CHAPTER 5
CONCLUSION

5.1 Findings of the Study

1. By the total of 1650 employees, the Company consists of 11 departments with the implementation of OSHMS by certification on OHSAS: 18000 in Year 2008.

2. The Company has their own Safety Policy whereby 78% of the respondents were discovered that they knew the Company's Safety and Policy that is directed towards the control of all types of hazards encountered in the performance of duties. With the safety motto, 'Towards Safe and Healthy Work Culture', the Company has their own safety plant systems that suits with OSHMS.

3. A sophisticated management system was developed by managements in preventing accidents, incidents and controlling risks, to achieve and implement the OSH effectiveness. The Company also has their own;
   (a) Safety and Health Manual (Appendix 19) that was prepared to minimize losses of material resources from accidental occurrences
   (b) Continual Improvement of Safety Implementation System provided as continuous program for employees, which focusing on the importance of safety and health information
   (c) Safety Kaizen Sytem (Appendix 27) in monitoring the use of procedures and checking of safety systems and equipment
   (d) Safety Penalty System for employees' discipline (Appendix 30)

4. "The participations of employees are involved in; (1) safety enhancing programs (2) safety training program (3) safety committee and others"- Mr. Mohd Zain b. Muhammad, Company' Safety Health Officer. ESH Committee Organization at Company consists of Safety Council, Safety Committee and Sub Safety Committee (Figure 4.8). The Company' SHC Manual shows in Appendix 28. Employees' participations can make a significant impact on the prevention of industrial accidents if it receives total support from the management as well.

5. Accident and Incident Investigations (Section 4.3.5), found that the Company has a systematic system in preventing the occurring accident, namely "The Incident Reporting System". It requires the application from all sections and individual, which can result in personal injury, illness, and/ or property and vehicle damage. If accident happened, the Preliminary Investigations was done and the following action was taken by identifying the Potential Accident Factors and Control Measures taken.

6. Work Place Inspections (Sec. 4.3.6) summarizes that, the Company emphasizes on good housekeeping program and physical arrangement (Appendix 33) which include careful planning, a clean-up schedule, effective inspection and continuous enforcement of goods, plant layout and items which will eventually lead to a safe and healthy working environment.

7. Failure Tree Analysis (FTA) (Sec. 4.3.7) indicates that, there are three major possible factors which include not wearing PPE, ESH procedures and human factors (Figure 3.7). This accident's causes are basically because they are not applying PPE that was provided by the Company.

8. The Company's Yearly Incident Case Compares, from Year 2005 until 2011 (Figure 4.1) shows the near miss cases happened, minor, fatal and also major cases reported to ESH Department. The fatal and major cases shows the reduction of cases, from 27 cases in 2009, 25 cases in 2010 and 16 cases in Year 2011 since the OSHMS implementation in Year 2008 (Table 4.1). The higher accident cases reported (4 cases) are from HSM and Caster Sections, with 4 accident cases, where both of these departments were involved in hot and danger area that can affect employee's bodies, which could cause the heat stress and other effects (Detail discussed in Section 4.3.4- Heat Stress Management).

9. 'The employee's attitude and behavior were the main factors that contribute to accident happened"- Mr. Abdul Razak b. Ariffin, ESH Executive. These employees are usually expected to acquire totally new skills on the actual job site but without any structured instruction or training program (Biggs *et al*, 2005). Usually a proper induction program that has been shown to be effective in safety and health program is not conducted for these new employees. These employees constitute the group which is more likely to be involved in accidents (Hinze, 1997).

10. The poor attitude of management towards OSH has been considered as the most important underlying factor for poor accident record. However, the managements play their responsibilities by providing safe workplace for employees. The Company has implemented two major programmes as the Principles of Accident Prevention; (1) (HIRARC) (2) OSH promotion, communication and encourge safe attitude"- Mr. Mohd Zain b. Muhammad, Company' SHO.

11. The potential hazards, was identified by HIRARC, based on Guideline of HIRARC by DOSH, 2008 (Appendix 4). The classify work activities/ processes involved the scrap process, steelmaking, continuous casting, hot strip rolling, and steel product as shown in Table 4.5. Hazards and recommended measures found that;

    (a) Health Hazards (Table 4.6); (1) Chemical; Provide a sealed cabin with filtered air conditioning, cooling ventilation (2) Physical; structure employees' work schedule (3) Psychosocial & physiological; ventilation, administrative controls.
    (b) Safety Hazards (Table 4.7); (1) Explosion and Fire Hazard; Design facility layout (2) Heavy Loads / Grinding & Cutting / Rolling Hazard; (i) Specific Load Handling and Lifting Procedures (ii) Grinding and Cutting Activities; Conduct regular inspection (iii) Rolling Processes and Activities; Provide grids and rails (3) Heat and Hot Liquid Hazard; Implement safety buffer zones.
    (c) Environmental Hazards (Table 4.8); (1) Iron oven preparation; dust (2) Coke ovens; dust, emissions, gases (3) Blast furnaces; silica, gases, asbestos (4) Steelmaking; dust, asbestos (5) Finishing operations; acids, dust, gases (6) Steam generation; gases, asbestos.

12. In preventing and controlling the exposure of air pollution, the Company has taken aggressive approaches by implementing; (1) Air Quality Monitoring (Ambient Air Quality) (2) Air Emission Control; (i) TSP and PM Sampling (ii) Dust (Isokinetic Stack and Air Emission Monitoring) and (3) Stack and Chimney Monitoring (Section 4.3.8 Hazard Controls);

    (a) Ambient Air Quality Monitoring was done regularly every six months in order to check level of air pollution. Based on Appendix 17 and Fig. 3.1-3.6, the results were found for ambient air qualities monitored on 24th - 30th Dec 2009 to be within the Malaysian Recommended Air Quality Guidelines.
    (b) Air Emission Control; TSP and dust are two main concerns to air pollution from plant operation at factory, by ensuring the quarterly analysis was recognized by DOE follow Standard C (Clean Air) Regulation 1978.
    (bi) TSP (TSP and PM Sampling) found that PM components; sulfate, nitrates, ammonia, sodium chloride, carbon, mineral dust and water.
    (bii) Dust (Isokinetic Stack and Air Emission Monitoring) two main types of equipments that covered an automatic sampler (Fig. 4.38) and continuous samplers. In controlling the dust, the mitigation measures done by using dust@ bag collection system (Fig. 4.39) and water spray (Fig. 4.40).

(c) Stack and Chimney Monitoring are complying with the Environmental Quality (Clean Air) Regulation 1978 where the levels of SO_2, CO, NO, CO, ozone, particulates, metals, polycyclic aromatic hydrocarbons was measured according to MCERTS-CAAQMS scheme (Appendix 37).

13. Based on Table 4.15, the Environmental Noise Level Monitoring Result shows that the L_{Aeq} was found to be within Malaysian (Recommended) Limit of 70.0 dB (A) for Daytime and 60.0 dB (A) for Night time at six Point Location (N1-N6). The preventive and protection method such as; (1) Noise Level Monitoring, (2) Appropriate Control Measures, (3) HCP (Appendix 38), (4) Audiometric Test (Appendix 39), (5) Employee's Training as in satisfying with the Factories and Machinery (Noise Exposure) Regulations 1989 (No.7) and Law of Malaysia (Act 127) EQA 1974 (No 23). Comprehensive approaches by using machine insulation with lower noise emissions@ silencer, use noise enclosures, barriers and implement the PPE (wear plugs/ ear muff).

14. "The Company has selected the suitable control in minimizing the hazards such as; (1) Eliminate Control, (2) Substitution Control, (3) Engineering Control, (4) Administration Control and (5) PPE Control"- Mr. Abdul Razak b. Ariffin, ESH Executive and Mr. Mohd Zain b. Muhammad, SHO (Table 4.16).

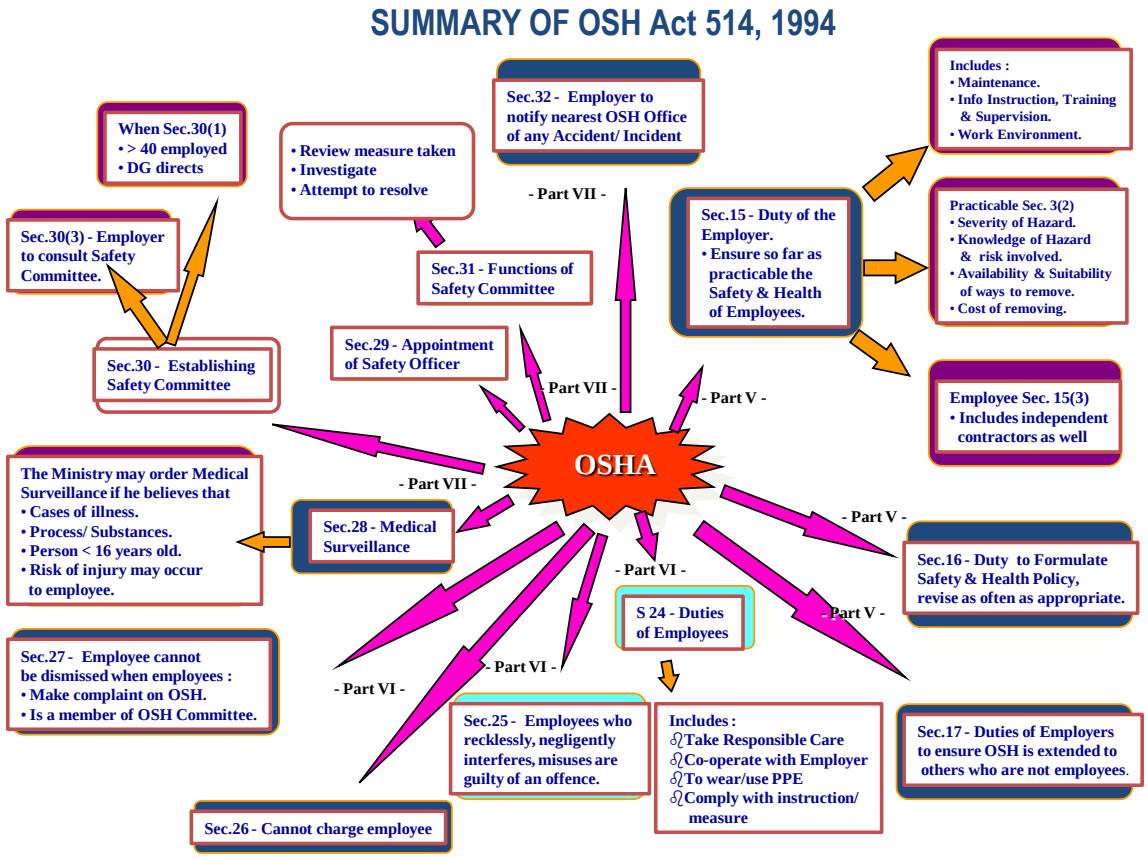
15. Summarized in Hazard Controls (Table 4.16) found that, the management has a good responsibility in controlling and preventing the hazards, towards accident minimizations; (1) Eliminate Hazards; At the source of the hazard (2) Engineering Controls; automation, dilution, barriers, absorption, water spray, machine guarding (3) Administration Control; Safe work procedures/ instruction, ERP, Training, Signage, Redesign/ Job rotations, Housekeeping and maintenance program, supervision and training and hygiene practice (4) PPE; Safety helmet, safety shoes, goggle, mask/respirator, ear protections.

16. The following PPE listed was provided at Company, proves that management has a good responsibility on employee' safety and health; (1) Safety goggles with side shields in compliance with ANSI Z87.1-1989 standards, (2) Safety helmet in compliance with ANSI Z89.1-1986, MS 183:1973 or equivalent, (3) Safety shoes with hard toed and soled in compliance with ANSI Z41-1991 standards or equivalent, (4) Ear plug to be worn in an area where the sound level is at/ more than 85 dBA, (5) Mouth mask and appropriate clothing as necessary.

17. The training that was done for employees in previous Year 2010-2011 which consists of; (1) Safe Work Procedures Training (2) OSH Training and Exercise (3) HIRARC (4) Safety and Housekeeping Inspection (5) SHE Committee Meeting (6) Noise Conservation Program (7) SHE Awareness Campaign (8) CHRA (9) CIMAH. The ESH Training Schedule in Year 2011 was shown in Appendix 44, First Aid Training (Appendix 45) and Fire Drill and Emergency Evacuation Training (Appendix 46). Earlier studies discovered the link between safety training and increased safety performance (Huang *et al.*, 2006).

5.2 OSHA (1994) Requirements and Legislations

Based on the goals, accountability and achievement, objectives of the safety plan of access, the Company have met the requirement of OSHA 1994 and complied with legal requirements on safety and health, by reviewing and continuous improvement of Company' performance, as summary in Figure 4.52 belows.



(SOURCE: Based on Company data, ESH Department)

Figure 4.52: Summary of OSH Act 514 (1994) complied by Company

5.3 Develop ESH Conceptual Model for Steel Factory

The purpose of the study is to develop an ESH Conceptual Model with some important elements and sub-elements, which can provide workable implementation of an OHSMS to steel factory, regarding the OHS obligations. According to Law, Chan & Pun, (2006), there are various phases in implementation of a successful OSHMS; (1) OHS outcome from this study's findings; (2) Establishment of safe person, safe place and safe system strategies; (3) Determination of OHSMS elements for priority; (4) Implementation & development of OHSMS elements; (5) Safety audit or safety review.

Based on the findings from this study, there are three important elements in developing the ESH Conceptual Model for steel factory such as; **(1) Management Leadership and Organizational (2) Potential Hazard Identification** and **(3) Practical methods and Preventions** which had been discussed in detail in the previous chapter. This ESH Conceptual Model was presented in Figure 4.53 below.

The first element and sub- element are as follows; (a) **Management Leadership and Organizational Commitment;** (1) Safety and Health policy; Quinlan and Bohle (1991) pointed out that the strategy for effective planning and implementation of an OHSMS should include the development and dissemination of the formal OHS policy, development, and maintenance (2) Management Commitment; Lin and Mills (2001) found from previous research that the leadership of the organization needs to play a major role in safety. Larsson, Pousette and Torner (2008) also indicated that increased manager safety behavior enables improvement in employee safety behavior. Some safety management elements included regular feedback, open communication, goal setting, accountability, safe working procedures, etc (Makin & Winder, 2008).

ESH CONCEPTUAL MODEL FOR STEEL FACTORY

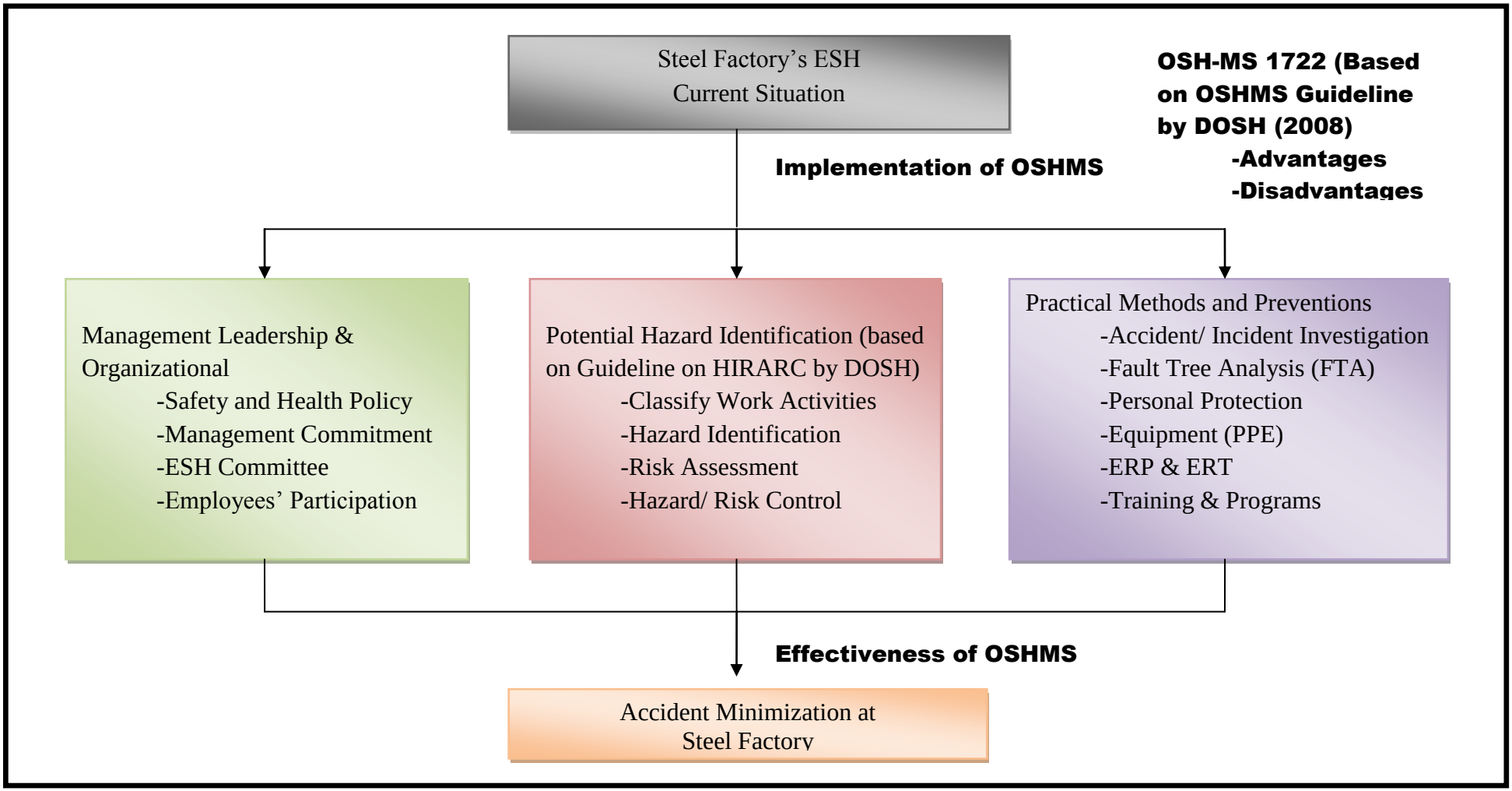


Figure 4.53: ESH Conceptual Model for Steel Factory

((3) ESH Committee; Gustin (2008) indicated that "safety is a condition of employment" and consequently everyone has to "make a commitment and assume responsibilities", Clear delineation of the safety and health responsibilities of every member of the organization (Quinlan and Bohle, 1991) (4) Employees' Participation; Reese (2009) highlighted that participation from everyone in the workplace is vital to ensure effective implementation and emphasized that safety training and education is crucial to the avoidance of accidents. The study conducted on employees' attitudes towards safety in the manufacturing sector in the UK also found a good physical working environment and employees' involvement as key factors that contribute to safety activities in organizations (Cheyne *et al.*, 2002).

The second elements from the findings of this study is **Potential Hazard Identification** (which is based on Guideline on HIRARC by DOSH), and the sub-elements are; (1) Classify Work Activities (2) Hazard identification (3) Risk Assessment (4) Hazard/ Risk Control. Cheyne *et al.*, 2002) have identified safety standards and goals, safety management, which included personal involvement, communication, workplace hazards and physical work environment as factors that enhance safety activities in an organization.

Mearns, Whitaker and Flin (2003) affirmed that "the identification of hazards and their corresponding control measures provide the foundation for a safety program and essentially determine the scope, content and complexity of a successful OHSMS" (Makin & Winder, 2008). Thus, effective risk management concentrates on blending three elements that exist in an organization: people, physical workplace and management.

Makin & Winder, (2008) reported that three strategies such as safe place, safe person, and safe system are used in dealing with hazards introduced by the combination of these three elements. Safe place strategies concentrate on a risk assessment process and hierarchy of control to remove hazards in the physical workplace. Some examples of safety management elements are inspection, job hazard analysis, accident control, hazard elimination, etc. (Law, Chan & Pun, 2006). Safe system strategies highlight hazards resulting from management aspects like poor supervision, lack of leadership, lack of feedback and poor communication, etc. (Makin & Winder, 2008).

The third element is **Practical Methods and Preventions**, and the sub-elements are as follows; (1) Accident/ Incident Investigation (2) FTA (3) PPE (4) ERP & ERT (5) Training and Programs. Safe person strategies emphasize the human factor in providing employees with the necessary knowledge, skill and abilities to deal with hazards around. Examples of the safety management elements are safety training, safety rules, PPE program, safety and health awareness, etc. (Law, Chan & Pun, 2006).

An international research study of OHSMS undertaken by the ILO, found a large number of documents or audit tools in use around the world and chose twenty four for content analysis. The majority were found to be strong in traditional areas of health and safety management such as risk assessment, hazard control, training and evaluation (Makin & Winder, 2008).

5.4 Criterias in Implementing a Good OSHMS

Excellence OSHMS *(Source; Petersen, 2000)*

Six criterias need to be fulfilled for excellence OSHMS; (1) Safety must be a core value of an organization through daily behaviour-based safety by supervisors and teams; (2) Involvement by middle managers to ensure quality performance of subordinates, supervisors or team performances to demonstrate safety behavior; (3) Visibly demonstrated executive action; (4) Obtain hourly involvement in meaningful daily activities; (5) Allow flexibility; (6) Be perceived as positive by employees.

Benefits of OSHMS *(Source; CASA, 2002)*

The benefits of OSHMS are as follows: (1) Market the safety standards of the organization's operations; (2) Guard against direct and indirect costs of incidents and accidents; (3) Improve communication, morale and productivity of employees; (4) Meet an organization's legal responsibilities to manage safety at the workplace.

Strengths of OSHMS *(Source; OSHMS, 2011)*

The strengths of OSHMS consist of; (1) The possibility of integrating OSH requirements into business systems; (2) Harmonizing OSH requirements, particularly pertaining to quality and environment; (3) Providing a logical framework upon which to establish and run an OSH programme; (4) Streamlining and improving communication mechanisms, policies, procedures, programmes, and objectives; (5) Establishing an environment conducive; (6) Strengthening social dialogue; (7) Distributing OSH responsibilities along the line management, involving all; (8) Adapting to the size and activity of the organization, and to the types of hazards encountered (9) Establishing a continuous improvement framework.

Key Elements for a Good OSHMS *(Source; OSHMS, 2011)*

Key elements for a good OSHMS; (1) Adapt the OSHMS accordingly; (2) Ensure that the system stays focused on the performance of preventive and protective measures; (3) Keep in mind that it is designed to improve rather than to justify itself; (4) Ensure that audits contribute to the continual improvement process rather than becoming a mechanism for improving audit scores only; (5) Remember that a management systems' approach is only as good as the OSH framework or programme in place in the organization; (6) OSHMS programmes must function within the national OSH legislation framework; (7) OSH related training for the implementation of the OSHMS programme should be carried out on a continuous basis at all levels; (8) Communication channels between the different levels of the organization need for the system to focus on people; (9) OSHMS could not be functioned properly without the existence of effective social dialogue; (10) The system is successful only when all the stakeholders are given defined responsibilities in running it.

Factors contributing to effective OHSMS *(Source; NOHSC, 2001)*

Factors contributing to effective OHSMS; (1) Type of System; Customized to organization's needs, Developed with support and involvement of all organization stakeholders (2) Management commitment; Strong senior management involvement, OHSMS introduced to improve OHS, Provision of adequate resources, OHS integral to management performance appraisals, Leading by example (3) Integration into Management Systems; All organizational functions incorporate OHS (4) Role of Employee Involvement; All employees encouraged and able to Participate, Independent representation of employees encouraged and supported.

5.5 Barriers and Limitations in Implementing OSHMS

(a) Barriers of OSHMS

The barriers are; (1) lack of success in meeting the necessary requirement; (2) unsuitable usage of audit tools to guarantee compliance; (3) difficulty of implementation in certain sectors due to workforce attributes such as in familiarity with OHSMS, lack of resources, temporary employees that are not committed, under-trained (Underhill and Rimmer, 2003). Other barriers according to NOHSC (2001) are; (1) Failure in meeting necessary conditions for OHSMS success (by not customizing systems to organizational needs, imposition without consultation, weak seniors' management commitment and poor employee involvement) (2) The inappropriate use of audit tools (where they become an end in themselves, are governed by misplaced management objectives, and are conducted without sound auditor skills, standards and criterias) (3) Application in hostile contexts (small business, precarious employment).

(b) Limitations of OSHMS *(Source; OSHMS, 2011)*

(1) The production of documents and records need to be controlled carefully to avoid defeating the purpose of the system by drowning them in excessive paperwork; (2) Imbalances between management processes (quality, OSH, environment) must be avoided to prevent dilution of requirements and inequalities in focus; (3) OSHMS usually puts greater emphasis on safety rather than health and with the risk of missing the onset of occupational diseases. Occupational health surveillance of workers must be incorporated in the system as an important and effective tool; (4) Depending on the size of the organization the resources that are required to set up an OSHMS can be significant and should be the object of a realistic appraisal of overall costs in terms of implementation time, skills and human resources required to install and run the system.

5.6 Summary of the Study

(i) Significance of the Study

The steel mill industry could be a major contributor to national economy. In this study, a conceptual model which related to ESH has been developed for the organization under study. The significance of this study lies in the fact that it has greatly enhanced the awareness of the employees with respect to their concern related to OSH at the workplace. This has enabled the organization to reduce the rate of accidents and has helped the government to bring out enforcement effectively pertaining to OSH legislation.

The main significance of the safety and health program at a workplace lies in its impact on the prevention of accidents so as to enhance the morale of the employees leading to an increase in productivity in an organization. Employees' awareness is influenced greatly by involvement in the safety and health programme where the successful of the OSH programme in the organization is based on co-operate with employers. With regards to this, the employers have also adopted a more positive culture towards the safety and health programme.

By means of OSH legislation, enforcement officers should help the management in implementing the regulations for safety and health in order to contribute a safe and comfortable workplace. The organization needs to ensure that regular monitoring is in place in order to avoid accidents and occupational diseases in the workplace.

(ii) Recommendations for Future Research

Based on the findings on a comparative study encompassing local and international regulations are recommended in order to set up a suitable benchmark for future development of ESH in a steel factory. Some of the recommendations are as follows:

a) Engineering and Administrative Controls

Identifying and implementing engineering controls would be the strategy of choice. With regards to this, a baseline has to be established with a view to eliminate hazards or reduce the exposure to hazards. This should enable the control of hazards at the source, unlike the other controls that generally focus on the employees after being exposed to hazard. On the other hand, administrative controls can also be implemented meaningfully with respect to OSHA's regulations in order to reduce employees' exposure to hazards by management control. It is normally used in conjunction with other controls which more directly prevent or control exposure to hazards that include rotation, additional relief and exercise breaks for employees concerned.

b) PPE and Preventive Maintenance Systems

A supplementary method of control is the use of protective clothing or equipment that are collectively termed PPE, which appropriate for controlling hazards while engineering controls, administrative controls and work practices are unable to provide sufficient additional protection. Good preventive maintenance plays a major role in keeping new hazards from arising according to equipment malfunction and also ensuring that hazard controls continue to function effectively.

(c) The Integration of Management Systems

The integrated management system proposed by Savic (2001) combines four systems: the Quality Management System (ISO 9000: 2000), the Environment Management System (ISO 14000), the Risk Management System (ISO 17000) and the Health and Safety Management System (ISO 18000). The integration of these systems will produce a synergetic effect and is possible as all systems focus on risk reduction and they enable human performance to be optimized.

Some benefits of integration from previous literature review as indicated by Beckmerhagen *et al.*, 2003, Zutshi and Sohal (2005) are: (1) more focused and simple standards of management systems (2) less paperwork needed for all management systems (3) cost reduction in registration, auditing and implementation (4) the elimination of repetitive policies, procedures and records for all management systems (5) coordination of documentation for all management systems (6) objectives, resources and procedures are standardized in all functional areas (7) concurrent auditing for integrated systems, and (8) an enhanced decision-making procedure due to the latest information from an integrated management system.

(d) Implement the "Plan-Do-Check-Act" Deming Cycle (PDCA) Principle

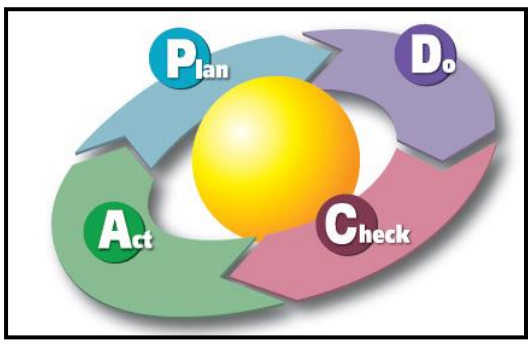


Figure 4.54: The Deming Cycle (PDCA) Concept

This concept of a process is based on the principle of the "Plan-Do-Check-Act" Deming Cycle (PDCA), designed in the 1950s to monitor business performance on a continual basis (Figure 4.54). When applied to OSH, "Plan" involves the setting of an OSH policy and planning. The "Do" step refers to actual implementation and operation of the OSH programme. The "Check" step is devoted to measure both the active and reactive performance. Finally the "Act" step closes the cycle with a review of the system in the context of continual improvement and the priming of the system for the next cycle.

(e) Promote the OSHMS Concepts & Performance

Nowadays, OHSMS has become one of the major strategies for addressing workplace safety and health, in systematically preventing and controlling the possibility of accidents and illnesses in the workplace and to comply with statutory requirements (LaMontagne *et al.,* 2004). Even though the use of an OHSMS approach has gained popularity, Gallagher (2000) stated that the research on the effectiveness of OHSMS was still not in agreement due to; (1) an inconsistent definition of what OHSMS is; (2) the focus was more on individual correlation rather than on OHSMS; (3) no reliable measures of OHS performance; and (4) inconsistent findings of empirical research especially to denote association between OHSMS performance and injury outcomes.

Organizations have started to show interest in OSHMS for the following reasons (Hale *et al.,* 1997); (1) Regulatory interest to comply with the OSH Act; (2) Reports on major disasters that emphasized the failings of management to protect the health and safety of their employees; (3) Government requirements for OSHMS to assist organizations to comply with regulations; and (4) Increased awareness of corporate responsibility.

(iii) Summary on Conclusion

It is undeniable that all countries in this world have dream of becoming an industrialized country. However, in the quest to fulfill the dream, the safety of the employees who work hard to help the county achieve its dream should not be ignored. Prior to attempt an identification of the solution for workplace accident, it is important to have a better understanding or what the elements are or factors that cause workplace accident first. It is therefore important to identify the causes of accident so that it can be prevented in future and to reduce injury, and ill health. The Government has introduced multiple approaches to address the issues of minimizing the risks that related to the steel's industry's activities by the legislation. However, the regulations and legislation themselves are not enough to reach desired goal of zero accidents and incidents. By the implementation of OSHMS, the Company has gained the positive benefits in minimizing and reducing the accident at workplace. The objectives set out in this study have been largely obtained.