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Effective Application of Behavioral Based Processes in Offshore Operations

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EFFECTIVE APPLICATION OF BEHAVIOR-BASED PROCESSES IN OFFSHORE OPERATIONS

1.0 INTRODUCTION

The introduction of the behavioral-based safety process in the offshore industry over the past decade has had a significant impact on safety in general and the offshore safety culture in particular. The Behavior-Based Safety (BBS) process compliments Human Factors Engineering (HFE) efforts in the struggle to improve safety by minimizing the risk in the hazardous offshore environment. The behavioral-based safety process and HFE both focus on the workers by taking advantage of their strengths and minimizing their weaknesses.

The four key steps of the behavior based safety process are as follows:

1. Identifying behaviors – Identification of and operationally defining the behaviors that make up the pool of risk is the first step. This is most commonly accomplished by studying a statistically valid sample of past incident reports and extracting the behaviors that facilitated the injury. The objective is to validate these and then to develop an operational definition of wht it looks like when the employee is executing the behavior in a risk averse manner.
2. Gathering data – This second step is to sample the occurrence of these identified critical behaviors out in the workplace. This measure is a proactive stimulus or predictor of whether there is likely to be an injury or not.
3. Providing performance feedback – This step trains the sampler to reinforce the safe behavior the employee is doing and dig in and find out why the behaviors that are being donne in a risky manner are being done that way.
4. Removing system barriers.- Lastly this step is to take the data from sampling and feedback and to use it as the impetus to do intervention at the system level.

The primary objective of HFE is to design the workplace or system to eliminate or minimize the potential for human error. The behavioral-based safety process uses a continuous improvement process based on observations and positive feedback to pinpoint at risk behaviors and weaknesses in management systems. Thus, whereas HFE's goal is to build a work environment that is as safe as practical, the behavioral-based safety process tackles the difficult task of identifying and rectifying bad habits and gaps in management systems with the ultimate goal of creating a safety culture that supports safe behaviors. Together, the two processes complement one another in improving safety by minimizing the risk in the hazardous offshore environment.

This paper presents the overlap and interaction between HFE and Behavior-Based Safety in managing workgroups safety performance. For example, It will highlight how BBS tools can provide useful feedback to the facility designer for consideration in improving the design, and in the design of future facilities. After introducing three categories of critical safety-related behaviors: enabled, difficult, and non-enabled, the paper discusses the primary concepts of the behavior-based approach to accident prevention. It then sketches six current myths about behavior-based safety, and addresses them through a detailed presentation of the four key activities of Behavior-Based Safety at the level of the workgroup. This paper will focus on what works and does not. Frequent references will be made to BAPP®, one approach fostered by Behavioral Science Technology (BST) for illustration sake. It is one of many available approaches that operationalizes the principles of BBS. A sample listing of some other available BBS approaches and programs are identified in the reference section of this paper.

2.0 BACKGROUND

Over the past few decades the focus on safe operations has become a norm for those businesses that have the potential for large loss of human life and environmental catastrophe. The two are not much different in the minds eye of the public.

The oil industry and specifically offshore industries came aboard with this thinking in the more recent past. This need to improve safety has been reinforced by the losses that have occurred in this industry and the realization that they had to find more economical means to operate given the pressure on profits from the global competition. Safety, in short, became a two edged sword for the offshore industry.

First, it was good business not to be incurring the financial burden of mishaps. It became a way to let the employee know that even in the uncertain world of re-engineering, reorganization, cost cutting, and other tough survival activities that the organization has to undertake, that it still cares about the employee.

3.0 THE REALITY

Behavior is one of the components of almost every injury. If we took the people out of the picture there would be no real injuries to speak of. This said, there are virtually no behaviors executed by anyone in pursuit of an injury. So the question that Behavioral science gives us is why people do things that enhance the chance of an injury occurring.

Another frequent component associated with injury is the facility or task design. These are the physical constraints built into the design that form the physical working environment for accomplishing task. Design shortcomings can negatively or positively impact the performance of a desired behavior that may be recognizable to the observer with basic HFE knowledge. Also, here is where the BBS and HFE processes can work together to improve the design, provided the design flaws are recognized and communicated back to the design engineer or to the design engineering process.

The conditions that increase the likelihood of a certain outcome are called risk factors. These are design-related that increase the likelihood of developing a work-related musculoskeletal disorder, also called repetitive stress illness or cumulative trauma disorders.

Example risk factors, associated with the design, that can positively or negatively impact behavior are as follows:

Awkward posture - For each joint in the body, there is a range of motion which is considered neutral or non-stressful. For example, any flexing, bending or twisting of the wrist takes it out of neutral (straight) posture.

Repetitive motions - Movements that are frequently repeated will increase risk. Finger movements at keyboard and mouse are examples.

Forceful motions or exertions - Activities involving forceful motions can increase MSD risk. Examples are gripping a pen too hard or striking the keys of a keyboard too forcefully.

Contact Stress - Pressure applied to a nerve can damage it. An example is resting the wrist of the hand on the sharp edge of a table, which applies excessive pressure to the median nerve coming out of the wrist.

Sustained posture - Any posture, even neutral, can be stressful if it is sustained over long periods. This is most often noticed when the neck, back or shoulder are held in one position for an extended time.

There are three types of behaviors that make up the pool of at risky behavior in any work environment and different types of interventions to deal with these very different types of behavior. It is also the case that the same behavior can fall into any of the three categories at any time depending on the circumstances. The three types of behavior are Enabled behavior, Non-Enabled behavior and, Difficult behavior.

3.1 Enabled Behavior

This is behavior that the employee has discretionary control over. This is not to say that there are very valid and insidious reasons that the employee would not execute it properly. For example, an improperly designed task may introduce certain risk factors that may cause discomfort and possibly injury, which would likely negatively impact the desired behavior. However, it may not always be so overt a barrier to doing it the right way. In most cases the reason for the employee doing this behavior in a risky manner may seem very benign. This is due to, for the most part, to the fact that they have done it many time for long periods with no adverse consequences. In fact, when it is done in the risky manner, it produces some very powerful positive consequences. Examples of these positive consequences are speed, ease, or less work, etc. In most of these cases changing the physical system is not going to yield much change.

3.2 Non-Enabled Behavior

This is the second and polar opposite of enabled behavior. This is a behavior the employee is not in control of. The system allows for one option, in the case of safety, usually that option is not the correct or least risky one. These situations demand some type of intervention strategy. This strategy almost always requires HFE. Without some formal change in the system the behavior has little or no chance of being changed.

3.3 Difficult Behavior

This behavior is one that crosses both of the above categories and is an interesting mix of both systems issues and perceptions. In managing risk in the difficult category the issue seems to be the risk-to-effort ratio. When doing something the correct way involves a lot of effort, or a level of preciseness that is perceived unrealistic, and if the perception of danger is not acute, the employee is very likely to improvise and not take the precautions necessary to avoid exposure.

An example would be the employee that jumps up on their chair or desk to change the light bulb above the desk. We all know that using a ladder would be best. What the employee knows is that to use the ladder they have to go down stairs, find the janitor, get the key to the supply room, unlock it, get the ladder, climb to the second floor, use the ladder then reverse all of the previous steps. This behavior is difficult enough to overshadow the risk in the employee's mind.

Another example was a machine that had identically designed controls on both sides of the operator's console for different functions. The operator would frequently engage the wrong control. The operator had to be one hundred percent alert to what they were doing to prevent a mishap. They had informally developed a method for use of the controls that prevented them from being used without breaking the train of thought.

These behaviors usually require HFE. In many cases, some thought and some action by the workers or supervisors is sufficient. These behaviors do not always require a capital-intensive solution.

4.0 THE HIERARCHY OF SAFETY & HEALTH CONTROLS

Initially most safety efforts were very traditional and focused on injury or mishap as the measurement medium and trigger for action. Human Factors Engineering and Behavior-Based Safety (BBS) were not on the radar screen. The proactive measures that the companies undertook were catastrophe prevention through engineering and design, and the approach to behavior management was training or rules and procedures. The order of the day was to utilize the Hierarchy of Safety Control. This Hierarchy consisted was a list of intervention methods that started out independent of employee behavior and as it progressed got increasingly dependent on employee behavior (See *Figure 1*).

Until fairly recently management only superficially recognized the HFE management approach in the hierarchy as a method of injury prevention. The problem was that it was seen as expensive and slowed things down. There was not a good way to determine the resultant impact of a particular design or redesign. Also, due to the limited number of HFE experts, it proved difficult for companies to hire such experts. Getting the everyday engineer to think in terms of human behavior was, and remains, difficult at best.

The prevailing thought was that you could not make it error-proof, so don't try; and there was a belief that the employee could overcome the obstacles if they wanted to. The real focus of HFE was primarily on guards and interlocks.

I am not saying that using this approach is incorrect or not something that needs to be done. But the fact remains that even though all or any of these interventions are implemented, none of them effectively assures that the employee is executing the right behaviors at the right time. Thankfully, it has grown in scope as more has been learned about HFE and HFE's potential for error reduction. It has become indisputable over the years the way things are designed and installed have a dramatic impact on error. I believe it is also the case that this methodology is in fact having an impact on the way we think about human behavior. Human behavior is for the most part shaped by the environment it functions in. The behavior you are getting in your organization is what the organization is asking for through the design of the work, facilities, equipment, and culture. If the behavior is occurring consistently it is a factor of the system.

There was another issue that was pushing companies away from taking the HFE or BBS approach. It was an acute recognition, especially in management ranks, that the employee was doing things that caused mishaps. This recognition in many instances resulted in an approach that then assigned blame to the employee. After all, if the employee did something that was obviously risky we need to do something that shows we don't condone it. The best illustration of this is looking at supervisory reports on mishaps.

In almost every instance the supervisors mitigating action of the mishap included solely, or as a major portion, the notion of re-instruction, counseling, warning, disciplining, or retraining the employee. To the naïve this looks like the employee is the problem. To the Behavior-Based Safety expert this means there were identifiable behaviors that the system was producing or reinforcing, that could be measured and could mitigated. Meaning, in essence, that the system was providing antecedents and consequences favorable to at-risk behavior, and the existing system was incapable of reliably producing the behavior that would reduce the risk and mishap rate.

5.0 BEHAVIOR- BASED SAFETY GOALS

Behavior-Based Safety is principally a method for focusing the organization on behavior as the improvement target. Behavior is the most accurate and proactive indicator of not only how safe the organization is working, but also how capable the environment is of producing the type of behavior that reduces the risk or exposure to the employee. By focusing on behavior a person is able to overcome several obstacles that are present when using injury/illness or incident rates as the sole performance measure.

First, you are able to get a more statistically valid sample of workplace safety. Having a hundred observations of workplace behavior in a three month period is a much more valid measure of safety performance to a workgroup than one injury in the same quarter. Second, the measure is active not passive and sets up the opportunity to do real value added activities such as feedback, and problem identification around the observations. Third, if you collect the data and analyze it, a firm has the basis for very focused system barrier identification and HFE can be applied in a more focused manner for system change.

The real goal of Behavior Based Safety is to reduce the variation in the safety related behavior through feedback and system change.

6.0 PRIMARY IMPLEMENTATION PHASE CONCEPTS

In applying BBS methods there are some principles that are utilized for insuring success. Some of these principles followed in the implementation methodology are:

- Build a process, do not implement a program
- Adapt to the culture of the organization versus adopt a canned program
- Engage employees in the adaptation and implementation
- Focus on the system versus blaming the employees
- Develop internal resources for leadership of the effort
- Management and the workforce need to understand and buy-in

6.1 Process Not Program

Many traditional approaches to safety have developed reputation for just a “program of the month.” The BAPP® approach is not just another program. It is *process* with the potential for continuous safety improvement. BAPP® technology allows for flexibility and focus within the process, eliminating the need to constantly change programs to match an evolving culture.

An ongoing process builds more credibility than a series of programs. The process becomes part of the culture, “the way we do things around here.” As the process produces results, it gains a larger following and moves into an upward spiral of credibility among the facility population.

The BAPP® approach is more effective than programs, but it means more work, especially at first. Establishing a new process in an existing culture requires an ongoing, focused, concerted effort. More training time and start-up time are required for a BAPP® implementation than for a program designed to last only a month or two. Facilities that are unable or unwilling to expend such time and effort are not ready for BAPP® technology.

While some safety programs provide quick wins, few produce long-term results. When the program ends, so does the impact. The BAPP® approach, on the other hand, has the potential to establish an ongoing cycle of improvement. While early efforts may produce some results through the Hawthorne effect, the real results come as the process matures and begins to change behavior and the cultural elements that reinforce behavior. While these changes tend to take longer than program changes, they also last longer.

These long-term results come from improving the system that sustains behavior. An approach that ignores the factors that reinforce behavior cannot accomplish lasting change. Instead, BAPP® technology looks through the lens of behavior at the issues of culture, attitude, and environment that shape behavior. It supplies the data that organizations need to identify areas where focus can launch permanent change. Identifying such areas is critical to accomplishing continuous long-term safety improvement.

This approach is what makes BAPP® technology a process, rather than just another safety program.

6.2 Adaptation vs. Adoption

Off-the-shelf products have little chance of becoming part of a company's culture. Every culture is different, and the differences must be addressed. For behavior-based safety to be effective, its principles must be adapted in every instance to fit the people and the environment involved in the process. BAPP® implementations may be similar across companies, but they will always contain critical differences. Adaptation often makes the difference between success and failure.

Adapting the process means involving people in meaningful ways to make the adaptations. Adaptation leads to another important principle of BAPP® technology.

6.3 Employee Involvement

Without involvement, there is no commitment. BAPP® safety initiatives provide opportunities for participation by people at all levels in the organization. People tend to support what they help to create. Adaptation allows many to help create the particulars of a process.

From the onset, each level in the organization has specific roles and responsibilities that are critical to the success of the BAPP® initiative. Continuous improvement in the maturing process provides many more opportunities for involvement, which can eventually reach every person in the facility.

The ownership of the nuts-and-bolts workings of the process is entrusted to the Hourly workforce. Since it is often the most stable group in a facility, involving the Hourly workforce actually becomes a mechanism to sustain the process over periods of change in various levels of Management, or even change of company ownership.

Once the expertise needed to run the process is taught to a group of workers and Supervisors, those workers, in turn, train Observers, and the rest of the workforce. This group of Hourly and Management are also the decision makers in the day-to-day administration of the process. They design the process around the basic principles of BAPP® technology and adapt it to their specific work environment.

6.4 Don't Blame Employees

Focusing on behavior does not imply fault-finding with individuals. Behavior is not a simple matter of personal choices. Behavior is affected by many factors, most of which are ultimately controlled by Management. Accurately placing blame for At-risk behaviors would be embarrassing and counterproductive. Fixing the problem, not fixing the blame, is the principle that truly prevents accidents.

Analyzing how systems affect behavior is a starting point for designing systems that stimulate and reinforce safe behaviors. Designing systems in this way is an ongoing process, adapted to the organization in which the system operates. The design of such system requires a high level of involvement and participation from all levels of an organization.

6.5 Parallels with Quality, Involvement

Quality is inextricably linked to the involvement of the people who perform the process. In the same way that Quality improvement relies on the people who manufacture a product, safety improvement depends on the people who are At-risk for injury: the Hourly workers. They have the most to gain from effective safety measures and the most to lose from ineffective ones. They have the most influence over each other and know the most about the details of the daily routines that shape behavior on the floor. Their support can ensure success; their opposition can make progress difficult, if not impossible.

6.5.1 Feedback

As Deming, Juran, and others began to explore the real questions of Quality improvement, they made an interesting discovery: most people in the plants of the 1940s were isolated from the results of their efforts. They made a product, or part of a product, and seldom knew if the product received praise or complaints from the customer. If they did get such information, it was much later. The net result was that the average worker got no meaningful feedback on the quality of his or her work. Likewise, the average worker today gets little or no feedback on safety behavior.

The feedback they get on At-risk behavior is often sporadic and usually comes in the form of criticism or discipline. The lack of feedback makes it difficult for workers to improve their safety performance. The BAPP® approach provides such feedback and provides it in an effective and usable form.

6.5.2 Measurement

Quality experts will tell you that “what can be measured can be managed.” However, this axiom is correct only if the measured signs truly point to the subject. The same principle applies to safety. Companies that learn to measure the real indicators of safety, develop tools to interpret this data, and use the data to design appropriate interventions into the process have an opportunity to effectively manage safety performance.

6.5.3 Upstream vs. Downstream

Just as inspecting the only finished product is an inefficient way to manage quality, reacting to accident data is an inefficient way to manage safety. The first step upstream from accidents is Behavior. Measuring behavior provides an invaluable tool for managing accident prevention. Shifting the focus from reaction to prevention, it works on the final common pathway of most accidents: At-risk behavior. As the number of At-risk behaviors occurring in the workplace declines, the number of accidents follows suit.

6.5.4 Problem Solving

Quality training provides problem-solving tools that equip employees to develop, test, and implement solutions to the problems they identify. BAPP® technology provides such tools also. Employees are trained to use behavioral analysis and Cause-Tree Analysis to identify root causes and multiple causes of At-risk behavior. They are also taught intervention methods to assure the process accomplish real results and measures success. Systematic approaches tend to produce better results both in quality (defect prevention) and in safety (accident prevention).

6.5.5 Statistical Methods

An important part of measurement and problem-solving requires a working knowledge of statistical methods. Quality teaches Statistical Process Control (SPC) in which workers mathematically determine whether a change is the result of some special causes or just normal flux. Safety also involves managing a process of behaviors that can have either normal or special flux. Many safety efforts panic or relax due to changes in incident rates that are statistically insignificant. The BAPP® approach teaches those involved how to interpret data according to sound statistical methods so that the action they take is based on significant information.

6.6 Develop Internal Resources For Implementation

Outside expertise is typically used to train those who initiate the process, but the ultimate goal is to bring the process in-house. This involves selecting the right individuals and exposing them to the right training and involvement experiences to build sufficient levels of commitment and confidence. This approach affords the maximum opportunities for involvement. Maximum involvement means maximum commitment. Maximum commitment means maximum change for long-term success.

BAPP® safety efforts are directed by *Steering Committees,* composed of Hourly employees and sometimes one or two First-line Supervisors. Once the Steering Committee members are trained and functioning, they have gained valuable experience in team building, problem solving, process analysis, and the basics of Total Quality Management, and the facility has gained a valuable resource for accident prevention. The Steering Committee members often amaze their Managers with what they learn and accomplish. They set the tone for future generations of participants in the BAPP® safety initiative.

6.7 Objective

It is important to always remember the goal of BAPP® safety efforts. Many safety efforts are satisfied with immediate reduction in recordables or other signs that the efforts are producing results. Such results could be nothing more than the normal variation in downstream safety statistics. The goal of BAPP® safety efforts is continuous, statistically significant improvement.

7.0 MANAGEMENT AND THE WORKFORCE MUST UNDERSTAND AND BUY-IN

In order to develop a process built on these primary concepts, it is imperative for both Management and the workforce to understand and buy into the effort. The first step towards buy-in is to have the key players in the organization develop a thorough understanding of what the process entails. This includes the theory of Behavior Management and the elements of a successful implementation. The next step is to develop a clear path forward including the distinct roles, responsibilities, and resources needed for a successful implementation, and a plan to acquire those resources.

Without taking these steps, the likelihood of a successful implementation is much lower. All of these principles help assure the process is effective and following them reduces the amount of organizational resistance that a change effort such as this normally encounters.

8.0 SIX MYTHS ABOUT BEHAVIOR-BASED SAFETY

Before getting to a detailed description of Behavior-Based Safety it is important to understand that BBS has some myths that have grown up with it. These myths are pervasive and have effected some organizations in their ability to understand and use the technology successfully. These myths have muddied the water in general about the technology. The most common myths are:

1. Behavior-Based Safety replaces or subverts HFE or the hierarchy of safety controls.
2. Just doing observations constitutes Behavior-Based Safety.
3. Behavior-Based Safety is for the hourly workforce only.
4. Behavior-Based Safety pushes blame onto the workers.
5. Behavior-Based Safety is just from the realm of psychology.
6. All this Behavior-Based Safety stuff is the same.

9.0 FOUR KEY STEPS OF A BEHAVIOR-BASED SAFETY PROCESS AND WHAT THE BEHAVIORAL SCIENCE SPECIALIST DOES TO IMPLEMENT THEM

The four key steps of the implementation process are as follows:

5. Identifying behaviors
6. Gathering data
7. Providing performance feedback
8. Removing system barriers

The first really critical step in utilizing the concepts and principles discussed above is to understand the context of the situation in which you are about to try to apply them or what is the organizational functioning level of the organization that you are going to work in. Understanding this is probably the single most important factor that the consultant or specialist must know and consider before proceeding. Every project should begin by conducting an assessment of the organization where the implementation is going to happen. The objectives of this assessment are to ascertain organizational characteristics that will influence implementation details.

The first stage of the assessment phase will be information gathering, which can be done through a series of interviews of personnel by consultant or specialist and through administration of a validated Organizational Functioning Survey.

Interviews should be conducted with a cross-section of personnel cutting across levels and functions. One-on-one interviews are conducted with senior leadership, small group interviews with supervisors, and larger group interviews with front-line workers. The objectives of these interviews are to help surface issues important to designing the implementation, and to collect information to support the 4 steps of the implementation.

The Organizational Functioning Survey needs to be a unique instrument that measures a series of variables indicative of the underlying organizational effectiveness factors that shape what we see as organizational culture. For example, where the quality of communications is often cited as a component of culture, the instrument should look "below the surface" at factors such as "organizational justice" and "leader-member exchange," which are root causes of the more readily apparent aspects of organizational culture. By understanding these culture factors, improvement strategies can be designed to strengthen culture and enhance organizational functioning.

The specialist should use these results, along with the information gathered in the interviews, to refine the strategy for the implementation. For example, survey results may inform the identification of critical behaviors for supervisors and managers, and/or may indicate areas where some focused skills training is needed.

During this assessment phase, you need to identify success metrics for the performance improvement initiative. These metrics are important for both the specialist and the organization to be able to assess the effectiveness of the implementation effort. The metrics should relate closely to your corporate objectives for this initiative, and should be measurable through reliable objective data.

In addition the composition of an Implementation Team – a cross functional, cross level group who will play the primary role in undertaking implementation activities should be chosen carefully to work with the specialist or consultant. It is also recommended from experience that a full-time facilitator be appointed for the initiative. This team and this individual must be selected carefully. Their skills and influence bear heavily on the likelihood and level of success.

Following the assessment, the implementation begins in earnest. The implementation will consist of a series of activities designed to build support for the behavior-based process and transfer the competencies needed to make the process successful. The specialist needs to periodically to work with your Implementation Team and management, and define work to be performed between visits by the Team.

It is important to understand that reducing the description of Behavior-Based Safety to these key activities does not in any way imply that it is easy to implement. In fact the one of biggest mistakes that some companies make is to underestimate the organizational resistance to this process or to not balance resources with objectives.

9.1 Identifying Critical Behaviors

The first step for the implementation team will be to figure out and validate which behaviors make up the pool of exposure for an organization. Operationally, this means which behaviors appear consistently before injuries. Once this list of critical behaviors has been determined then operationally defining those behaviors. In other words what would each of these behaviors look like if they were being done in a way that it reduced exposure, communicated to everyone what acceptable risk looks like. Or from the other perspective when you are not doing it as described you are at risk. This list and definitions should become the yardstick for measuring the safety performance of the organization especially at the workgroup level on a day-to-day basis.

The specialist needs to work with the Implementation Team to refine and validate the critical behaviors, gaining buy-in from the team at the same time, until a final instrument is complete.

During this step of the implementation, it is also critical to conduct introduction/buy-in meetings for all employees within the affected organization. These meetings usually take approximately an hour each and are designed to explain the process and build enthusiasm and support among the workforce. The number of meetings should be determined with the principle of interaction and the feasibility of freeing people up for these sessions. Past experience has shown that these meetings are most effective if limited in size to about 20 people.

Another task early in the implementation will be to develop critical behaviors for the management group. The behaviors for these individuals will be those things critical to supporting the implementation and supporting the organization's objectives. It is easier to identify critical behaviors for management group members in small meetings involving two or three management group members.

When critical behaviors have been identified and introductory meetings held it is then time to begin training the Implementation Team to be able to conduct observation and feedback.

9.2 Gathering Data

The next activity is to formally begin to measure or sample the behavior being executed by workforce in a systematic and standardized way. This usually requires formal observation. The objective is to discover where the critical behaviors are occurring in way that exposes the worker and at what frequency they are occurring. This measure is a much more proactive measure than using injury numbers after they occur. This measure is also more statistically valid than the injury numbers due to the fact that whether an injury occurs or not is to some degree a factor of luck or randomness. The same behavior can be done literally thousands of time with no injury associated with it the next two times it happens and injury results. No one can predict when it will occur or how serious it will be. Having this data allows us to begin to truly see where the exposure or risk is.

This data gathering or observation also sets us up for a couple of other high leverage activities. First it allows us to provide the employee feedback on what we see them doing that we want to reinforce and continue to generalize. It also sets us up to discover why the behavior is being done in lieu of the safest behavior and whether the behavior falls into the enabled, Non-enabled or difficult category. In other words it is easy for the observer to discover from the worker, in the feedback, the reason the behavior is being done in the manner it is. This data is very critical to the organization. It is now the case that the human factors group has literally engaged every set of eyes and ears in the field. They are collecting data that clearly pinpoints where the exposure is and why the exposure is occurring.

Key principles that are embedded into this training are to avoid blame, to recognize systems causes of undesired behavior, and to produce quality documentation that can be used to make the HFE group more effective and to be able to change the employees ability to recognize hazards.

9.3 Providing Performance Feedback

Providing ongoing, two-way feedback is the third key activity in Behavior-Based Safety is the mechanism for dealing with the discretionary behavior that is occurring that puts the employee at risk. Feedback in this application is defined as information about performance in relation to a goal. This feedback is intended to be a two-way exchange between the observer and the observed. The purpose is to reinforce and get a generalization of the behaviors that the employee is able to change and to discover which behaviors the employee has incentive to do in a risky manner. This incentive is a naturally occurring factor of the system. Also, the purpose is to determine which behaviors the employees really have no control over, due to the system.

9.4 Removing Barriers to Continuous Improvement

Lastly but most important for lasting and reliable change in the behaviors that are producing the most exposure are identified from the observation data and dealt with in the manner most effective. If the behaviors identified as producing the most exposure turn out to be not a result of the equipment or engineering then other systems are examined such as training, feedback, or design of the work. If the behaviors identified are driven by culture the feedback and other methods are utilized. If the behaviors are due to engineering or equipment then those are dealt with through engineering or new and better equipment. In other words the barriers to the best behavior for the situation are identified and systematically removed.

10.0 EIGHT CRITICAL SUCCESS FACTORS

In implementing Behavior-Based Safety it is the case that there are many opportunities for error and missteps. It is critical that the factors leading to success in implementing behavior-based technology are known and attention is paid to them. As with HFE, the more we know about what works and why it works the more effectively the technology can be utilized. We have studied the factors present in about 800 implementations of Behavior-Based Safety and there were eight that seemed to make the real difference in whether a company was successful in its use of Behavior-Based Safety.

They are:

1. Having a blueprint for implementation
2. Demonstrated leadership
3. Highly competent implementation team
4. Communication
5. Buy-in and understanding
6. Skills training
7. Use of data for process improvement
8. Ongoing technical support

Interestingly, a parallel study of TQM implementations turned up the same factors as critical to success.

11.0 CONCLUSION

In conclusion, Behavior-Based Safety is a natural extension of a compliment to HFE. The technologies are not in conflict at all. It is the case that HFE could benefit from the data generated from a Behavior-Based Safety process and a Behavior Based Safety process could benefit from the gains and learning's of HFE. It has been my experience that in almost every accident the employee did something that was the final pathway to the event. I am not attaching blame. I am saying that the system that that employee functioned in made the "at risk" behavior more attractive than the "safe" behavior. Until the organization recognizes that and aggressively attacks the system, the behaviors and resulting events will continue.

It also seems the use of behavior-based systems suffers from the same hardships as HFE. It requires integration of all systems in the organization, behavior-based methods are not widely understood, it is seen as a cost to be added rather than a way to be world class and successful, a good measurement system is not readily available to measure its true impact. The catastrophe that is prevented is never recognized. The result of these hardships is when implemented the first question seems to be how can we cut corners. In today's environment of cost pressure, doing the same or more with less, and pushing responsibility to the lowest possible level, doing it right the first time seems of more importance than ever before. Spending resources on new and better ways to achieve reliability and error reduction seems to make as much sense as investing in new technology for drilling or exploration. Integrating the two technologies seems to be the next natural evolution.

Attached is a longitudinal study conducted by BST on over 100 sites that implemented BBS over a 15-year period.

11.1 BAPP® System Longevity

Behavior-based technology is highly sustainable. This chart shows the percentage of all BST-led implementations across the globe started in a given year and still functioning today. The majority of these sites have experienced major reorganizations, changes in site leadership, changes in ownership, downsizing, or other disruptive events. Even with these changes their Behavior-based initiatives survive and their organizations continue to reap the benefits.

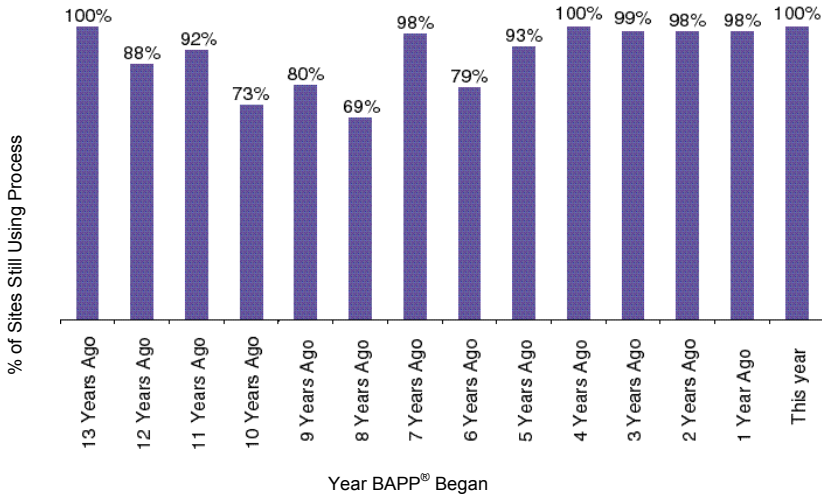


Figure 1. BAPP® System Longevity

11.2 What the Data Show

This chart summarizes at-risk behavior over a two-year period from five sites. A total of 13,264 risks were logged and categorized by the primary factor preventing safe behavior. Arguably, only one category represents enabled behavior: Personal Choice. All other barrier categories contain elements of being non-enabled. Personal choice was the primary barrier in only 17% of the risks, which means the majority of at-risk behaviors are not enabled. *These findings support the conclusion that reinforcement alone won't work in many situations.*

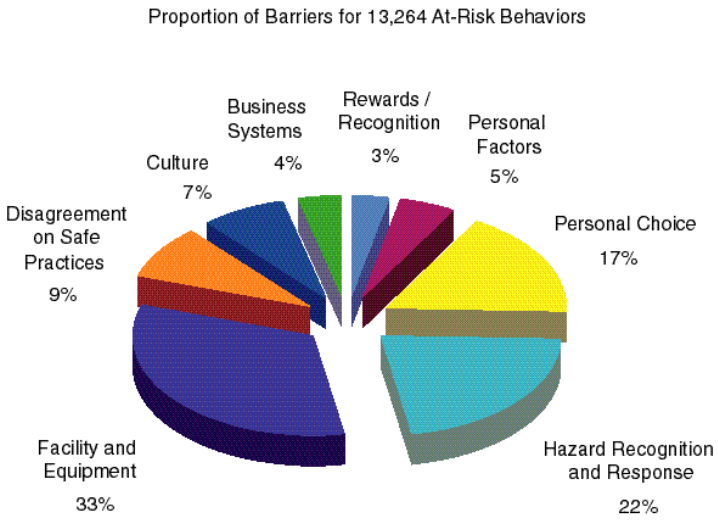


Figure 2. Proportion of Barriers for 13,264 At-Risk behaviors

11.3 The Limitations of Behavioral Observation and Reinforcement

Many simple "behavioral" safety approaches are based on the concept that reinforcement shapes behavior, and therefore reinforcing safe behavior is all one needs to do to improve safety. As the above study shows, this approach is flawed; there are many situations in which no amount of reinforcement, however skillfully delivered, can make a difference. Why? Because the root cause of the problem is not the person, but rather the *interaction* between the person and his/her environment. This is what BST has called the *working interface*.

BST has studied how skillful reinforcement interacts with the working interface. The charts seen here contrast two items observed over a period of three years in which employees received specific, credible, and collaborative reinforcement.

The housekeeping chart shows an enabled item that responded to skillful reinforcement. The percent score for this item consistently increased over the three-year period in which the reinforcement was provided.

The pinchpoints chart at right shows a non-enabled item that responded to reinforcement only after barriers were removed. Initially, observation and feedback did not change this exposure. However, the BAPP observers captured useful information and system barriers to safe behavior were removed. Initially, the item improved by about 25%, but because it was now possible for employees to avoid pinchpoints and still get their jobs done, skillful reinforcement helped improve the item further.

11.4 Perceptions of Success

Organizations use Behavior-based technology for a variety of reasons, not just to reduce workplace injuries or illnesses. Roughly one third of BST clients already have exemplary safety performance when they come to us; these sites implement Behavior-based technology to build on their existing success. Some see the use of Behavior-based technology as a way to improve communications, teamwork, morale, and even operations efficiency. This study asked a representative sample of facilitators from BST consultant-led projects in the United States to answer the question, ***"To what extent do you agree that your process is a success?"***

The respondents had been using Behavior-based technology from anywhere between 1 to 15 years. Responses did not vary by the age of the process. *The overwhelming majority (93%) of facilitators either agreed or strongly agreed their process was a success.* Even those who rated it a moderate success wrote very positive comments, such as, "Our department has gone four years without a [disabling injury] case," and "Behavior-based technology is definitely working." Reasons for disagreement included, "We're in the midst of labor contract negotiations," and "The process really never got started."

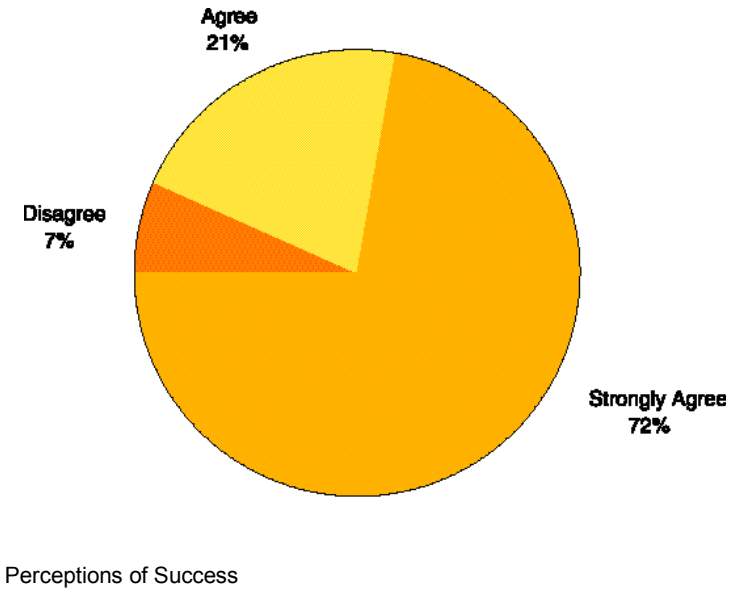
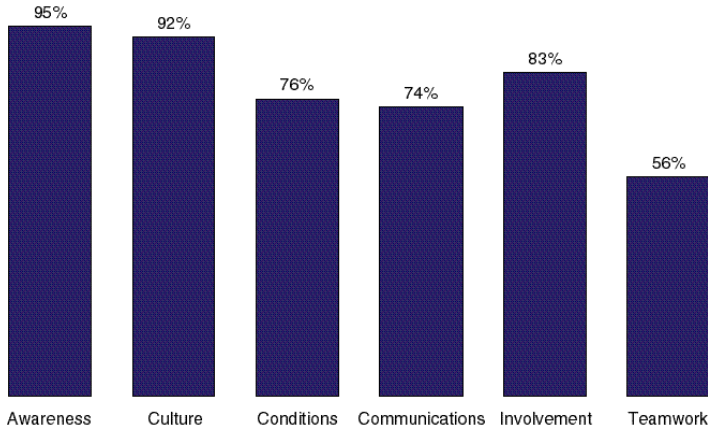


Figure 3. Perceptions of Success

11.5 Positive Organizational Change

When an effective performance improvement process is implemented in a way that builds ownership, skills, and involvement among site personnel, positive cultural change easily follows. Behavior-based technology is exceptionally strong in the areas of employee buy-in, building feedback and coaching skills, and systematic problem solving — all of which support culture change.

This chart is derived from a study that evaluated managers' perceptions of the impact of the Behavior-based technology in a variety of areas. We asked a representative sample of managers how strongly they agreed that their Behavior-based implementation had contributed significantly to improvements in each of the areas charted. Nearly all managers agreed that the technology had significantly helped improve awareness, culture, and employee involvement. A majority of managers also agreed that it significantly helped improve conditions, communications, and teamwork.



Positive Organizational Change

Managers response to how strongly they agreed or disagreed that their BAPP implementation had significantly contributed to improvements in each of the areas charted.

Figure 4. Positive Organizational Change

11.6 How Well Does BAPP Technology Work?

The chart at left shows the results of the largest study ever published demonstrating the effectiveness of any behavior-based approach; however, the results are specific to BAPP technology and do not generalize to all behavior-based safety approaches. Based on a representative sample of 153 BAPP user sites, it shows that the average BAPP user site achieves a 25% improvement over baseline in the first year of its process, increasing to 55% improvement over baseline in the fifth year. The top 25% of users achieve better than 45% improvement over baseline in the first year, increasing to 72% in the fifth. An early edition of this study has been reviewed by independent experts and published in a peer-reviewed journal *(Safety Science,* 1999, Vol 32, pp 1- 18).

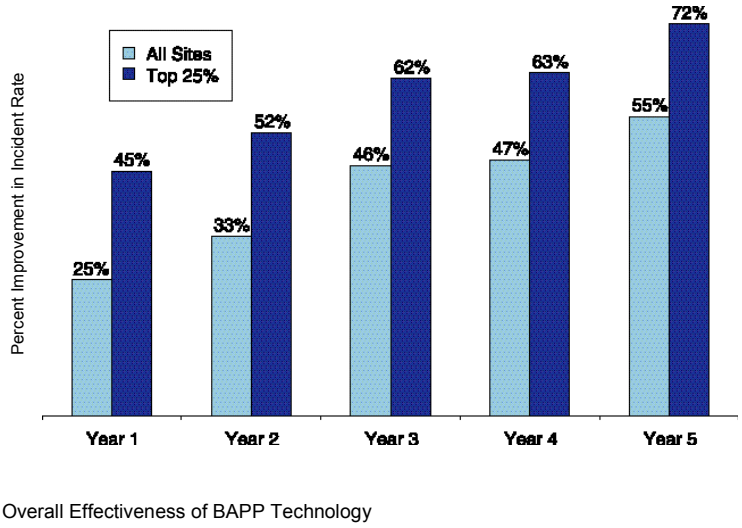
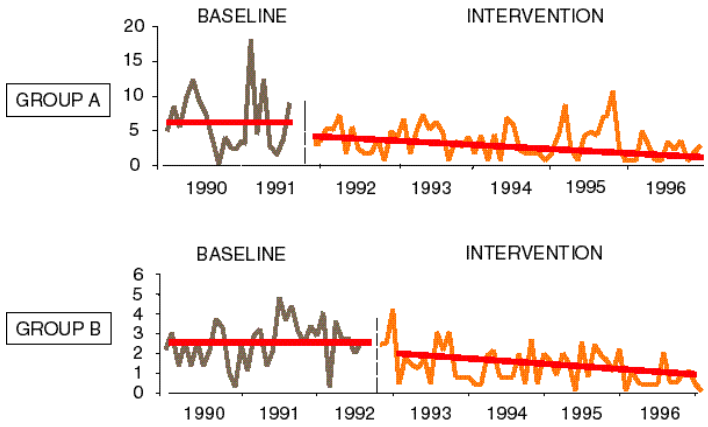


Figure 5. Overall effectiveness of BAPP Technology

11.7 Multiple Baseline Study

Establishing cause and effect relationships in applied research is nearly impossible to do. Demonstrating improvements in safety performance coinciding with hundreds of Behavior-based implementations across various times, companies, industries, etc. goes a long way toward establishing Behavior-based technology as the causal influence, but it is not conclusive. Multiple baseline studies like the one shown here help rule out alternative explanations for the improvement. Combined results from two groups of organizations starting Behavior-based observations at different times show that improvement did not occur until after Behavior-based observations began in either case. This type of research design is widely accepted as providing relatively strong evidence of a cause-and-effect relationship, in this case between Behavior-based technology and the improvement seen.



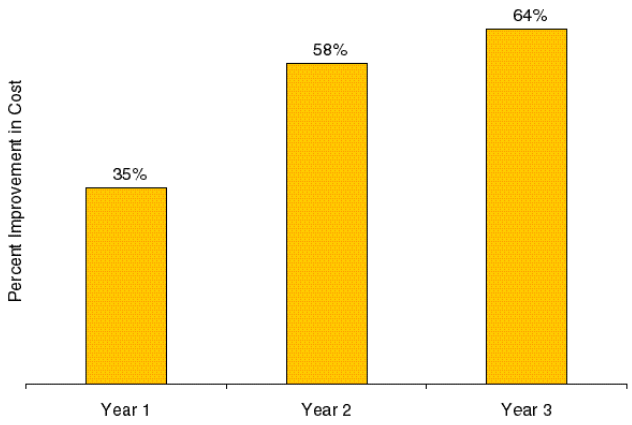
Multiple Baseline Study of BAPP results

Figure 6. Multiple Baseline Study of BAPP Results

11.8 Workers' Compensation Costs Reduction

Evaluating the impact of safety initiatives on workers' compensation costs is a slippery business. Claims history and reporting are so highly variable that they seldom provide a reliable measure of the financial benefits of any initiative. Nevertheless, we would be very concerned if, on average, organizations did not experience a reduction in workers' compensation claims coinciding with their Behavior-based technology implementations.

This chart shows the average percent reduction in workers' compensation costs across 21 sites. Comparing each year of implementation to baseline, these organizations reduced workers' compensation costs by 35% within 1 year of observations, 58% within 2 years, and 64% within 3 years.



Workers' Compensation Cost Reduction (21 Sites)

Figure 7. Workers' Compensation Cost Reduction (21 Sites)

11.9 Union and Non-Union Sites

We are often asked how effective Behavior-based technology is in union environments compared to non-union environments. This study compared the results of 75 union sites to 77 non-union sites in the United States. Contrary to many expectations, union sites see greater improvement in incident rate in their first year, although non-union sites catch up by the second year. Differences after Year 1 are not statistically significant.

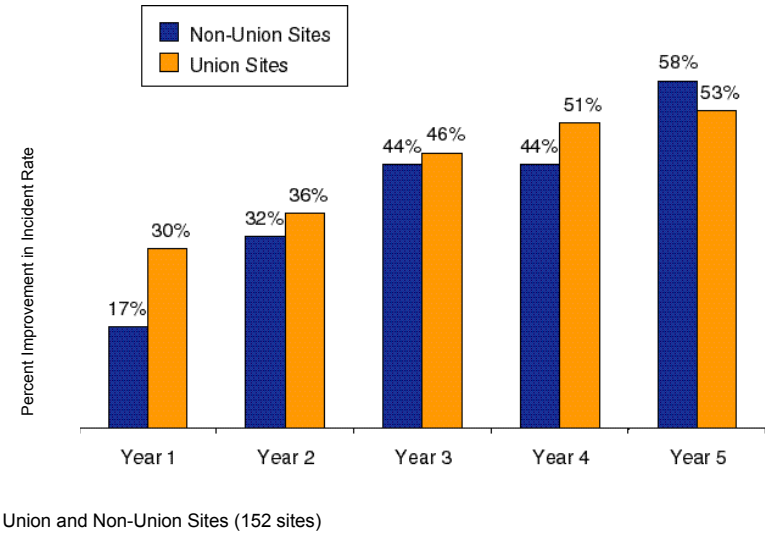


Figure 8. Union and Non-Union Sites (152 Sites)