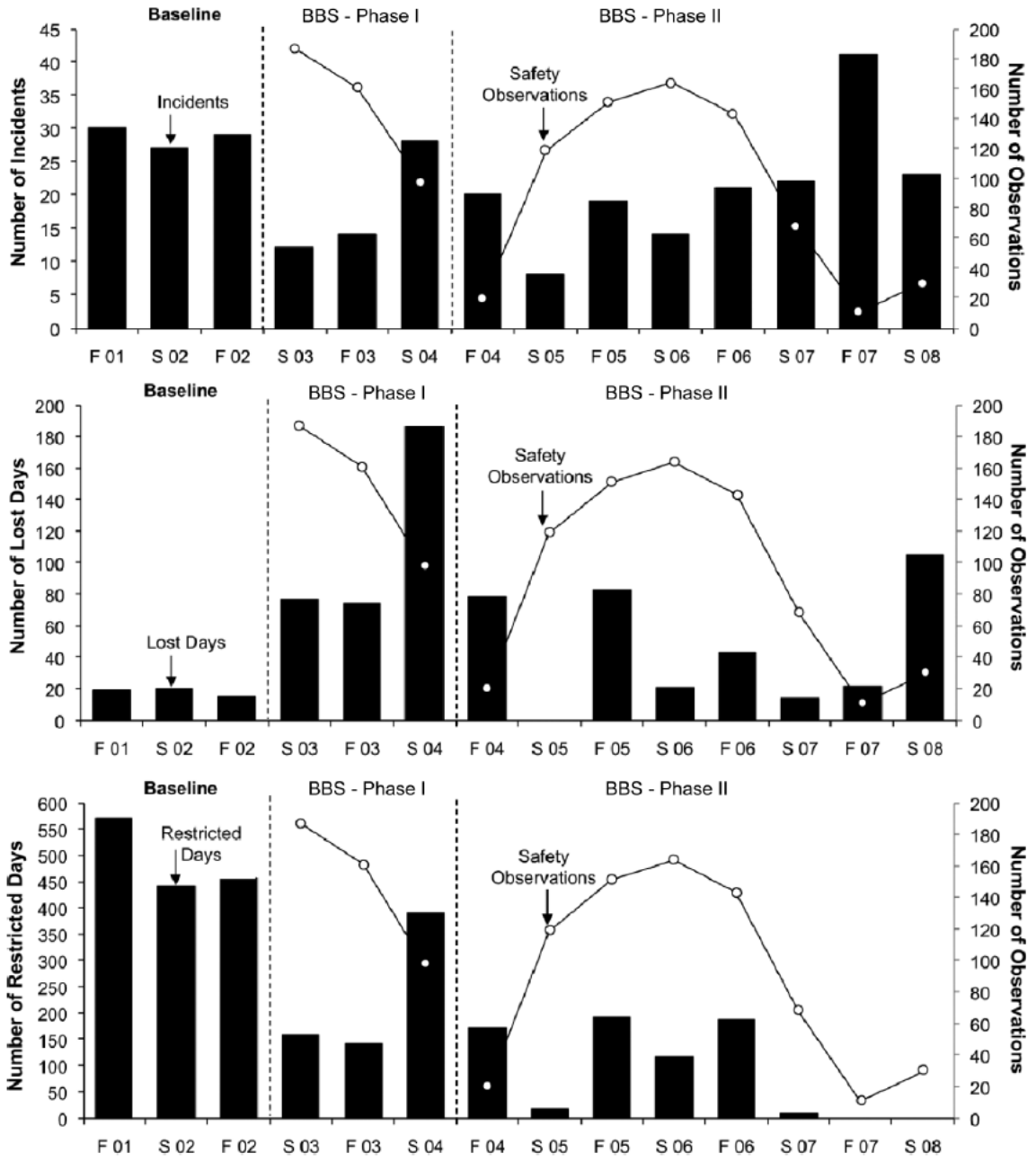


FIGURE 2 Number of peer observations and number of recordable incidents (upper panel), lost days (middle panel), and restricted days (lower panel) across fall (F) and spring (S) semesters.

The data that was collected for this research project shows that there is an inverse between OSHA recordable injuries and observations. As more observations were preformed, the number of injuries decreased and vice versa. BBS Phase 1 represents when 29 employees were trained to perform BBS observations. BBS Phase II represents when there were over 100 employees were trained to conduct BBS observations.

Overall safety scores are typically tracked rather than tracking a decrease in injuries (Williams et al., 2000). Percent safety scores are calculated as follows: Total safe observations/total safe observations x 100. Many meta-analysis research studies that are performed for BBS are completely statistical analysis of pooled data from different sources. A research study was conducted on 20 different companies (over 700 employee's total) who were surveyed to determine how they felt about BBS being instituted into their organization (DePasquale et al., 1999). The following components were measured.

- ✓ Interpersonal Trust
- ✓ Impulsivity
- ✓ Involvement and self perception of BBS Training

The data for their research was collected via focus groups and surveys. This allowed determinations to be made which compared BBS against other external organization and also allowed the researchers to extract critical groups who felt negatively/positively about the impact BBS has had on their

organization since implementation. These focus groups also gave the researchers the opportunity to give the employees the platform to offer their suggestions on improvement criteria that they felt would enhance the program.

BBS has also been described by one researcher as a “data driven approach” (DeJoy et al., 2005). Data collection begins at the initial observation level and without it (data collection and measurement), there would not be a mechanism for tracking progress, providing feedback, or establishing a baseline. Further research in data collection/measurement has been proposed on the following components (Wirth et al., 2008):

- “Does the number of checklist items affect the accuracy of measurement”?
- Does the frequency of observations affect measurement accuracy or reliability”?

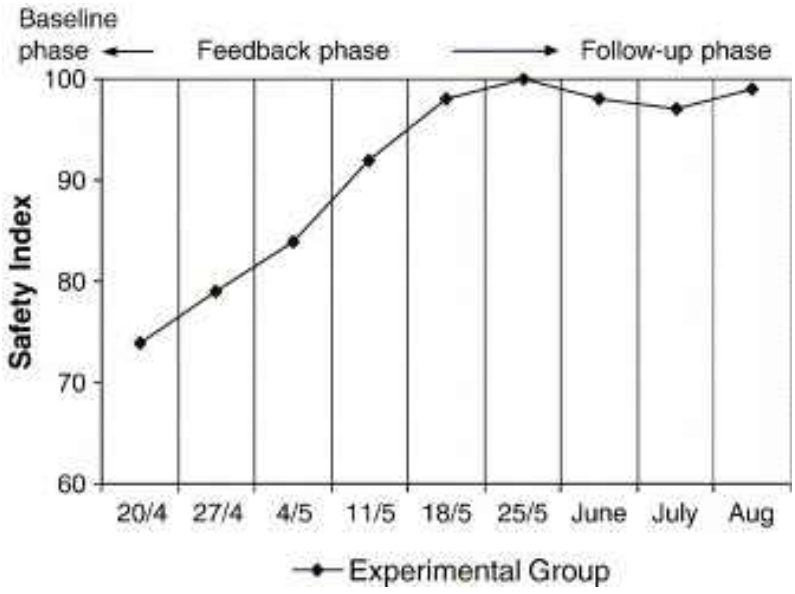
One of the most important components of the measurement collection process is the ability to track established safety goals. Goals should be set after an accurate baseline measurement has been established in the target area. A goal can be comprised of a single point of interest (ie reduction of struck by incidents by 20% before the next fiscal year) or a goal can encompass a multitude of key critical items (ie reduction of all non reportable injuries before within 30-days). Researchers have noted that when a set goal for an “at risk” behavior has been reached, then that behavior should be decommissioned and

a new “at risk” behavior should be established (Wirth et al., 2008). The decommissioned behavior should be periodically revisited (observed and measured), thus making this process systematic.

2.3 Phase 3 – Feedback

The final phase of the BBS process allows all participants to discuss the program and individual progress towards increased safe observations. In a research study involving housekeeping practices on a shipyard, BBS participants were individually informed successes in safe behaviors as well as their inadequacies related to accidents/injuries (Lund et al., 2004). If employees are made to feel as though their company is concerned about their safety and health, the potential for a shift in companies organizational values (Neal et. al., 2000). Providing feedback to BBS participants creates an environment where “at risk” behaviors that contribute to safety will decrease and those behaviors which enhance safety will increase (DeJoy et al., 2005).

An educational research facility in Kuwait instituted BBS techniques in their work environment and concluded that when feedback was ceased during the project, safety performance decreased back down to the baseline measurement of safety (Al-Hemoud et al., 2006).



If training is required, it is administered during the feedback stage. It is only during the Observation phase is BBS principles/applications are taught to the participants. During the feedback phase, if there are deficiencies that were noticed, then they are typically corrected in this phase of the program. Feedback can be provided verbally, graphically, informally, etc. It is also encouraged to provide "praise" as a form of feedback for participants that exemplify acceptable behavioral acts. Further research has been suggested in this phase of the BBS application in the following areas (Wirth et al., 2008):

- "Is performance feedback always necessary for behavioral change? Under what conditions is feedback critical"?
- "How does the timing of performance feedback impact intervention effectiveness (ie frequency, immediacy, or duration)"?
- "Is the mode or type of feedback important (e.g. verbal or written, tangible vs non tangible, specific vs general)"?

- "Who should provide feedback"?
- "Should feedback be individualized to each worker? Under what conditions is group-based feedback effective"?

3. Management and Leadership BBS Roles and Responsibilities

The leader's job is to assist their followers in attaining their goals and to provide the direction or support needed to ensure that their goals are compatible with the overall goals of the three phases of BBS.

Effective leadership creates a clear path to help their followers get from where they are to the achievement of their work goals and make the journey along the path easier by reducing roadblocks and pitfalls.

Four different Potential BBS leadership behaviors.

a. The *directive leader* lets subordinates know what is expected of them, schedules work to be done, and gives specific guidance on how to accomplish tasks.

b. The *supportive leader* is friendly and shows concern for subordinates' needs.

c. The *participative leader* consults with subordinates and uses their suggestions before making a decision. This is the type of leader that integrates well with the BBS applications and techniques. This type of leader takes an active role in the program.

3.1 Organizational Culture and Leadership

1. **Cultivate a "People Motivated Culture."** Effective programs thrive in organizations with policies and programs that promote respect throughout the organization and encourage active worker participation, input, and involvement. The BBS environment should be built on trust, not fear. It's the role of leadership to make employees feel confident that they will not be punished for "at risk" behaviors noted during the observation phase. If workers believe their information is not kept confidential, the program is less likely to succeed.

2. **Demonstrate leadership.** Commitment to worker health and safety, reflected in words and actions, is critical. The connection of workforce health and safety to the core products, services and values of the company should be acknowledged by leaders and communicated widely. Safety participation can be increased by incorporating "soft" leadership tactics. These include consultation with employees, asking for employee input, etc. (Clarke et al., 2006).

3. **Engage mid-level management.** Supervisors and managers at all levels should be involved in promoting BBS. As previously stated, BBS is tool that is only successful when incorporated throughout the organization. Supervisors are the direct links between the workers and upper management and will determine if the program succeeds or fails. Mid

level supervisors are the key to integrating, motivating and communicating with employees.

Tailored Program Design

4. **Establish clear principles.** Effective programs have clear principles to focus priorities, guide program design, and direct resource allocation. Prevention of disease and injury supports worker health and well being.

5. **Integrate relevant systems**. Program design involves an initial inventory and evaluation of existing programs and policies relevant to health and well-being and a determination of their potential connections. In general, better integrated systems perform more effectively. Integrate separately managed programs into a comprehensive health-focused system and coordinate them with an overall health and safety management system. Integration of diverse data systems can be particularly important and challenging.

6. **Eliminate recognized occupational hazards.** Changes in the work environment benefit all workers.

7. **Be consistent.** Workers' willingness to engage in worksite health-directed programs may depend on perceptions of whether the work environment is supportive. Individual interventions can be linked to specific work experience. Change the physical and organizational work environment to align with BBS goals.

8. **Promote employee participation.** Ensure that employees are not just recipients of services but are engaged actively to identify relevant health and safety issues and contribute to program design and implementation. Barriers are often best overcome through involving the participants in coming up with solutions. Participation in the development, implementation, and evaluation of programs is usually the most effective strategy for changing culture, behavior, and systems.

9. **Tailor BBS programs to the *specific* workplace** and the diverse needs of workers. Workplaces vary in size, sector, product, design, location, health and safety experience, resources, and worker characteristics such as age, training, physical and mental abilities, resiliency, education, cultural background, and health practices. Successful programs recognize this diversity and are designed to meet the needs of both individuals and the enterprise. Effective programs are responsive and attractive to a diverse workforce. One size does not fit all—flexibility is absolutely necessary.

10. **Consider incentives and rewards**. Incentives and rewards, such as financial rewards, time off, and recognition, for individual program participation may encourage engagement, although poorly designed incentives may create a sense of "winners" and "losers" and have unintended adverse consequences. There currently isn't enough research

available to assess whether incentives/rewards adversely impact data related to BBS.

11. **Find and use the right tools.**

Measure risk from the work environment and baseline environment in order to track progress. For example, a Health Risk Appraisal instrument that assesses both individual and work-environment health risk factors can help establish baseline workforce health information, direct environmental and individual interventions, and measure progress over time. Optimal assessment of a program's effectiveness is achieved through the use of well trained observers.

12. **Adjust the program as needed.** Successful programs reflect an understanding that the interrelationships between work and health are complex. New workplace programs and policies modify complex systems. Uncertainty is inevitable; consequences of change may be unforeseen. Interventions in one part of a complex system are likely to have predictable and unpredictable effects elsewhere. Programs must be evaluated to detect unanticipated effects and adjusted based on analysis of experience.

13. **Make sure the program lasts.** Short-term approaches have short-term value. Programs aligned with the core product/values of the behavior modification are long lasting. There should be sufficient

flexibility to assure responsiveness to changing workforce and market conditions.

14. **Ensure confidentiality**. Be sure that the program meets regulatory requirements and that the communication to employees is clear on this issue. BBS is not a substitute for regulatory compliance. All regulatory jurisdictional programs must be followed.

Program Implementation and Resources

15. **Be willing to start small and scale up.** Although the overall program design should be comprehensive, starting with modest targets is often beneficial if they are recognized as first steps in a broader program. For example, target reduction in injury rates or percent safe behaviors. Consider phased implementation of these elements if adoption at one time is not feasible. Use (and evaluate) pilot efforts before scaling up.

16. **Provide adequate resources.** Identify and engage appropriately trained and motivated staff. Allocate sufficient resources, including staff, space, and time, to achieve the results you seek. Direct and focus resources strategically, reflecting the principles embodied in program design *and implementation.*

17. **Communicate strategically.** Effective communication is essential for success. Everyone (workers, supervisors, etc.) with a stake in BBS should know what you are doing and why. The messages and means of

delivery should be tailored and targeted to the group or individual and consistently reflect the values and direction of the programs. Communicate early and often, but also have a long-term communication strategy. Provide periodic updates to the organizational leadership and workforce. Maintain program visibility at the highest level of the organization through data-driven reports that allow for a linkage to program resource allocations.

18. **Build accountability** into program implementation**.** Accountability reflects leadership commitment to improved programs and outcomes and should cascade through an organization starting at the highest levels of leadership. Reward success.

Program Evaluation

19. **Measure and analyze independently outside of the BBS measurements.** Develop objectives and a selective menu of *relevant* interval measurements. Integrate data systems across programs and among vendors. Integrated systems simplify the evaluation system and enable both tracking of results and continual program improvement. For example, the BBS data injury percentage rates may be calculated once per month at your site by, however; you may desire to track this information every week in order to ensure that injuries are being reduced.

20. **Learn from experience.** Adjust or modify programs based on established milestones and on results you have measured and analyzed.

Conclusion

Even though behavior based safety has been practiced by psychologist for many years, it is still in a development phase in the occupational safety field (Al-Hemoud et al., 2006). Its application hasn't been practiced for a substantial amount of time and there is limited data available on the topic in general. Herbert Heinrich (in 1980) provided the initial research with evaluating human behavior in safety (Wirth et al., 1980). Safety culture seems to be the closest type of literature and while these two mechanisms are alike in a lot of ways, they also differ in their application in the workplace.

Table 1
Summary comparison of behavior-based and culture-change approaches to safety management

Characteristic	Behavior-based approach to safety	Culture change approach to safety
Background/origin	Operant psychology/ behavior modification	Organizational behavior/anthropology
Key aspects	"Bottom-up" approach Analytic/data-driven Setting specific Continuous process	"Top-down" approach Intuitive/ethnographic Setting specific Self-sustaining
Typical implementation	Identify and define critical behaviors Set performance goals Observe/sample behavior Provide contingent feedback/reinforcement	Assess aspects of culture (values, beliefs, assumptions, etc.) Devise alternative vision Work with leadership (and employees) to implement change
Principal strengths	Specific technology Objective/empirical Shop floor focus Participatory (usually) Positive	Emphasizes organizational change Focuses on basic causes Participatory (often) Comprehensive
Principal weaknesses	Victim-blaming Minimizes environment Focuses on immediate causes	Diffuse technology Subjective/intuitive Indirect

(DeJoy et al., 2005)

There are strength aspects in establishing a safety culture that are actually weaknesses when establishing BBS techniques (Dejoy et al., 2005). These two mechanisms share an inverse relationship and I feel it's important to highlight that fact because there are many safety researchers/professionals who classify both of these techniques as being the same program. BBS can be applied in many fields of professional industries, however; integrating each phase of the application has to be tailored to fit the individual organization. Below are a few descriptions where BBS has been applied in different industries.

Industry	**Description of the Study**	**Results**
Research, educational, & training institute in Kuwait (Al-Hemoud et al., 2006)	Random sample of 10 individuals selected from a department that a moderate number of safety incidents. BBS trained to the target group and no training provided to the baseline group.	Experimental group results showed that the mean percent safe scores increased from 74% (at baseline) to 100% by the end of the sixth week of the study.
Food and Drink Industry operating on a college campus (Lebbon et al., 2012)	Consultant instituted BBS for a period of 6-years to 120 full time workers.	Over a six year time period, safety incidents decreased by approximately 30%.
Meta-Analysis of 73 Companies who have instituted BBS. Conducted by a research firm (Krause et al, 1999).	The only requirement was the evaluation of OSHA reportable injuries going back 4 years before BBS was instituted in the selected organizations.	✓ 1st year – 26% reduction in safety incidents. ✓ 2nd year - 42% reduction ✓ 3rd year -50% reduction ✓ 4th year -60% reduction ✓ 5th year - 69% reduction
Liberty Mutual Insurance Company (McCann et. al., 1996)	CTS from data entry prevalent. BBS applied to promote proper wrist postures.	Dramatic spike in the increase of correctly performed wrist postures.
Fabrication plant (Al-Hemoud et al., 2006)	Hearing loss was prevalent and ear plug usage was minimal prior	Earplug usage improved 50% from the established baseline within a 5-month time

	to BBS.	frame.
Shipyard (Al-Hemoud et al., 2006)	Eye injuries were higher than all other injuries (60% higher) prior to BBS techniques.	Injury rates went from 7.4 per 100 workers to approximately 1.1 per 100 workers.

The literature described here is a brief representation defining what Behavior Based Safety (BBS) is and what steps have to be taken to implement the program in to the workplace. BBS has been proven through research to increase safe behaviors, but the application can only be successful when it is used in the entire organization (DePasquale et al., 1999).

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