CHAPTER - I

INTRODUCTION

Organisations are becoming increasingly aware of the need to provide a workplace that is not only free of common injuries but one that also protects workers, facilities and the environment from the consequences of more serious incidents involving safety, security, environmental and other risks. The industrial revolution brought in new inventions of machines and techniques of production which changed the ways of man’s living and thinking throughout the world. The industrial revolution and the consequent industrialisation have brought in lot of hazards and risks to the industrial workers. The advancement in science and technology have paved way for more and more complex and hazardous industries which further increase the risk to the industrial workers. Every year millions of industrial accidents occur causing immense suffering to the accident victim, their family and enormous loss to the organization and ultimately to the nation.

Considering the human sufferings and economical loss due to accidents, it becomes imperative on the part of every one to prevent the accidents by removing or controlling the hazards in industries. Despite advances in accident prevention and providing safe and healthy environment to the industrial workers, safety at work still needs to find a complete solution. Accident prevention does not lie on devising safe machines alone but also on improving the knowledge, skill, attitude, behavior and morale of the industrial workers.

Current safety culture assessment techniques identify general organisational strengths and weaknesses, which are not usually directly linked to specific behaviors. This can limit the identification of specific behaviors which need to be adopted or promoted to enhance a positive safety culture. Furthermore, the specific behaviors
required to promote a positive safety culture are likely to vary over time and between organisations. It is therefore often necessary for an organisation to further analyse the results of their safety culture measurement processes in order to identify the specific behaviors required to promote or maintain a positive safety culture. Once these behaviors have been described, one way to promote them is via a behavioral safety programme. Safety culture consists of values, attitudes, perceptions, competencies and behavior of the people that make up the organization.

The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies and patterns of behavior that determine the commitment to, and the style and proficiency of an organization’s health and safety management. Safety culture consists of values, attitudes, perceptions, competencies and behavior of the people that make up the organisation. In an organisation with a positive safety culture there are high levels of trust; people agree that safety is important and that safety management systems are effective. The identification of a poor safety culture as a factor contributing to the accident led to a large number of studies investigating and attempting to measure safety culture in a variety of different high-risk, high-hazard industries. Therefore a research study on safety management to identify the need for implementation of Behavior Based Safety to enhance total safety culture at Visakhapatnam steel plant is attempted.

**Concept of Behavior Based Safety Management:**

Behavior Based Safety (BBS) is defined as the process that identifies & corrects the “At-Risk Behaviors” and positively reinforces “Safe Behaviors” in individuals.
Behavior is variously defined as:

- How a person conducts himself;
- The demeanor and manners of an individual;
- An observable action of a person.

Behavior refers to the actions of a system or organism, usually in relation to its environment, which includes the other systems or organisms around as well as the physical environment. It is the response of the system or organisms to various stimuli or inputs, whether internal or external, conscious or subconscious, overt or covert and voluntary or involuntary.

Human behavior is the population of the behaviors exhibited by humans and influenced by culture, attitudes, emotions, values, ethics, authority, rapport, hypnosis, persuasions, coercion and or genetics.

The behavior of people (and other organisms or even mechanisms) falls within a range with some behavior being common, some unusual, some acceptable, and some outside acceptable limits. In sociology, behavior is considered as having social behavior, which is more advanced action, as social behavior is behavior specifically directed at other people. The acceptability of behavior is evaluated relative to social norms and regulated by various means of social control.

**Controlling of unsafe behavior:**

Unsafe behaviors of human beings can be controlled by the following approaches

1. Elimination of hazards by engineering controls
2. Changing of people attitudes
3. Punishment to people
4. Praising people
5. Implementation of Behavior based safety system
Behavior Based Safety is the "application of science of behavior change to real world problems". Behavior Based Safety "focuses on what people do, analyzes why they do it, and then applies a research-supported intervention strategy to improve what people do". At its very core Behavior Based Safety is based on a larger scientific field called Organizational Behavior Analysis. To be successful a Behavior Based Safety program must include all employees, from the CEO to the floor associates. To achieve changes in behavior, a change in policy, procedures and/or systems most assuredly will also need some change. Those changes cannot be done without buy-in and support from all involved in making those decisions. Behavior Based Safety is not based on assumptions, personal feeling, and/or common knowledge. Focusing on workgroups, in static settings was demonstrated to be the most efficient at behavior change and injury reduction.

A good Behavior Based Safety program will consist of:

- Common goals
- Definition of what is expected – Specifications of target behaviors
- Observational data collection
- Feedback to associates being observed
- Review

The phrase "Behavior Based Safety" was coined by Dr. E. Scott Geller of Safety Performance Solutions (SPS) in 1979. Dr. Geller and his colleagues continue to implement Behavior Based Safety around the world. Over time, Behavior Based Safety became the catch phrase of the safety systems industry. Traditionally BBS has been used in industrial settings. A new generation has found success using BBS in office/lab settings as well.
To any organization Behavior-Based safety management provides a convenient means to understand the required safety performance, rate their safety culture, psychological aspects of safety, individual differences, behavior as function of self and situation, perception of danger and acceptance of risks, knowledge and responsibility namely, the safety performance.

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.

The concept of the BBSM will not proceed in a uni-dimensional mode. The psychological aspects of organizational safety are varied and its functional at many levels of complexity requires a very refined approach to its manipulation. Traditional safety has been thought to be especially applicable to the reduction of injuries; its approaches were thought to be relevant primarily in convicting people to follow common sense hazard avoidance rules and to correct patent causes of injury.

**Evolution of Behavioral Based Safety Management:**

Behavioral science traces its inception to a merging of different fields of science a medical doctor who held a university chair in Philosophy in 1876. The Human factors as a concept and professional practice emerged from the work of experimental psychologists during World War II. New and advanced military equipments could not be effectively managed by their operators and hence solutions were sought through a border understanding.
The History of Behavioral Based Safety Management can be summarized from
the past to the present as follows:

1960’s – 1st formal study on Behavior Change. Fortune 500 companies 
begin use of behavioral principles with Quality and Productivity.

1970’s – Robust academic studies = Fledgling BBS movement

1980’s – US Academe & Commercialization = BBS providers

1990’s – BBS spreads to entire English speaking world

2000 Plus – BBS spreads to become worldwide phenomena

It is difficult to pinpoint precisely the beginning of the field of behavior-based
safety as it is known today. However, there was a flurry of work starting in the early
1970s. Fox, et. al., worked on open pit mining in Utah starting in 1972 where they
showed that with the use of a token economy, improvement in safety results were
maintained for over 12 years. Komaki, et.al, showed the positive effects of feedback
and reinforcement on the safety of bakery workers. Dr. Beth Sulzer-Azaroff, a true
pioneer in the field of behavior-based safety, published the first of many articles on
behavior-based safety in the Journal of Organizational Behavior Management in
1978. The article was titled, “Behavioral ecology and accident prevention.” Her
chapter, “Behavioral Approaches to Occupational Health and Safety,” in Handbook of
Organizational Behavior Management by Fredericksen, remains to this day one of the
best explanations of behavior-based safety.

This is by no means an exhaustive history of the early work in the field of
behavior-based safety. Many others have contributed substantially to the evolution of
the practice. McSween (1995), a behavior analyst, who authored The Values-Based
Safety Process: Improving Your Safety Culture with a Behavioral Approach, and
Geller, who wrote Working Safe have had a significant impact on the field in the past two decades.

There is some argument as to the origination of the term “Behavior-Based Safety.” Some say Geller but many others say it was Dan Petersen. The evidence seems to favor Petersen who wrote 17 safety books before his death in 2007, and was probably the best known safety professional in the United States. In 1978 he wrote, Safety Management: A Human Approach and referred to the research and writings of B.F. Skinner, the father of behavior analysis.

Since its inception and application in the mid-1970s, behavioral safety has undergone a series of evolutionary changes. The first approach, popular in the early 1970s to mid-1980s, was largely a supervisory, top-down-driven process. Based on operant theory (Skinner, 1953), supervisors observed worker behavior, gave feedback and provided some form of positive or negative reinforcement. Behavior change did not last once reinforces were removed. Simple and cheap to implement, this approach attracted legitimate criticism (Howe, 1998) that has since been hard to dispel. Perhaps as a reaction to those criticisms, employee-led processes emerged during the early-1980s.

In these interventions, which are still common, employees develop the overall process, conduct peer to-peer or workgroup-based observations and provide feedback. However, the downside was (and is) the exclusion of management, leading to the common perception that behavioral safety processes focus solely on employee behavior (Hopkins, 2006). This led, in the 1990s, to the cultural approach based on the concept of a managerial and employee partnership. Employees monitor the behavior of all members of a workgroup or work area, and managers regularly monitor their own safety-related leadership behaviors (e.g., whether they reviewed and closed out
corrective actions). Everyone involved receives regular feedback, with some also receiving tangible reinforcers or incentives (Chandler & Huntebrinker, 2003). Surveys of behavioral safety users show that all three approaches are widely used around the world (Cooper, 2008).

1Behavior-based safety is a topic that has been around for a long time. BBS originated with the work of Herbert William Heinrich. In the 1930s, Heinrich, who worked for Traveler's Insurance Company, reviewed thousands of accident reports completed by supervisors and from these drew the conclusion that most accidents, illnesses and injuries in the workplace are directly attributable to "man-failures", or the unsafe actions of workers. Of the reports Heinrich reviewed, 73 percent classified the accidents as "man-failures"; Heinrich himself reclassified another 15 percent into that category, arriving at the still-cited finding that 88 percent of all accidents, injuries and illnesses are caused by worker errors. Heinrich's data does not tell why the person did what they did to cause the accident just that accident occurred. BBS programs delve into the acts that cause the accident. It delves into the workplace; environment, equipment, procedures and attitudes.

Basic Organizational Behavior Analysis is what is used to identify the actions that put the associate in the risk position. Organizational Behavior Analysis has been done for 100 years. Directing the applied research to an organizational application specifically to safety has been going on for around 20 years.

Heinrich published work describing the results that he derived by evaluating the accidents from an extensive data base compiled by the insurance industry. He came to the conclusion that roughly 90 percent of all incidents are caused by human error. This conclusion became the foundation of what BBS has come to be today. BBS addresses the fact that there are additional reasons for injuries in the workplace: environment,
equipment, procedures and attitudes. Behavioral Science Technology (BST), pioneers in applying BBS processes, expanded on this work and identified the "working interface", the point where exposure to injury occurs.

The main principles of behavior based safety can be traced back to early behavioral theory starting with controlled laboratory experiments on animals. It is associated with Pavlov in Russia (classical conditioning) and Thorndike, Watson and Skinner in USA (operant conditioning). It makes use of stimuli – response models and principles of operant conditioning and reinforcement. Behavior based safety has also much in common with safety management perspectives which often make use of goal theory (Krause, Seymour & Sloat, 1999; Depasquale & Geller, 1999; Geller, 2001; Johnson, 2003; Cox, Jones & Rycraft, 2004; Seo, 2005). A distinction is often made between behavior modification and applied behavior analysis, reserving the last term for applications in natural settings, such as work places (DeJoy, 2005).

The history and description shows that behavioral-safety is continuously evolving as problem areas are identified and researched until solutions are found that maintain its integrity as a proactive data-driven safety improvement process aligned with modern management theory and practice. Based on scientific evidence and numerous case studies such evolution should be applauded, not denigrated as mere re-packaging on a massive scale. Evidence suggests that more lives are saved and the scale of injuries reduced each time behavioral-safety evolves. We take it for granted that other products (e.g. cars, televisions) evolve over time. We do not recommend that later models of these products are abandoned simply because earlier models were not as effective as they could have been.

Moves towards ‘cultural’ models of behavioral-safety should be welcomed by everyone as they tend to achieve the actual results everyone wants: management and
workers partnering to enhance and improve the whole safety management system to everyone’s benefit.

To facilitate understanding, there are three models of Behavioral Based Safety in circulation:

1. Pure behaviorist models that were primarily implemented in the early 1970's - 1980's. This approach largely adopts a supervisory, 'top-down' approach. Supervisors are trained in the method, which they then apply to ‘hourly’ employees. Often, the sole focus is on giving consequences (reinforces) such as praise for desired safety performance. Once the reinforces are removed, behavior change does not last. Simple to implement, with minimal training, this is the model that raises legitimate concerns and criticisms from Trades Unions and others.

2. The ‘employee-led’ behaviorist-cognitive model, developed during 1982 – 1997, draws distinctions between cognitive conditions (e.g. Training, Instructions, Goals) to direct people to behave safely and the use of consequences (e.g. Feedback, Praise, Awards, Punishment) to maintain desired behaviors. Although behavioral safety was being done with people, not at people, the downside was the lack of managerial involvement which impacted on behavioral safety in many ways, not least being open-hostility from some managers. This manifest itself as a lack of commitment to help the process succeed which led to many failures (and still does).

3. The absence of managerial involvement and the recognition of management system faults (e.g. a lack of training or equipment) led to the ‘Cultural’ model (1993 – present) that focuses on the reciprocal interactions between ‘Behavior-Cognition-Situations (e.g. Safety Management Systems) based on the work of
American psychologist Albert Bandura. Cultural models explicitly recognize that management systems, management decision-making, plant and equipment, etc., all affect and influence how safely someone behaves. Thus, modern behavioral-safety systems explicitly link the process to the organizations overall safety management system and is based on a management-employee partnership. Used successfully for over 10 years to significantly reduce accident / incident rates it is now being adopted in many regions around the globe.

**Importance of Behavioral Based Safety Management:**

Behavioral issues are important, because behavior turns systems and procedures into reality. It is not enough for an organisation to have good systems, because performance is determined by how organisations actually ‘live’ or ‘act out’ their systems. Behavioral interventions can yield both safety and other business benefits if they are implemented properly. Traditional safety has been thought to be especially applicable to the reduction of injuries; its approaches were thought to be relevant primarily in convicting people to follow common sense hazard avoidance rules and to correct patent causes of injury. Behavior Based Safety Management (BBSM) is an evolving and dynamic field that challenges the ability of even the most seasoned professional to policies, procedure, compliance requirements, and best safety practices.

The safety of the workplace is influenced by a number of factors such as the organizational environment, management attitude and commitment, the nature of the job or task, and the personal attributes of the individual. Safety related behavior at the workplace can be modified by addressing these major influences. The successful introduction of a behavioral safety process, focusing on identifying and reinforcing
safe behavior and reducing unsafe behavior, is one means of improving safety performance.

Behavioral programmes have become popular in the safety domain, as there is evidence that a considerable proportion of accidents are caused by unsafe behavior. Whilst a focus on changing unsafe behavior into safe behavior is appropriate, this should not deflect attention from also analyzing why people behave unsafely. To focus solely on changing individual behavior without considering necessary changes to how people are organized, managed, motivated, rewarded and their physical work environment, tools and equipment can result in treating the symptom only, without addressing the root causes of unsafe behavior. Behavioral based safety programmes are probably at their best in an organization which already has a good basic safety management system.

There is strong research evidence that behavior modification techniques can be effective in promoting critical health and safety behaviors, provided they are implemented effectively with continued support from management. The behavior modification programmes currently in use mostly focus on promoting safe behavior among frontline staff. Behavioral safety techniques improve health and safety risk control by promoting behaviors critical to health and safety. Behavioral safety techniques are based on a large body of psychological research into the factors that influence behavior.

Health and safety behavior observation and feedback programmes promote desired behaviors by introducing positive reinforcement for behaving safely. The positive reinforcement is provided through positive feedback. This approach focuses on the measurable behaviors critical to safety and recognizes workers as mature human beings with a genuine interest in their own well being and thereby can
influence their own safety. Measuring “at risk behaviors” is a proactive safety performance measure as distinct from the reactive traditional measurement of accident rate.

Human behavior has a direct influence on safety in many aspects of life – at work, in the home and on the road. Evidence drawn from past disasters, such as the incidents at Flixborough, Kegworth and Moorgate, and the Piper Alpha incident, indicate that a failure in human behavior was a significant contributory factor.

BBS brings together parts of behavioral science with industrial safety to create a “new” process to promote safety as an organizational value. In 1951, Heinrich reported that about 90 percent of all accidents were caused by “unsafe behavior” by workers. Subsequent studies by DuPont (1956) confirmed Heinrich’s contention.

Traditional engineering and management approaches to counter this, such as automation, procedure compliance, administrative controls and OSHA type standards and rules were successful in reducing the number of accidents significantly. There was however, a persistence of incidents and accidents that kept rates at a level that was still disturbing to customers, managers, and workers. Developed in the late 1970s, Behavior-Based Safety has had an impressive record. Research has shown that as safe behaviors increase, safety incidents decrease. Measurement of percent safe acts is a leading safety indicator. In contrast most safety measures are lagging measures. They are recorded after the incident.

The Construction Owners Association of Alberta (COAA) Safety Committee recognizes that behaviors are a key component of the safety equation and that Behavior Based Safety programs have been shown to increase awareness of safety expectations, to contribute towards continuous improvement in safety performance and to lead to achieving the desired safety goals and targets.
Modern safety theories firmly place the responsibility for creating a good safety climate upon line managers. A positive safety climate is not something that can be taken for granted, it has to be managed. It is for this reason that managers must strive to extend their safety knowledge and skills in order to achieve high levels of safety in their area of responsibility. BBS is primarily a management and supervisory tool and when embraced by an organization, with a structured regime, it provides a systematic approach to establishing a strong and robust safety culture within the workplace. BBS will need to be pro-actively managed to ensure it is introduced and maintained and provides managers and supervisors with the process and skills to help them fulfill this expectation.

Herbert W. Heinrich, an early pioneer of accident prevention and industrial safety discovered that 88 percent of industrial accidents were originated from human factors. (Goetsch, 2005) and in the recent years, safety experts estimated that human factors contributed to 80 – 90 percent of all industrial accidents (Fleming & Lardner, 1999). Analysis of incidents shows that +/- 90 percent of them has the behavior of the person(s) involved as a key contributing factor. Of the 10 percent remaining, +/- 90 percent of them have the behavior of a person, not directly involved in the incident, as a contributing factor. Increasing the number of safe behaviors being performed is essential for incident elimination. Behavior Based Safety helps with this. It is not a silver bullet or "THE" solution however; it is a process that goes along with the other elements of a good incident reduction program.

The reduction percent of incident by various safety intervention strategies studied by National Safety Council is given in table (1.1).
Table 1.1 Safety Intervention Strategies by National Safety Council

<table>
<thead>
<tr>
<th>Approach</th>
<th>#of Studies</th>
<th>#of Subjects</th>
<th>Reduction percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior Based</td>
<td>7</td>
<td>2,444</td>
<td>59.6</td>
</tr>
<tr>
<td>Ergonomics</td>
<td>3</td>
<td>n/a</td>
<td>51.6</td>
</tr>
<tr>
<td>Engineering Change</td>
<td>4</td>
<td>n/a</td>
<td>29.0</td>
</tr>
<tr>
<td>Problem Solving</td>
<td>1</td>
<td>76</td>
<td>20.0</td>
</tr>
<tr>
<td>Government Action</td>
<td>2</td>
<td>2</td>
<td>18.3</td>
</tr>
<tr>
<td>Management Audits</td>
<td>4</td>
<td>n/a</td>
<td>17.0</td>
</tr>
<tr>
<td>Stress Management</td>
<td>2</td>
<td>1,300</td>
<td>15.0</td>
</tr>
<tr>
<td>Poster Campaign</td>
<td>2</td>
<td>6,100</td>
<td>14.0</td>
</tr>
<tr>
<td>Personnel Selection</td>
<td>26</td>
<td>19,177</td>
<td>3.7</td>
</tr>
<tr>
<td>Near-miss Reports</td>
<td>2</td>
<td>n/a</td>
<td>0</td>
</tr>
</tbody>
</table>

The average reduction of Injury Frequency on implementation of BBS is as follows:

- After 1 year  34 percent
- After 2 years  44 percent
- After 3 years  61 percent
- After 4 years  71 percent

For BBS to be fully effective in an organization, the organization needs to be committed to, and fully implementing, the incident control measures listed above. In this way workers should see BBS as an addition to an already strong safety program, not a replacement for it. If workers see BBS as a way of “dumping” the responsibility
for injury elimination onto their behaviors BBS will not be effective. The idea behind BBS is to fix the behavior problem, not assign blame. Companies should not rely on BBS to do it all for them - it probably won’t work.

Imagine an incident could occur every time a worker performs a risk behavior. With a 75 percent safe behavior level there is still a 1 in 4 chance of an incident. Even at 90 percent safe behavior level, there is a 1 in 10 chance of an incident we cannot rely on chance or luck to avoid incidents. That would be like spinning a roulette wheel. Only at 100 percent safe behavior levels down and eliminates the chance of an incident. Incident is defined as any event ranging from a near miss, through first aids right to a fatality.

There are multiple reasons that human error occurs, these include:

- Communication failure
- Lack of effective training
- Memory lapse
- Inattention
- Poorly designed equipment
- Exhaustion, fatigue
- Ignorance
- Noisy working conditions
- Other personal and environmental factors

Some advantages of Behavior Based Safety are:

- Lower Internal Resource Requirements
- Lower Cost
- Shorter Start-up
- Better Results in Shorter Time
• Broader Distribution of Information
• Less Disruption to Operations
• Less Resistance from Workers and Unions

**Basic system of belief of Human Error:**

• Everyone commits errors
• Human error is generally the result of circumstances beyond the control of those committing the errors
• Systems or processes that depend on perfect human performance are inherently flawed

Current safety culture assessment techniques identify general organisational strengths and weaknesses, which are not usually directly linked to specific behaviors. This can limit the identification of specific behaviors which need to be adopted or promoted to enhance a positive safety culture. Furthermore, the specific behaviors required to promote a positive safety culture are likely to vary over time and between organisations. It is therefore often necessary for an organisation to further analyse the results of their safety culture measurement processes in order to identify the specific behaviors required to promote or maintain a positive safety culture. BBS is based upon techniques that have been proved in many different industries to have dramatic effect upon the safety related behaviors at all levels within the organization.

Many organizations experienced problems in managing health and safety at work, as the “people” element tends to engage in safe or unsafe behaviors according to their interpretation. Behavioral Based Safety implementation has provided breakthrough levels of improvement in the following areas:

• Reductions in serious injuries
• Reductions in accidental releases of hazardous materials
• Reductions in regulatory agency violations
• Reductions in property damage incidents
• Improved Security preparedness
• Increases in critical tests and inspections conducted on schedule

**Objectives of Behavior Based Safety Management:**

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. Behavioral safety shares a concern with human behavior and safe performance in the workplace. Behavior analysis is the science of behavior change. Behavior analysis is the application of the science of behavior change to real world problems, such as safety performance. As we do this, we are looking for functional or systematic relationships between:

- Environmental changes, i.e., the stimuli or cues that lead to behavior
- The behavior itself, such as specific areas of work performance
- And the consequences of behavior, i.e., the positive or negative responses that occur immediately after a person performs a particular work task.

A major focus over the past 150 years has been on developing the technical aspects of engineering systems to improve safety, and these efforts have been very successful. This success is demonstrated by the low accident rates in the majority of safety-critical industries, however many believe that a plateau has now been reached. The effectiveness of engineering and procedural solutions has highlighted the key role of human behavior in the causation of the residual accidents.

The situation all companies should be striving for is to have work groups performing at 100 percent safe behavior levels. This would give the best chance of eliminating incidents. BBS will get a company beyond workplace audits and
inspections, past the policing role and closer to really knowing how much your workforce understands their work practices, procedures, conditions and behaviors that cause people to make mistakes.

Developing safety culture in an organization requires manager’s special attention to two aspects such as:

- Environmental factors like equipments, tools, machines, systems, workplace etc.
- People factors like abilities, job, skills, attitudes, and behavior etc.

These factors have influence on safety culture in organization. The traditional have given results in improving safety standards in which there is no need to find and apply newer methods to reach the target of zero accidents. This need to improve further with some new ways of managing safety has promoted safety professionals to develop Behavior Based Safety approach which includes,

a) To define safe behaviors & prepare check list.

b) To observe behavior & give feedback.

c) To decide behavioral action plans and to implement.

Wanting people to value safety or to work safely for the right reasons is an intensely practical goal. To be effective in the long term, our safety efforts must produce an organization where people will work safely when there is no threat of punishment from other people. All management really cares about is the numbers,” the reference being to budget figures, production records, efficiency targets, or safety statistics.

In such numbers-oriented companies, when the results are not achieved, the tendency is to find someone to blame. The resulting fear and distrust often make improvement efforts difficult. Employees resist efforts to establish effective
performance measures because they are skeptical about how managers will use those measures. Employees feel frustrated and believe that the organization does not care about them. In fact, results-oriented organizations seldom systematically address how managers and employees should treat one another. The result is that the quality of personal relationships can become a further barrier to any significant culture change.

Creating a culture that has safety as one of its core values is not easy. It is a complex task that requires a long-term commitment. A behavioral safety process is a state-of-the-art process that provides a solid foundation for the employee involvement and continuous improvement that are critical to success. 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 behaviors of people are fundamental to safety in the workplace. Without control, safety related behaviors in an organization could be good or bad. Poor safety behavior is sometimes termed working at-risk or unsafe acts when applied to those performing hazardous operations. Equally, poor safety supervision or poor managerial control of safety could be termed unsafe acts in their own right.

It is generally accepted that 98 percent of all accidents are due to the unsafe acts of people. BBS can assist in developing and maintaining good safety performance by a hazard spotting section where a number of key safety behaviors are highlighted in an interactive fashion.

Analysis of industrial accidents reveals that 80 to 90 percent of them are caused by the Unsafe Acts of the individuals whereas unsafe conditions contributed for the rest. The safety initiatives undertaken by the industries mostly revolve round the
elimination of unsafe conditions through introduction of safety systems like Inspections for Identification of Hazards, SOPs, Work Permits, Audits, Training programmes etc. All these efforts could help the industries in identifying the unsafe conditions and its related accidents.

The challenge before the industries now is how to prevent the recurring unsafe behaviors that are contributing to accidents? The factors and the environment that influence and compel the individuals to do unsafe acts is the area we should deal with now. To equip the industries to face this challenge is the main objective of Behavioral Based Safety Management has been emerged.

**BBS will help in changing from a culture that:**

- Condones unsafe practices
- Reacts to accidents and concentrates on statistics
- Treats safety as an extra or add on part of the business
- Sees safety as "someone else's responsibility"

**To a culture that:**

- Observes, identifies and eradicates unsafe acts
- Is proactive in safety and concerned about people
- Integrates safety into the greater business culture
- Accepts that safety is a personal responsibility for everyone within the organization

**Need for the Study:**

The review of literature on Behavioral Based Safety in various organizations shows that different authors and researchers examined the concept from different dimensions. Behavioral research on learning teaches us powerful lessons about how to teach and build performance improvement on safety. Many companies have spent a
lot of time and effort improving safety, usually by addressing hardware issues and installing safety management systems that include regular line management safety audits.

Over a number of years these efforts tend to produce dramatic reductions in accident rates. Often, however, a plateau of minor accidents remains that appears to be stubbornly resistant to all efforts to remove them. Although many of these are attributed to peoples' carelessness or poor safety attitudes, most of these are triggered by deeply ingrained unsafe behaviors. Behavioral Based Safety addresses these by making use of proven management techniques which almost always results in a positive step change in safety performance and safety attitudes.

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. The steel industry is unique in the sense that it is capital intensive as well as labor intensive process with technology mix available in the industry. Steel making being a complex process, the people operating and maintaining the process have to be motivated.

The review of literature reveals that there is no enough research evidence from India about a comprehensive study in the area of Behavioral Based Safety has been taken up in the specific sense of a multi-unit integrated steel plant in the public sector in India. So far no study has been taken up on accident prevention and safety measures with a special reference to Behavioral Based Safety in Visakhapatnam Steel Plant. The review of earlier studies also indicates a perceptible research gap in this area.
In view of the above, a modest attempt is made to study the safety management to identify the need for implementation of Behavior Based Safety to enhance the total safety culture at M/s. Visakhapatnam Steel Plant, RINL, Visakhapatnam. The study broadly envisages an evaluation of the safety measures in Visakhapatnam Steel Plant and will also help significantly in formulating policies towards improving the accident prevention and safety measures in the company which in turn leading to the target of “Zero Accident” and increased productivity. Hence it is hoped that this study will fill in that gap and provide the much-needed organizational relevance to academic research.

**Objectives of the Study:**

As the safety culture plays a vital role in any organization, the study on the prevailing safety culture and the link between Behavioral system and health and safety performance is the main focus of the study. This also focuses on the main dimensions used to assess safety culture, and the relationship between safety culture and Behavioral safety. Such studies and assessments help an organization to improve its safety performance so as to enable the organisation to better its safety goals. Hence this present study is undertaken to carry out the safety culture survey of Executives and Non-Executives in Visakhapatnam Steel Plant, Visakhapatnam.

**The Main objectives of the present study are:**

1. To study and understand the Behavioral Based Safety Management and its relevance to the industries in India.
2. To study the international perspective on Behavioral Based Safety Management.
3. To study the profile of steel industry in global, domestic and Visakhapatnam Steel Plant in particular.
4. To study the Safety Management Practices, the causes of various accidents and assess the Safety Culture prevailing in Visakhapatnam Steel Plant.

5. To analyse the perceptions of the respondents from the various levels of employees in Visakhapatnam Steel Plant in order to understand the existing safety management practices.

6. To suggest strategies and action programmes for further enhancement of the Safety Culture by implementation of Behavioral Based Safety Management at Visakhapatnam Steel Plant.
Methodology:

The process of gathering reliable and meaningful information is the cardinal aspect of the enquiry that forms a central link in the operational plan for the entire research design and is vital to draw valid conclusions. The present study is based on both primary and secondary data. The study entailed a good deal of preparation and planning in order to secure the necessary updated data and information. Keeping the objectives of the study in mind, the following methodology has been adopted for conducting the present study. Critical study of the various Safety Management System elements of Visakhapatnam Steel Plant was made by personal discussions, perusal of records and plants inspection by walk-through survey to arrive at technically feasible conclusions. The observations were prominently taken for assigning weightages to various components of a comprehensive safety management system. Information was collected from various sources that include records, certificates and relevant documents. The data was verified at site for their implementation. In order to get further clarifications, discussions were held with all the concerned representatives of the Safety department, Safety Committee members of the various departments and other departments’ Managers and workers.

The following methodology has been adopted to do this work:

- Studying the existing Safety Management System by physical observation and collecting of data by actual visit to the plant facilities.
- Study of important documents / records.
- Gathering of information about Safety Management System and various related issues from the books and journals.
- Gathering of information about all the elements of safety management system and various related information from the internet.
This study mainly involves a review of literature discussing the roots of various theoretical safety cultural perspectives, differences and similarities, and potential consequences for the understanding of safety and safety interventions. Both primary and secondary sources of data have been used for this study.

**Primary Data:**

The content of the primary data is gathered from the employees through a structured Questionnaire aimed at various aspects as a part of the study. Qualitative data were gathered from informants focusing on the following six main dimensions measured in the questionnaire study:

1. Safety Commitment
2. Safety Compliance
3. Safety Awareness / Communication
4. Safety Behavior
5. Stress Recognition
6. Teamwork

A well structured questionnaire was used for collecting data from target respondents, processing and analyzing the data and arriving at conclusions. The respondents forming an integral part of the source of primary data are the Executives from Junior Manager (E0 Grade) to General Managers (E8 Grade) and the Non-Executives at various levels who are working in the different departments of Visakhapatnam Steel Plant, Visakhapatnam.

The researcher administered the questionnaire to the respondents figured in the sample, based on the prior appointments he consulted directly and distributed the questionnaire for the executive cadres whereas for the non-executive cadres he was present when each respondent was answering the questionnaire and saw that the
respondents answered on their own and did not consult any one. The respondents were apprised of the purpose of the study and they were given time to answer the questionnaire.

**Secondary Data:**

The content of the secondary data required for the study is obtained from various earlier studies in the relevant field, journals, magazines, text books, various Safety Reports from the intranet portal of SED, accident statistics and investigation reports, safety audit reports, safety inspection reports, annual reports, Steel Industry (JCSSI) report records, and personal manual of Visakhapatnam Steel Plant.

**Sampling:**

The universe for the present study is a Public Sector Undertaking (PSU) located at Visakhapatnam. It is largely manpower intensified and holds 14,703 permanent employees in this unit. There are different cadres in the organization like below supervisory level, front line managers, middle management and higher management etc.

The sample size is calculated after conducting the pilot study using the results obtained from the pilot study and by using the below formula we have selected the sample size as 382.

\[
n = \left( \frac{p(1-p)}{z^2 \frac{A^2}{N}} \right)
\]
As we know the total population is \( N=14703 \), based on the pilot study we have estimated the variance in the population as \( P=50\text{percent}=0.5 \), and precision desired is assumed to be \( A=5\text{percent}=0.05 \), and the confidence level assumed is at 95\text{percent}, then the table value of normal \( Z=1.96 \) and the response rate is found to be \( R=0.95 \) considering the pilot study.

**Selection of sample:**

The study has taken into consideration Executives and Non-Executives employees working in Visakhapatnam Steel Plant. All the major production departments are selected for the study. Out of total 14703 permanent employees a sample of 164 executive employees and 218 Non-Executive employees are selected for the survey. All the population of Visakhapatnam Steel Plant divided into different stratus based on the activities of production and from each stratum the respondents have been chosen on stratified sampling basis. For below supervisory level and supervisory level the researcher used systematic random sampling method to collect primary data through questionnaire whereas for the middle management and Head of the departments the researcher used simple random sampling technique. Thus total samples of 382 respondents are surveyed.

**Hypothesis:**

The following hypotheses are formulated for testing the relationship between the variables.
1. Cadre has no significant impact on all the dimensions related to Safe / unsafe behavior.

2. There is no significant relation between the dependant variables’ dimensions and the independent variable number of dependants.

3. Educational qualification has significant collision with all the dimensions.

4. There is no significant relation among the independent variable age with each and every other dimension.

5. There is no significant change in the opinion of the respondents on all the dimensions related to safe / unsafe behavior with their respective salary.

6. The opinion of the respondents has no effect on the variables with respect to income.

7. There is no significant average difference in the opinion of the respondents belongs to different positions with regard to all the dimensions related to safe / unsafe behavior.

8. Nature of job does not play a vital role on all the dimensions related to safe / unsafe behavior.

**Scoring and Measurement of variables:**

The different items in the Schedule indicate different scale factors, i.e., variables. The different items relating to both the dependent variable and the intervening variables are provided on Likert pattern of 5-point scale. The five response categories together with the numerical values assigned to them for computation are: Strongly Agree (2) Agree (1) Neutral (0) Disagree (-1) Strongly Disagree (-2).
The values on each of the items together with the values of the items measuring each variable for each respondent are added and the same is taken as the raw score of that particular respondent on that specific variable.

**Reliability of the Questionnaire:**

**Cronbach's alpha:**

Cronbach's alpha is a measure of internal consistency that is, how closely related a set of items as a group. Cronbach's alpha can be written as a function of the number of test items and the average inter-correlation among the items. For conceptual purposes, the formula for the standardized Cronbach's alpha is given below.

\[
\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}}
\]

Here \(N\) is equal to the number of items, \(\bar{c}\) is the average inter-item covariance among the items and \(\bar{v}\) equals the average variance.

The researcher has administered the alpha scale method of reliability analysis for each and every dimension. Table (1.2) shows how the statements are related to one another for each and every dimension.

**Table 1.2 statements relation on every dimension**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Dimensions</th>
<th>Alpha</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Safety Commitment</td>
<td>0.768</td>
<td>7</td>
</tr>
<tr>
<td>2.</td>
<td>Safety Compliance</td>
<td>0.818</td>
<td>8</td>
</tr>
<tr>
<td>3.</td>
<td>Safety Awareness / Communication</td>
<td>0.869</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Safety Behavior</td>
<td>0.754</td>
<td>6</td>
</tr>
<tr>
<td>5.</td>
<td>Stress Recognition</td>
<td>0.720</td>
<td>9</td>
</tr>
<tr>
<td>6.</td>
<td>Teamwork</td>
<td>0.899</td>
<td>8</td>
</tr>
<tr>
<td>7.</td>
<td>Overall</td>
<td>0.953</td>
<td>48</td>
</tr>
</tbody>
</table>
For the present study, the alpha coefficient for the 48 items is 0.953, suggesting that the items have relatively high internal consistency.

**Statistical Tools:**

The data were fed to the computer. The tabulations and the results for analysis were done with the help of SPSS (Statistical Package for Social Sciences) version 14, MINITAB version-14 and Microsoft Excel for Statistical measurements such as simple percentages, mean values and cross tabulations etc.

In relation to all the dimensions of safety culture at RINL, Visakhapatnam, the researcher has applied Z-test by cadre wise and ANOVA TEST to ascertain the difference in the average opinion score of the respondents by position wise and type of job. Further, the researcher has used Correlation analysis by assuming the dimensions as dependent variables and the independent variables are taken as number of dependents for the respondents, educational qualification of the respondents, age, salary and experience of the respondents to check the whether there is any relationship among them also the researcher checked whether there is any relationship within all the dimensions of safety culture taken up for the study and conducted Factor analysis to check whether all the dimensions combined together get a single factor i.e., safety culture.

Further, these tests incorporate box plots, Individual value plots scree plot were as well. Bar diagrams, multiple bar diagram and error bar diagrams also incorporated in the study which gives a clear picture in all the aspects.

**Box Plot:**

The box plot explains the variation of the opinion score and also shows the average value, median value, highest value, lowest value, 25th percentile, 75th percentile as well as the outliers of the data as shown below:
Individual Value Plot:

By using an individual value plot to assess and compare individual data points, this graph plots each data point for each group, making it easy to spot outliers and see distribution shape. Display options include symbols for the mean and the median.

Limitations of the Study:

Given the certain objectives of the study, there are perhaps no major limitations in this study. However, as a piece of academic research, the following limitations of the study are required to be noted so that the conclusions of the study are understood in their proper perspective.

The limitations of the study are as follows:

1. While the questionnaire survey administered over such a large respondent sample has been a major strength, it is evident that, on occasions, social desirability effect has contaminated the responses and employees have tended to give rather generalized views on the various items.
2. Another limitation of this study is that the personal bias of respondents may be involved in their opinion of expressions.

3. During the collection of information, it was found that some of the respondent officials were hesitant in providing the desired information and the non response rate is at around 2 percent.

4. The generalizations of the study cannot be expected to have universal application. Even when one tries to apply to organizations of similar nature, these must be applied with caution. This study being an analysis of Visakhapatnam Steel Plant, its conclusions need not necessarily apply to all steel industries in India.

5. Employees were hard pressed for time in view of the job demands and rigorous work schedule. The researcher had to persuade them for sparing time for responding to the schedule and interviews. When he found that the respondents were not in a position to spare adequate time for the purpose, he had to request them to allot time after the shift timings.

6. However, the above-mentioned limitations do not detract from the quality output of the present study.

**Presentation of the Study:**

The study has been presented in eight chapters. The first chapter “Introduction” deals with the concept, evolution, importance, and objectives of Behavior Based Safety. Besides that, this chapter also explains need for the study, objectives, methodology, sampling and limitations of the study.

The Review of Research and literature has been presented in the second chapter. This chapter outlines a brief review of earlier studies and review of literature.
In the third chapter, a brief about the selected organization for the study i.e. Rashtriya Ispat Nigam Limited (RINL), Visakhapatnam Steel Plant (VSP), the scenario of the Indian Steel Industry and that of the global Steel Industry are presented.

The fourth chapter outlines the Indian scenario of Behavior Based Safety Management. The fifth chapter presents the Global scenario of Behavior Based Safety Management.

The sixth chapter narrated the different factors of safety management system in Visakhapatnam steel plant. The seventh chapter is concerned with the perceptions of respondents regarding various issues of safety culture.

The eighth chapter describes the summary, findings and Suggestions emanating from the study.
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