CHAPTER - II

REVIEW OF LITERATURE

Behavior-Based Safety Management focuses on the identification and modification of critical safety behaviors and emphasizes how such behaviors are linked to workplace injuries and losses. Behavior Based Safety is a process that reduces unsafe behaviors that can lead to incidents occurring in the workplace. The process works by reinforcing safe behavior and identifying the causes of unsafe behavior. Behavior Based safety management also discusses the future directions or strategies for improving the management of workplace safety. In India and abroad some researchers undertaken many surveys on Behavior Based Safety in different organizations. 

1In the words of Borg (1966) the literature in any field forms the foundation upon which all future work will build. The review of some select literature and research studies is briefly explained in this chapter.

2The report of the 8th Annual Behavioral Based Safety Conference 2012 states that the cause of most workplace accidents and incidents is directly related to human failure and error. Behavioral Based safety is frequently turned to when organisations have reached a plateau in their safety performance and the only logical step left in reducing the risk of accidents is to encourage the more active involvement of operatives themselves. The aim of implementing BBS in an organisation is to get all employees to view safety in the same way and in a continuous, unconscious manner. The report has looked at how to instill a culture of BBS throughout the workplace and how to make safety a priority when recruiting, training and rewarding employees.

3Tharaldsen (2011) says that Behavior Based safety (BBS) approaches are rooted in behavioral psychology and makes use of stimuli – response models and principles of operant conditioning and reinforcement. A BBS approach will look for
problematic behavior and will mainly be concerned with observable behavioral outputs. Behavior Based safety, which mainly is concerned with observable behavioral outputs, it tries to grasp the tacit or embodied sides of culture, to balance the formal and informal sides and may consider how external and internal conditions influence employees’ possibility of behaving in a safe or unsafe manner. In Behavior based safety approaches they examine the specific context of the employees, diagnose and treat the critical behavior, and work with the outcomes of culture. In safety research, it is generally assumed that there is a relationship between safety climate and safety performance; i.e. that the employees’ safe or unsafe practices or behaviors are a function of the underlying organizational safety culture and the reflected or measured safety climate. A mutual relation implies that safe behavior may lead to a safer culture and less accidents or reverse, that accidents may urge the organization towards a safer culture and better scores on safety climate measures. One might also finds situations where an improved safety culture involves better incident reporting and hence an apparent worsening of safety performance, and that employees with high safety awareness might expect more and, hence, be more critical than those who expect less. Safety climate, culture and reporting practices may depend on both local level engagement and trusting mechanisms between workers and management.

4Dr.H.L.Kaila, (2011) conducted a study covering multi-national organisations such as petroleum, engineering, automobile, cement, power, chemical, pharmaceutical companies etc. The author observes that the managements have started believing that engineering and administrative controls alone do not provide adequate safe workplace unless Behavioral Based Safety (BBS) is practiced and unsafe behavior of the workers is controlled in order to ensure total safety at workplaces.
Andreas Lumbe Aas, (2010) investigates how selected standards are applied within an industrial context and suggests strategies to improve their application. His thesis focuses on the human part of large and complex systems. Human beings are essential in any large and complex system, but their complexity makes it virtually impossible to predict their behavior and impact on such systems. Safety standards applications should aid to handle such complexity in a safe, efficient and effective manner.

David D. Woods, Leila Johannesen, Sidney Dekker, (2010) observed that human error is the cause of incidents and accidents. The authors strongly opine that the label "human error" is prejudicial and unspecific, and leads to system failure and in turn leads to accident.

Sandy Smith, (2010) conducted safety assessment surveys at the worksites, and made four recommendations for the management to prevent accidents at worksite. These are, organization commitment towards safety, training on proactive management skills for senior and mid-level managers, motivation of supervisors, and active participation of employees in safety, will definitely prevent accidents.

M. Dominic Cooper (2009) says that behavioral safety has many advocates and many critics. In reality, like other safety management interventions, behavioral safety processes require a concerted effort by all to produce desired results. The purpose of a behavioral safety process is to reduce incidents triggered by unsafe or at-risk behaviors. To achieve this, specific behavioral problems are identified by focusing on incidents that result from the interaction between people and their working environment. Once these problems are identified, attempts are made to discover which antecedents are driving at-risk behavior, and which consequences are reinforcing or maintaining that behavior so that appropriate corrective actions can be
taken. Executing the change strategy usually involves addressing the antecedents to remove barriers while the associated safety behaviors are placed on checklists so workers can conduct observations of ongoing behavior. The results of his review show that the design of a behavioral safety process is as important as the psychology of behavioral safety. Simply measuring behavior and providing consequences is not enough to sustain incident reduction. Designs that incorporate daily observations, focus on workgroups in static settings and use participative goals with multiple feedback mechanisms will reduce injuries more than others. All behavioral safety processes require strong management support to help deliver the intended benefits and sustain them over the longer term (Cameron & Duff, 2007; Cooper, 2006a; 2006b).

Kofi Annan, (2009) strongly believes that Safety and health is not just for specialists and professionals. It should become the concern of all people at workplaces. In the name of global competition measures like cost cutting, quicker output, better profits etc. should not cause any hazard in the work place and surroundings.

M.Paswn and A.Mukopadhyay, (2008) observe that most of the accidents are caused by the failure of people, equipment, materials or environments. The authors opined that the investigator should examine each event as well as the sequence of events that led to the accident. The accident type is also important. Their study concludes that the key element in developing safety culture is developing a rigorous safety discipline that only will make the plant a safe place to work.

H.L.Kaila, (2008) has conducted over twenty-five safety awareness surveys of organizations in various locations in India and reveals that eighty to ninety percent of accidents are triggered by unsafe acts or behaviors. Therefore, the author emphasizes the need of Behavior Based Safety (BBS). The author observes that BBS has shown
positive results in terms of safe behavior and reduction in accident rates across industries and countries.

M.K. Pandhe, (2006) states that the neglect of safety aspects results in a large number of fatalities in the Steel industry. The author finds that about 49 percent of the fatal accidents are caused in rail and road movements while the second largest killer is the hitting of a worker by any object in the Plant. About 10 percent of accidents are caused due to falling from height. Burns, explosion, metal spillage, suffocation, electrocution and gas poisoning have also led to loss of precious lives of the workers. An interesting observation by the author in this context is that a dubious practice is prevailing in the steel industry is to allow a worker to remain at home and mark him present to prevent reporting of the accident. The author is of the view that studying of non-reportable accidents may help in increasing the safety standards in the industry.

Amit Kumar Gupta, (2006) finds out the causes of accidents and labels them under the acronym PEEPS. That is reasons for any accident are Plant, Equipment, Environment, People, and System. The author prescribes preventive measures using three Es that are:

- Engineering: The job has to be engineered for safety
- Education: Employees are to be educated in safe procedures and
- Enforcement: Safety rules should be properly enforced.

The author further states that by collecting and analysing the data, selecting and applying the remedy, and by proper monitoring, accident prevention can be accomplished.

James I. Chang and Cheng-Chung Lin (2006) review 242 accidents of storage tanks that occurred in industrial facilities over the last 40 years. Fishbone diagram is applied to analyze the causes that lead to accidents. Corrective actions are also
provided to help operating engineers handling similar situations in the future. There were 80 accidents (33 percent) caused by lightning and 72 (30 percent) caused by human errors including poor operations and maintenance. Other causes were equipment failure, sabotage, crack and rupture, leak and line rupture, static electricity, open flames etc. The authors opine that most of those accidents would have been avoided if good engineering practices had been followed.

15 A. Ian Glendon Sharon Clarke, Eugene F. McKenna, (2006) addressed safety culture and models of risk. They delineate a risk management approach that includes a range of techniques such as risk assessment, safety audit, and safety interventions.

16 Dan Hopwood and Steve Thomson, (2006) the authors discussed the core OSHA regulatory requirements; safety needs assessment, workers' compensation and insurance, disaster and emergency planning, ergonomics, risk management and loss prevention, injury management, incident investigation, workplace security, best practices, and formation of workplace safety culture.

17 Roger L. Brauer, (2006) has focused on safety and health with economical engineering in industries. Modern engineers are required not only to create products and environments, but to make them safe and economical as well. The author addresses the fundamentals of safety, legal aspects, hazard recognition, the human element of safety, and techniques for managing safety in engineering decisions.

18 The General Manager of DuPont Australia, in an interview with Professor Andrew Hopkins, said: “Both government safety organizations and unions are quite simplistic on safety. They focus on equipment, not on the acts of People. In our experience, 95 percent of accidents occur because of the acts of people.” The statistics that 80 - 96 percent of workplace injuries are caused by workers' unsafe behaviors stem from "research" conducted by an insurance investigator named H.W. Heinrich in
the 1930's in the United States. Heinrich's “research” consisted of reviewing supervisors' accident reports and drawing conclusions about accident causation from those reports. Most of those reports blamed workers for the accident. Heinrich concluded that 88 percent of all workplace accidents were caused by worker's unsafe acts. Behavioral Based Safety is an approach to safety that focuses on workers' behavior as the cause of most work-related injuries and illnesses. Promoters of behavior-based safety programs maintain that 80 - 96 percent of workplace injuries are caused by workers' unsafe behaviors. Once the programs identify the workers who are behaving "unsafely", they are coaxed, cajoled and/or threatened into behaving “safely" on the job or sacked.

19The Code of Practice of the International Labour Organisation (ILO), (2005) lists the most common causes of injury and illness in the Iron and Steel Industry are Slips, trips and falls, falls from height, unguarded machinery falling of objects, engulfment, working in confined spaces, moving machinery, on-site transport, forklifts and cranes, exposure to controlled and uncontrolled energy sources, exposure to asbestos, exposure to mineral wools and fibers, inhalable agents (skin contact with chemicals, contact with hot metal, fire and explosion, extreme temperatures, radiation, noise and vibration, electrical burns and electric shock, manual handling and repetitive work, failures due to automation, etc., are among the list.

20Richard J Butler and Seung Park, (2005) state that the indirect costs of accidents are lost wages, damage to equipment, training and rehabilitation expenses. They opine that On-the-job-injury costs are an important component of the firm's operating expenses.

21E. Scott Geller (2005) states that Industrial safety has been identified as a domain in need of large scale and long term behavior change. For this to happen, a
prominent paradigm shift is required. The standard command-and-control or enforcement approach to industrial safety has limited impact, as witnessed by the safety performance plateaus experienced by numerous organizations. The BBS approach provides tools and procedures employees can use to take control of their own safety performance, thereby enabling a bottom-up empowerment approach to reducing occupational risks and preventing workplace injuries. An effective BBS approach requires a careful analysis of the context in which desirable and undesirable behaviors occur. Subsequently, behavior change interventions need to be designed, implemented, and evaluated. Safety-related behavior in a work setting usually starts out as other-directed. Such direction can come from a policy statement, an operations manual, or a training program. After people learn what to do, essentially by memorizing or internalizing the relevant instructions, their behavior can become self-directed. They talk to themselves or formulate an image of the work practice before performing to activate the appropriate behavior. Sometimes they talk to themselves after emitting a behavior to reassure them they performed it correctly. Or, they use self-dialogue to figure out ways to do better next time. At this point, they are usually open to receiving corrective feedback. When some behaviors occur frequently and consistently during a period of time, they become automatic. A habit is formed. Some habits are desirable, and some are undesirable, depending on their short and long-term consequences. If implemented correctly, rewards, recognition, and other positive consequences can facilitate the transfer of behavior from the self-directed state to the habit state. In this state, people are knowingly at-risk. It is often difficult to change self-directed behavior from at-risk to safe, because such a transition usually requires a relevant change in personal motivation. Before a bad habit can be changed to a good habit, the target behavior must become self-directed. In other words, people need to
become aware of their undesirable habit (as in at-risk behavior) before an adjustment is possible. Then, if people are motivated to improve (perhaps as a result of corrective feedback or an incentive or reward program), their new self-directed behavior can become automatic.

22R.B. Whittingham (2004) describes that it is human to make mistakes and in any task, no matter how simple, errors will occur. The frequency at which they occur will depend on the nature of the task, the systems associated with the task (whether they are physical or organizational systems) and the influence of the environment in which the task is carried out. It has been estimated that about 80 percent of all accidents are due to human error in some form. It is the reason why the study of human error is crucial to preventing accidents. It is crucial both to the prevention of major accidents with multiple fatalities, as well as to the host of minor accidents leading to injury and disability, which rarely make the headlines, but still cause untold human suffering. The fact that human error cannot be entirely eliminated must therefore have an important bearing on the level of residual risk of an activity where human error is a potential accident contributor.

23Erik Hollnagel Ashgate, (2004) opines that there is a practical need for constructive methods. He focuses on accident prevention rather than accident analysis and advocates a proactive rather than reactive approach. Further, the author assesses three types of accident models (i.e. sequential, epidemiological, and systemic) and compares their strengths and weaknesses. He asserts that accidents can be prevented through a combination of performance monitoring and barrier functions, rather than through the elimination or encapsulation of causes.

24Sharon Clarke and Cary L. Cooper, (2004) strongly believes that working in a stressful environment not only increases the risk of physical illness or distress, but
also increases the likelihood of workplace accidents. He deals with the risk management approach to stress evaluation in the workplace and offers practical guidelines for the audit, assessment and mitigation of workplace stressors.

Terry E. McSween, (2003) states that their studies replicate the DuPont findings regarding the extent to which unsafe behavior contributes to injuries. Over ten years of analysis at hundreds of organizations their findings suggest that in most organizations behavior contributes to between 86 percent-96 percent of all injuries. These data are not meant to suggest that employees are directly to blame for 96 percent of their injuries. From the perspective of behavioral psychology, all behavior is a function of the environment in which it occurs. Unsafe work behavior is accordingly the result of the physical environment, the social environment and Worker’s experience within these. He also discusses about complacency of the workers which refers to the loss of the fear of injury that typically motivates employees to work safely. Too often the problem is that employees become complacent and begin to short cut safety procedures. The management support is the single most important element for ensuring a successful behavioral safety process. Behavioral safety is much easier in organizations where employees see their leaders consistently promoting and paying attention to safety. The managers spend far more time paying attention to production and too little time paying attention to safety.

Kathryn Mearns, Sean M. Whitaker, Rhona Flin. (2003) conducted a safety climate survey on 13 oil and gas installations in United Kingdom. The study regarding communication about health and safety, perceived supervisor competence, perceived management commitment to safety, Frequency of general unsafe behavior, frequency of unsafe behavior under incentives, safety policy knowledge, job satisfaction, Written rules and procedures and Willingness to report accidents. Analysis of data
revealed that supervisors provided more favorable scores than other respondents on most of the scales.

27 An article in the December 2002 issue of Safety & Health, asserted that behavior-based safety has run its course and is in decline. A construction worker and trades unionist for many years, Dr Dominic Cooper witnessed too many accidents resulting from unsafe behavior. Since then he spent many years researching and implementing behavioral safety in 12 industries on four continents, conducted an online survey of actual Behavioral-safety end-users on the www.behavioral-safety.com website which attracted 247 respondents. Explorations of the freely available results reveal the flaws in Jim Howe’s and Ron Millers assertions about the decline of behavioral safety and its effects as described below:

Assertion 1: Less people now attend behavioral-safety seminars and training events
Assertion 2: Behavioral-safety looks at the wrong things
Assertion 3: Behavioral-safety doesn’t include and unfairly blames workers
Assertion 4: Behavioral-safety fails to prioritize the important elements of a quality safety program
Assertion 5: Behavioral-safety costs too much
Assertion 6: Behavioral-safety leads to under-reporting of accidents
Assertion 7: Behavioral-safety does not produce lasting results
Assertion 8: Those aspects of behavioral safety which reduce injuries is unknown.

28 Richard W. Lack, (2002) provides accurate, up-to-date information in the rapidly changing field of asset protection. The author handles various concepts such as regulatory compliance, technical standards, legal aspects, risk management, and training requirements to mitigate the occurrence of accidents in industries/organisations. In the light of the global workplace, the author highlights
some of the technical standards and cultural approaches to asset protection in the international arena.

29 Thomas Burns, (2002) presents a model to systematically identify and execute the steps needed to make the operations in organisations/industries incident-free. He opines that serious incidents affect a company's most important and most visible measures of performance, including profitability and company image. In order to prevent such occurrences the author propounds a method from a team perspective. It describes the power of Behavior Based techniques and the benefits of developing teamwork skills. Further, the author has included safety performance scorecards, a practical and effective tool for preventing serious incidents.

30 James E Roughton and James Merucurio, (2002) state that working safely is a cultural issue. They indicated that an effective safety culture will eventually lead to the desired goal of zero incidents in the work place. They have discussed the management’s role in developing an effective safety culture, determining the direction of management system pathway to safety excellence, employees participation, assigning responsibility, developing accountability, developing hazard inventory, developing a hazard prevention and control system, conducting effective incident investigations etc.

31 Trevor A. Kletz, (2001) presents a systematic, professional and scientific approach to accident investigation. By analysing accidents that have occurred, the author shows how we can learn and thus be better able to prevent accidents happening again. Looking at a wide range of incidents, covering the process industries, nuclear industry and transportation, he analyses each accident in a practical and non-theoretical fashion and summaries each with a chain of events showing the prevention and mitigation which could have occurred at every stage.
E. Scott Geller, (2001) presents science-based and practical approaches to improving attitudes and behavior for achieving an injury-free work environment. The author discusses the proactive applications of Behavior Based psychology for improving health and safety in organisations/industries. He provides the safety professionals with the information and examples related to behavioral science methods capable of enhancing safety awareness, reducing risk behavior at work, and facilitating ongoing participation in safety-related activities.

E. Scott Geller, (2001) provides theory, procedures, and tools to guide an organization's long-term continuous improvement. He proposes certain methods to decrease the frequency and severity of accidental injuries in organizations. He covers all areas of psychology directly relevant to understanding and influencing safety-related behaviors. The author presents not only principles and practical procedures for improving safety-related behaviors, but also illustrates how to increase people's willingness to use these techniques to create a Total Safety Culture.

Alice F. Stuhlmacher, Douglas F. Cellar, (2001) examined safety behavior and outline practical interventions that help to increase safety awareness. The authors explained various ways of defining and measuring safety as well as a variety of individual differences like gender, job knowledge, conscientiousness, self-efficacy, risk avoidance, and stress tolerance that are important in creating safety interventions and improving the selection and training of employees.

M.D. Cooper states that Psychological and environmental influences function as joint rather than separate determinants of behavior. However, the degree to which each element influences the other in relation to developing, enhancing or maintaining organisational safety culture is unknown. In relation to ongoing safety-related
behavior(s) much evidence is available to show that behavioral safety performance
management techniques have great utility for improving safety.

36Ron C. McKinnon, (2000) has developed a software kit for safety
professionals to identify the key factors. The author opines that the most important
objective in accident investigation is not to establish blame, but to reveal cause and
prevent recurrence. The author has used cause-and-prevention approach to help to
start with the most productive strategy, and finished with the most usable results.

37Varonen and Mattila, (2000) studied the structure of safety climate in wood
processing industries in Finland and found that organizational responsibility, workers'
safety attitudes, safety supervision and company safety precautions accounted for
40 percent of the total variance. The factors were found to be reliable and showed
negative correlation with accident rates.

38Faisal and Abbasi, (1999) they deal with some of the major accidents in
chemical process industries, which occurred during 1926-1997. The authors opine
that in order to understand the mechanisms of accidents and to develop accident
prevention and control strategies, it is essential to know about and learn from past
accidents. Their study finds that most of accidents take place due to malfunctioning
of a component of equipment and/or minor negligence of personnel during operation
or maintenance. The damage potential of an accident and the area affected by it
depends upon the chemical in use, causative factors, operating conditions and site
characteristics.

39Cooper, M.D. (1999) states that around 6 people die and around 80 people
suffer a lost-time injury at work as a result of unsafe behavior everyday in the UK.
This cost UK businesses billions of pounds each year, while the pain, suffering and
burdens placed on families are immense. All efforts to reduce accidents and improve
safe performance in the workplace are concerned with human behavior. "Behavior and attitudes is what it's all about," is a commonly heard phrase. Because of their dramatic successes in reducing accidents, safety professionals and line managers are increasingly adopting workforce-driven behavioral safety programmes. Other business benefits often include improved co-operation, involvement and communications between management and the workforce, enhanced team working, and reductions in workplace stressors.

40Marsh, T.W., Davies, R., Phillips, R.A., Duff, A.R., Robertson, I.T., Weyman, A & Cooper, M.D. (1998) explain that following the principles of Heinrich's triangle (Heinrich, 1959), behavioral programmes focus on the key behaviors that lead to accidents rather than either accidents or attitudes. Attitudes can prove difficult to change because of attention, understanding and perception issues. In addition, attitudinal measures can only be validated by a criterion such as behavior. Finally, the relationship between attitudes and behaviors has been shown to be not necessarily direct. For these reasons, behavioral programmes focus directly and proactively on potentially risky behavior. In part, the behavioral approach has become popular following the relative lack of success of other measures. Disciplinary action can result in reduced morale and it is difficult for organisations to meet the necessary requirements of immediacy, consistency and severity of punishment that are vital if there is to be a consistent and meaningful impact on behavior in the long term (Skinner, 1953). The most frequently researched form of commitment in occupational psychology is organisational commitment. Organisational commitment can be thought of as psychological attachment to, or identification with, an organisation. Previous research (e.g. Donald & Canter, 1993; Rodgers et al., 1993) has shown that management commitment is important to the success of safety initiatives. Perhaps the
most important factor, however, was management's attitude to the increase in safety-related communication generated by the intervention.

41 Frank R. Spellman, (1998) brings together all of the Occupational Safety and Health Administration's regulatory requirements for making safe and proper confined space entries. Because confined space entry is a complicated procedure and a process that contains inherent risks-those concerned with safety in the workplace are constantly concerned with how to reduce the risks associated with confined space entry, how to eliminate or decrease the hazards workers face in confined spaces and how to prevent injuries and fatalities from occurring in confined spaces. He feels that workers should have more knowledge of the hazards of their work environments especially of confined spaces.

42 Thomas D. Schneir, (1998) contends that a Safety Manager must be creative in order to draw the attention to workplace safety issues. Creative Safety Solutions present innovative ways to solve complex safety and health problems in the office or factory. The key to its distinctive approach is to motivate employees to "think safety." While offering effective solutions for common health and safety issues, the author also explains how safety specialists can foster creative thinking-ideal for working out situations particular to one's own workplace.

43 Trevor A. Kletz, (1998) examines the causes and aftermaths of numerous preventable plant disasters. The author is of the view that case histories illustrate what went wrong, why it went wrong, and then offers solutions to circumvent similar tragedies. He advises organisations/industries to learn from the mistakes of others.

44 Report by Committee on Human Resources Working Group on Improving Steel Plant Safety (1998) states that establishing and developing a safety culture within an organisation and managing safety from a behavioral perspective is the most
powerful approach to the management of safety. The main elements in creating a safety culture are described including policy statements, the central role of management and the role of employees, trade unions and employee representation. All the approaches whether used together or in isolation have failed to produce the results in safety performance that were sought. Companies making real progress in this field have turned their attention to and concentrated increasingly on behavioral aspects.

Krause, T.R. (1997) says that Behavior-based safety targets employee safety behaviors and thus intervenes at the exposure level. To some extent, behavior-based efforts might seem to leave safety to the lower tiers of the organizational hierarchy, and view it as an issue that primarily involves the behavior of individual workers. But on the other side, an organization’s commitment to a full-blown behavior-based program would seem to reflect a certain level of management commitment to safety. Organizational culture is also important to behavior change proponents since it provides the context or backdrop for installing a behavior-based safety management program. Advocates of behavior-based safety management argue that a positive or supportive culture is crucially important to the ultimate success of behavior-based safety management and that it is very difficult to implement behavior-based safety management in a non-supportive or dysfunctional organizational culture. Behavior-based programs mostly target behaviors at the exposure (or immediate cause) level of the safety management sequence. Behavior-based safety offers a well specified objective and empirical process for modifying safety related behaviors. Arguably, behavior modification techniques may be superior to most other approaches to changing individual behavior at the point of exposure.
J. T. Reason, (1997) opines that major accidents are rare events because of many barriers, safeguards and defenses developed by modern technologies. He deals comprehensively with the prevention of major accidents arising from human and organizational causes. He argues that the same general principles and management techniques are appropriate for many different domains. The author also describes tools and techniques for managing the risks of such organizational accidents that go beyond those currently available to system managers and safety professionals.

Jacques Van Steen, (1996) presents the practical examples, demonstrating how various multinational companies measure the effectiveness of safety management systems. The author defines safety as the ‘absence of danger from which harm or loss could result’. He advocates the method - ‘Accentuate the positive to eliminate the negative’ indicating that performance indicators are also required for the positive input.

James Co Van, (1995) describes the methods to prevent the devastating effects of improper or unsafe practices in the creation and delivery of work outputs or activities. The author offers a wide range of techniques for instituting a well-planned, organized, systematic and meticulous safety programme. Further, he presents general methods regarding the use of safety engineering discipline and offers suggestions for further information.

Dr Dominic Cooper (1994) presents that within the field of occupational safety and health many efforts have been made to improve safety in the workplace. Engineering approaches have often been based on a reactive process founded on somewhat misleading perceptions of accident causation, and typically does not take account of the effects of rapidly changing technologies (HSC, 1993). Other kinds of interventions designed to improve the poor accident record by raising operatives'
safety consciousness through the use of safety poster campaigns, and other informational safety campaigns, have not been consistently successful. Similarly, despite the notion that safety training will cure most ills in regard to accidents, evidence exists showing that it is not always effective (Hale, 1984), which may be related to the variability of the quality of training given. Both the engineering and legislative approaches are based on the assumption that influencing the situation will influence people’s behavior. To some extent this is correct, but it is not the whole picture. These approaches have only gone part of the way down the road. The above approaches to improving safety have broadly addressed either people’s attitudes or the situations they find themselves in, in an indirect fashion, without specifically focusing on people’s behavior. McAfee & Winn (1989) conducted a review of empirical studies that attempted to change people’s safety behavior using psychologically based management techniques. Every study was successful in improving safety behavior.

Jeffrey W. Vincoli, (1994) discusses the need and procedure of accident investigation. He opined that when an industrial accident occurs, the managers and line supervisors are held responsible.

A.R Duff, I.T. Robertson, R.A. Phillips and M.D. Cooper (1994) state that previous research (e.g. McAfee and Winn, 1989) has shown improvements in safety behavior in several industries, through the use of psychologically-based techniques. These techniques, generically termed ‘applied behavior analyses, involve the use of goal-setting and performance feedback. McAfee and Winn (1989) showed that safety behavior can be improved by systematically monitoring safety-related behavior and providing feedback in conjunction with goal-setting and /or training. The research conducted has shown that Safety behavior can be objectively and reliably measured without excessive use of managerial or supervisory resource, producing performance
data which could be used in many different safety management strategies; Goal setting and feedback can be used to produce large improvements in safety performance. Commitment of site management appears to enhance the effectiveness of the goal-setting and feedback approach.

52John Ridley (1986) has developed a study called ‘Bird’s study”, stating that the majority of accidents are either near miss or property damage only accidents. He is strongly convinced that in order to derive the optimum results from any accident control programmes the organisations must concentrate on these two areas.

53Charles Perrow (1984) analyzes the social side of technological risk. He argues that the conventional engineering approach in providing warnings and safeguards fails because the complexity of the systems makes failures inevitable. He asserts that typical precautions, by adding to complexity, may help to create new categories of accidents.

54Geller, E. Scott says that Heinrich’s well-known Law of Safety implicates at-risk behavior as a root cause of most near hits and injuries (Heinrich et al., 1980). Over the past 20 years, various behavior-based research studies have verified this aspect of Heinrich’s Law by systematically evaluating the impact of interventions designed to lower employees’ at-risk behaviors. Feedback from behavioral observations was a common ingredient in most of the successful intervention processes. At-risk behaviors are presumed to be a major cause of a series of progressively more serious incidents, from a near hit to a fatality. According to Heinrich’s Law, there are numerous risky acts for every near hit and many more near hits than lost-time injuries. People usually know what at-risk behaviors to avoid and have the ability to do so, but their motivation might be lacking or misdirected.
Behavior change techniques are used to align individual and group motivation with avoiding the undesired at-risk behavior.

Matthews, Grainne A. explain that everybody who works to reduce accidents and improve safe performance is concerned with human behavior. “Behavior and accidents is what it’s all about,” is a commonly heard phrase. While behavioral safety shares a concern with human behavior and safe performance in the workplace with other approaches, it is more than that. Behavioral safety is the application of behavioral research on human performance to the problems of safety in the workplace. In workplaces with troublesome rates of unsafe performance, behavioral safety programs, properly implemented, produce significant improvements in safe performance and major reductions in workplace injuries and illnesses. Human suffering and financial costs are sharply reduced. Moreover, the costs of producing these gains in human performance are a good investment, paying for them many times over.

Jack Toellner designed a technical article to demonstrate in the simplest of terms that the efforts to improve safety by displacing unsafe behaviors with safe behaviors are supported by math fundamentals. Safety is a mathematical set of behaviors. It may be a set of individual behaviors, or a set of team behaviors, or a set of system behaviors. It may also fairly represent a combination of individual, team, and/or system behaviors. Many studies have demonstrated that accidents happen as a result of unsafe individual behaviors, and/or unsafe team behaviors, and/or unsafe system behaviors. Accidents usually happen as a result of some combination of unsafe individual, team, and system behaviors. When we promote safe behaviors and displace unsafe behaviors, we then mathematically statistically reduce the chance of an accident unfolding and/or the potential outcome of the event. "Getting to Zero" is
all about displacing unsafe behaviors with safe behaviors. The more safe behaviors we promote within our organizations and industry, along with displacing unsafe behaviors, then the greater our chance of success in hurting fewer people. Along with promoting safe behaviors we should focus on creating ways for the organization to spend more time on safety. Safety is a journey and the destination is "Nobody Gets Hurt".

Dr Rod Gutierrez, Principal Psychologist, DuPont Sustainable Solutions writes that Based on the operant conditioning principles developed by prominent psychologist B.F. Skinner, Behavioral Based Safety (BBS) works on the basis that behaviors that are encouraged through positive reinforcement (the application of a positive stimulus) or negative reinforcement (the removal of an aversive stimulus) that are more likely to occur again. On the other hand punishment (the application of an aversive stimulus) decreases the likelihood of a particular behavior occurring again. Thus, the main tenant of BBS is that reinforcement and punishment can be used through the provision of feedback and consequences to influence safety behavior at work. A combination of positive and negative reinforcement can simultaneously encourage safe-and discourage unsafe behaviors in the workplace. What is proposed goes beyond influencing behavior by external motivation, and takes the form of an in-depth training experience aimed at encouraging employees to choose to be safe; to acknowledge and assess their own safety (independence) and the safety of those around them (interdependence). Indeed, the presence of a safety culture is a meaningful predictor of safety performance behaviors, safety knowledge and safety motivation. A “safety climate” is more about the perception of safety in the workplace. The strategies through which a safety culture can be achieved include ensuring organisational commitment, management involvement, employee
empowerment, appropriate systems for reward and reporting. These mechanisms directly align with the principles of BBS in influencing the thoughts and beliefs of employees through contextual and social influence.

Grainne A. Matthews presents that Behavioral safety is the application of behavioral psychology to promote safe behavior in the workplace using employee involvement. Ongoing research in the United States and Europe shows that behavioral safety typically results in injury reductions of approximately 30 percent, with a range from 20 percent to 50 percent. A reduction in the severity of injuries is also seen. Behavioral safety has been extensively studied since the early 1970's and is one of the only safety approaches proven through empirical research to change safety practices and reduce injuries. Research and experience indicate that even the most safety-sophisticated of companies, such as those in the petrochemical industry in the US; continue to reap additional benefits from implementation of a behavioral process. Nevertheless, improving the systems that produce and maintain safe behavior continues to decrease the probability of injury. Behavioral safety creates employee ownership by working with a team of employees to plan and implement the process.

Terry E. McSween writes that most quality improvement efforts such as Statistical Process Control and Total Quality Management stress that organizational improvement efforts must include an objective assessment of the process, often using the acronym PDCA for plan, do, check, act. Most quality improvement efforts encourage us to monitor the process and to use the information we gather to further refine our efforts. Behavioral safety places a similar emphasis on the use of data. In fact, one of the defining features of behavioral safety is that decisions are based on data. Objective information is the basis for action. Another defining feature is the
involvement of employee teams in managing the process through regularly reviewing data in order to develop action plans for continuous improvement.

Grainne A. Matthews, Ph.D. and Terry E. McSween, Ph.D. explain that since two of the most important features of behavioral safety are employee observations and participation, clearly we should attend to these two dimensions of the process. Critical aspects of observations also include their quality, quantity, and accuracy. One of the reasons that the quality of the observations is so important is that they will guide action planned by Site Teams and the Steering Committee to address trends in safe and at-risk practices and other safety concerns. The challenge of behavioral safety is the maintenance of process integrity beyond the initial implementation. Attention to the level and quality of involvement will do much to ensure that your behavioral safety process will continue to generate improvements in accident and injury rates.

Grainne Matthews says that If you are interested in improving performance (whether it be safety or any other dimension of workplace performance such as quality, productivity, or leadership), you probably think of feedback as one of the essential components of any program you plan to implement. For example, in behavioral safety, observation and feedback is often said to be the heart and soul of the process. It's no wonder that most people insist upon the inclusion of a feedback component.

Terry E. McSween writes that implementing a successful behavioral safety process requires active support and involvement from employees, management and the safety department. Using a behavioral safety process, management and employees can form observation teams that honestly review and evaluate work habits and practices. The observers and the observed have an opportunity to discuss ‘the
Terry E. McSween states that research by Du Pont and others suggest that 80 to 90 percent of today's accidents are a result of unsafe acts rather than environmental conditions. Yet very few companies achieve consistently high levels of compliance with safety procedures. New research shows the effectiveness of a behavioral approach to safety that increases compliance and greatly reduces accidents.

Terry E. McSween and Grainne A. Matthews write that “Culture” is one of those words that we tend to overuse both in our discussions and in our literature on management and organization change. As a name for a consistent pattern of behavior or results, culture may be quite reasonable. In such usage, culture simply refers to the fact that certain events typically generate certain kinds of behavior on the part of people within the organization. And, worse still, if we accept that our behavior is caused by this abstract concept “culture”, we have effectively prevented ourselves from improving our behavior because we have no reliable, empirically validated method for changing culture. We can’t directly observe and measure culture; therefore we can’t easily change culture. If our definition of culture is to include not just what people do, but also why they do it, our discussion should clarify the factors that influence behavior. One 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. The informal processes include social norms and values that define the practices that are supported by the social environment. Behavioral safety is the
only approach that has routinely produced significant reductions in incidents in well-designed research studies.

Grainne A. Matthews in the article states that Behavioral safety is simply the use of scientific psychology to promote safety in the workplace, community, and home. At work, it typically involves creating a systematic, ongoing process that clearly defines a set of behaviors reducing people’s risk of injury. The process provides that information on frequency and consistency of these practices is collected and then ensures discussion and positive reinforcement to support those behaviors occurs. Employees usually conduct peer observations and coaching on safety practices within their own work areas. These observations are the basis for recognition, problem-solving, and continuous improvement.

The objectives of Industrial Psychology are productivity, morale and mental health. High morale is not always found with high productivity. High morale is not necessarily means good mental health. Psychology is not magic. It is an art that applies scientific principles which have been found useful in dealing with people. Behavior is caused by a stimulating situation which acts on a person to behave in sort of way and may lead to some accomplishment. Therefore to understand the behavior, one has to understand the stimulating situation as the person sees it. Only by a change in the stimulating situation, or by a change in the person, can one expect a change in the behavior or accomplishment. Everyone wants to be liked and everyone wants to be important. Frustrated behavior is behavior without a goal and frustrated behavior is harder to understand; but the rewards of understanding it are greater. Four types of frustrated behaviors are there. Viz. Aggression, Resignation, Regression and Fixation.

Man is a machine, a mechanism with a shadowy entity of a mind somehow attached to it. Therefore, after all, there are limits to what can be done with financial
incentives. The industrialists satisfies all possible physical needs and leaves the psychological ones viz. responsibility, pride of craft, self-respect, status, and a sense of social usefulness, still unsatisfied.

68 Industrial psychology has so much in common with the work of general psychology, the distinction between them lying in the fact that the former strictly limits its scope to the material and social environment to which the worker adapts himself while he is at work, and by which he is therefore modified.
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68


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