CHAPTER - V

GLOBAL SCENARIO OF

BEHAVIOR BASED SAFETY MANAGEMENT

For more than a decade, Behavior Based Safety (BBS) has been prospering in organizations nationwide and more recently throughout the world (Geller, 2005). Behavioral approaches to safety management are now common place (Cooper et al., 1994; Cox and Cox, 1996) and are designed to improve workplace safety by promoting those behaviors deemed critical to health, safety and risk control (Cox et al., 2004).

According to the Basic Behavioral Principles, Safety in the workplace is a combination of the following three measurable components:

1. The person component that consists of the employees’ Physical capabilities, Experience, and Training.

2. The work environment component that represents Engineering Controls, Equipment, Job task and the work culture.

3. The final, most often overlooked component is Behavior.

Accident Causation Theories:

Many studies have brought into light several issues concerning the safety measures in industries. Most of these studies have been carried in various fields to study the role of safety, industrial safety, accident prevention, loss control approaches and so on. Hence, it may be relevant to include some studies, which have a bearing upon safety measures in various industries as the same facilitate the distinction of the present study from those of the previous ones.
Industries are more prone to hazards and accidents. Therefore, before going to study the accident prevention and safety measures, it is better to see the studies and developed theories by the great people who have studied the safety aspects in industries in-depth. These theories are still valid and followed to achieve safe production and very much useful in accident prevention.

Heinrich in 1930s has developed a theory called “Domino theory”. This theory explains the accident process in terms of five factors:

1. Ancestry and social environment;
2. Fault by the person;
3. The unsafe act and/or mechanical or physical hazard;
4. The accident;
5. The injury.

These factors are in a fixed and logical order. Each one is dependent on the one immediately preceding it, so that if one is absent, no injury can occur. The theory can be visualized as five standing dominoes in which the behavior of these dominoes is studied when subjected to a disturbing force. When the first, social environment, falls, the other four follow automatically unless one of the factors has been corrected, i.e. removed, thereby creating a gap in the required sequence for producing an accident.
Heinrich (1959):

Figure 5.1 Heinrich’s theory of accidents

F.E. Bird (1964):

Study carried out over 17, 53, 498 accidents in USA

Figure 5.2 F.E Bird’s theory of accidents

Tye & Pearson (1974):

Study carried out over 1, 00, 000 accidents in U.K.
Although the figures vary from study to study, the basic principle remains the same. All these theories assert that the "no-injury" incidents, no visible injuries/damages or "near misses" accidents are potential hazards to become events with more serious consequences. They may become fatal or serious injuries. What all the events do indicate is a failure of control. The "near misses" at the base of the accident triangles offer preventative opportunities. If adequate action is taken at this level, the chances of more serious injuries occurring will be greatly reduced.

Years ago many people held the view that, if organizations complied with the law, there would be no accidents. The problem with the law is that it does not take into account, in general, the question of human behavior and, in some cases, unsafe behavior.

People are different in terms of skills, knowledge, experience, attitude, motivation and other psychological elements. To this extent, behavioral safety endeavors to examine those elements of human behavior which are a contributory factor in accidents and ill-health.
A substantial number of workplace accidents are instigated through unsafe Acts and the unsafe conditions created by the employees in the work place. The employers need to be aware that further reducing accidents can only be achieved by identifying, examining and focusing upon such unsafe behavior or the At-Risk behavior. A typical Hazard pyramid is shown below in figure (5.4).

**Figure 5.4 Hazard Pyramid**

![Hazard Pyramid Diagram](image)

Here, the "At-Risk Behavior" at the base of the accident triangle offers preventative opportunities. If adequate action is taken at this level, the chances of more serious injuries occurring will be greatly reduced.²

**Standards / Statutes on Behavior Based Safety:**

The International Organisation for Standardisation (ISO) standard OHSMS 18001, 2007 version has been revised to include the behavior aspects of the employees at the work place and they are addressed in the following clauses:

1. Clause No: 4.4.2 states that the organization shall implement & maintain a procedure to make persons working under its control aware of:
a) OH&S consequences, actual or potential of their work activities, their behavior & the OH&S benefits of improved personal performance.

d) & e) Training procedures shall take into account differing level of, responsibility ability, language skills & literacy.

2. Clause No: 4.3.1 (C) states that the procedure for Hazard Identification & Risk Assessment (HIRA) shall take into account:

c) Human behavior, capabilities & other human factors.

j) The design of work areas, process including their adaption to human capabilities.

Behavioral Safety and Major Accident Hazards (MAH):

The Advisory Committee on the Safety of Nuclear Installations (ACSNI) arguably produced the most widely accepted and comprehensive safety culture definition. They defined safety culture as

“the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine commitment to, and the style and proficiency of, an organisation's health and safety management. Organisations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety and by the efficacy of preventive measures’ (ACSNI 1993, p23).

Research evidence (Komaki, 2000) suggests that behavioral safety programmes can enhance the safety climate of an organisation. They provide an opportunity for management to demonstrate their visible commitment to health and safety, involve employees, and provide an opportunity to learn about the behavioral causes of accidents, and preventative measures. For example, one behavioral safety study (Cooper and Phillips, 1994) measured site safety climate before and after a behavioral
safety programme was implemented. Over a one-year period, significant positive changes in the plant’s safety climate occurred, suggesting the programme’s impact extended beyond its initial focus on behavior.

Other research (Fleming & Lardner, 2000) suggests that behavioral safety programmes need to be matched to the maturity of an organisation’s existing safety culture. This suggests a two-way relationship between behavioral safety programmes and safety culture. The existing level of maturity determines the type of behavioral safety programme which is appropriate and is likely to succeed, and this behavioral safety programme will in turn enhance the maturity of the organisation’s safety culture.

**Typical results of the BBS approach include:**

- Rapid and consistent improvements in safety behavior
- Rapid improvements in unsafe conditions
- A rapid downward pressure on accident rates and their associated costs
- Improved communications, involvement and co-operation between the workforce and management
- Ongoing improvements to Safety Management Systems
- Improvements in attitudes towards and perceptions about the importance of safety
- Ownership of safety by the workforce
- Enhanced acceptance of the responsibility for safety at all levels
- Better understandings of the relationship between safety behavior and accidents

Research by Collins and Keeley (2003) shows that although the immediate causes of major incidents frequently involve ‘human error’ of operators or
maintenance personnel, the reasons that these errors occurred in the first place were the responsibility of those more senior in the organization.

Extracts from the research conducted by Anderson make interesting reading when considering behavioral safety interventions. For example, of 110 incidents due to maintenance, only 17 were due to a failure to ensure that planned maintenance procedures were followed (a front line issue and therefore possibly candidates for a behavioral intervention), but 93 were due to a failure by the organization to provide adequate maintenance procedures (a management issue, which would not be addressed by the majority of behavioral interventions) (Anderson, 2005).

Collins and Keeley state that ‘the cause of any incident or accident, including loss of containment, can usually be traced back to a failure of safety management’. Behavioral safety approaches are based on the premise that a significant proportion of accidents are primarily caused by the behavior of front line staff. Although these behaviors may be largely the result of attitudes, it has been shown that changing behaviors first is more effective (Anderson, 2005).

Komaki et al. (1978) conducted one of the first studies utilising behavioral analysis to improve worker safety and concluded that this mode of safety intervention was effective in significantly improving employee safety performance. They also reported that not only did employees react favorably towards the behavioral safety intervention, but also that the study organisation was able to maintain the initiative with a continuing decline in the injury frequency rate.3

Behavior Based safety interventions are people focused and are often based upon one to one or group observations of employees performing routine work tasks, feedback on safety related behavior, coaching and mentoring. The majority of initiatives have a proactive focus, encouraging individuals and their work groups to
‘consider the potential for accident involvement, and their own behavior as safe versus unsafe before somebody gets hurt’ (Sutherland et al., 2000).⁴

Behavioral approaches to safety management characteristically focus on changing employee behaviors rather than attitudes (Bem, 1967).⁵ To secure long-term positive changes in safety performance researchers suggest that it is necessary to change both behavior and attitudes (Fishbein and Ajzen, 1975).⁶

Theories of motivation have also had an impact on the behavioral safety intervention under investigation. Studies conducted in Australia found that safety motivation is an important factor in predicting compliance (Griffin and Neal, 2000).⁷ Trust, within and amongst operational teams, is an essential component if behavioral safety initiatives are to be an effective aspect of an organisation’s safety management system (Lane and Bachmann, 1998).⁸

Behavioral safety provided considerable value to the study organisation as it supported cultural realignment towards a ‘safety first’ culture (Cox et al., 2004). BSP was an effective motivational tool, which assisted in both individual behavior and attitude change (Cox et al., 2004). Employee motivation to behave in a safe manner is enhanced by utilising a behavioral approach to safety management (Cox et al., 2004).⁹

¹⁰Using the behavioral approach, a major U.S. drilling company has reduced its OSHA recordable accident rate by 48 percent and moves from the industry average to be one of the top five safety performers in the industry as shown in Figure (5.5).
The B-Safe Management Solutions Inc, USA, recognized as 'Global Experts' in Behavioral Safety (Business & Legal Reports, 2006), claims that their clients realize 'world-class' safety performance, by achieving the lowest injury rates in their industry. They offered services to customers within all market segments like Agriculture, Agrichemicals, Aviation, Chemicals, Construction, Finance, Food & Drink, Health Services, Manufacturing, Mining, Offshore Oil & Gas, Petrochemicals, Pharmaceuticals, Paints, Paper, Transportation and Steel and their improvements given at Figure (5.6) below.
They have assisted companies in 30 countries, across the America's, Africa, Asia, Australasia, Europe and the Middle East and brought performance improvements. They have outperformed their major competitors by 10 percent or more per year and usually deliver larger, more rapid, injury reductions in year one and sustain this above average performance for over 7 years.

Westinghouse Savannah River Company has reported for the period of 1999 through July of 2003 that the whole site Total Recordable Cases rate went from 115 to 33, almost a fourfold decrease when BBS was implemented as shown in Figure (5.7).
In addition to the above, the losses incurred due to workman’s compensation and medical reserves went from $370,000 to $190,000 and the costs are projected at only $4000 for the April 2003 to March 2004 period as shown in Figure (5.8).
Los Alamos National Laboratory (LANL) has reported that the radiological incident rates for two facilities were reduced significantly with a BBS process in place. It is depicted in Figure (5.9) below:
At BlueScope steel, safety is the number one priority and the goal is zero harm. The improvement in the Frequency Rate at BlueScope steel after the implementation of BBS is given in the Figure (5.10).
Mitsubishi Motors Australia Ltd (MMAL) is one of Australia’s vehicle manufacturers. The company continues to have a strong presence in the Australian market with over 2,000 direct employees. On implementation of the BBS, among the many safety accomplishments at MMAL the following are also included:

- A 55 percent reduction in Lost Time Injury Frequency Rate (LTIFR)
- Workers compensation claims down by 43 percent
- 63 percent savings in workers compensation direct costs
- Substantial improvement in contractor safety management performance
- An increase in near-miss reporting

Since taking to the skies in 1920, Qantas has been proud of its reputation as the safest airline in the world. To reinforce this achievement, the Qantas leadership team recognised the need to improve employee safety through BBS and committed to deliver the same performance in occupational health and safety as their exemplary
record in the air. In less than 3 years, be safe! and in particular the People Safe component, has delivered outstanding safety improvements and financial and operating gains, including:

- Lost Time Injury Frequency Rate has reduced by 70 percent across the organisation, and by 100 percent in some departments.
- Over 20,000 lost days are being saved annually.
- $11 million of workers compensation provisions have been removed from the company’s books in the past year alone.
- Workers compensation claims costs have reduced from 1.5 percent of wages to 1.0 percent.
- A 500 percent return on investment.
- Direct cost savings of $500 million predicted over 5 years.

A History of Success with Behavioral Safety in the Oil and Gas Sector:

1981 Dixilyn-Field Drilling Company:

This is one of the pioneering behavioral safety interventions conducted in 1981. The company achieved a 50 percent reduction in lost time injuries, moving from the industry average to the top 10 percent of their industry. In 1982 they won industry recognition for their safety performance from the International Association of Drilling Contractors. The process remained in effect until 1985 when the parent company, Pan Handle Eastern, sold off its drilling assets.
1992 Tenneco Gas Pipeline:

In 1992, Tenneco Gas Pipeline, headquartered in Houston, TX, implemented a Values Based Safety to build trust between employees and managers. Employees usually worked alone or in pairs at stations stretching from South Texas to Massachusetts. During a nine-month pilot of the Values Based Safety at nine locations, lost time accidents were down 30 percent, dropping from 1.6 to 1 per 200,000 work hours. In a survey of 151 employees at the pilot locations, 90 percent said the process should be rolled out to the rest of the organization, 85 percent reported that they were more aware of safety as a result of the process, and 81 percent reported that they worked more safely as a result of the process. Three years after implementation, Tenneco had the best safety record in its industry. The process survived until Tenneco was taken over by El Paso Natural Gas and underwent a 30 percent reduction in headcount. Since the takeover, several of the original participants remain so committed to behavioral safety that they are working to initiate a similar process within El Paso Energy.

1993 Citgo Petroleum Corporation:

The Citgo petroleum refinery in Lake Charles, LA has one of the longest-lived Behavioral Safety processes. The company began to work with Quality Safety Edge in 1993 in order to break through a plateau in injury rates. An employee team from each of nine major areas customized and managed the process. All 1,400 employees conduct observations and provide coaching to their co-workers. The initial pilot area went from a three-year annual average of three recordable incidents to two years without a recordable incident. After the pilot phase, the process was successfully implemented in each operating area. Citgo - Lake Charles also achieved significant reductions in workers compensation costs. The Behavioral Safety process has
removed variation in safety outcomes so that the site maintains a consistent level of performance and remains a safety leader in the refinery industry. Citgo - Lake Charles employee teams improve their process through annual workshops and refinery-wide conferences with Quality Safety Edge. All site contractors are required to develop their own Behavioral Safety process with the help of the Citgo employee Steering Committees. On the basis of the results achieved at this site, Citgo identified Behavioral Safety as a corporate "Best Practice". In 1998, Quality Safety Edge initiated the Behavioral Safety process with the 600 employees of the Citgo refinery in Corpus Christi, TX. In 1999, Dr. McSween traveled to Venezuela to teach safety officers and executives of Citgo's parent company, Petroleos de Venezuela, about the Behavioral Safety process.

1996 Amoco Pipeline Company – Gulf Coast Business District:

These 85 Amoco Pipeline employees service and maintain Amoco gas pipelines along the Texas Gulf Coast and in the Gulf of Mexico. They often work or drive long distances alone. When designing the Values Based Safety Process in October 1996, the employee Design Team worked hard to include peer observation, rather than self-observation, so that the important social feedback component of the process would be retained. Creative planning and arrangement of work schedules provide ample opportunity for co-worker observations. Results were impressive - only one OSHA-recordable incident since the process began.

1997 Chevron Canada Resources:

Chevron Canada Resources (CCR) produces and transports gas throughout Alberta, Canada. Quality Safety Edge worked with CCR in 1997 to design and pilot the Values Based Safety Process, rolling out to 14 other locations in 1998. During 1999, CCR experienced a significant reorganization, including the sale of two
locations, a joint venture involving another location, consolidation of work groups, and reductions in work force. The resulting organization has ten teams of employees working at ten production plants and fields compared with 23 teams of employees working at 14 production plants and fields in 1998. The number of field employees dropped from more than 250 in 1998 to approximately 150 in 1999. CCR had a rate of .76 OSHA-recordable injuries in 1997 per 200,000 work-hours, and .79 in 1998. In 1999, the company's rate of OSHA-recordable injuries was .72. The company was pleased to maintain this low incident rate during the period of change.¹²

The University of Manchester Institute of Science and Technology (UK) recently invited a number of representative bodies (for example the HSE, the Trades Union Congress and the Institute of Occupational Safety and Health) to discuss the setting up of specific standards of implementation of a behavioral safety programme. The idea is that once a forum is properly established all major providers of Behavioral Safety Consultancy would be invited to contribute. It was suggested standards focus on:- level of genuine workforce ownership and participation accuracy of behavioral measurements effectiveness of the feedback and communication systems level of management support and response As the field grows it is important that organisations claiming to have implemented a behavioral programme have actually implemented the main elements of the process correctly. (Though it is, of-course, important to remember that there is no such thing as universal best practise - so standards must allow organisations to innovate and tailor whilst sticking within inviolate principles). However, benchmarking standards for the various stages and elements of the process will prevent organisations claiming "we tried that behavioral safety - but it didn't work" when they should be saying "we were unable to properly implement a behavioral programme".
Many supporters of behavioral safety programmes state that large improvements in safety have been made in the past decade or so in engineering and safety management systems; and that new approaches are required to encourage further improvement (Anderson, 2005). Behavioral safety approaches have their place in the management of health and safety on major accident hazard installations and so they are not merely a ‘shot in the dark (Anderson, 2005). Behavior-based safety (BBS) provides tools and procedures workers can use to take personal control of occupational risks (Geller, 2005).

One of the many responses to the ever-evolving challenges facing occupational safety and health professionals over the past decades is the theory of Behavior Based Safety (BBS). Unlike traditional safety systems that focus on management, engineers, and safety professionals as responsible owners of safety within an organization, BBS shifts that focus of responsibility to an organization's workforce. In other words, BBS theorizes that frequencies of illness and injury can be decreased through modification of worker behaviors (Boyce & Roman, 2002), and that such modification be accomplished by focusing management attention on unsafe acts committed by workers.13

Safety consultants in the United States were well positioned to fill a void created by a sharp decrease in the number of new OSHA edicts in the mid-1990s, and many of them proposed Behavior Based Safety to their clients, who themselves were well positioned for such contracts due to the favorable economic condition of the decade (What Happened, 2002). The influx of BBS initiatives throughout the country created a wave of acceptance due to the fact that so many organizations were embracing the theory. So much so, in fact, that U.S. health and safety agencies not only seemed to turn a blind eye, but also provided support in many cases (Frederick &
Lessin, 2000). For instance, there is evidence to suggest that at one point OSHA may have been requiring BBS as a Voluntary Protection Program criterion, and that NIOSH was also involved in expanding the wave of BBS acceptance and implementation (Frederick & Lessin, 2000). In a November 2000 Multinational Monitor article, James Frederick and Nancy Lessin stated that "NIOSH has awarded research grants, studying the impacts of Behavior Based Safety, to the very consultants who market and sell the BBS programs" (Frederick & Lessin, 2000, p.7). To be more specific, BBS proponents typically assert that such unsafe acts are responsible for approximately 85 percent of all incidents (Frederick & Lessin, 2000). However, these presumptions are based on 1930s research conducted by insurance investigator H.W. Heinrich, which consisted of accident report reviews (Frederick & Lessin, 2000). 14

Although safety systems involving BBS vary from one organization to another, at the core of each is the theory that unsafe acts committed by workers are the primary causes of accidents and injuries (Topf, 2002). 15
References:


10. “The record” by Terry E. McSween

12. Grainne A. Matthews, Ph.D., Quality Safety Edge, “Behavioral Safety: Save Lives By Involving Employees”

