

Occupational Health and Safety Management in Manufacturing Industries

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The study aims at analysing the occupational health and safety of Manufacturing Industries in South India by gathering information on health management, safety management, motivation, leadership and training, welfare facilities, accident statistics, policy, organization and administration, hazard control and risk analysis, monitoring, statistics and reporting. Data were collected by using questionnaires which were developed on health and safety management system. The data collected are analysed by using graphical and D&S method. The overall status shows that the performance on health and safety management system needs improvement in order to ensure a better working condition for the workers.

Keywords: Accident statistics, Hazard Control and Risk Analysis, Manufacturing industries, Occupational health, Occupational Safety, Southern Part of India, Welfare Facilities.

Introduction

According to the study done on manufacturing industries in southern part of India, it was found that only some industries have an occupational health and safety management system, out of which only a few industries are strongly implementing, maintaining and following the occupational health and safety management system. This study can be used for the ground work for evaluating the occupational health and safety of manufacturing industries in south India.

The information for this study are collected on health management, safety management, motivation, leadership and training, welfare facilities, accident statistics, policy, organization and administration, hazard control and risk analysis, monitoring, statistics and reporting. The data for health management are collected on the basis of cleanliness, lighting, drinking water and ventilation & temperature. Safety management data's are collected by analysing the fire emergency procedure, hoists or lifts, means of exit, elevating devices, electrical devices and confined space.

The information collected for motivation, leadership and training are done by considering training, motivation, education, rest pause, job shift and personal protective equipment. The factors which are considered for collecting data on welfare facilities, canteen, first aid appliances and facilities for sitting. Near miss, dangerous occurrences, minor accidents, major accidents

and fatal have been considered for preparing accident statistics. The information for policy, organization and administration are collected by considering resource allocation, policy, communication, responsibility allocation, management review and documentation.

The data for hazard control and risk analysis are collected on the basis of hazard identification, risk assessment, determination of control measures, and implementation of risk assessment and documentation of risk assessment. Proactive monitoring performance, reactive monitoring performance, incident investigation, corrective action and preventive action are considered for data collection on monitoring, statistics and reporting.

Literature review

Extremely slow and steady efforts are needed for developing and establishing a safety culture in an organization (Guirong Shia *et al.*, 2012). The government and enterprises have to give more importance to occupational safety and health management (XiaohongGuo., 2012). A risk assessment scheme has been implemented in order to overcome the limitations and defects in industrial safety and health act to develop an advanced industrial safety and health policy (Hyuckmyun kwon1 *et al.*, 2010). Working conditions and work situation can influence reporting, communicating and discussing of safety issues (AsaEkn *et al.*, 2013).

Risk perception and safety-related behaviour has a close relationship and up to some extent there is a relationship to the attributes towards safety. Studies

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say that risk perception may influence the risk taking behaviour. (AsaEkn *et al.*, 2013). To maintain social stability and to develop national economy work safety is essential for a country (XueqiuHea *et al.*, 2011). The enterprise safety can be effectively increased by continuous improvement of safety standardization and work promotion (ZhiminLiua., 2012). The insufficiency of management and ineffective regulations in terms of health and safety in workplace results in disaster (Masahiro Horia., 2012). Human factors have become an important issue that has to be solved urgently to prevent and decrease accidents (HUANG Ping *et al.*, 2012). Active involvement in behavioural safety compliance results in greater influence among the workers (Sulastre Mat Zin *et al.*, 2011). The safety legislations and management systems are becoming complex, which are to be made simple to avoid unnecessary confusions and complexity (Huang Lin-juna *et al.*, 2013).The effectiveness of the safety management system and its practices in reducing the accidents depends on the workers engagement and the focused level of safety (Jan K. Wachter *et al.*, 2013). One of the methods of improving safety performance is Behaviour based safety (BBS), helps in decreasing the accident rate in workplace (Faridah Ismail *et al.*, 2012). Accident rate is higher for those firms with more flexible production technologies (Pablo Arocena *et al.*, 2008).

Method

Development of Questionnaire

The questionnaires were developed on the basis of health, safety, welfare, motivation, leadership and training, accident statistics, organization and administration, hazard and risk control. The questions developed are as per the requirement to ensure a healthy occupational health and safety management system in the industry.

Mail Questionnaires

The prepared questionnaires were mailed on the basis of process of industry, shift system, description of working force. Questions were designed such as managerial attitude towards OHS and work force demographics (Sybil Geldart *et al.*, 2010).The mails were forwarded to the Senior Manager, Health Safety and Environment Manger, Safety Committee Member, Human Resource Manager.

Walk Through Survey

The relevant data were collected on the basis of the framed questionnaires by Walk through Surveys. The

evaluation was mainly aimed on health management, safety management, motivation, leadership and training, welfare facilities, accident statistics, policy, organization and administration, hazard control and risk analysis, monitoring, statistics and reporting. It is a realistic survey which provides a clear picture of the actual scenario inside a manufacturing industry. The walk-through technique is a direct observation method. (Madbuli H. Noweir *et al.*, 2013)

Data Analysing

The data which has been collected from the framed questionnaires are analysed by using means and percentages, D&S method and graphical method.

D&S Method

It is a method used for measuring the quality and quantity of the safety activities inside the industries or a company. This method was developed by Diekemper & Spartz in 1970.Latter the modified version of this method has been developed by Arto Kuusisto in 2000.This method has four categories. The first category is Policy, Organization & Administration which is having a weighted value of 20. The second one is Hazard control and Risk analysis with a weighted value of 40.The third category is Motivation, Leadership and Training with a weighted value of 20 and fourth category is Monitoring, Statistic and Reporting with a weighted value of 20. The developer of this method says that D&S is a measurement of activity rather than measure of results or performance as shown in Table 1. It is because the nature and level of activities cannot always be translated into appropriate results (Arto Kuusisto., 2000). The modified D&S method was used for assessing the safety management system in an enterprise (Piia Tint *et al.*, 2010). The Diekemper and Spartz (D&S) method was included in the 11 distinct audit instruments which are designed for the audit of occupational health and safety management system. (Philip L. Bigelow *et al.*, 2006).

Table 1 - The categories and values of D&S method

| S. No: | Category | D&S value |
|--------|---------------------------------------|-----------|
| 1. | Policy, Organization & Administration | 20 |
| 2. | Hazard control and Risk analysis | 40 |
| 3. | Motivation, Leadership and Training | 20 |
| 4. | Monitoring, Statistic and Reporting | 20 |
| 5. | Total (%) | 100 |

Result and analysis

Health Management

The result shows that most of the industries are taking care of implementing and maintaining health within the organisation. An overall of 52.05% as shown in figure 1 and figure 2 are having health management system. The factors which have been considered for taking the statistics of health management system with their average percentage values are cleanliness 48%, lighting 46.6%, drinking water 62.8%, ventilation and temperature 50%. The effectiveness of the health and management system differs from one another. Health insurance is being provided for ensuring the legal requirements. Better maintenance of health records was found. Many of the enterprises show the management commitment towards the health of the workers, which also increases the self-confidence of the workers and helps in improving the interrelationship between workers and top management.

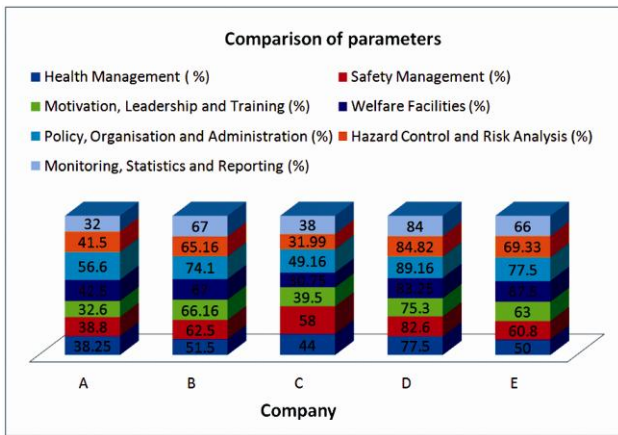


Fig. 1 - Comparison of parameters

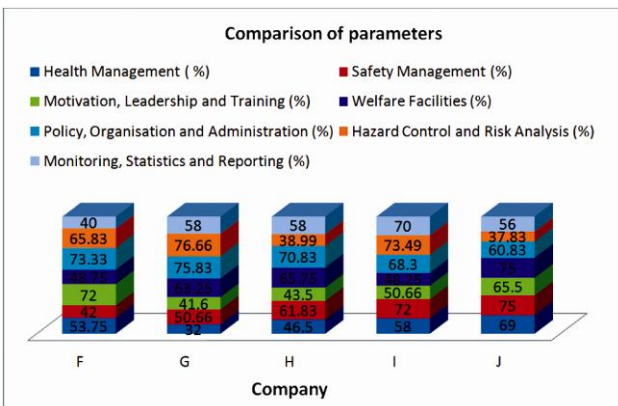


Fig. 2 - Comparison of parameters

Safety Management

The statistics shows that most of the enterprises were taking care on implementing and coordinating the safety within the factory premises. The statistics gives an overall percentage in safety management as 60.4, as shown in figure 1 and figure 2. The main reason for lower safety performance is the lower safety awareness among the organization. Insufficient resources like providing of onsite safety equipment and facilities are also playing a vital role (S.X.Zeng *et al.*, 2008). From the available data the remaining 39.6% is because of lack of awareness, training, education and motivation. The factors that were taken for analysing the safety management and their individual percentages are fire emergency procedure 55.6, hoist and lift 53.6, means of exit 72, elevating devices 64.05, electrical 56.9 and confined space 62.5. These factors play a vital role in the safety management. Information related to safety at work will reach the workers through several form of mass media namely a company’s public relation board 80.7%, a meeting 79.3%, a training session 70% and newsletter/company pamphlet 37.9% (Pornpimol Kongtip *et al.*, 2008).

Motivation, Leadership and Training

The effectiveness of motivation, leadership and training were taken on the basis of individual factors. The individual factors and their efficiency in implementing and maintaining are training with 64%, motivation with 60%, education with 50%, rest pause with 45%, job shift with 57%, and personal protective equipment with 56%. The overall statistics on motivation, leadership and training in the enterprises is 54.9% as shown in figure 1 and figure 2. 73.9% of the small and medium scale enterprises arranges occupational health and safety training, 82.5% provides safety training for new workers and workers with new task. 79.5% provides safety training on how to use personal protective equipment and 49.6% provides safety training for temporary workers relating to personal responsibility for training, company assigned safety officers 68.9%, foreman 69.8% and personal section leaders 56.4% as trainees (Pornpimol Kongtip *et al.*, 2008). There is a decrease in the use of head and face protection, hand protection and protective clothing in the recent study. There is an increase in the use of ear and respirator protection, foot protection. In both studies the large plants provide more personal protection as compared to small plants (Madbuli H. Noweir *et al.*, 2013).

Welfare facilities

Almost all manufacturing enterprises are taking good care on ensuring sufficient welfare facilities for the workers as per the Factories Act 1948 (Chapter V welfare) and regarding other statutory requirements. The result has been accessed by considering washing facilities, canteen, first aid appliances and facilities for sitting. The average values for the factors are washing facilities at 62.8%, canteen at 58%, first aid appliances at 60%, and facilities for sitting at 52% respectively. The overall statistics of welfare facility is 59.2% as shown in figure 1 and figure 2. Separate washing facilities are provided for the male and female workers as per factories act 1948 chapter V section 42. Sufficient and suitable arrangements for sitting should be provided and maintained for all workers in every factory (factories act 1948 section 44). There should be first-aid boxes with prescribed contents, There should be a minimum of one for every one hundred and fifty workers ordinarily employed (factories act 1948 section 45). A canteen or canteens should be provided and maintained by the occupier for the workers, if more than two hundred and fifty workers are ordinarily employed. (factories act 1948 section 46).

Accident Statistics

The accident statistics made from the survey on manufacturing industries give a much clear picture on accidents and incidents which are happening in the industries. The result has been analysed by considering the following factors and finding the average values of each factor per year. The factors and the corresponding average value are near miss with 44.3, dangerous occurrences with 9.8, and minor accidents with 3.4, major accidents with 2.7, and fatality with 0.5, as shown in figure 3.

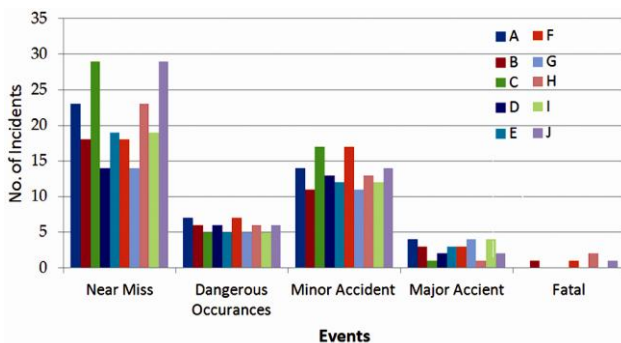


Fig. 3 - Representation of Accident statistics. Here A,B,C,D,E,F,G,H,I,J represents the companies.

A study was done on six types of industries which are gas & water supply services, construction, mining, electricity, manufacturing and forestry in Indonesia during 1995 to 1999, in which manufacturing enterprises had highest rate of accident cases (Pornpimol Kongtip *et al.*, 2008).

Policy, organization and administration

Most of the manufacturing industries are having a better a policy, organization and administration system, which can be referred as the backbone for a strong health and safety management system. The result has been analysed by considering the following factors and finding the average percentage of value of each factor. The factors and the corresponding average values are policy 58, resource allocation 62, communication 73.5, responsibility allocation 75, management review 73 and documentation with 72. The overall percentage of organization and administration is 69.56, as shown in figure 1 and figure 2.

Hazard control and risk analysis

The result analysed by the data collected on hazard control and risk analysis shows that the most of the manufacturing industries are having hazard control and risk analysis procedure which helps in reducing the hazards in the industry and will provide a better working environment for the workers to work freely, fearlessly and confidently. The factors which has been considered for analysing the hazard control and risk analysis in manufacturing sectors with their average value in percentage are hazard identification 63.3, risk assessment 58, determination of control measures 54.0, implementation of risk assessment 57.5 and documentation of risk assessment 59.9. the overall percentage for hazard control and risk analysis is 58.56, as shown in figure 1 and figure 2.

Monitoring, statistics and reporting

The data collected on monitoring, statistics and reporting shows that the manufacturing industries are providing importance on it, which will increase the level of safety in organisation in the industry and helps in prevention of incidents. The factors with their average values in percentage which has been considered are proactive monitoring performance 63, reactive monitoring performance 56, incident investigation 54.5, corrective action 58.5 and preventive action 52.5. The overall percentage for monitoring, statistics and reporting is 56.9, as shown in figure 1 and figure 2.

Table 2 - Calculated D&S values. A, B, C, D, E, F, G, H, I, J represents each industries

| Category | D&S standard value | Calculated value of D&S | | | | | | | | | |
|---|--------------------|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | A | B | C | D | E | F | G | H | I | J |
| Policy, Organization and Administration | 20 | 11.32 | 14.82 | 9.83 | 17.8 | 15.5 | 14.6 | 15.16 | 14.16 | 13.66 | 12.16 |
| Hazard control and risk analysis | 40 | 16.6 | 26.06 | 12.76 | 33.92 | 27.72 | 26.32 | 30.64 | 15.56 | 29.36 | 15.12 |
| Motivation leadership and training | 20 | 6.52 | 13.22 | 7.9 | 15.06 | 12.6 | 14.4 | 8.32 | 8.7 | 10.12 | 13.1 |
| Monitoring statistics and reporting | 20 | 6.4 | 13.4 | 7.6 | 16.8 | 13.2 | 8 | 11.6 | 11.6 | 14 | 11.2 |
| Total (%) | 100 | 40.82 | 67.50 | 38.09 | 83.58 | 69.02 | 63.32 | 65.72 | 50.02 | 67.14 | 51.58 |

D&S method

The data collected has been analysed by using D&S method and the overall percentage for each industry is also calculated as shown in Table 2. According to D&S method industry D is having a better health and safety management system with an overall percentage of 83.58 and industry C with 38.09 percentages, which is the least of all.

Conclusion

A detailed study and analysing of occupational health and management system based on health management, safety management, motivation, leadership and training, welfare facilities, accident statistics, policy, organization and administration, hazard control and risk analysis, monitoring, statistics and reporting. It is found that most of the manufacturing industries are lacking in occupational health and safety management system with a least value of 52.5% on health safety management and a highest value of 69.56% on policy, organization and administration system.

It is clear from the study that there is an immediate need in implementing and maintaining a good health safety and management system to ensure health and safety to the workers and to improve the safety standards in the manufacturing sectors. The commitment from the top level management is required to improve the existing conditions. The level of communication between the workers and the management has to be improved, which helps in implementing safety and health in an organization.

References

- Kongtip P, Yoosook W & Chantanakul S, Occupational health and safety management in small and medium-sized enterprises: An overview of the situation in Thailand, *Safety Sci* **46** (2008) 1356-1368.
- Noweir M H, Alidrisi M M, Al-Darrab I A & Zytoon M A, Occupational safety and health performance of the manufacturing sector in Jeddah Industrial Estate, Saudi Arabia: A 20-years follow-up study, *Safety Sci* **53** (2013) 11–24.
- Geldart S, Smith C A, Shannon H S & Lohfeldb L, Organizational practices and workplace health and safety: A cross-sectional study in manufacturing companies, *Safety Sci* **48** (2010) 562–569.
- Zeng S X, Tam V W Y & Tam C M, Towards occupational health and safety systems in the construction industry of China, *Safety Sci* **46** (2008) 1155–1168.
- Kuusisto A, Safety Management Systems Audit tools and reliability of auditing, VTT Publications (2000) 428.
- Shi G & Shiichiro I, International Symposium on Safety Science and Engineering in China, 2012 (ISSSE-2012) Study on the Strategies for Developing a Safety Culture in Industrial Organizations, *Proc Engine* **4** (2012) 535 – 541.
- Guo X, International Symposium on Safety Science and Engineering in China, 2012 (ISSSE-2012) First Responsibility Person for Enterprise Safety: Transition from “Employer” to “Business Owner”, *Proc Engine* **43** (2012) 565 – 568.
- Kwonl H, Cho J H, Moon I, Choi J, Park D & Lee Y, Advanced Korean Industrial Safety and Health Policy with Risk Assessment, *Safety and Health at Work* 2010; 1:29-36.
- Ek A, Runefors M & Borell J, Relationships between safety culture aspects – A work process to enable interpretation, *Mar Policy* **44** (2014) 179– 18 6.
- He X & Li Song b, First International Symposium on Mine Safety Science and Engineering Basic Characteristics of Work Safety in China, *Proc Engine* **26** (2011) 1 – 9.
- Liu Z, International Symposium on Safety Science and Engineering in China, 2012 (ISSSE-2012) Common Problems and Countermeasures in Work Safety Standardization Process in Beijing, *Proc Engine* **43** (2012) 578 – 581.
- Hori M, International Symposium on Safety Science and Engineering in China, 2012 (ISSSE-2012) The Trend and Issues of Occupational Safety and Health in Japan, *Proc Engine* **43** (2012) 610 – 614.

- 13 Zin S M & Ismail F, Employers Behavioural Safety Compliance Factors toward Occupational, Safety and Health Improvement in the Construction Industry, *Proc Soc Behav Sci* **36** (2012) 742 – 751.
- 14 Lin-jun H & Dong L, Development of Safety Regulation and Management System in Energy Industry of China: Comparative and Case Study Perspectives, *Proc Engine* **52** (2013) 165 – 170.
- 15 Wachter J K & Yorio P L, A system of safety management practices and worker engagement for reducing and preventing accidents: An empirical and theoretical investigation. Accident Analysis and Prevention (2013).
- 16 Ismail F, Hashim AE, Ismail W Z W, Kamarudin H & Baharom Z A. Behaviour Based Approach for Quality and Safety Environment Improvement: Malaysian Experience in the Oil and Gas Industry, *Procedia - Soc Behav Sci* **35** (2012) 586 – 594.
- 17 Ping H, Xudan X, Rui Q & Guanqun L, 2012 International Symposium on Safety Science and Technology Statistical analysis on production safety accident of heavy casualties of the period 2001-2011 in China, *Proc Engine* **45** (2012) 950 – 958.
- 18 Arocena P, Nunez I & Mikel Villanueva, The impact of prevention measures and organisational factors on occupational injuries, *Safety Sci* **46** (2008) 1369–1384.
- 19 Tint P, Paas O & Reinhold K, Cost-Effectiveness of Safety Measures in Enterprises, ISSN 1392 – 2785 *Inzinerine Ekonomika-Engine Economics*, 2010, 21(5), 485-492.
- 20 Bigelow P L & Robson L S, Occupational health and safety management audit instruments, Institute for Work & Health, 2006.
- 21 The factories act, 1948 [Act 63 of 1948].