

IMPLEMENTATION OF A BEHAVIOR BASED SAFETY SYSTEM FOR THE  
OPTICAL SYSTEMS DIVISION AT MINNESOTA MINING AND  
MANUFACTURING COMPANY  
MENOMONIE, WISCONSIN

By

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ABSTRACT

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The Implementation of a Behavior Based Safety System in the Optical System Division  
at 3M Menomonie, Wisconsin.

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The Optical Systems Division (OSD) is located at the 3M Plant in Menomonie, Wisconsin. This division has been in operation since 1995 and has seen significant growth in the division's operations. As OSD has increased in both size and nature, the amount of safety, health, and environmental concerns have also increased. A tremendous amount of work spent developing the division's safety systems ( incident review process, lockout/ tagout program, safety training program, etc.) has helped to reduce the risks associated with these concerns. As time has progressed, it has been seen that the department's recordable incidents have plateaued to a level that is good but not great. OSD has concluded that to continue to further reduce the recordable incidents within the division a behavior based safety system should be implemented.

This study evaluates the implementation of a behavior based safety system within the Optical System Division at the 3M Menomonie plant. The study answers 3 main questions.

1. What is the current readiness of the safety systems within OSD?
2. What are the employee perceptions of organizational safety?
3. How will the effectiveness of the process be measured.

The first and second questions were answered using questionnaires. These questionnaires were developed to survey both management and production workers. Each questionnaire was tailored to determine the level of safety readiness within the division. The third question was answered through the development of a database system that allows the division to track the data that is generated through the behavioral safety system. The research that was conducted into the field of behavior based safety also allowed the division to understand which data should be measured.

Finally, all of the information gathered from the study was analyzed, and the researcher makes recommendation in the conclusion of the paper on the direction that division should take towards the implementation of a behavior based safety system.

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## **CHAPTER 1**

### **RESEARCH PROBLEM AND OBJECTIVES**

#### **Introduction to the Study**

The 3M Menomonie Plant has been in existence since 1974. The site was originally created to operate as a pilot plant; bringing new processes into the site, perfecting the process, and then moving the process to another 3M site to run in a full production capacity. Many divisions have come and gone in the 25 years that the Menomonie Site has been in existence. Within the last 10 years, the focus of the plant has shifted from pilot plant to a more full production oriented site. The Optical Systems Division (OSD) was created in March of 1994, and began producing product on a laboratory line that was very small in size. Many experimental products and processes were developed in the first years of Optical Systems' existence. Since that time, the process has grown in both size and nature. As this growth has transpired within OSD, the amount of safety, health, and environmental related concerns has also increased. Analyzing OSD's loss data shows a significant amount of doctor's cases in the early years of the department's existence. In Optical Systems, over the last 6 years, 15 employees have sustained injuries that required medical treatment outside of work. This medical treatment cost 3M over \$40,000 in medical costs that were directly related to injuries or illnesses sustained at work.

While the number of incidents that are considered to be OSHA recordable incidents have decreased significantly of the last two years, OSD still recognizes the need to further reduce these numbers. OSD also believes strongly that implementing a total BBS system within the division is the best way to increase employee participation, thereby increasing

the overall effectiveness of the department's safety system and then reducing overall incident rates.

The term Behavior Based Safety is defined as the use of applied behavior analysis methods to achieve continuous improvement in safety performance. These methods include identifying and defining critical safety related behaviors, observing to gather data on the frequency of those behaviors, providing feedback on these behaviors, and using this feedback for continuous improvement. The popularity of Behavior Based Safety in the industrial sector has grown dramatically in the last ten years. Thomas Krause noted in his book "The Behavior-Based Safety Process", that as of 1990, Krause's company had implemented fewer than 45 Behavior Based Safety Systems throughout the United States. In contrast, by the mid-1990s, Krause's company had assisted over 400 companies in the implementation of behavior based safety systems (Krause, 1997). This growth in the interest of Behavior Based Safety can be seen throughout industry. An important concept of any BBS system is the involvement of workers in their own safety. This involvement is seen as a key factor in reducing recordable incidents within companies. Some see BBS as the method to further reduce recordable incidents when companies have plateaued at incident rates at around 3.0. There is an argument that suggests that BBS can be used to take a company's safety success to another level. This effort requires the involvement of everyone into the safety process. According to the most recent statistics from the Bureau of Labor Statistics, the average incident rate for the manufacturing industry is around 5.7 (Bureau of Labor Statistics, 1999). 3M's Corporate Safety Division reports 3M's incident rate for total US operations at 3.25 for 1999. Premiums collected to cover claims decreased 19.2% from 1998 to \$17.4 million in 1999 (3M, 1999). The Optical Systems Division located at the 3M Menomonie Plant has seen a reduction of recordable

incidents of around 33% over the last two years. When reviewing Optical Systems loss data over time, it can be seen that the division has improved safety performance since creation of the division, but that the division's safety performance has leveled off. The problem of this study was to further decrease the division's incident rate through the development and implementation a Behavior Based Safety System and also to develop a system to measure the effectiveness of the BBS system within the Optical Systems Division at 3M Menomonie.

### **Purpose of the Study**

The purpose of the study was to create a strategy or process for implementation of a Behavior Based Safety System in the Optical Systems Division.

### **Research Objectives**

Objectives of this study were to:

1. Determine the division's readiness through management and employee surveys.
2. Develop a BBS model for implementation.
3. Set up a data collection system to check the effectiveness of the process.

### **Justification for the Study**

When reviewing Optical Systems loss data over time, it can be seen that the division has improved safety performance since its creation, but that the division's safety performance has leveled off. In the 6 years that the division has been in existence, OSD has reduced incident rates from a rate of over 13, to an incident rate of just of 3 the last 2 years. Optical Systems would like to take a proactive approach to safety. This proactive

approach to safety can help increase the division's safety performance through operator involvement in their own safety. A total safety culture change can be accomplished through the introduction a person based, employee driven behavioral safety process.

### **Limitations of the study**

The limitations of the study are as follows:

1. The Optical Systems Division will be the only division that will be evaluated in the study.
2. All recommendations for the implementation of BBS will be based on information provided from Safety Performance Solutions Inc. (SPS) located in Blacksburg VA. However, SPS does encourage customization of the process to fit an organization's safety culture.
3. All implemented changes will apply to all areas of Optical Systems.

### **Definition of terms**

**Activators** – Events that precede and trigger behaviors. Activators both direct and indirect influence on behaviors.

**Behaviors** – Observable actions.

**Consequences** – States or events which follow behavior. Consequences have a direct influence on behavior.

**Critical Behaviors** – Behaviors which are critical to safety. When performed safely, critical behaviors prevent injury. When performed in an at-risk manner, critical behaviors constitute exposure to injury.

**Incident Rate** – The number of injuries, illnesses, or lost work days related to a common exposure of 100 full time workers.

### **Summary**

Behavior Based Safety can simply be defined as the use of applied behavior analysis methods to achieve continuous improvement in safety performance. These methods include identifying and defining critical safety related behaviors, observing to gather data on the frequency of those behaviors, providing feedback on these behaviors, and using this feedback for continuous improvement. The Optical Systems Division at 3M Menomonie has determined that the implementation of a total behavioral based safety system will allow the division to further expand on the safety performance improvements that the division has seen over the last two years. The OSD also feels that BBS allows the division the opportunity to remain proactive in its approach to safety. The proactive approach begins with the observation and feedback process. An appropriate review of literature is needed to better understand the relationship between employee behaviors (safe and at-risk) and the safety performance that is seen in a particular company or division. The psychology of behavior and safety will be discussed in the following chapter.

## **CHAPTER 2**

### **REVIEW OF LITERATURE**

#### **Psychology**

Psychology is defined in the American Heritage College dictionary as “1. The science that deals with mental processes and behavior, 2. The emotional and behavioral characteristics of an individual, a group, or an activity” (p. 1104). According to the American Psychological Association, psychology is “a source, an art, and a means of promoting human welfare”( London, 1970). In translation, that means that psychology is both a scholarly discipline and an applied one. As a science of mind and behavior, psychology is a vast field of numerous sub-disciplines. The scholarly and scientific disciplines aim to understand human behavior; the applied ones try to solve practical people problems. The common academic divisions of psychology are: experimental, social, and developmental. Experimental psychology takes in both the biological and psychological foundations of behavior. Social psychology studies how people interact with each other, especially the effects of groups and individuals on each other, and how attitudes and opinions are formed and modified. Developmental psychology studies how children change psychologically as they mature physically (Landy, 1985). The main applied branches of psychology are clinical and counseling psychology, school psychology, personnel and guidance and industrial and organizational psychology. Clinical and counseling psychology are concerned with helping people with emotional problems and behavior disorders. Personnel and guidance psychology deals mainly with problems of vocational choice, aptitudes, and interests. School psychology combines all these methods in the settings of schools and educational systems. Industrial psychology

deals with some personnel and guidance problems, but it is also concerned with job efficiency, worker morale and productivity, with relations between people in work settings, and with the ways people behave in large organizations. The history of industrial and organizational psychology is best characterized as the “application of psychological principles and methods to problems in the work context” (Landy, 1985). It represents one of the most direct attempts to put the principles of behavior to use. As is true in most areas within psychology, its roots can be found in experimental psychology, that traditional part of the discipline that seeks general principles or “laws” describing the behavior of its subject matter. In psychology, such laws are attempts to describe how people respond to certain conditions that are systematically manipulated by the experimenter. The goal of experimental psychology has been to describe principles that characterize the behavior of people in general. Such principles are extremely useful for understanding behavior in an industrial setting. They are also useful in predicting how certain conditions of work, or the modification of those conditions, will affect the behavior of the worker. Modern industrial psychology also has important historical roots in differential psychology, the study of individual differences. In the latter part of the 19<sup>th</sup> century, psychologists became interested in the identification, description, and measurement of the ways that people differ in abilities, traits, interests, and the like. The differential psychologist found these individual differences interesting and challenging and sought to account for them through the measurement and interrelation of abilities, interests, aptitudes, and personality traits. Industrial psychology has also been influenced by developments in industrial engineering, including time and motion study and the design and arrangement of work and machines. These three distinct forces have made it possible to identify differences as well as similarities between individuals, to take these

differences and similarities into account in the design of machines, work stations, and work routines, and to evaluate the relative efficiency of various worker-machine-process combinations. Having an understanding of psychology and behavior is crucial in developing an understanding of how workers react within a safety system. Scott Geller notes in his book, *The Psychology of Safety*, that you must consider the human element, or the psychology of safety, and that BBS directly addresses this human aspect of safety by targeting human behaviors and relying on interpersonal observation and feedback for intervention (Geller, 1996). Krause (1997) goes a step further and states that many companies are learning that the observation data can also be used for action planning to make improvements to the safety system. The combination of these two aspects of behavior based safety are very powerful. These improvements come about specifically because of the involvement of the production operators in their own safety. Once a company has this by in and increased level of involvement, the limits for how far a behavioral safety process can go are almost limitless. However, it should also be noted that there is a very systematic process that needs to be followed when assessing behaviors and action planning, one that includes defining the critical behaviors, implementing interventions, and testing the intervention to see if it has the desired affect upon behavior.

### **Behavior Based Safety**

Behavior is defined in the American Heritage College dictionary as “The actions or reactions of persons or things in response to external or internal stimuli”(1993). In 1970, Bird and Schlesinger introduced the concept of "safe behavior reinforcement" to the safety profession. These authors did not invent the concepts, they merely borrowed them from the field of psychology and suggested their potential application to safety. Behavioral concepts had actually been introduced even earlier. These concepts stem

from the works of John Watson, a psychologist who wrote about "behaviorism" as early as 1910; Ivan Pavlov, who experimented with "classical conditioning" in the 1920s; and B.F. Skinner's "operant conditioning" concepts of the early 1940s (Peterson, 2000). Behaviorism as a science, holds that the subject matter of human psychology is the behavior of the human being (Watson, 1925). The *behaviorist* states that we should limit ourselves to things that can be observed, and formulate laws concerning only those things. There are other behaviorists whose principal interests are in the extension of behaviorism to all facets of human activity. This group of behaviorists, usually known as "radical behaviorists" generally identify themselves with the work of B.F. Skinner, and are interested in behaviorism as a social and intellectual movement as well as in its technological development. Radical behaviorism is behaviorism in its broadest sense in that it incorporates all behavioristic methodologies, treatment strategies, etc., but pushes for explanations of behavior in terms of controllable arrangements rather than seeking hypothetical explanations (Vargas, 1977). The behavioral approach to safety focuses on the people side of safety. In Scott Geller's book *Working Safe*, Scott states that a key assumption of a behavior-based approach to safety, is that behavior (desirable and undesirable) is learned, and can be changed by providing people with new learning experiences. (Geller, 1998) Krause also states that there are two reasons to focus on behavior. First, that behavior can be measured and therefore managed, and secondly that a change in behavior can lead to a change in attitude (Krause, 1997). The behavioral approach to safety has become increasingly more popular of the last couple of years, with more and more companies implementing behavior-based safety systems into their companies. Yet many safety professionals don't truly understand the behavioral side of safety. There is much more to behavior-based safety than the creation of critical behavior

checklists and observing operators as they work. To truly understand behavioral safety, one must understand the culture of the organization and what truly motivates behavior.

This process of understanding comes with experience and research.

## **Focus on Culture**

Culture is the integrated pattern of human behavior that includes thought, speech, action, and artifacts and depends on man's capacity for learning and transmitting knowledge to succeeding generations. Values are the bedrock of any corporate culture. As the essence of a company's philosophy for achieving success, values provide a sense of common direction for all employees and guidelines for their day to day behavior. Often companies succeed because their employees can identify, embrace, and act on the values of the organization (Deal, 1982). Organizational culture can aid or hinder organizational effectiveness, and the leadership of the organization is the fundamental method by which organizational cultures are formed and changed. Organizational cultures are created by leaders, and one of the most crucial functions of leadership may well be the creation, the management, and if necessary, the destruction of culture. Culture and leadership are two sides of the same coin, and neither can really be understood by itself. In fact, the only thing of real importance that leaders do is to create and manage culture and that a unique talent of leaders is their ability to work with culture (Schein, 1985). Each behavioral safety system must be tailored to the culture of the organization. Geller (1998) defines culture as the assumptions, shared beliefs, and values by which people live. It can also mean the "rules of the game" for getting along in an organization. Traditional safety cultures typically fail to provide the necessary support for employees to strive beyond minimal efforts, and organizations relying on conventional safety and leadership approaches often fail to inspire the necessary safety-related behaviors and attitudes in their employees. In addition, these organizations have difficulty identifying, then removing barriers to safety excellence. Another way of defining culture is to break it into the formal and informal processes that impact on

behavior. The formal processes are the formal systems, policies, and procedures that the organization uses to influence behavior within the organization. The informal systems, on the other hand, are the social interactions between group members that sanction certain forms of behavior within the organization. These informal processes include social norms and values that define the practices that are supported by the social environment (McSween, 1999). Although most individuals possess these necessary values and intentions, their actual behaviors may not support a Total Safety Culture. Scott Geller (1998) defines in his book *Working Safe*, ten basic changes in belief, attitude, or perceptions that are needed to develop the ultimate Total Safety Culture from a traditional safety approach. These include:

1. Moving from OSHA regulations to corporate responsibility.

Many safety programs are driven by OSHA rather than by the employers or employees who can benefit from a safety process. It makes more sense to talk about safety as a company mission that is owned and operated by the very people it benefits.

2. Move from failure oriented to achievement oriented.

Measuring safety with only records of injuries not only limits evaluation to a reactive stance, it also sets up a negative motivational system that is apt to take a back seat to the positive system used for productivity and quality.

3. From outcome focused to behavior focused.

Companies are frequently ranked according to their OSHA recordables and lost-time injuries. Offering incentives for fewer injuries can often reduce the reported numbers while not improving safety. Pressure to reduce outcomes without changing the process often causes employees to cover up their injuries.

4. From top-down control to bottom-up involvement.

A Total Safety Culture requires continual involvement from the operations personnel such as hourly workers. These are the people who know where safety hazards are located and when the at-risk behaviors occur.

5. From rugged individualism to teamwork.

An employee driven safety process requires teamwork founded on interpersonal trust, synergy, and win/win contingencies.

6. From a piecemeal to a systems approach.

This systems approach requires detail to all areas of an organization including environmental, person, and behavior factors.

7. From fault finding to fact finding.

Blaming an individual or group of individuals for an injury-producing incident is not consistent with a systems approach to safety

8. From reactive to proactive.

Investigating events preceding an incident, be it a near hit or an injury, demonstrates the need to think and act proactively.

9. From quick fix to continuous improvement.

Proactive can be substituted for reactive only with a systems perspective and an optimistic attitude of continuous improvement through increased employee involvement.

10. From priority to value.

Labeling a behavior as a priority implies that its order in a hierarchy of daily activities can be rearranged. Labeling safety as priority rather than a value implies those safety activities can also change based on production or quality pressures.

The observation and feedback portion of behavior-based safety is a good way to influence this safety culture through the recognizing of critical safety behaviors and the one-on-one safety feedback that occurs between workers. Krause refers to this activity as developing a behavior inventory. He states that safety related behaviors need to be identified, operational definitions for these behaviors are then developed, finally, data sheets need to be prepared to be used by the observers (Krause, 1997). These observation checklists can then be either general or job-specific. A generic checklist is used to observe behaviors that may occur during several jobs. A job-specific checklist is designed for one job. Deciding which items to include on a critical behavior checklist is a very important part of the BBS process. A critical behavior is a behavior that: 1 has led to a large number of injuries or near hits in the past, 2 could potentially contribute to a large number of injuries or near hits because many people perform the behavior, 3 has previously led to a serious injury or a fatality, 4 could lead to a serious injury or fatality. The development of critical behavior checklist is a continuous improvement process. Further development and refinement of the checklist benefits both the observer and observee. However, an observation and feedback process is only one component of an effective safety culture. Other management systems must also support a Total Safety Culture. Incident and near hit reporting, incident analysis procedures, performance accountabilities, reward/recognition practices, and disciplinary policies to name a few, significantly impact the overall safety culture of an organization.

### **Focus on Behavior**

For the behavior-based approach to safety performance improvement, the word "behavior" is a technical term, different from the everyday meanings of the word. In this context, the word behavior is focused strictly on those observable, measurable actions

that are critical to performance in a particular organization. This focus on behavior does not mean to imply blaming the worker. Workplace behavior is affected by many factors, most of which are ultimately controlled by management. Fixing the problem, not the blame, is the principle that brings results and develops internal resources. There is no way to understand why a workforce behaves as it does without looking at the entire organizational picture: training, procedures, management systems, company values, equipment design, etc. Peterson (2000) writes that in some cases, BBS is perceived as "the safety program," which allows other crucial elements to wither. For example, results of peer observations may not be measured; consequently, site management simply does not know whether behaviors have improved. Or, the results are measured by the number of "cards" generated, with no valid measure of the reduction of unwanted behaviors. The typical outcome is more paperwork and fewer results; this leads to an even wider chasm between management and the workforce. Such changes are dangerous. Safety can only be achieved when both management and employees work together. A confidence and trust must exist between them so that everyone perceives safety to be a value, not a priority subject to shifts depending on other circumstances. Again it should be stated that a BBS system is more than just collecting checklists. Behavioral safety also requires the attention to three areas of an organization's culture. The environmental factors; meaning equipment, tools, machines, management systems; person factors, including operators knowledge, skills, abilities, and attitudes; behavior factors, including things such as wearing personal protective equipment, following procedures, lifting properly, and coaching peers. A behavioral safety system focuses on behaviors to reduce injuries, but it still needs to be remembered that the environmental and person factors also are very

important and affect an organization's safety performance. The reaction of these factors within a safety system can be shown through the following model:



For instance, we can not expect employees to modify their potential at-risk behaviors if companies do not provide employees the means to conduct their work in a safe manner to begin with. Examples of this would include lockout/ tagout procedures or proper training programs. Aubrey Daniel's book, *Bringing out the Best in People*, states that behavior is a function of its consequences. Technically defined, behavioral consequences are those things and events that follow behavior and change the probability that the behavior will be repeated in the future (Daniels, 2000). True behavior change means knowing the importance of the ABC model. This model describes behavior as a function of both activators and consequences. Research conducted by B. F. Skinner shows that behaviors are guided or directed by activators such as rules and regulations, and motivated by consequences such as injury, discipline, or peer approval. Safety can be a continuous fight with our own human nature. We often feel that at-risk behaviors are more comfortable, convenient, and/or more time efficient than safe behaviors. Perhaps employees also feel that at-risk behaviors rarely result in the sort of *consequences* (e.g., injury, discipline) that are sufficient to discourage their occurrence. Therefore, safety leaders must view the situation through the performer's eyes. Some consequences may seem positive to an observer, yet are viewed as negative by the performer. Krause (1997) states in his book *The Behavior Based Safety Process* that many well-intended safety programs fail because they rely too much on antecedents—things that come before behavior—such as safety rules,

procedures, meetings, and so on. All too often these same antecedents have no powerful consequences to back them up. The ABC model states that both activators and consequences influence behavior, but they do so differently and that consequences influence behavior directly. Activators (or antecedents as Krause also defines them) influence behaviors indirectly, primarily serving to predict consequences. Aubrey Daniels states that understanding and managing consequences is the most effective way to improve performance. Understanding why people behave the way they do and then arranging consequences to influence that behavior is only the beginning. The major factor in determining whether you can change behavior in the long term is dependent on the extent to which you can consistently pair antecedents with consequences. We call this dependable pairing of antecedents with consequences trust (Daniels, 2000). Building this trust into the BSS system can be challenging. Operators are not used to have fellow employees watch them as they work, recording behaviors as they complete their tasks. This must be realized and addressed early in the process. Once this trust in the system is established, the operators will be more willing to discuss behaviors, activators, and consequences. That is why it is so important to focus on the ABC model to determine why behaviors occur.

### **Different Approaches**

The behavioral approach to safety focuses on operator involvement in safety through the observation and feedback process. This is true of all of the different behavioral systems that are currently being used in industry. The only real differences in these systems is in the way that they implement the various systems. The two prevalent systems in behavioral safety currently are Behavior Safety Technology Inc.(BST),

founded by Thomas Krause; and Safety Performance Solutions Inc. (SPS), founded at Virginia Tech by E. Scott Geller.

BST and SPS are very similar in the basic theory of behavior based safety. Each believes in identifying critical behaviors, developing critical behavior checklists and definitions, providing one-to-one peer feedback using this checklist, and developing actions plans to break down the barriers that natural exists between workers while giving peer feedback. This method of observing workers while they work to identify potential at-risk behaviors is directly linked to the work of the early behaviorists. As stated earlier, it is known through behavioral research that behavior can be observed, managed, and changed. The basis behind behavioral safety is to use these observations to provide feedback to fellow employees so they can potentially modify at-risk behaviors. These observation/peer feedback processes are also very similar with each company identifying behaviors and developing critical behavior checklists to focus safety efforts to both eliminate these at-risk behaviors and to also increase positive behaviors. BST however tends to focus a companies efforts on all of the critical behaviors that have affected a companies safety efforts over the last several years. This list of critical behaviors can get quite lengthy and complex. SPS prefers to have its clients focus on a smaller list of critical behaviors, the behaviors that have been the focus of most of the organization's injuries and illnesses over the last several years. Once the company has gotten a good handle on controlling these behaviors, it is then that the organization is encouraged to expand their critical behavior checklist. The approach that SPS uses tends to be more flexible for companies during the implementation phase. SPS and BST both encourage as much employee participation as possible, making sure that the BBS process is a bottom-driven, top supported safety system. However, BST is much more adamant on companies adopting

their system wholly, with not a lot of room for individual company creativity. This approach does allow BST to provide a training package that is better able to handle resistance to training and the BBS process in general. BST is also able to provide a more detailed, comprehensive software package for displaying observation and feedback data as well as more extensive data tracking capabilities. They are also able to provide services such as ergonomic training, incident review training, and vast many other resources that SPS does not have the people or resources to provide. All of these resources do however come at a price. Typically, BST implementations run two to three times as much as an SPS implementation. Cost can be a significant selling point for many companies. Most companies are beginning to realize that safety and health programs can significantly affect a company's bottom line. Companies that consistently send worker after worker to the emergency room will eventually figure out that they could more wisely spend their money implementing a person-based approach to safety. This paper focuses on the need to improve upon a safety system that is already made significant safety process improvements. OSD felt that SPS's ability to be flexible in its implementation of a behavioral system was key to being able to truly understand the culture of the OSD organization, thereby increasing the departments opportunity for success.

### **Benefits**

The most important benefit of behavioral safety systems the ability of organizations to include the most important people the are in the safety process; the worker's themselves. They are by far the people that are the most aware of the at-risk behaviors that are occurring in the workplace on a day-to-day basis. They are also the ones who, with proper training, can provide the feedback to their peers that can help

eliminate these at-risk behaviors. It is also important to remember that these workers also need to encourage the *safe* behaviors that also occur everyday in the workplace. This positive peer feedback is essential for sustaining significant, long-term safety success. A term that SPS uses to describe this peer feedback is “Actively Caring”. This term describes how the feedback process functions. It is not just enough to care about your fellow workers; a worker must take an active role in the safety of others. Typically, workers have not had this ability. The task of providing feedback and talking about safety to fellow co-workers is not typically taught in industry. There is a major hurdle that needs to be crossed when the safety professional talks about increasing a worker’s own responsibilities towards safety. Workers tend to think that safety is someone else’s job, that management is responsible for providing a safe and healthy work environment. Whereas it is very important for companies to provide this environment to employees through the development of lockout/tagout procedures, equipment guarding, or providing personal protective equipment to operators, the only true way to improve beyond these traditional approaches to safety is to ask workers to get involved in their safety as well as the safety of their fellow co-workers. Behavioral safety provides the means to accomplish this task. Scott Geller (1996) describes building a Total Safety Culture (TSC). This TSC requires a long-term continuous improvement process. It involves cultivating constructive change in both the behavior and attitudes of everyone in the culture. In a Total Safety Culture everyone feels responsible for safety and pursues it on a daily basis. At work, employees go beyond “the call of duty” to identify environmental hazards and at-risk behaviors. Then they intervene to correct them. Safe work practices also need to be supported with proper recognition procedures. In a TSC, safety is not a

priority that gets shifted according to situational demands. Rather, safety is a value linked to all situational priorities.

### **Drawbacks**

As discussed earlier, behavior based safety relies on employee involvement to improve an organization's safety performance. This can create pitfalls for companies. An organization can not simply turn the safety system over to the operators and expect the process to be employee driven. BBS is just one component of a total safety culture or system. If behavior based safety has any drawbacks, it is that for some companies it is seen as a fix-all for any and all safety problems. That is simply not the case. Companies that implement BBS systems by simply asking operators to do observations are doomed to fail. The total BBS system also needs a formal system for following-up on identified behaviors or equipment problems. A BBS system can not adequately function without also having a formal safety system to handle such things as incident reviews, a discipline process, and all of the numerous environment (equipment, guarding) controls. It is also easy within a BBS system to get hung up on at-risk behaviors while ignoring the safe behaviors that occur everyday as well. This is natural part of human nature. Safety shouldn't be about finding out all of the bad things that happen on a daily basis. This however can be the focus of many employees and companies. It is very important to always continue to stress that the real value of a BBS system is the peer-to-peer interaction that occurs between employees. The fact that BBS gives employees the opportunity to talk about safety in ways that are both new and positive is the real benefit of the BBS process. Companies that do not recognize this opportunity will have short-lived success with their BBS process. BBS systems can not also think that there is only one safe way of performing a task, and then force all employees to adopt one method.

The culture of a workplace varies too greatly to think this is possible. Instead, a BBS process must continue to stress the diversity of the workplace. The BBS process must also take into account the way in which employees are interviewed, trained and treated on the job, as well as the design of work methods, materials, machinery and equipment. Organizations also can not forget that the observation and feedback process is a new and unfamiliar task to most employees. This unfamiliarity can create high levels of stress for some employees. That is why it is very important to stress that the nature of the observation is to attempt to improve the work place, not catch people doing things wrong. Any system which allows managers and supervisors to use the observation data to discipline or reward workers will fail. A BBS system needs total trust by all workers. Some organizations can not provide this level of trust in a system that encourages workers to observe each other doing potentially at-risk behaviors. There is extensive training that needs to be conducted to prepare the workforce for the entire observation process. The BBS process has its good and bad points. Companies need to realize that a BBS system is simply a tool in the entire safety toolbox. It can not be stressed enough that every other portion of the safety process must still receive the proper time and resources to ensure their success. If this is not done, the BBS process will fail over time.

### **Conclusion**

The overall impressions of BBS systems have been very positive in nature. If a company takes the time to really understand the culture of their organization and the people that operate within that organization, the implementation of a behavioral safety system will be seen as effective at all levels of the organization. As stated earlier, it is very important to involve the workers in the development of this new safety system. The creation of a dedicated implementation team will go a long way to ensure the success of

the new BBS system. There is significant training and work that the safety professional and implementation team will become involved with in the early stages of a BBS implementation.

## **CHAPTER 3**

### **METHODOLOGY**

#### **Introduction**

In accordance with the purpose of this study, *to create a strategy or process for implementation of behavior based safety system in the Optical Systems Department*, Chapter 3 describes the research methodology. The framework is organized into 4 specific categories: Review of literature, Safety culture questionnaire, Safety systems questionnaire, and data collection system that will be used to measure the effectiveness of the process. The following is a breakdown of these areas in outline form:

#### **Review of Literature**

Chapter 2 documents the study's Review of Literature in detail. The information gathered was organized into 7 sub-sections. These sections were titled: Psychology, Behavior Based Safety, Focus on Culture, Focus on Behavior, Different Approaches, Benefits, and Drawbacks. Each sub-section was derived from information gathered from multiple areas of literature research. Areas reviewed included periodicals, journals, textbooks, and 3M data related to company incident rates. Particular attention was paid to the information gathered concerning the implementation of behavioral safety systems. It should be noted that there are many authors in industry today that are advocating their own behavioral systems. This study focused mainly on the works of Scott Geller and Thomas Krause, the two industry leaders in the development of behavioral safety systems.

#### **Safety Culture Questionnaire**

A questionnaire was developed with the help of SPS Inc. to determine the perception of organizational safety within the department. This questionnaire is located in Appendix A. The 20 questions in this survey were designed to assess the perceptions

of organizational safety within OSD. The questions will also be used to determine areas within the department that may need special attention during implementation, and to help develop the model for implementation. This questionnaire was given to 56 employees of OSD during monthly employee meetings by the OSD Safety Coordinator. A short discussion about the questionnaire and its content was also given to the employees. This was done so that there was no confusion about the meaning of the survey.

### **Safety Systems Questionnaire**

The questionnaire distributed to the management team was designed with the help of SPS Inc. to determine the effectiveness of the safety systems used in the division. This questionnaire is located in Appendix B. The objective of the questionnaire was to determine if the safety systems currently in use in the department were able to support the implementation of a behavioral safety system. The safety systems that will be surveyed will include such things as incident reporting and follow-up, safety training systems, documentation, personal protective equipment evaluation, lockout/tagout program, and the like. These systems must be adequately developed before any behavioral system is introduced. To collect this information about OSD's safety systems, a brief questionnaire was developed and given to all 5 members of OSD's management team. The questionnaire was also designed to measure management's knowledge of the safety systems within OSD.

### **Model for Implementation**

Based on the information gathered in the questionnaires, as well as the research that was conducted into the field of BBS, a model was developed with the help of SPS Inc. for OSD to use during implementation. Phase one of the model focused on Site Leader and supervisor training. This training involved a one-day workshop that was

conducted by SPS Inc., and gave senior leaders a better understanding of the current culture within OSD and the role they would be playing in supporting the observation and feedback process.

Phase two included the behavioral observation and feedback process design and implementation. This process was developed in three steps.

1. Implementation team training.

This is a three-day workshop that gives team members in-depth training in the principles and tools involved in the behavior-based safety process. All the documentation that will be needed to support the observation and feedback process is developed during this three-day workshop. This documentation is included in Appendix E.

2. Employee Training

This one-day workshop is designed to give all employees an understanding of the principles of the behavior-based safety process and allows employees to gain hands-on experience with the behavioral checklists and peer feedback process.

3. Process Roll-out

Implementation team members are now ready to begin the observation and feedback process. All members of the division are encouraged to participate in the process, however, no one will be forced to participate. Implementation team members are encouraged to assist production personnel in the early stages of the observation and feedback process. Various aspects of the system will be evaluated including participation rates, observation data, problem solving activities and improvement results.

### **Data Collection System**

The data collection system was designed to collect observation data from the behavioral safety system after implementation. It was determined that OSD needed a capable method of measuring safety performance other than traditional measurements such as incident rate. A Microsoft Access program was chosen to collect and interpret the data. A graphing program was also linked to the software so that progress in the system can be displayed to the division on a daily basis. This program needed to be flexible enough to collect and analyze data on a daily, weekly, monthly, or yearly schedule. The implementation team is solely responsible for the up-keep of this system. Over time, this data collection system will be used to make adjustments to the behavioral safety system. It also will allow management to keep apprised of the daily or weekly activities related to the BBS system.

### **Summary**

Chapter 3 provided information on the methods and procedures utilized to achieve the objectives and goals of the study. The importance of methodology documentation is to ensure the repeatability of the study and to aid in the validation of the research findings. Chapter 3 forms the foundation for Chapter 4.

## **CHAPTER 4**

### **RESULTS AND DISCUSSION**

#### **Introduction**

The purpose of the study was to create a strategy or process for implementation of a Behavior Based Safety System in the Optical Systems Division. The study was initiated to determine if 1) the culture of OSD was capable of supporting a behavioral safety system, and 2) if this was the case, develop a model for implementation as well as a method for tracking the success of the system over time.

The study's objectives are broken down into two major areas. These areas are focused around the results of the questionnaires given to both management and production, as well as in the development of the behavioral model that the division would follow during implementation. These objectives are discussed in detail in the following paragraphs

#### **Objective 1**

The study began with the administration of the safety culture questionnaire. As stated above, this questionnaire was developed with SPS Inc. and was designed to measure individual perceptions about the organizational safety within OSD. 56 individuals completed the questionnaire, with most answers being positive in nature. The tabulated results of the safety culture questionnaire are located in Appendix C. When the questionnaire was evaluated, the OSD Safety Coordinator was looking to determine if the attitudes and beliefs that exist within OSD would support peer observations. The questions that related to peer observations were answered very favorably, with 97 percent of OSD employees supporting the idea of observing peers while they work. The fact that not all members of the division were in support of the process is not a surprise. There

will be natural resistance to any new process that is introduced into an existing culture. OSD fully expects that these “natural resistors” will eventually see the benefits of the behavioral process. Other questions within the survey were designed to measure the perceptions that employees had about their manager and supervisor’s approach to safety. These questions were also answered positively, with 92 percent of employees believing that their first line supervisors and managers are genuinely concerned about their safety and actively pursuing measures to improve safety within the organization on a daily basis. Again, any questions that did not show 100 percent positive answers were attributed to natural resistance to any new process. Scott Geller states in *Working Safe* that resistance to change is natural, and the best way to deal with resistance is to arrange for situations that that enable of facilitate peer influence (Geller 1998).

The questionnaire that was designed to evaluate the safety systems within OSD was administered to five members of the management team. The questions within this survey were also developed with the help of SPS Inc. The tabulated safety systems questionnaire results are located in Appendix D. The areas within OSD that were evaluated favorably include the Incident Review process, Lockout/Tagout program, and safety meetings. Some areas within the division that were evaluated and determined to need some improvements include safety training system and monthly safety audit program. All areas of the questionnaire were discussed with the management team to determine the division’s safety system’s readiness for BBS. Any areas that were determined to need improvement were then assigned to the appropriate personnel. All systems were viewed to be adequate prior to implementation.

## **Objective 2**

The second objective of the study was to develop a model for implementation of the behavioral safety system. This was completed with the help of SPS Inc., and consisted of phases that were developed to aid in implementation. The model was well developed and addressed all aspects of implementation, from training to document creation to process roll-out. This model is located in Appendix F. The training the all members of OSD received was viewed very positively. It provided member's of the division with the basic training needed to complete peer observations. This training also provided OSD employees with the theory behind behavioral safety. The training that the Implementation Team received also was viewed very positively. This three day training class was very "hand's on", allowing the team to create all of the documents that would be needed to guide their BBS efforts. Examples of the documentation created by the implementation team are located Appendix E.

### **Objective 3**

The software used for tracking the effectiveness of the system was developed with the help of SPS Inc. using Microsoft Access. This was used so that the division could "model" the observation checklist in the software. This database was designed so that the implementation team could track such things as percent safe and percent at-risk related to each section of the checklist. Each area of the checklist can also be tracked over time to determine if the areas in question are in need of improvement or could be used as a model for improvement in the future. A very important part of the database also allows the team to track the comments that accompany the checklists. This is perhaps the most important piece of the software. Implementation team members need to analyze these comments for areas that may need improvement.

### **Summary**

Data collected in the study when analyzed was determined to support the implementation of behavioral safety system within OSD. Results from the questionnaire given to all members of the division tended to support the belief that OSD had a culture that would support operators observing and giving each feedback related to safety. The results from the second questionnaire also, when reviewed with the management team, satisfied the division's belief that the current safety systems within OSD are capable of supporting a behavioral safety system. The model developed for implementation also contained all of the necessary elements to ensure a smooth implementation. The conclusion section of Chapter 5 will discuss in greater detail the study findings.

## **CHAPTER 5**

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **Introduction**

Chapter 5 contains the final conclusions and recommendations drawn from information gathered in the first four chapters. Based on the findings, a number of conclusions are made, with specific recommendations suggested for each conclusion.

#### **Summary**

#### **Restatement of the Problem**

The purpose of the study was to create a strategy or process for implementation of a Behavior Based Safety System in the Optical System Division. The objectives of the study included determining the division's readiness for a behavioral safety system through two questionnaires designed with the help of SPS Inc. to measure the current safety culture within OSD. The study also included objectives to develop a model of implementation as well as the development of a data tracking software to measure the effectiveness of the system over time.

#### **Methods and Procedures**

The methods and procedures involved in the study included a review of literature, development of two safety questionnaires design to measure safety culture, development of a model for implementation, and the design of a data tracking program to aid in measuring the effectiveness of the system over time.

The review of literature was conducted using periodicals, journals, textbooks, and 3M company data. This information was gathered to give the researcher background in the theory of behavior based safety. Information was also gathered concerning implementation guidelines and potential difficulties when developing new safety systems.

Safety Performance Solutions Inc. aided in the development of two safety questionnaires design to determine the level of safety awareness and culture of the Optical Systems Division. The safety culture questionnaire was administered to all members of OSD and consisted of questions aimed at determining how members of OSD would feel about conducting peer observations. It also was used to determine how people feel about the safety systems that they work around everyday.

The safety systems questionnaire was administered to the members of the OSD management team. This questionnaire focused on determining if the safety systems that OSD employs support a behavior based safety system. Areas of focus included incident reviews, safety training program, personal protective equipment evaluations, lockout/tagout program, and the like. The model for implementation was designed with the help of SPS Inc. and was developed in two phases. The first phase of implementation focused on site leader and supervisor training and was designed to give senior leaders within OSD a better understanding of BBS and the role they would have in supporting the process. Phase two of implementation included the design of the observation and feedback process. This process was designed in three steps that included implementation team training, employee training, and process roll out. Finally, a data collection system was designed to measure the effectiveness of the process over time. This system was developed with the help of SPS Inc. and allows the implementation team to input observation data that will be used to improve any potential at-risk areas within the division.

## **Major Findings**

The study found that the division's safety systems and current safety culture support a behavioral safety system. The questionnaire's that were designed for the study, when evaluated, showed that the perceptions regarding safety within OSD are conducive to peer-to-peer observations. The current safety systems within OSD also will work very well within the behavioral safety system. While not all systems were seen to be perfect, the tools for improvement are located within OSD, and support the activities that make the behavioral safety system function at a higher level.

With the help of SPS Inc., the model for implementation that was developed was viewed to be very good. SPS stresses the involvement of production workers in the design of the new system. All documentation related to new system was created by the implementation team, thereby increasing operator buy-in to the process. The training that was given to production workers and the management team was also seen as very effective. Production workers received the theory behind behavioral safety, and management received information on how to fully support the process without interfering in the development stages.

## **Conclusions**

Several conclusions can be reached based on the findings of the study. Since the researcher found that the current safety culture is very conducive to peer observations, it can be concluded that OSD's culture will support the implementation of a behavior based safety system.

The researcher also found that the safety systems located within OSD are complete and designed to include operators in the daily operations and improvements in these systems. This leads to the conclusion that these systems also will support the implementation of a

behavior based safety system. As stated above, without the proper development of the systems that operators interact with on a daily basis, a safety system based on observing peers at work will most certainly struggle.

The researcher also found that the data tracking software is a useful tool for measuring the systems effectiveness over time. This leads to the conclusion that the implementation team should begin using the software and entering data as soon as observations begin.

This software package should be used to show progress in the system to all employees of OSD.

### **Recommendations**

Based on the conclusions of the study, the following recommendations are brought forth.

#### **Recommendations related to This Study**

1. The Optical Systems Division located in Menomonie WI., should proceed with the implementation of a behavior based safety system. After analyzing the safety systems and the perceptions of organizational safety located within the division, it can be seen that the division is ready to proceed with peer observations. Many companies look for ways to improve safety without taking into account the most important aspect of safety, that being the people that work amongst these systems day after day. Behavioral safety is an excellent way to include the operators in their own safety. OSD is currently a good match for BBS. It has the willingness of operators to become involved in safety, as well as the management systems needed to support such efforts.

2. OSD should also use the services of Safety Performance Solutions Inc., to help tailor their behavioral system. SPS Inc. uses an approach that encourages tailoring of their system to match an organization's culture. This tailoring of the system allows for flexibility and encourages operators to get involved in their own safety.
3. OSD should also make sure that they develop expectations for the division that ensure success in the future. Behavior Based Safety will provide OSD with excellent opportunities to improve their safety performance, but these improvements will be easier to achieve if the division develops clear expectations for everyone in the division.
4. The Implementation team should begin using the data tracking software as soon as observation checklists are collected. This software will be used to relay successes and opportunities for improvement to the division. Operators will be able to see that the observations that they conduct are being evaluated on a weekly basis, and that improvements in the system are being driven by the workers on the production floor.
5. The management team of OSD should also be aware of potential pit falls in the early stages of implementation. Many operators will have concerns that completed observations will be used by management punish workers or be used against them during yearly appraisals. Management must be keenly aware of this fact.
6. During the early stages of implementation, the researcher recommends that only production workers conduct observations. When trust in the system begins to

- develop, and workers see that observation will not be used to punish them, the management team should then begin to conduct observations.
7. The OSD management team should be given regular updates on the system by the implementation team. It is not recommended that management be able to view observation checklists, however, management does need to know how the system is functioning and if there are proper resources to support the system.
  8. That OSD should nominate two co-facilitators to handle much of the early implementation duties. This would include such things as gathering completed checklists, entering them into the database, presenting information at crew meetings, and also keeping management apprised of needs of the system.
  9. That OSD should after six months and one year evaluate the system. Things that should be looked at include percent participation, percent safe in areas of concern, does the implementation team have the time and resources to do their jobs in an adequate manner, and an overall evaluation of the entire system. OSD should also be aware that as the division grows in size and complexity, the division will need to reevaluate the resources and time that will be designated to the implementation team.

## REFERENCES

American Heritage College Dictionary (1993). Third College Edition. New York, New York: Houghton Mifflin Company.

Bureau of Labor Statistics (1999). <http://stats.bls.gov/oshum98.htm#Summary> Tables

Daniels, A.B. (2000). Bringing Out the Best in People. New York, New York: McGraw-Hill, Inc.

Deal, T.E., Kennedy, A.A. (1982). Corporate Culture. New York, New York: Addison-Wesley Publishing Company

Geller, E.S. (1998). Working Safe, How to help people actively care for health and safety. New York, New York: CRC Press LLC.

Geller, E.S. (1996). The Psychology of Safety, New York, New York: CRC Press LLC.

Krause, T.R. (1997). The Behavior-Based Safety Process, New York, New York: Van Nostrand Reinhold.

Landy, F.J. (1985). Psychology of Work Behavior, Homewood, IL.: The Dorsey Press.

London, P. T. (1970). Beginning Psychology. Homewood, IL. The Dorsey Press.

McSween, T. E. (1999). "Behavior vs. Values: Achieving Lasting Improvement in Safety." Professional Safety, May 1999, Vol. 44 Issue 5, p 21-26.

3M (1999). Annual Report. <http://trixie.mmm.com/EHSSsafety/anreport/us98/Summry98.htm>

Petersen, D (2000). "The behavioral approach to safety management." Professional Safety, Mar 2000, Vol. 45 Issue 3, p37-39.

Schein, E.H. (1985). Organizational Culture and Leadership. San Francisco, CA: Jossey-Bass Publishers.

Vargas, E. A., Frapfl, J.E. (1977). Behaviorism and Ethics. Kalamazoo, MI: Behaviordelia, Inc.

Watson J.B. (1925). Behaviorism. New York, New York: W.W. Norton and Company, Inc.

**APPENDIX A**

**OSD SAFETY CULTURE QUESTIONNAIRE**

<p align="center">Optical Systems Division Safety Culture Questionnaire</p>	<u>HIGHLY AGREE</u>				
	<u>AGREE</u>				
	<u>NOT SURE</u>				
	<u>DISAGREE</u>				
	<u>HIGHLY DISAGREE</u>				
1. The risk level of my job concerns me quite a bit.	1	2	3	4	5
2. When told about safety hazards, supervisors are appreciative and try to correct them quickly.	1	2	3	4	5
3. My immediate supervisor is well informed about relevant safety issues.	1	2	3	4	5
4. It is the responsibility of each employee to seek out opportunities to prevent injury.	1	2	3	4	5
5. At my plant, work productivity and quality usually have a higher priority than work safety.	1	2	3	4	5
6. The manager in my division really cares about safety and tries to reduce risk levels as much as possible.	1	2	3	4	5
7. When I see a potential safety hazard (e.g., resin spill), I am willing to correct it myself if possible	1	2	3	4	5
8. Management places most of the blame for an accident on the injured employee.	1	2	3	4	5
9. "Near misses" are consistently reported and reviewed at our plant.	1	2	3	4	5
10. I am willing to warn my coworkers about working unsafely.	1	2	3	4	5
11. Employees seen behaving unsafely in my department are usually given corrective feedback by their coworkers.	1	2	3	4	5
12. Compared to other divisions, I think mine is rather risky.	1	2	3	4	5
13. Working safely is the Number One priority in my division.	1	2	3	4	5
14. I have received adequate job safety training.	1	2	3	4	5
15. Many first-aid cases in my division go unreported.	1	2	3	4	5
16. Information needed to work safely is made available to all employees.	1	2	3	4	5
17. Management here seems genuinely interested in reducing injury rate.	1	2	3	4	5
18. Safety audits are conducted regularly in my department to check the use of personal protective equipment.	1	2	3	4	5
19. I know how to do my job safely.	1	2	3	4	5
20. Most employees in my work group would not feel comfortable if their work practices were observed and recorded by a coworker.	1	2	3	4	5

**APPENDIX B**

**SAFETY SYSTEMS QUESTIONNAIRE**

<p>Optical Systems Division Safety Systems Questionnaire</p>	<u>HIGHLY AGREE</u>				
	<u>AGREE</u>				
	<u>NOT SURE</u>				
	<u>DISAGREE</u>				
	<u>HIGHLY DISAGREE</u>				
	1	2	3	4	5
1. The division's current incident review process is effective in determining root cause without placing blame.	1	2	3	4	5
2. The division's safety training program addresses all aspects of OSD's daily work activities.	1	2	3	4	5
3. The division's safety related documentation is complete and well communicated to all employees.	1	2	3	4	5
4. I would rate OSD's overall safety management systems as effective.	1	2	3	4	5
5. OSD's current lockout/tagout program is complete for all equipment. Operator training is also up-to-date.	1	2	3	4	5
6. OSD currently does a good job of evaluating the personal protective equipment needed for tasks located within the division	1	2	3	4	5
7. OSD's monthly safety tours are effective and help identify areas of concern within the division.	1	2	3	4	5

**APPENDIX C**

**SAFETY CULTURE QUESTIONNAIRE RESULTS**

Optical Systems Division Safety Culture Questionnaire	<u>HIGHLY AGREE</u>				
	<u>AGREE</u>				
	NOT SURE				
	<u>DISAGREE</u>				
	<u>HIGHLY DISAGREE</u>				
1. The risk level of my job concerns me quite a bit.	3	47	3	2	1
2. When told about safety hazards, supervisors are appreciative and try to correct them quickly.	1	2	0	44	8
3. My immediate supervisor is well informed about relevant safety issues.	1	2	0	43	9
4. It is the responsibility of each employee to seek out opportunities to prevent injury.	1	6	6	41	2
21. At my plant, work productivity and quality usually have a higher priority than work safety.	5	46	3	1	1
22. The manager in my division really cares about safety and tries to reduce risk levels as much as possible.	1	0	1	50	4
23. When I see a potential safety hazard (e.g., resin spill), I am willing to correct it myself if possible	0	1	3	12	40
24. Management places most of the blame for an accident on the injured employee.	3	48	2	1	2
25. "Near misses" are consistently reported and reviewed at our plant.	6	33	18	6	3
26. I am willing to warn my coworkers about working unsafely.	0	0	7	31	18
27. Employees seen behaving unsafely in my department are usually given corrective feedback by their coworkers.	3	6	7	39	1
28. Compared to other divisions, I think mine is rather risky.	11	38	4	2	1
29. Working safely is the Number One priority in my division.	1	5	0	49	1
30. I have received adequate job safety training.	1	6	8	39	2
31. Many first-aid cases in my division go unreported.	3	17	10	24	1
32. Information needed to work safely is made available to all employees.	1	2	1	38	14
33. Management here seems genuinely interested in reducing injury rate.	1	2	21	28	4
34. Safety audits are conducted regularly in my department to check the use of personal protective equipment.	2	7	21	14	2
35. I know how to do my job safely.	1	0	0	41	14
36. Most employees in my work group would not feel comfortable if their work practices were observed and recorded by a coworker.	4	36	10	4	2

**APPENDIX D**

**SAFETY SYSTEMS QUESTIONNAIRE RESULTS**

Optical Systems Division Safety Systems Questionnaire	<u>HIGHLY AGREE</u>				
	<u>AGREE</u>				
	<u>NOT SURE</u>				
	<u>DISAGREE</u>				
	<u>HIGHLY DISAGREE</u>				
1. The division's current incident review process is effective in determining root cause without placing blame.	0	0	0	4	1
2. The division's safety training program addresses all aspects of OSD's daily work activities.	0	2	1	2	0
3. The division's safety related documentation is complete and well communicated to all employees.	0	0	0	4	1
4. I would rate OSD's overall safety management systems as effective.	0	0	0	5	0
5. OSD's current lockout/tagout program is complete for all equipment. Operator training is also up-to-date.	0	0	0	5	0
6. OSD currently does a good job of evaluating the personal protective equipment needed for tasks located within the division	0	0	1	4	1
7. OSD's monthly safety tours are effective and help identify areas of concern within the division.	0	2	1	2	0

**APPENDIX E**

## OPTICAL SYSTEMS PROTOCOL

### Behavior Observation and Feedback Process

- 1.) All employees, including Group Leaders, **excluding Staff at present time**, completing SPS training are encouraged to do observations. Implementation team members are available for questions and any other assistance needed. ( e.g. pairing up for Observations etc.)
- 2.) All employees, including Group Leaders, **excluding Staff at present time**, are encouraged to be observed. With on - the - spot permission given.
- 3.) Observations should take 15 minutes ( or as needed ) with the time to give feedback and discussion.
- 4.) Employees are encouraged to conduct 2 observations per month.
- 5.) Observations should begin after SPS employee training is completed on Dec. 14,15,16.
- 6.) Initially, operators should concentrate observations within their own area. Individuals may conduct observations in other areas of the department if they choose. As time goes on, cross area observations will begin.
- 7.) Observations usually will be done by a single observer, but in the beginning employees may conduct observations in pairs.
- 8.) Observation check lists and clipboards with pens will be next to drop off boxes which are located in the back hallway and in the MRC clean room
- 9.) Your completed observation checklist can be placed in the drop off boxes by the observer or the observee.
- 10.)The Co-Facilitators will collect all completed observation checklists weekly from the drop off boxes.
- 11.)The Co-Facilitators will enter the data collected to produce summaries and graphs for a monthly report. (e.g. percent safe, number of observations, % participation.)
- 12.) **Meetings will be scheduled month by month until the new work schedule and crewing is established.**
- 13.)The Co-Facilitators or other Implementation team members will attend management meetings every other month. Management will attend the Implementation team's meetings on the opposite months.
- 14.) The Co-Facilitators or other Implementation team members will gather and post on a monthly basis information for the hallway bulletin board.
- 15.) All information will remain confidential.

## **OPTICAL SYSTEMS BEHAVIORAL**

### **CHECKLIST DEFINITIONS**

#### **Personal Protective Equipment:**

##### **1.1 Head:**

Head protection being worn properly.

\*Hardhat being worn, or hair tied back, in designated areas.

##### **1.2 Eye:**

Approved safety glasses or splash shields being worn for designated procedure or operation.

\*Safety glasses are mandatory in plant, use splash shields when mixing chemicals

##### **1.3 Face:**

Face shields and hoods being worn for designated procedure or operation.

\*Task where chemical could be released or splashed on the face

##### **1.4 Hearing:**

Approved hearing protection being worn in all designated areas where noise level is potentially unsafe.

\*Hearing protection when operating loud equipment. And in designated areas.

##### **1.5 Breathing:**

Approved facemasks respirators and cartridges being worn as required.

\*Respirator equipment is cleaned and stored properly after use.

##### **1.6 Hand:**

The proper hand protection being worn to prevent injury or chemical exposure to hands.

\*The proper chemical resistant gloves are being used when working with chemicals and resins.

##### **1.7 Body:**

Employee is wearing the proper body protection for the job being performed.

\*Wear clean room suits where specified and aprons when mixing chemicals.

##### **1.8 Foot:**

The proper footwear is being worn for the procedure or operation.

\*Shoes with closed toes and steel toes are required.

#### **Body Use and Positioning:**

##### **2.1 Pinch Points:**

The employee is keeping body and/or body parts free of any objects or mechanisms that come into contact with themselves or other parts of a machine.

\*The hand is free from area where the bearings go into the blocks or cradles. Avoid pinching hands when moving J-hooks on hoist spreader bars.

##### **2.2 Line of Fire:**

Employee is putting one's self or others in harms way. In case something would break, slip, or fall. Employee is keeping all obstacles free from path of travel for self and others.

\*Hoist is raised to its highest elevation to prevent any head/ and or body injury.

### **2.3 Lifting:**

Employee is using proper lifting techniques and/or is incorporating as many or all lifting principles

\*Bending knees, feet spread shoulder width apart. Build a bridge, and keep items close to keep proper back curve.

### **2.4 Pushing and Pulling:**

Employee is using safe work practices for pushing and pulling.

\*Pushing heavy items instead of pulling. Pushing at shoulder level, while standing with solid balanced footing. Pushing the wrench not pulling, and making sure wrench is in a firm grip.

### **2.5 Cramped Space and Extending:**

Employee has positioned themselves in such a way as to avoid contact with workplace hazards and /or equipment.

\*Positioning of the body so that not to move or hit objects in surroundings. Checking for clearance before standing up from a kneeling position. Avoid twisting and standing on toes or reaching over equipment.

### **2.6 Visual Focus:**

Employee is visually aware of their surroundings, as to keep out of paths which may contact potential hazards.

\*Standing to the side when hoists, carts, and loaded pallet jack, etc. are moving. Focus on walking path and coworkers around you. Stable position of the body to keep balanced and in control.

### **2.7 Pace of work:**

Employee is performing their operations at a safe pace.

\*Moving and operating hoists, carts, and pallet jacks, etc. at a safe pace. Stop, look, and listen before entering and exiting rooms and hallways. Moving and turning with chucks and other equipment at a safe pace. Not rushing to finish the job.

## **Tools and Equipment:**

### **3.1 Proper Selection:**

Employee is using the proper tool or equipment to perform the job safely.

\*Using the appropriate tool or equipment for the task being performed. Do not use a wrench for a hammer.

### **3.2 Proper Use:**

Employee is using the tool or equipment as it is designed to be used.

\*Using the closed end of a combination wrench rather than the open end when first breaking a bolt loose. Using ladder instead of a chair to reach high places.

### **3.3 Condition:**

The tool or equipment being used is in good condition.

\*The wheels on the handcart are in good condition. The hand tools are straight and free from cracks.

## **Housekeeping:**

### **4.1 Keep Area Free of Clutter:**

Employee eliminates or avoids an accumulation of any clutter that could cause potential hazards.

\*Pallets, spills, and wipes.

### **4.2 Storage and Labeling of Chemicals:**

Stores in proper area and makes sure labels are correct and legible.

\*Bottles, pails, and drums.

### **4.3 Storage of Tools:**

Making sure tools are put back in respective area and free from chemicals.

\*Wrenches, screwdrivers, etc...

### **4.4 Disposal of Waste and Recyclable:**

Work area is clear of any trash.

\*Gloves, plastics, and paper.

## **Communication:**

5.1 The employee has informed others that may be affected by the work being performed.

\*Shutting down pumps. Communicating with others when operating hoists.

## **Other:**

6.1 Procedures are addressing the operation being performed. Are they being followed?

The employee is referring to the procedures for activities they are unsure of. Did the employee discuss the procedures with others for understanding?

## **Roles and Responsibilities of**

### **Optical Systems Division Management**

1. Provide full support of Implementation Team. Whether it is by providing resources, attend Implementation Team meetings when applicable, provide the financial responsibilities for Implementation Team as necessary, and model safe behaviors.
2. Allow time for the Implementation Team to administer the process. It is a new process and results may not be seen for a couple of years.
3. Recognize the participation efforts given from individuals taking part, more or less, the active observers and observees.
4. Allow an “Open Door Policy” for discussion about process.
5. Communicate successes...even the baby steps as successes.
6. Talk positively about the system and/or give constructive criticism.
7. Attend meetings and/or training when applicable

## **Roles and Responsibilities of**

### **The Group Leaders**

1. Support team by being an example of what Behavioral Based Safety is all about.
2. Help cover or make arrangements to cover any team member making observations, examining data, or taking part in any meetings.
3. Be observers and observees.
4. Communicate any feedback, to the Implementation Team or crews, about the Behavioral Based Safety system when applicable.
5. Initiate feedback, help keep track, and communicate the status of any Shop Work Order pertaining to the Implementation Team.
6. Keep informed of any meetings that you may be asked to attend.

## **Roles and Responsibilities of**

### **Co-Facilitators**

1. The facilitators' role will be a role in which they will "Lead By Example". This will have a profound influence on each and every person that bears witness to each facilitator performing his or her own job.
2. Will organize and schedule meetings.
3. Will organize all data provided whether the office or production has provided it.
4. Will communicate results of process and any other issues to the office as well as production.
5. Will look for support from the Group Leaders to schedule meetings, to do observations, or work on any material pertaining to Behavioral Based Safety.
6. Network with other facilitators for education, new ideas, or trouble-shooting.
7. Follow-up on related Work Orders.
8. Answer any related questions or will find the necessary resources to do so.
9. Will be the employee/management/team communications link whether it is by e-mail, postings, meetings and/or one-on-one conversation.

## **Roles and Responsibilities of**

### **Implementation Team**

1. Support the process by attending meetings, helping to improve the process, and model safe behaviors.
2. Coaching of observers and observees by answering any questions in a timely manner. Also, accepting and reciprocating any feedback when necessary.
3. Communicate with everyone from management to production about the process via newsletters, bulletin board, e-mail, or one-on-one discussions.
4. Conduct and participate in refresher training. Train and be trained.
5. Assisting co-facilitators when necessary.
6. Staying calm, cool, and collective during implementation and beyond. Lead by example, listen when necessary, and talk positively about the process.
7. Maintain confidentiality

## **Roles and Responsibilities of**

### **Production Workers**

1. Participate in training and observations
2. Support the implementation team. They are taking a positive role in everyone's safety. Help cover for meetings and anyone participating in the observation process.
3. Avoid grief when asked to participate with observations. Be open to the process.
4. Practice safe behavior
5. Provide quality feedback during observations to help locate the at-risk behaviors and potential hazards.
6. Consider a possible rotation onto the implementation team.

## **Roles and Responsibilities of**

### **Safety Coordinator**

1. Provide and help interpret technical and other resources for implementation team.
2. Help coordinate technical help if necessary like OSHA, corporate, etc...
3. Attend meetings, provide feedback, contribute suggestions, etc...
4. Help with observation process by observing and being observed.
5. Post the Shop Work Orders on bulletin board to keep everyone informed.
6. Help team stay focused, aligned, answer any questions if needed, recognize positive the positive role the Implementation Team has accomplished and reinforce beliefs of Implementation Team.

## **APPENDIX F**

## **OPTICAL SYSTEMS IMPLEMENTATION MODEL**

### Phase 1

#### Site Leader and Supervisor Training

One-day workshop conducted to give senior leaders within the Optical Systems Division a better understanding of how they will be supporting the behavioral safety system.

### Phase 2

#### Behavioral Observation and Feedback Process Design and Implementation

- Implementation team Training – A three-day workshop that gives implementation team members in-depth training into the development of a behavior based safety system. During this training, all documentation related to the observation and feedback process is developed
- Employee training – A one-day training session that allows employees the opportunity to participate in observation and feedback techniques. This training also is designed to provide the theory behind the behavioral safety process.
- Process Roll-Out – Implementation team members are now ready to begin conducting observations. All members of the division are encouraged to participate in the process. During the early stages of the process, participation rates and initial observation data will be evaluated.