CHAPTER - VIII

SUMMARY, FINDINGS AND SUGGESTIONS

Summary, major findings and conclusions emanating from the study are presented in this chapter. Suggestions and recommendations are also given with a view to correct the prevailing situations and to further improve the existing safety management practices in the organisation in order to minimise the unsafe behavior of the employees for the prevention of accidents to a great extent in Visakhapatnam Steel Plant.

SUMMARY:

Organizations 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. 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. 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 (BBSM):

Behavior Based Safety (BBS) 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".

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.

Behavior is variously defined as:

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

The causes of human behavior are associated with attitude, personality, motivation and memory, together with those physical and mental characteristics which constitute a person and his environment. Behavior Based Safety (BBS) is a process that reduces unsafe behaviors that can lead to incidents occurring in the workplace. 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.

Our basic premise is that behavior is a function of the immediate environment. Once we have pinpointed a specific behavior, we can then divide environmental events into two sets of categories: events that precede the behavior and events that follow the behavior. Behavioral psychologists use the terms ‘Antecedents’ for events that occur before the behavior and ‘Consequences’ for those that follow behavior. Antecedents are events that precede behavior and prompt or cue the occurrence of that behavior. Consequences are events that follow behavior and that influence the likelihood that the behavior will occur again under those antecedent conditions in the future. Consequences either strengthen or weaken behavior.

The relationship between these behavior events is a contingency relationship, that is, an if-then relationship. If the antecedent conditions are present, then the behavior will occur. If the behavior occurs, it will be followed by the consequence. Behavior Based Safety is a proactive process that helps to get changes in a work group’s safe behavior levels before incidents happen. Behavior Based Safety seeks to change the person’s mindset, habits and behaviors so that the “at risk” behaviors will not be performed.

**Evolution of Behavioral Based Safety Management:**

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. Since its inception and application in the mid-1970s, Behavior Based 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.
Heinrich in 1930s published work describing the results that he derived by evaluating the accidents and came to the conclusion that roughly 90 percent of all incidents are caused by human error. This conclusion became the foundation of what Behavior Based Safety has come to be today. Moves towards ‘cultural’ models of Behavior Based 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.

**Importance of Behavioral Based Safety Management:**

Behavioral issues are important, because behavior turns systems and procedures into reality. Behavioral interventions can yield both safety and other business benefits if they are implemented properly. Behavior Based Safety Management 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.

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. Research has shown that as the safe behaviors increase the safety incidents decrease.

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. Everybody who works to reduce accidents and improve safe performance is concerned with human behavior.

**Objectives of Behavior Based Safety Management:**

Developing safety culture in an organization requires manager’s special attention to two aspects such as;
1. Environmental factors like equipments, tools, machines, systems, workplace etc. and

2. People factors like abilities, job, skills, attitudes, and behavior etc.

A regular focus on actual safety behavior is proactive as it allows other safety-related issues in the accident causal chain to be identified and dealt with before an incident occurs. The purpose of a Behavior Based 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. 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

**Need for the Study:**

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.

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. The literature review reveals that there is no enough research evidence from India about a comprehensive study in the area of Behavioral Based Safety that has been taken up in the specific sense of a multi-unit integrated steel plant in the public sector in India.

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 RINL, Visakhapatnam Steel Plant, Visakhapatnam.

**Objectives of the Study:**

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 present study is based on both primary and secondary data. 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 paper 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.

**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. 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.

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. 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.

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n = \frac{Z^2 \cdot \frac{p(1-p)}{N}}{A^2 + \frac{p(1-p)}{N}}
\]
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 95percent, then the table value of normal $Z=1.96$ and the response rate is found to be $R=0.95$ considering the pilot study.

**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.

Limitations of the Study:

The limitations of the study are stated 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.

**Review of Literature:**

A Review of Literature is made relating to the identified research problem to
know what has been found so far. About Sixty Eight review of literature is made on
the aspects related to General Safety Management and Behavior Based Safety
Management carried in India and abroad.

**Profile of the Visakhapatnam Steel Plant:**

Rashtriya Ispat Nigam Limited (RINL) - a Navratna Public Sector Enterprise
(PSE) with 100 percent ownership of GOI, is the corporate entity of Visakhapatnam
Steel Plant (VSP) - India’s first shore based integrated steel plant, located at
Visakhapatnam, which is now in the midst of commissioning the 6.3 MT expansion
stage, in line with its Mission of expanding to 20 MT. The production processes can
be broadly broken down into three categories: iron making, steel making and product
rolling. Production at VSP comprises mainly of long steel products, such as plain wire
rods, rebars, rounds and structurals, and semi-finished steel products, such as billets
and blooms.

The Indian steel industry is classified into main producers (SAIL, Tata Steel
Limited and RINL), major producers (plants with crude steel making capacity above
0.5 MTPA including Jindal Steel Power Limited (“JSPL”), JSW Steel Limited, Essar
Steel Limited and JSW Ispat Steel Limited) and other producers.

Iron and steel comprises one of the most important inputs in various sectors of
economy of a country. India is currently the fourth largest crude steel producer in the
world, according to the Ministry of Steel, Government of India, and is forecasted to be the second largest steel producer by 2016.

Indian Scenario of Behavior Based Safety Management:

Indian industries generally do not accord high priority to safety like the developed countries, barring some few industries. The industries do not aim at the best safety practice but only attempts to meet the minimum legal requirements on safety. The concept of the safety in the present era of industrialization has become vital. The Factories Act, 1948 strongly envisages that the adoption of safety measures cannot be postponed until provision is made for them in rules.

The present scenario is -- we do not want production and safety or production with safety but, rather, we want safe production. In this context, the study of “Behavior Based Safety Management” has gained momentum in researches related to industrial safety. BBS exposure to employees has been an enriching and refreshing experience on understanding the fact that in order to prevent near misses at workplaces, we need to tackle first unsafe / at-risk behaviors through BBS approach.

With the inclusion of behavior aspects in the OHSAS 18001:2007 as safety compliances, Indian organizations have taken Behavior Based Safety seriously in its training applications. Behavior Based Safety has shown positive results in terms of reducing unsafe behaviors, promoting safe behaviors and creating safety culture in Indian organizations.

Research and experience indicate that:

1. 90 percent or more of the accidents are due to unsafe human acts or behaviors
2. 50 percent of the unsafe behaviors are identified or noticeable at any plant any given point of time.
3. 25 percent-30 percent of safety awareness is lacking among employees which gets reflected in their unsafe behaviors.

4. So we need to focus our efforts on unsafe and safe behaviors in safety.

5. BBS secret of success is that safety control is in the hands of each and every employee, they feel empowered and responsible.

Behavior Based Safety has provided better accident prevention practices than before. Many Indian companies viz. Tata Chemicals Limited (TCL), Mithapur, Tata Steel Ltd (construction), Hindustan Uniliver Ltd and Dr. Reddy’s Laboratory etc. have gone for implementation of Behavior Based Safety in their organisation.

Research indicates that BBS has reduced accident rates by 40 percent to 75 percent within six months to one year of its implementation (Kaila, 2008). BBS makes workers aware of their unsafe and safe behaviors and helps to maintain an accounting of these behaviors on a monthly basis (Kaila, 2010). With BBS approach, we can not only bring down accidents, we can also prevent them.

The concept and process of BBS can bring for safety professionals and everyone who are concerned about correcting unsafe behaviors for reduction of accidents and promoting safe behaviors for developing injury free culture in their organizations.

**Global Scenario of Behavior Based Safety management:**

For more than a decade, Behavior Based Safety (BBS) has been prospering in organizations nationwide and more recently throughout the world (Geller, 2005). Behavioral approaches to safety management are now common place and are designed to improve workplace safety by promoting those behaviors deemed critical to health, safety and risk control (Cox et al., 2004).
According to the Basic Behavioral Principles, Safety in the workplace is a combination of the following three measurable components:

1. The person component that consists of the employees’ Physical capabilities, Experience, and Training.
2. The work environment component that represents Engineering Controls, Equipment, Job task and the work culture.
3. The final, most often overlooked component is Behavior.

The International Organisation for Standardisation (ISO) standard OHSMS 18001:2007 version has been revised to include the behavior aspects of the employees at the work place.

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

- Rapid and consistent improvements in safety behavior
- Rapid improvements in unsafe conditions
- A rapid downward pressure on accident rates and their associated costs
- Improved communications, involvement and co-operation between the workforce and management
- Ongoing improvements to Safety Management Systems
- Improvements in attitudes towards and perceptions about the importance of safety
- Ownership of safety by the workforce
- Enhanced acceptance of the responsibility for safety at all levels
- Better understandings of the relationship between safety behavior and accidents
Research evidence (Komaki, 2000) suggests that Behavioral Based Safety programmes can enhance the safety climate of an organisation. Using the behavioral approach, a major U.S. drilling company has reduced its OSHA recordable accident rate by 48 percent and moves from the industry average to be one of the top five safety performers in the industry. The B-Safe Management Solutions Inc, USA, recognized as 'Global Experts' in Behavioral Safety (Business & Legal Reports, 2006), claims that their clients realize 'world-class' safety performance, by achieving the lowest injury rates in their industry. They have outperformed their major competitors by 10 percent or more per year and usually deliver larger, more rapid, injury reductions in year one and sustain this above average performance for over 7 years.

Westinghouse Savannah River Company has reported for the period of 1999 through July of 2003 that the whole site Total Recordable Cases rate went from 115 to 33, almost a fourfold decrease when BBS was implemented. Los Alamos National Laboratory has reported that the radiological incident rates for two facilities were reduced significantly with a BBS process in place.

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

**Safety Management System in Visakhapatnam Steel Plant:**

General safety measures are the safety measures which are generally followed in any industrial organisation. These are common to all the manufacturing industries, whatever may be the product they are manufacturing. General safety measures are to be taken care right from the design stage itself. Some of the important General safety measures are: - Layout, Housekeeping, Guarding, Illumination/Lighting, Ventilation, Stacking, Dust safety, Usage of Personal Protective Equipment (PPEs).
Steel industry is a combination of complex and large-scale operations and processes. Safety at Visakhapatnam Steel Plant is largely the responsibility of Safety Engineering Department (SED), who has limited control on tasks being performed at various works departments. Safety engineering department advises and assists the management in the fulfillment of the obligation concerning prevention of accidents and maintaining a safe working environment. SED imparts regular safety training, conducts safety inspections, conducts safety campaigns and co-ordinates the procurement of quality safety appliances.

A steel industry is extremely hazardous by its very nature. In an integrated steel plant, the steel making process involves a number of hazardous processes starting from raw material handling, melting of iron ore, and converting iron into steel till the finished products. The Plant layout has been specially designed after studying many steel plants in India and abroad to ensure orderly movement of materials. Visakhapatnam Steel Plant selected the state of the art technologies with built in extensive safety features. The equipments used for handling and processing these materials are subjected to hazardous chemical reactions and may cause undesirable accidents.

From the detailed HAZOP study, various possible hazards and their associated processes & equipments are identified. Hazard Identification and Risk Assessment (HIRA) is given thrust and more than 3000 risks with appropriate control measures have been prepared. The applicable legal requirements, Material Safety Data Sheet (MSDS) obtained from suppliers and other OH&S requirements are taken into consideration while evaluating the HIRA and Risk control measures. Risk involved in each hazard is assessed taking into account the probability of occurrence and the
severity of harm. VSP being an ISO 18001 certified company, the HIRA is done systematically.

Appropriate procedures, work instructions, operation control procedures are established and issued to all concerned for safe & effective operation. Training to contractor employee is given before deputing on day to day activities. Work Permit system is implemented for hot work, Electrical isolation and Non-Isolation works.

Emergency Planning begins with the identification and assessment of the principal hazards which are normally fire, explosion and toxic release. To minimize the losses and risks to human, plant & equipment due to an incident, various risk control measures are available in VSP. For combating fire, a well planned Fire Fighting System is provided in the plant. Visakhapatnam Steel Plant has adopted integrated Quality, Environment, Occupational Health and Safety, policy.

A Two-Tier safety committee system is established. Each department has a Safety committee having equal representation of workers and management level personnel. There is a Central Safety committee having equal representation from workers and management. Annual safety budget is prepared and utilization is monitored on regular basis.

Every department maintains incident register, which includes accidents and near-miss / close-call / dangerous occurrences. In case of accidents, joint investigation is carried out by a committee consisting of the concerned departmental person, Zonal personnel in-charge and the Zonal safety Officer to find out the root cause and the joint investigation report is prepared. The identified actions are implemented.

All incidents are reported by the person responsible (shift in-charge/ section in-charge etc.) to the HOD, plant control and SED immediately. Reporting of incidents to the statutory authorities is done by SED in accordance with the procedure. The
safety audits are conducted internally and externally by the qualified and competent authorities.

Accident rate alone does not reflect a safe work environment. A company may have a low incident rate, but have a high number of lost work days associated with each incident. A high severity rate is like a red flag, signaling serious safety concerns. Modifications to the existing controls and the new controls needed are implemented to ensure that corrective actions are taken and they are effective.

**Findings:**

1. From the study, it is observed that in executive cadre 96.3 percent respondents are males and 3.7 percent are females whereas in non-executive cadre 99.1 percent are males and the remaining 0.9 percent is females. So it can be concluded that in VSP greater part of the employees are male while the female employees are less in numbers both in executive and non-executive cadre. It has been derived from the study that as the plant works round the clock and women cannot work in shift system as per the Factories Act 1948, women are more in administrative type of jobs in VSP. Hence the effect Gender in our study does not play a great deal.

2. The study found that cadre-wise 97 percent of the executive respondents are married and the remaining 3 percent are unmarried whereas in case of non-executive cadre 98.6 percent are married and only 1.4 percent members are not married. So, it is observed that only a few employees are unmarried and a majority of the employees both in executive and non-executive cadre are married. This factor is important as it might have a lot of bearing in the attitude and behavior of the individual towards safety.

3. It is noted from the sample that a majority of the employees are having 3 to 4 dependents in case of Non-executives cadre (60 percent) as well as in executive
cadre (45 percent). The study finds that nuclear families are playing a major role in the present society. The predominance of nuclear family system is observed in the present study. It shows that the respondents are conscious of the adverse effects of large size families. Exposure to urban life made them to shed traditional and superstitious beliefs and more careful in observing family planning to have concise families.

4. The study witnessed that an overall of about 82 percent of the employees’ spouse from both the cadres is not employed and hence this factor may not have any impact in our study.

5. Educational qualifications are well associated with the variables of the safety cultural dimensions. The study reveals that almost all the employees are well educated except a small lot of 8 percent in the non-executive cadre who have done below Intermediate. From this analysis related to educational background of the respondents of the sample study, it is observed that the level of education varied according to the requirements of job.

6. It is evident from the study that a majority (83 percent) of the employees is of above 40 years of age in both executive cadres as well as in the non-executive cadre. This factor is very important as it might have a lot of bearing in the attitude and behavior of the individual towards safety.

7. The study makes it clear that more than 70 percent respondents from executive cadre are living below 10kms from the plant and that the executives are living very nearer to the organization when compare to Non-executives. The chi-square test proves that there is a significant association between the variable and cadre at 5 percent level of significance i.e., executives living very nearer to the organization when compared to non-executives.
8. The study shows that 67.7 percent respondents from executive cadre and 78 percent from non-executive cadre are coming by motor cycle. The mode of transport is an important factor as far as the employees’ behavior while driving and the road safety is concerned.

9. From the study, it can be concluded that the employees of Visakhapatnam Steel Plant are paid good salary and the payments is according to their cadre, qualification, and work experience in the organization while taking other aspects into consideration. Besides the monthly income the employees are provided with incentives based on monthly production targets which motivate the employees to increase the productivity.

10. It is noted from the study that in the non-executive cadre a majority (68.3 percent) are doing field work whereas the majority (63.4 percent) of executive cadre do both office and field works. So, it can be found that the majority of the employees in VSP work at the site in the shop floor. Further, the P value: 0.000 signifies that there is a significant association between these two variables i.e., based on the cadre, the respondents are doing their nature of job.

11. From the study it can be observed that a majority (70 percent) of the employees have more than 20 years of experience from both the executive cadre and non-executive cadre. P-value is 0.011 that is less than the standard value of significant level 0.05; hence, both the variables are dependent to each other.

12. The study shows that a greater part of the employees are from 85 percent of the respondents from both the executive and non-executive cadre is either from town/taluk or from village/panchayat during their childhood. This shows that the employees of VSP might be having high values and ethics towards the work.
13. The study has witnessed that the average value of safety behavior (0.887) is greater than the remaining dimension followed by team work (0.8413) which divulges that on these two dimension respondents’ opinion is more positive than the remaining dimensions. Then it is followed by the average value of Safety Compliance (.7048), Safety Awareness / Communication (.6529), Safety Commitment (.6470) and Stress Recognition (.6245).

14. The study found that from the overall opinion of the respondents on the dimension safety commitment is high at Visakhapatnam Steel Plant. It can be conveniently concluded that the safety practices followed is up to the satisfaction of the employees as can be observed from the affirmative response of about 64.23 percent respondents of the total sample. As Visakhapatnam Steel Plant is a public sector organisation which gives much importance to safety measures, more than 60 percent of the respondents of the total sample agreed with the statements in the dimension safety commitment at Visakhapatnam Steel Plant that is the vital aspect of safety in any organisation. However, in some areas it is found that whether the Senior Managers seem interested in health and safety before an incident / accident happens, the response is 46.3 percent negative and about 23.6 percent are silent about their answers. Also the neutral answer is more in numbers in case of accidents investigation and follow-up measures, Safety Committee and Safety audits / inspections.

15. From the study, it may be asserted that the overall safety compliance at Visakhapatnam Steel Plant is prompt and to the satisfaction of its employees. But, it is to be noted that here also almost a quarter 21 percent of the responses are neutral that are related to workplace incidents / accidents and near misses reporting (23.8 percent), work environment viz. noise, dust, heat and vibration (23 percent), SPOC
i.e. Specific Point Of Contact system (23 percent) and seriousness of liquidation of safety related issues raised in various audits / inspections (29.8 percent).

16. The study has revealed that the overall opinion of 67.57 percent of the respondents on the dimension Safety Awareness / Communication is positive and is interesting to note that the safety awareness of the employees at VSP is well. However, it is worth noting that about 27.5 percent of the responses are neutral in both the cases of information on type, cause and recommendations of accidents to employees and imparting new training based on any accident. Also about 40 percent of the responses are to the neutral and negative side as far as the safety instructions to the visitors before they are permitted to enter inside the department.

17. The study exhibited from the opinion of the respondents on the dimension safety behavior that an average of 73.16 percent optimistically responded towards the said dimension. About 30 percent given neutral on timely identification of hazards and correction of Safety and health issues which perhaps indicates that the employees are not interested in revealing the facts. Also it is to be noted that about 85 percent of the respondents opined that observing both the safe / unsafe behavior of individuals and giving them feedback will improve the safety levels in the plant and rewards and incentive for safe performance would cause employees to work more safely.

18. It is observed from the study that VSP recognizes employees’ stress. It can further be stated that there exists a healthy co-operation and co-ordination between the management and its employees. It is worth noting that 25.9 percent respondents have not shared their opinion and 55 percent respondents have positively responded with the statement of working under crisis / under pressure. Also 16 percent respondents have not shared their opinion and 72 percent respondents have positively responded
with the statement of hurrying has been a factor in an incident / accident or near miss. The above indicate that sometimes the momentary stress level is more for the employees while carrying out some jobs.

19. The study reveals that the overall opinion of the respondents on the dimension team work and conveys that a healthy average of 74.42 percent respondents has perceived the aspects of the dimension positively. From the majority assenting opinion of the respondents, it may be concluded that the ambience at the Plant is conducive to team work as it fosters a sense of unity among the employees.

20. It can be found that in the dimensions safety behavior, stress recognition and team work the difference are found to be statistically not significant (i.e. P value>0.05) which suggests that for these three dimensions the respondents of both cadres have opined more or less in a similar fashion in VSP. In the remaining dimensions such as safety commitment, safety compliance and safety awareness / communication, the perception of the respondents belonging to executive cadre is greater than the non-executives; this may be due to the awareness of non-executives cadre in these areas are less when compared to executive cadre. So, it may be conveniently concluded that the majority of the respondents attend the safety training for academic purpose only.

21. The study divulges that there is no significant relationship between the dependent variables Safety commitment, safety compliance, safety awareness / communication, safety Behavior, stress recognition and team work with the independent variable number of dependents, but the relationship is negative i.e., as the number of dependents increased the perception of the respondents for these dimensions are decreased but the decrease is not significant at 5 percent level of significance except the dimension stress recognition.
22. The study reveals that there is no significant relationship between the dependent variables related to safety management practices with the independent variable educational qualification i.e., as the education level increases the opinion of the respondents on these dimensions are not significantly increased. Further, there is a positive relationship between dependent variables safety commitment, compliance, communication and overall with the independent variable education whereas the remaining dependent variables have negative relationship between them but the relation is not significant at 5 percent level.

23. The test of association between the independent variable age and parameters of the dependent variables related to safety culture and the p-value (> 0.05) of all the dimensions suggests clearly that as the age increases the opinion of the respondents for all these dimension has not increased significantly. Further, except the variables safety behavior and stress recognition the remaining variables have positive relationship with age but the relation is not statistically significant.

24. From the study, it can be found that except the variable stress recognition, the remaining variables P-values are less than 0.05 which suggests that as the salary increases the opinion of the respondents on dimensions related to safety culture are increased statistically. Whereas for the stress recognition it could be concluded that as the salary increases the opinion of the respondents on this dimension decreases but the decrease is not statistically significant.

25. It is found that there is no significant correlation between the dependent variables with the independent variables experience. The positive values indicates in the table that there is a positive relationship between the safety awareness and team work with the independent variable experience i.e., as the experience increases the opinion of the respondents for these two dimension are increases but the relation
is not statistically significant. The negative values in the said table suggest that there is a negative relationship between the independent variable experience with the dependent variables and the relationship is not statistically significant at 5 percent level of significance.

26. From the study, it is evident that the average opinion scores of all the four positions on the dimension safety commitment have no significant difference. Further, the average opinion score of the respondents belongs to below supervisory position is less than the remaining three positions. The average opinion score of the respondents from senior management is greater than the remaining three positions which concludes that the respondents belongs to this position has more positive opinion on this said dimension when compare with the remaining position.

27. The study indicates that there is a significant difference between the average opinion scores of the respondents as per their respective position. The average opinion score of the respondents belonging to senior management (1.1544) position is greater than that of other three positions, which further thrusts a positive opinion on the dimension ‘safety compliance’ from this cadre, at 5 percent level of significance. Further, it may be observed that the mean score is above 1.0 implying that opinion of the respondents from this cadre is greater than agree level whereas the remaining three positions opinion score is low when compare to senior management position.

28. It is observed that the perception of the respondents on the aspects of safety awareness / communication at the plant is positive i.e. the employees are satisfied with the system of awareness / communication and training in the area of safety. The respondents belonging to the position of senior management hold a more
positive view as compared to other positions. The P-value, which is found to be significant at 0.05 percent level, indicates varying degrees of perception among the respondents of all four positions. However, mean scores of the positions clearly indicate that there is satisfaction among the respondents of all positions in respect of this dimension.

29. The average opinion score of the respondents from senior management is greater than that of the remaining three positions i.e. below supervisory level, front line management and middle management. Further, these average opinion scores are greater than 0.8, implying that the respondents belonging to these positions have an affirmative perception of the aspects of safety behavior at the Plant. Further, the P-value, which is found to be not significant at 0.05 percent level, reveals that the respondents of these three cadres have a similar and positive opinion on the said dimension.

30. The P-value (0.045) exemplifies that there is a significant mean difference between the opinion scores of the respondents on stress recognition by their positions. The average opinion score of the senior management (0.6928) is greater than that of the positions of below supervisory level, front line management and senior management. It can be further observed that the average opinion scores are not greater than 1. It can be illustrated that the respondents belonging to all the four positions are not have that much affirmative opinion of the aspects of stress recognition at VSP, inferring that they are not significantly gainfully engaged.

31. It is revealed in the study that the mean scores of the respondents among the four positions chosen for the study on team work are positive. Besides this, the average opinion score of the senior management is greater than the remaining three positions followed by front line management implying that the perception levels
of the respondents of the this positions are much better. The P-value is found to be significant at 0.05 percent level exhibiting a significant average difference in the opinion scores of the respondents of the positions. The positive mean scores of the present dimension clearly indicate that the team work at VSP is somewhat conducive and employees are satisfied with the said dimension.

32. The study indicate that there is a significant difference between the average opinions scores of the respondents belongs to all the four positions on the factor related to safety management practices. It is observed that the opinion score of the senior management is greater than that of the remaining three positions, which indicates that the senior management are more satisfied with the aspects of safety management practices facilitated by aegis when compared with the remaining three positions.

33. It may be found that the average opinion scores of the respondents of all types of jobs indicate a positive orientation. This implies that safety commitment at Visakhapatnam Steel Plant is somewhat effective and employees are satisfied. Further, the study clearly suggests that the respondents doing both the types of job exhibited a better perception on this dimension as compared to other two. Similarly, the difference in the mean opinion scores is indicated by a significant P-value as it reveals that the opinion of the respondents on the present dimension is varied, but positive.

34. The study indicate that there is a significant difference between the average opinion scores of the respondents belongs to all the three types of jobs they are doing on the dimension of safety compliance. It is observed from the above that the average opinion score of the respondents who were doing both office and field work is greater than that of the remaining two, which indicates that the these
respondents are more satisfied with the aspects of safety compliance facilitated by VSP.

35. The study reveals that the average opinion score of the respondents who were doing both types of jobs is more when compare with the remaining two. Further, there is a significant difference between these three averages. Also the positive score of respondents suggests that their opinion towards the safety awareness is positive.

36. The study depicts that the average opinion scores of the respondents with various types of jobs are found to be insignificant for the dimension safety behavior at 0.05 percent level. The opinion score for the respondents who is doing both office job and field work is greater than the respondents who were doing individual office job and field work.

37. The study presents the average opinion score of the respondents who were doing both types of jobs is greater than the remaining two and the difference is significant at 5 percent level of significance. Further, the respondents who were doing office job has less opinion on stress recognition as the average score is very low when compare with the remaining two.

38. The study gives the average opinion score of the respondents who were doing both types of jobs is greater than the average opinion score of office job respondents and field work respondents but the difference is not statistically significant as the p-value in the above ANOVA test is greater than 0.05, the level of significant i.e., all these three types of respondents opined more or less unanimously about the dimension team and the score is greater 0.7 which suggests that the team work of the present organisation is somewhat better.
39. The study indicate the average opinion score of the respondents who were doing both jobs (office job and field) is greater than the office job respondents and field work respondents and the difference is significant at 5 percent level of significance. It indicates that their perception levels are more positive than those of the other categories.

40. From the study it can be observed that the occurrence of accidents at the plant for has been on the decline. It can be inferred from these details that the management of VSP is very keen on reducing the accidents in the organisation and this expounds the sincerity of the organisation in the effective implementation of safety measures. It is also found from the secondary data in the study that the frequency of accidents has been reducing. However, it may be noted that in the current year it has shot up to very high because of a major accident.

41. From the accident statistics of VSP, it is observed that the maximum numbers of accidents are on account of general safety and particularly on housekeeping aspect. The cause-wise statistics of incident shows that in case of slip and fall in the Plant, the rate is always on the higher side every year and that on 2011-12 it is 34.48 percent.

42. The Plant is providing a wide range of personal protective equipments (PPEs) around 35 numbers to the employees working in various departments. It seems that plant is very cautious towards employee’s safety. This is also proved in the study that the majority of the respondents are satisfied with the PPEs supplied by the organisation.

43. The study reveals that the Plant is providing good safety measures as such the accidents occurred are less and most of them are minor accidents. A look at the
Secondary data reveals that VSP has drastically reducing the severity rate in accidents that occurred in the organisation.

44. The study concludes that the safety inspections and effective implementation of safety inspection points will definitely improve the safety at shop floor. OHSMS: 18001 ensure the regular safety inspections at shop floor and its compliance report. Conducting safety inspections by appropriate authority is a healthy sign because they will identify the major and minor unsafe conditions in the department. As such the study concludes that in VSP, routine safety inspections are being conducted by an appropriate authority.

45. The study finds that the employees at VSP are mostly helpful, friendly and courteous with each other in discharging their duties. This may be one of the reasons that the Plant is progressing in all dimensions. It could be concluded that among the work force of VSP, there is a better understanding and everyone respects each other. This is because of the changing environment in the present industrial scenario with high education, morals, etc. people are developing good attitudes towards others. From the above study, it could be concluded that the employees of the plant share a healthy relationship.

46. It may be concluded from the majority opinion of the respondents that the employees of the Plant are aware of the fact that being hurry in work leads to accidents. And this awareness among the employees of the organisation will certainly help in mitigating the accidents. If this tendency in the employees prevails, the organisation will better its goal in the safety aspects very soon. The opinion of all the respondents on this aspect is more or less similar.

47. It may be concluded that the management of Visakhapatnam Steel Plant conducts meetings on safety at regular intervals to ascertain safe working atmosphere to its
employees. It can be inferred that the employees at VSP take active participation in the decision making process on safety measures. In VSP there are lots of committees on different safety activities like; shop floor safety committee, central safety committee, incident enquiry committee, safety inspection committee, internal audit on safety, safety week celebration committee, etc. and most of the employees are involved in one of these safety committees. As such the participation of employees in decision making on safety measures is considerably high.

48. The study reveals that there is a big scope for implementation of BBS system because in each study area there has been a scope for improvement from the present level of these parameters. Further from the accident data analysis still lots of accidents are happening despite the existence of the fully functional safety management system. The human errors being a fundamental cause for accidents the implementation of BBS is the only solution for creating positive behaviors among the workers, staff and managers for effective accident prevention programmes.
Suggestions:

1. Because of the Factories Act and OHSMS, the working conditions are to be maintained as per the prescribed standards. Visakhapatnam steel plant is not exception to this. It is known from the study that the organisation is maintaining the working standards well. In spite of majority respondents had good opinion on present safety standards yet there are few respondents who disagree to it. So it is suggested that the management should improve the present safety standards further to satisfy all the employees in the organisation.

2. The safety culture should be made as an integral component of operation, maintenance, training, purchase and project activities of VSP. The BBS and safety culture programme should be dovetailed with existing safety management system of the industry to make them to be highly effective and successful.

3. VSP should take necessary steps in case of safety awareness to convert the attitude of employees from academic purpose to other practical purposes like life saving, avoidance of property damage etc. and also it to see that all the employees are having the habit of reading safety related reports / statements to take useful decisions in their own area of work which are useful to VSP. The employees should be motivated to read any published statistical data on safety and any lack of availability of concerned books, journals and magazines in the library therefore should be seen by VSP regarding the availability of above books and journals. It is suggested that all the employees of the Plant should acquaint themselves with this aspect and organisation should circulate the accident reporting procedure to all the employees through Employees Information System (EIS).

4. It is suggested that VSP may bring further improvement in good housekeeping at the shop floor in order to reach zero accident level. This can be improved by
conducting housekeeping campaigns, housekeeping competitions between departments, regular surprise checks, and training, etc. In this particular aspect the management of Visakhapatnam Steel Plant has to pay much attention towards safety inspections to avoid accidents.

5. It is observed from the opinion of the respondents that VSP conducts enquiries into the accidents at the plant and it indicates the commitment of the organisation towards the safety aspects besides adhering to the procedure laid down by OHSMS. Usually non-reportable accidents are recorded but not investigated by the authorities. Hence, it is suggested that all the non-reportable accidents should be investigated for finding the root causes of the accidents. Elimination of these root causes may help in avoiding the reoccurrences of the accidents in future.

6. In every organisation all the near miss accidents are to be identified and investigated systematically to mitigate the probabilities of major accidents to happen. It may be concluded that steel plant is also taking precautionary and preventive measures to avoid near miss accidents and dangerous occurrences. It is further recommended that the employees should be encouraged to report the near miss accidents and dangerous occurrences without fail and the near miss accidents and dangerous occurrences are also to be investigated thoroughly to find out the probable reasons without hiding the facts. These are very important in safety point of view. If these are neglected, then these near miss accidents may become big mishaps.

7. It can be concluded that the employees working at the site are at the receiving end in most of the accidents that occurred in the organisation. Negligence and over confidence on job, particularly in industrial jobs is very dangerous and it may lead to accident. This is the direct working group who is working in the shop floor and
the organisation should see that the employees of this cadre adhere to the safety provisions prescribed to them. Further, it should also pay keen attention in implementing these safety measures without failure and initiate stringent disciplinary action against the defaulters. It is advisable to interact with such employees and if required a refresher training to all these employees on regular basis may be arranged based on the earlier case studies of accidents.

8. The study suggests that VSP has to improve some of its safety measures to avoid the few minor and major accidents; on the other hand, the employees are also supposed to be extra-cautious while on duty. It is a general phenomenon that man is quick-enough to attribute his faults to his environment or to other people as no one prefers to blame him/her for the mistakes. As the result the employees attribute the accidents to the unsafe conditions. Moreover organisation must ensure safe working conditions to the employees.

9. Providing adequate safety measures at the work place is the prerequisite for any industry and it is benefited to both the organisation and employees. The respondents agreed that VSP authorities are providing adequate safety measures to overcome accidents. It implies that the management of the Plant is good at providing adequate safety measures to ensure the safety of its employees. But some respondents opined negatively with regard to the measures being taken on working conditions such as dust, noise levels etc. in shop floor. It is suggested to take appropriate engineering methods to reduce these noise levels.

10. It is suggested that the copy of the general safety rules that are to be followed should be given to the new entrants of employees at the time of joining and to that of the visitors at the time of issuing the entry gate pass so that they may be aware of the general safety rules and behave at the work site safely. It is also
recommended that some short films on connected with VSP safety may be continuously played at some key locations such as the visiting lounges etc.

11. It is well arrived from the study that the BBS systems should be implemented in phases for a continuous period for better results, as seen from the Indian and Global industry practices in BBS implementation.

12. Every employee of the organization should be motivated for BBS system, thus emphasizing the concept with its requirements.

13. International expertise should be drawn in to the organisation for a successful BBS System implementation.

14. The case studies of BBS implementation in other Indian industries should be studied before implementing the same in VSP.

15. The BBS team of VSP should be trained for successful completion of the BBS implementation.

16. Conference room, training facilities, computers and other logistics should be made available for the BBS team.

17. The BBS implementation requires financial budget and adequate dedicated manpower and hence the management should ensure that the above are available for a successful BBS programme.

18. The BBS programme should be implemented in a holistic manner such as to cover all the employees including contract workers.

19. The management should conduct periodical reviews on BBS implementation to ascertain its effectiveness in attaining the set targets and goals.

20. The plant should take necessary steps to create awareness on BBS to all the employees of VSP to overcome the resistance, problems and criticisms about BBS
like employees may make irrational demands, it is just wastage of money and other resources etc.

**Conclusion:**

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. 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. 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. 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.
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. The BBS system will help the dilemma of maintaining safety as a priority in peoples’ minds when competing with the day-to-day pressures and multiple demands.

The study has revealed that there is a big scope for implementation of BBS system in VSP. The BBS systems should be implemented in phases for a continuous period for better results, involving international expertise thus covering entire workforce including contract workers, as seen from the Indian and Global industry practices.

The BBS implementation requires financial budget and adequate dedicated manpower and hence the management should ensure that the above are available for a successful BBS programme and the BBS programme should be implemented in a holistic manner. The effectiveness of the BBS programme can only be ascertained by ensuring a review mechanism. It is felt that the safety culture should be made as an integral component of operation, maintenance, training, purchase and project activities of VSP, making VSP a trend setter among steel industries in India. The BBS and Safety Culture programme should be dovetailed with existing Safety management system of the industry to make them to be highly effective and successful.

The research suggests that Visakhapatnam Steel Plant should implement the Behavior Based Safety Management system as discussed and arrived in this study, for protection of mankind, the ultimate objective of the existence of the universe.
Scope for Further Research:

The study “A Study on Behavior Based Safety Management (With Reference to Visakhapatnam Steel Plant, Visakhapatnam)” was limited to the regular employees working in the works departments’ areas only. On the basis of the exposure to the literature and the inferences drawn from the study, the researcher feels that the following areas are amenable for further research.

As an extension to this present study, the following further studies may be carried,

i. Behavior Based Safety Management of contract employees working in the works department area of Visakhapatnam Steel Plant.

ii. Behavior Based Safety Management of the regular employees working in the projects departments’ area of Visakhapatnam Steel Plant.

iii. Behavior Based Safety Management of the contract employees working in the projects departments areas of Visakhapatnam Steel Plant.

A more intensive study at micro level may be carried in the following areas like,

i. Behavior Based Safety for the Road accidents in Visakhapatnam Steel Plant.

ii. Behavior Based Safety Study of accidents due to “slips, trips, and falls” in Visakhapatnam Steel Plant.

All these areas are very interesting in carrying research studies and can contribute to the organization in a great way.