Chapter 1

AN INTRODUCTION

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1.1 An Overview

On 25 March 1911, 146 female garment factory workers died in a fire at the Triangle shirtwaist factory in New York. The main reason behind this accident was factory lacked sufficient exits and there was only one stairway, which was locked that time. In 1984, world’s worst chemical disaster, a methylisocyanate gas leak from the union carbide plant in the Bhopal city killed over 4000 people. Another factory disaster happened in June, 1993 in Kader industrial factory in Bangkok, where 189 women died in due to fire. Workers were trapped due to exits locked and regulatory controls were inadequate.

The Deepwater Horizon drilling rig explosion refers to the April 20, 2010 explosion and subsequent fire on the Deepwater Horizon semisubmersible Mobile Offshore Drilling Unit (MODU) killed 11 workers and injured 16 others. The explosion caused the Deepwater Horizon to burn and sink, resulting in a massive offshore oil spill in the Gulf of Mexico, considered the largest accidental marine oil spill in the world, and the largest environmental disaster in U.S. history.

On 25 August 2012, an explosion caused by the ignition of a leaking gas at the Amuay oil refinery, which is part of the Paraguana Refinery Complex, killed 48 people; primarily National Guard troops stationed at the plant, and injured 151 others.

According to the report developed by the NORA Oil and Gas Extraction Council; In the US, during 2003-2008, 648 oil and gas extraction workers were fatally injured on the job, resulting in an occupational fatality rate of workers and employees working in wholesale trade, textile mill production, plastic manufacturing, insurance, real state, personal services, or printing and publishing are exposed to thousands of chemical products. Every day more than 80000 chemical products are added to the market every year (Enander, Gute, Cohen, 313). According to the United States
environmental protection agency Toxic release inventory, reported releases for 522 chemical compounds during 2001 show that more than 750 million tons of chemical compounds were emitted to the air, more than 100 million tons were discharged to surface water and more than 1500 million tons were released to the land solely in the United States. Among the 522 chemical compounds included in the list are asbestos, ammonia, arsenic compound, heavy metals (like chromium, mercury and lead), pesticides (like malathion) and solvents (like xylene, benzene, acetaldehyde, and derived compounds), just to mention a few.

The latest statistics on work-related health and safety show that 2 million people are suffering from illness they believe it was caused or made worse by work, with approximately 30 million days (1.3 days per employee) lost per year due to work-related ill health or injury. Approximately 24000 workers are injured every eight hour work day and almost 17 workers are killed on the job each day in the United States (OSHA, 2007). In 2009 there were 3277700 non-fatal injuries and 4340 fatalities (Bureau of labour statistics 2009). These incidents and fatalities are estimated to cost 170 billion dollars per year (OSHA, 2008). The national safety council estimated 1330000 dollars per death and 53000 dollars per disability injury (National safety council, 2009). International labour organisation (ILO), that acts in the interest of the workers, embraces the idea that worker’s point of view need to be heeded and given equal status with those of others stakeholders in the workplace in ensuring sound business development. ILO estimate that the cost of work related ill health and accidents is 4% of the global GDP or 1.25 trillion US dollars. Bennet(2002) argues that workers, unlike tools or objects of production, are living human beings that need to be involved in the improvement of working conditions and should participate at all levels, including international levels, on issues that affect their livelihoods. Worker’s
perspectives need to be considered in devising and carrying out health and safety measures at the workplace (Bennet, 2002). Work-related ill health, accidents and injury present in every economy whether it is developed, developing or under developed and employers, as well as to individual employees and their families who experience the personal impact of work-related health and safety issues – an impact which may be felt long after the event. As a result an increased number of fatal and nonfatal illness and diseases, and increases in morality risks from exposure in the workplace are now, reality.

Workplace prevalence and incidence rates have become common measures in health statistics publications while occupational illness, such as chronic pulmonary diseases, ischemic heart disease, myelodysplasia syndromes or malignant neoplasms are regularly documented. Even with workforce, industrial societies are suffering from the burdens of environmental hazards.

1.2 Meaning of Accident
Accidents may be defined as an unplanned event which causes injury to a person. A legal definition of the accident has been provided by the **Factories Act 1948** which states that “Accident is an occurrence in an industrial establishment causing bodily injury to a person which makes him unfit to resume his duties in the next 48 hours.” There are various types of industrial accidents. It may be classified as major and minor; it depends upon the severity of the injury. Minor accidents include a scratch or cut which does not disable him but a deep scratch may or may not immediately disable the worker, but he or she may develop disability later.
The civil law establishes the extent of damages or compensation which organisation has to bear due to accidents. Under the criminal law, sentences are prescribed under the pollution control laws.
An accident may be internal or external. An internal injury means sometime a worker fall he or she may show no external injury but he may have fractured a bone or strained on muscle or nerve.

1.3 Major industrial accidents in India

- **Bhopal, December 1984** in the world’s worst chemical disaster, a methylisocyanate gas leak from the union carbide plant in the city killed over 4000 people. Thousands suffered irreversible health damage.
- **Delhi, December 1985** an Oleum gas leak from the Sriram Foods and Fertilizers plant in Delhi severally affected workers and those living in the neighborhood.
- **Rourkela, December 1985** blast furnace accidents in Rourkela steel plant, 18 workers affected.
- **Durgapur, June 1987** Chlorine leak at Durgapur Chemical Factory created panic all around. Long distance trains were halted. Over 100 workers were affected.
- **Mumbai, November 1988** fire at the Bharat Petroleum Refinery at Mahul, north-east Mumbai killed 32 workers.
- **Ramagundam, September 1989** major gas leak at Fertilizers Corporation of India unit at Ramagundam.
- **Nagothane, November 1990** explosion at the Indian petrochemicals, Nagothane complex, 35 persons killed, over 50 suffered 70 percent burns.

Gwalior, December 1991 blast at the dyeing department of GRASIM unit of Gwalior, 14 killed and 22 severally injured.

Panipat, August 1992 ammonia leak at the National Fertilizers plant killed 11, many injured.

Kahalgaon, October 1992 boiler explosion in the National Thermal Power corporation (NTPC) 11 killed and several injured.

Chhattisgarh, September 2009 Korba chimney collapse occurred in the town of Korba it was under contract for the Bharat Aluminum Co Ltd (BALCO). At least 45 deaths were recorded.

Jaipur, October 2009 a huge ball of fire with loud explosion broke out engulfing the leaking petrol tank in Indian Oil terminal and other nearby petrol tanks with continuous fire with flames rising 30–35 meter and visible from a 30 km radius.

Vaniyambadi, Tamil Nadu January, 2010 five people died in Vaniyambadi district, after inhaling poisonous gas at a local tannery.

The victims were cleaning a tank used for chemical treatment of leather, when they were exposed to the gas.

Pune, January 2011 twenty people were hospitalised due to chlorine gas leak from an effluent treatment plant in PimpriChinchwad area.

Vellore, Tamil Nadu, January 2015 Ten factory workers, died after a wall collapsed in an industrial plant in Vellore district. The accident happened in the SIPCOT industrial area in Vaniyambadi after a waste treatment plant at the site burst open and the sledge knocked down the wall, which collapsed on the workers sleeping in the adjoining plot, say police officials.
1.4 Causes of Accidents

There are various factors which causes the accidents. Accidents may not happen they are caused. A study was conducted on the basis of 75000 accidents by Heinrich, it was concluded that 98 percent of accidents were caused either by unsafe action or unsafe mechanical or physical conditions or both and these could have been prevented. He put a theory of chain if injury occurrence. Thus:

1. An injury occurs only as the result of an accident
2. An accident occurs only as a result of unsafe condition or unsafe act or both
3. Unsafe conditions or unsafe acts exist only because of faults on the part of persons; and
4. Faults of persons are inherited or acquired from the environment anatomical or physiological characteristics, lack of knowledge or skill, and improper mechanical and physical environment.

Based on the theory of chain of injury occurrence, it can be concluded that in every accidents, there is a chain of events which occurs in a logical and fixed order. There are a variety of factors which cause the occurrence of this chain and accidents. These factors may be grouped into two categories:

- Unsafe conditions
- Unsafe acts
1.4.1 Unsafe Conditions
Unsafe conditions are work related causes and are the most frequent causes of accidents. Such causes are associated with defective plants, equipments, tools, materials, buildings, and other technical factors. Since these causes are related to the technical aspects of the work, these are known as technical causes. Various work related factors which cause accidents to occur are as follows:

1. **Nature of job:** Nature of a job itself is a source of accidents. Some jobs are more prone to accidents as compared to others, e.g. job of a crane operator as compared to foreman. Generally, those jobs are more accident prone in which the workers come into direct contact with machinery in motion or hazardous materials like different types of chemicals, explosive etc.
2. **Nature of machinery and equipments:** Some machinery and equipments have danger zones as compared to others. For example, about one-third of accidents occur around hand lift trucks, wheel borrows and other handling and lifting equipments. The most serious accidents usually occur near saws or transmission machinery like gears, pulleys and flywheels- stairs, ladders, walkways, scaffolds, and handrails. Similarly, hand tools- chisels and screwdrivers and electrical equipments- extension cords, electric drop lights etc. are also major sources of accidents. Chemical tanks, boilers, gas storage devices, etc. causes serious industrial accidents.

3. **Poor physical conditions:** While nature of jobs, machinery and equipment affect every organisation uniformly, these become causes of accidents when these are not properly laid down or maintained. Poor physical conditions prevailing at the workplace causing accidents are of the following types:
   - Hazardous layout of plant and machinery
   - Defective work procedure in and around machinery and equipment
   - Defective machinery and equipments
   - Unsafe storage, congestion and overloading
   - Inadequate and faulty safety devices
   - Improper illumination-glare or insufficient light
   - Improper ventilation causing insufficient air charge and impure air source

4. **Psychological climate at the workplace:** Apart from physical conditions, psychological factors are in the form of mental fatigue, anxiety, monotony, boredom, frustration and other emotion
arousing factors. All these factors cause inattention in the workers and they become prone to the accidents. However, all workers may not be equally affected by these factors but their personal characteristics play role in this respect.

5. **Work schedules:** Work schedules are also responsible to some extent for the accidents. Work schedules involving long hours of continuous working generate fatigue which may be cause of accidents. Similarly, night shifts generate more accidents as people are not accustomed to working in night which is considered to be the rest period. It has been observed that more accidents occur during the late hours as compared to early hours of work schedules.

### 1.4.2 Unsafe Acts

Unsafe acts are those activities which are not taken according to the prescribed standards or procedures. Such acts are of the following nature:

1. Operating without authority
2. Failure in using safety devices
3. Failure to listen to warning
4. Throwing material on the shop floor carelessly
5. Operating machines/equipment at unsafe speed
6. Making safety devices inoperative by removing, adjusting or disconnecting them
7. Using unsafe equipments or using equipments unsafely
8. Using unsafe procedures in loading, placing, mixing and combining
9. Taking unsafe positions under suspended loads
10. Cleaning, adjusting, oiling, repairing etc. on moving equipments
11. Any other improper act against prescriptions
1.5 Financial losses of various accidents

Industrial accidents affect to both employer and employee in following way:

- Cost of compensation to the affected employees
- Cost of medical aid
- Cost of training a new worker
- Cost of lost time when work stops due to an accident
- Cost of investigation into the accident
- Cost of supervision and inspection
- Cost of government in terms of factory inspection and public health services
- Cost of spoilage of materials
- Cost of damage to machinery
- Cost of wages payable during injury
- Impact of loss of morale and reputation of the company

Financial losses of various accidents are revealed in the table:

<table>
<thead>
<tr>
<th>Date of occurrence</th>
<th>Name of Organisation</th>
<th>Estimated loss (Rs. in crore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-01-87</td>
<td>Madras Ref., Manali</td>
<td>4.85</td>
</tr>
<tr>
<td>11-11-87</td>
<td>HPL Ref., Virag</td>
<td>3.40</td>
</tr>
<tr>
<td>09-01-88</td>
<td>JK synthetics</td>
<td>6.92</td>
</tr>
<tr>
<td>20-09-88</td>
<td>Monika Electronics</td>
<td>3.86</td>
</tr>
<tr>
<td>05-05-88</td>
<td>Zenith chemical, Tarapur</td>
<td>4.00</td>
</tr>
<tr>
<td>30-08-88</td>
<td>IOC, Mathura</td>
<td>4.63</td>
</tr>
<tr>
<td>07-09-88</td>
<td>IEL, Gornia</td>
<td>5.00</td>
</tr>
<tr>
<td>09-11-88</td>
<td>BPCL</td>
<td>9.00</td>
</tr>
<tr>
<td>02-02-89</td>
<td>IPCL, Baroda</td>
<td>41.82</td>
</tr>
<tr>
<td>09-02-89</td>
<td>IAAI, Mumbai</td>
<td>43.00</td>
</tr>
<tr>
<td>23-02-89</td>
<td>Voltas, Warora</td>
<td>5.00</td>
</tr>
<tr>
<td>08-01-95</td>
<td>ONGC</td>
<td>41.44</td>
</tr>
</tbody>
</table>
In the early 1900s the only mission of business firms was profit earning, and workers in the organisation are treated as factor of production. But, in today era social involvement of business has increased and the importance of workers has been increased. Now they are not treated as factor of production but they are treated as the asset of the organisation.

Although in the era of competition the measure of excellence is profitability but significance of human factor cannot be ignored. Today every organisation whether it is private or government recognizes the urgent need for productivity improvement. Productivity means effectiveness and efficiency in individual and organisational performance. Today the prime necessity of any organisation is to achieve the target of acceptable degree of effectiveness and efficiency in an industry and accident-free environment. It is essential because accidents create not only personal grief and distress but also huge financial costs and unwelcome negative publicity for the organisation. Due to the emergence of concept of social responsibility of business people will not allow organisation to ignore the impact of their activities on surrounding communities. Various stakeholders have different interest. In meeting their health, safety and environmental responsibilities, businesses have to maintain a balance between conflicting interests. When a firm puts forward a safety recommendation some stakeholders want to know about the expenditure incurred on the health and safety program, whilst the another stakeholders like employees are more likely to ask about the illness, injuries or deaths it is likely to prevent each year.

1.6 Meaning of Health

Before understanding the importance of health and safety management it is essential to understand the exact meaning of these words.
Health can be described as a complete state of physical, mental and social well being. Sometimes it can be defined as an absence of disease. But in real the scope of health is broader than it. It is the outcome of the interaction between the individual and its environment. An individual can be considered as healthy when he is well adjusted in his environment. The basic objective to study the industrial health is to anticipate potential hazards and preventive actions rather than curative action. Basically it is the condition of enterprise operation in which accident free production is achieved. Generally accidents means when machinery or instruments are damaged, material is spoilt or someone is injured. Sometimes accidents may not result in personal injury but in both situations individual is exposed to an unsafe condition. So it is essential that engineers, chemists and personnel officers think and identify potential hazards areas and develop control measures to prevent hazards.

A joint committee (WHO & ILO) was constituted on organisational health, which defines industrial health as follows:

1). The promotion and maintenance of physical, mental and social well being of workers in all occupation;

2). Prevention among workers of ill health caused by the working conditions;

3). Protection of workers in their employment from risk resulting from factors adverse to health;

4). Placing and maintenance of the worker in an occupational environmental adapted to his physical and psychological equipment.

So the modern concept of health anticipates and recognises potentially harmful situations and applies measures to prevent disease and infirmity.
Workers spend minimum eight hours at workplace and during this time they should be alert, healthy and active the work as per quality and quantity expectations. This is possible only if work environment is good. With the impact of industrialisation and globalisation, workers are exposed to various types of health hazards. Due to such health hazards, workers cannot concentrate on their work. This would cause the absenteeism and labour turnover.

This will directly affect the productivity of the organisation. These reasons also lead to industrial indiscipline and discontent. Mr. RB Blake states, “Accidents are expensive. Substantial saving can be achieved by preventing them.” There are mechanical, electrical, chemical and biological hazards along with radiation which are endangering human life all throughout. So the subject of industrial safety is given due care and a proper safety program should be evolved and implemented. Safety management involves the elimination of the agents of injury as well as a reliable control of harm to the employees. Thus the importance of health program has been increased.

### 1.7 Importance of Heath

Occupational health is an integral part of the health management system. It is concerned with the interrelationship between work and health. Occupational health is defined as the prevention of health at the workplace (ABOHN,2003). Among its activities, it includes then detection of work and workplace hazards, evaluation of regulatory compliance, and counseling crisis intervention (ABOHN,2003). Practitioners of occupational health have among its functions the following: (1) health supervision of employees, (2) pre-placement health
assessment, (3) routine health assessment, (4) health education, (5) environmental surveillance, (6) employee counseling, treatment and rehabilitation, (7) record keeping of employee health data. It is also expected that occupational health professional are able to identify hazards at the workplace, such as exposure to infections, chemicals, allergens, irritants, and hazardous waste (Dixon, 1984).

Main objectives of an occupational health are:

- Protect, promote and maintain the health and welfare of people at work;
- Advice on the provision of safe and healthy conditions by informed assessment of the physical and psychological aspects of the working environment;
- Identify and advise management on the causes of occupational disease and injury and the means of their prevention;
- Advise on the rehabilitation and placement in suitable work of those temporarily or permanently incapacitated by illness or injury; and
- Assist in the planning and preparedness of emergency response plans.

To achieve these aims, a team approach should be taken by occupational physicians, occupational nurses, industrial hygienists, other occupational health professionals and administrative and other staff.

As discused earlier, in the era of industrialisation and globalisation improved the employment opportunity and per capita income but another side workers are facing various hazards in the workplace, interaction between worker and the environment leads to occupational health hazards, so there is a need to monitor the worker’s health and working
environment. A good industrial hygiene program, effective implementation of which the design engineers, medical experts, supervisors ensure, and workers translate this to action at the shop floor is a necessity. So the importance of occupational safety has been increased. In order to enable the employees to carry out their duties which cannot be eliminated, safety measures should be followed. The word ‘safety’ seems easy to hear which means just make sure that workers of the organisation don’t get hurt but in practice the scope of word safety is more broader which means to achieve the a safe organisation that is capable of sustained safe performance in the face of significant hazards. If there is absence of health and safety measures it would increase the accidents resulting injuries to workers, damage to equipment and machinery, financial loss to both employer and employees.

Dr. S Radhakrishnan, former president of India said, “Our own constitution puts it down as a directive that we must provide safe and humane conditions of work for our industrial workers. We should do our utmost to see those conditions of life for them are adequate and they are well looked after. There must be integration between the management and labour.

What we must try to do is to prevent accidents as much as possible and encourage education in industrial safety. What exactly is required is will, determination, effort and dedication to see this country proposer and progress.”

During early days it was believed that accidents were the results of employee’s carelessness but later on various legislations like factories act 1948, ESI act 1948, Workman’s compensation act 1923, duly amended from time to time which stated the importance of industrial safety. This
act adopted by industrialized nations. This act also adopted by other nations with the aim of reducing industrial accidents. Under this act safety has been recognized as an integral part of the normal operating procedures and has a definite responsibility of all supervisory personnel along with all employees.

A study was carried out on the Challenger Space Shuttle accident of 28 January 1986 in which seven people died. This revealed that there were differences, and between engineers and managers, upper and lower levels managers, and insufficient provision for upward communication outside the chain of command which caused the accident.

In recent years, there are various reasons which force to managers to think about industrial health like pressure of trade unions, various labour legislations and enlightened behavior of workers. National commission on labour and other committees have also stressed on creation and maintenance of as healthy environment as possible both at the work place and in the homes of workers.

According to Section 2 of Health and safety at work act, “Employers have a general duty to ensure the health, safety and welfare of their employees at work.” Section 4 of this act defines that people in control of non-domestic premises have a duty towards people who are not their employees but use their premises. A proper health management system helps to organisation to control the health risks and improve the performance of employees. This system helps to convey the company’s structure, responsibilities, practices, procedures and resources for implementing health management, including processes to identify root causes of poor performance, prevent recurrences and drive continuous improvement. The health management system should be designed to
complement national and international standards and regulatory requirements as necessary, as well as individual corporate health guidelines within which companies and contractors conduct their business.

Occupational health plays an important role. It helps:

- To improve the production and productivity of the organisation
- To reduce the industrial accidents and indiscipline
- To preserve and improve the physical and mental health of the workers
- To reduce the absenteeism and labour turnover
- To reduce the wastage and cost of production
- To improve the employee’s morale and motivation
- To reduce rework and rejection
- To reduce complaints and unhappiness

1.8 Occupational Health and Safety Management System

In the year 1995, Australian Industry Commission inquiry and report into OH&S recognised that best practice organisations, measured in terms of OH&S outcomes is enterprise safety management systems. The Commission recommended that OH&S legislation in each jurisdiction recognise safety management systems as a means for managing risk. According to the commission a structured systematic means for ensuring that both general and particular aspects of what the organization does are effectively managed to meet high standards of safety.
Standards Australia defines an OH&S management system as, “That part of the overall management system which includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the OHS policy, and so managing the OHS risks associated with the business of the organization.

Occupational health and safety management system (OHSMS) have been defined by Gallagher as “……a combination of the planning and review, the management organizational arrangements, the consultative arrangement, and the specific program elements that work together in an integrated way to improve health and safety performance.”

The institute for work and health defines HSMS as “the integrated set of organizational elements involved in a continuous cycle of planning, implementation, evaluation and continual improvement directed towards the abatement of occupational hazards in the workplace.”

Gallagher’s classification of health and safety management is more comprehensive approach. Under this approach the types which are identified all meet the basic requirements of an OHSMS.

The whole system is classified by difficult OHS control strategies and second by different management structure and styles. OHS control strategies are categorized as either “SAFE PERSON” or “SAFE PLACE” management structures and styles are either traditional or innovative.

System types

1. Safe person control strategy: Prevention strategy focused on the control of employee behavior
2. **Safe place control strategy:** Prevention strategy focused on the control of hazards at source through attention at the design stage and application of hazards identification, assessment and control principle.

3. **Traditional management:** Under this system type:
   - The key persons in health and safety are the supervisor and/or any OHS specialist
   - A low level of integration of health and safety into broader management systems and practice
   - Employees may be involved, but their involvement is not viewed as critical for the operation of the OHSMS, or alternatively a traditional health and safety committee is in place.

4. **Innovative management:**
   - Senior and line managers have the key role in health and safety
   - A high level of integration of health and safety into broader management systems and practices
   - Employee involvement is viewed as critical to system operation and there are mechanism is place to give effect to a high level of involvement
The key components of any health management system should include the following (E & P Forum, 1994)*:

- Leadership and commitment;
- Policy and strategic objectives;
- Organizational, responsibilities, resources, standards and documentation;

Health and safety management of oil and gas industry includes:

1. National and international standards such as:
   - BS OHSAS 18001: 2007 Occupational Health and Safety management system
   - BS EN ISO 9001:2008 Quality management system

2. In house standards, procedures or codes
3. Sector specific framework such as the
   - Energy institute’s high level framework for process safety management
   - Chemical industries association’s responsible care framework

Health management system plays an important role in organisation. The benefits of effective health management are:
   - Ensuring safety in organisation
   - Eliminating illness related to work
   - Managing medical care
   - Maintaining a healthy workforce
   - Meeting legal requirements
   - Ensuring cost-effectiveness
   - Optimizing business performance and reputation
   - Risk management
   - Planning and procedure
   - Implementation and performance monitoring
   - Audit and management review

Now this system is recognized by the government, workers and employers that occupational safety and health management system make positive impact, both on the reduction of hazards, risks and on productivity.

OHSAS-18000 was developed by the group of 13 European certification companies and the British standardization institute (BSI). The occupational Health and Safety Assessment Series (OHSAS) 18000 correspond to the structure of ISO 14000 and thus can be
implemented without conflicts where this is always being used. India has also published IS 18001:2007 Indian standard on occupational Health and Safety management system requirements with guidance for use which is based on OHSAS 18000 and adapted to the Indian needs.

In IS, 18001, has four stages

1. Planning
2. Implementation and operation
3. Measurement and evaluation
4. Management review

Annex C of IS 18001, describes six steps

1. Classification work activities
2. Identifying hazards
3. Determination risks
4. Deciding if risks is tolerable
5. Preparing risk control action plan
6. Reviewing adequacy of action plan

The reaction to introduction of any new system to control the existing activities is always the same.

In the view of management it helps to being discipline and being in effective control but the contract workmen, operators, technicians view it more as a hindrance in executing their work rather than as an improvement of their overall well being. Recently a survey was conducted on safety climate in one of the leading refineries indicated the perception difference among different section of employees.

Out of 17 elements surveyed for acceptable safety perception level (ASPL) as per top management. 13 elements are above ASPL. As per
middle management only 6 elements are close to ASPL and when it came to operators, technicians and contract workmen only 3 elements are close to or above ASPL.

Further analysis yielded various actionable points for top and middle management. One of the main observations of the field level personnel was the inflexibility of the system or the system not being modified to meet local conditions.

In 2001, international labour organisation (ILO) issued its guidelines on safety and health and management system which is known as ILO-OSH 2001. As per the guidelines there is no formal procedure of national acceptance the required translation into a national OHSMS only can be achieved on a voluntary basis. So the ILO-OSH guideline has become the framework for national initiative to implement OHSMS. There are two main objectives of ILO-OHS-guidelines:

1) To assist countries with the establishment of a national framework for occupational health and safety management
2) To provide guidance to organisations regarding the integration of OSH elements into their overall policy
OSH guideline consists of three major parts: a short section on objectives, a second section on transforming the guidelines into national practice and third sections on integrating the OSH management system into the organisation. The third section covers 21 topics, including the employer’s OSH policy, workers’ participation, responsibility and accountability, training, hazards prevention, performance monitoring and evaluation, preventive actions and continual improvement (Bennett, 2002). The OSH management should have some major components like policy, organisation, planning and implementation, evaluation and action for implementation (Figure 1).
1.9 Importance of health and safety management system: There are various reasons for reducing work-related accidents and ill health. These are:

- **Economic reasons:** In the competitive world the measure of excellence is profitability. Every business wants to achieve its targets in minimum cost. Thousands of work-related accidents, resulting in more than three days work off are reported to the health and safety authority each year. It is difficult to measure work related diseases and ill health due to their long latency period but its result year in excess of one million days lost at work each year, which is very dangerous for the organisation. Although health and safety management increases the burden on the organisation but it has gained the reputation of being more of the burden than a benefits. There are various type of costs might include like providing cover for the injured worker, cost of providing immediate first aid treatment to injured worker, value of work not done by the injured person and cost of defending acclaim or prosecution against the organisation. It damages the equipment and premises of the organisation.

  Serious accidents also affect the morale of employees and volunteers and reduce the standing of the organisation.

- **Legal reasons:** Days have gone when workers were illiterate and they were ready to work in any working conditions. But now a day with the workers are conscious about their rights. Every organisation has trade union. Various legislations have been passed time to time. **According to The Supreme court of India, “An enterprise which is engaged in a hazardous or inherently dangerous industry which poses a potential**
threat to the health and safety of the persons working in the factory and industry in the surrounding areas, owes an absolute and non-delegable duty to the community to ensure that no harm results to anyone on account of the hazardous or inherently dangerous nature.”

The safety, health and welfare at work act 2005 requires all the duty holders to ensure, so far as is reasonably practicable, the safety, health and welfare of workers and members of public and to manage and conduct all work activities in such a way as to ensure their safety, health and welfare. This requires all who have these legal responsibilities to be proactive in managing their safety, health and welfare responsibilities and with them in a systematic way. It help the organisation to improve their safety and health performance by providing advice on how safety and health should be managed, and in the process help them to comply with their legal requirements.

- **Moral and ethical reasons:** Most religions have emphasized on the importance and sensitivity of life. So this become the moral duty of employer to look after their workers

### 1.10 Development of Health and Safety Management

In 18th century industrial revolution took place and the method of producing goods has been changed. The most important change was the substitution of machines for people. This resulted in organisation of work into large units called “Factories” followed by direct supervision of the manufacturing process and efficient division of work among the labour. As the industrial revolution continued its rapid growth, unsafe production methods exacted a heavy toll on the workforce in terms of job related injuries and deaths (Felton, 1986).
In twentieth century, as new technology has been emerged associated hazards also grew it. This resulted in collective efforts and thinking in the direction of controlling work related hazards and accidents. In 1913, a group of specialist, management leaders, safety professionals, public officials and insurance professionals met together in New York had a desire to attack the problem of occupational health and safety which most people considered either unimportant or insoluble. Thus a voluntary organisation called “National safety Council” came into existence which helped to create the safety movement. After that similar voluntary organisation such as International labour Organisation, British Safety council etc. came up with support from industries in various in various part of the world.

Early legal actions were taken related to safety were converted into laws to investigate working conditions. After that the concept of worker’s compensation payments has emerged. In subsequent years, governments gradually expanded their roles in regulating industry on safety matters.

In 1970 “Occupational safety and health act (OSHA)” was passed in United States America. It was a comprehensive safety law. After the enactment of OSHA safety took a new meaning and direction. Similar steps were followed by other countries such as United Kingdom (Health and Safety at work, 1974), Australia (Victoria Occupational Health and Safety act, 1985) etc.

Due to the above acts, safety and health of workers became a major concern and priority of management. In addition to the losses due to downtime, costs of worker’s compensation insurance, medical and administrative expenses resulting from disability death and impaired productivity, they were liable to face series monetary penalties and
criminal sanction from the government side for non-compliance of law. Therefore, safety management became an important part of human resource management.

Many organizations from chemical/process, manufacturing, engineering and construction industries have gone for management system certifications such as ISO 9001, OHSAS18001 and ISRS certifications. With globalization and opening up of our economy, Indian organizations from various sectors have started to take initiatives to get the above certifications to compete in the international market. OHSAS 18001 and ISRS are occupational health and safety management based whereas ISO 9001 is based on quality management.

Every Indian organization is supposed to prepare a ‘Safety Manual' based on ‘The Factories Act, 1948’ and state ‘Factory Rules’ to take care of the health and safety of its employees, covering the various manufacturing activities employed in the company. To what extent these are practiced in reality depends on the commitment of the top management of the organization. Committed managements subsequently adopt various safety management practices to safeguard their employees from work related hazards whereas others try to manage safety of employees by encouraging them to work safely. A scientific investigation into this only can reveal what is happening inside the organization so that improvement methods can be suggested.

1.11 Health and Safety Management on International level

Exploration and production activities are subject to extensive legislation and regulation concerning Occupational health and safety (OSH). All organisation whether they are large or small have own OSH strategies to
satisfy their own operating and regulatory requirements, and safety management system are a principal component of such strategies. Safety management systems are a principal component of such strategy. There is wide recognition of the benefits of safety management. An important principle that came into existence concerned with international standard on quality systems, ISO 9000.

Although there are important differences in the detailed handling of safety and environmental issues, safety and environmental management are tending to coverage towards the systems model of ISO 9000. In 1974, an international association of oil companies and petroleum industries was formed, which is known as “The oil industry international exploration and production forum (E & p Forum) to protect the oil and gas industries workers from hazards. It is also concerned with environmental protection. It represents its member’s interests at United Nations agencies, European Union and other international bodies. At present the forum has 52 members made up of 38 oil companies and 14 national oil industry associations, operating in 60 different countries. Guidelines have been issued to assist in the development and application of health and safety management in exploration and production operations. Forums members have participated in the work, to ensure that their collective experience is used and that the guidelines have wide acceptance. Many E&P Forum members operate joint Health, safety and environment management systems, and the American Petroleum Institute (API) has issued recommended practices, such as RP 75, to assist those developing Safety and Environmental Management Programms (SEMP) in the off-shore oil industry. The HSEMS guidelines have been developed by the E&P forum to:
- Cover relevant Health, Safety and environment (HSE) issues in a single document.
- Be relevant to the activities of the E&P industry worldwide.
- Be sufficiently generic to be adaptable to different companies and their cultures.
- Recognise, and be applicable to, the role of contractors and sub-contractors.
- Facilitate operation within the framework of statutory requirements.
- Facilitate evaluation of operations to an international standard as appropriate.

The above guidelines help to develop, implement and maintain an HSEMS. They also recommend the company’s set policies and objectives taking into account information about the significant hazards and environmental effects of their operations.

The guidelines may be used as template by any company which is seeking to help assure it about HSE policies and also help to support rather than to suggest replacement of, existing sound, workable and effective company systems and practices.

The phrase “The Company should maintain procedures….” Is used throughout the guidelines, however, it is not intended to prescribed that written procedures are necessarily required for all practices. The HSE- critically of a given operation or situation dictates whether it warrants a formally documented and controlled procedure. In many instances the existing company practices will be less formal but nevertheless fully acceptable. Assuring the suitability of all aspects of the HSEMS remains the responsibility of each company and the guidelines should be read in this context of self regulation.
There are various forces which increase the importance of health and safety management. On, 19 November 2010 in New Zealand an explosion at the Pike river coal mine resulted in the deaths of 29 employees. Hon Simon Bridges, Minister of labour of New Zealand said, “We are at an important turning point in workplace health and safety in New Zealand. We have an opportunity to create a world class system.”

After the above incident government of New Zealand established the independent task force on workplace health and safety to advice on possible ways to meet our goal of reading the rate of fatalities and serious injuries in the workplace by at least 25% by 2020. He also said that for this purpose health and safety crown are appointed.

The model Health, safety and environmental management System which forms the basis of these guidelines is shown systematically in the following figure:
1.12 Safety management in Indian Perspective

Constitution of India provides the various provisions regarding occupational safety and health. Apart from this there are also a plethora of statutory acts, rules and regulations. India has also signed various international treaties and covenants while being a member of the WTO and ILO. In India, The factories act, 1948 (central act 63 of 1948) came into force on 1st April, 1949 to ensure the healthier and safer work atmosphere for the workers, and for improving the general welfare of workers. The act sets out the broad outline of the measures for achieving the object of protecting the workers from industrial and occupational hazards and for their welfare. Power is given to state governments to
frame rules regarding the details of the measures for various types of factories so that the local conditions prevailing in the state are appropriately reflected in the enforcement.

Government of Kerala has framed various rules such as ‘Kerala Factories Rules, 1957’, ‘Kerala factories (Welfare officers)Rules, 1957’, ‘Control of Major Industrial Accidents Hazard (Kerala) Rules, 1993’, etc to provide guidelines for the enforcing agencies.

National Safety council was set up by Ministry of Labour, Govt. of India in 1966, as a non-profit making, non-political voluntary organisation to generate, develop and sustain a voluntary movement at the national level to promote awareness of safety, health and environment so as to supplement and strengthen government efforts in this fields. They have local chapters in all states and offer consultancy services to industries in all areas of safety management.

Safety management attained significance in India only after the Bhopal gas tragedy in 1984. Gupta (2002) points out the major causes of these accidents as, indifferent attitude of the management towards safety and lack of enforcement of existing regulations by regulatory bodies. Learning lessons from Bhopal disaster, most of the industrial organizations in India have made considerable investments in safety related infrastructure, equipment and training, enforcement rules and regulations have also been made more stringent with the number of amendments in the acts and rules.

Many organizations from chemical/process, manufacturing, engineering and construction industries have gone for management system certifications such as ISO 9001, OHSAS 18001 and ISRS certifications. With globalization and opening up of our economy, Indian organisation
from various sectors has started to take initiative to get the above certification to compete the global competition. OHSAS 18001 and ISRS are occupational health and safety management based whereas ISO 9001 is based on quality management. Since “Safety” is a dimension of “Quality” when any attempt for quality management is made, it also ensures safe work environment for its employees (Carder and Ragan, 2003).

Every Indian organisation is supposed to prepare a “Safety Manual” based on “The Factories Act, 1948” and state “Factory rules” to take care of health and safety of its employees, covering the various manufacturing activities employed in the company. To what extent these are practiced in reality depends on the commitment of the top management of the organisation. Committed managements subsequently adopts various safety management practices to safeguard their employees by encouraging them to work related hazards whereas others try to manage safety of employees by encouraging them to work safely. A scientific investigation into this only can reveal what is happening inside the organisation so that improvement methods can be suggested.

The constitution of India also provided various provisions regarding safety. These are:

**Article 21**

The ambit of Article 21 of the constitution provides for protection of life and personal liberty. The courts in India have been liberal in its interpretations and have encompassed various issues in their judgments which highlight that OSH in necessary for protection of life. In one case the Supreme Court has ruled that public health and ecology have priority over loss of revenue, therefore organizations cannot ignore and refuse to
implement OSH measure on the plea that it is non-profitable. The apex court has also ruled that checks and safeguards should be adopted to guard against the ill effects of radiation of x-rays, necessity of pollution free air and water for full enjoyment of life.

**Article 24**

This article restricts the employment of children below the age of fourteen years in any factory or mine or in any other hazardous employment.

**Articles 39(e) & (f)**

These articles require the states to direct its policies towards ensuring that the health and strength of workers are not abused and provide for opportunities and facilities for children to develop in a healthy manner and protect them against exploitation.

**Articles 47**

This article requires the states to formulate policies that aim towards improving public health and raise the standard of living.

With such wide and unlimited scope for interpretations, these articles can be effectively employed to ensure that OSH management system put in place by organizations can actually improve the OSH standards and not provide mere lip service to the cause.

Apart from the constitution, there are various legislations which stipulate the OSH standards to be followed in various industries as under:

1. The plantations labour act, 1951 sections 8 to 18
2. The mines act, 1952 sections 19-21
3. The apprentices act, 1961 section 14
(4) The atomic energy act, 1962 section 17
(5) The Beedi and cigar workers (conditions of employment) act, 1966 section 8 to 17
(6) The building and other construction workers (regulation of employment and conditions of service) act 1996 section 28 to 38
(7) The child labour (prohibition and regulation) act, 1986 section 13
(8) The contract labour (regulation and abolition) act, 1970 section 16 to 19
(9) The interstate migrant workmen (regulation of employment and conditions of service) act, 1979 section 16

1.13 Legal framework regarding Health and Safety management

The management of Health and Safety at work regulations 1999 requires employers to put in place arrangements to control health and safety risks.

As a minimum, an organization should have the processes required to meet the legal requirements, including

1. A written health and safety policy (if there are five or more people are employed)
2. Assessment of the risks to employees, contractors, customers, partners and other people who could be affected by your activities and record the significant findings in writing if there are five or more people are employed).
3. Arrangements for the effective planning, organizing, control, monitoring and review of the preventive and protective measures the come from risk assessment.
4. Access to competent health and safety advice.
5. Providing employees with information about the risks in the workplace and methods of protection from such risks.
6. Instruction and training for employees in how to deal with the risks.
7. Ensuring there is adequate and appropriate supervision in place.
8. Consulting with employers about their risks at work and current preventive and protective measures.
Key elements of HSEMS are shown in the table below:

<table>
<thead>
<tr>
<th>HSEMS Elements</th>
<th>Addressing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership and commitment</td>
<td>Top-down commitment and company culture, essential to the success of the system.</td>
</tr>
<tr>
<td>Policy and strategic objectives</td>
<td>Corporate intentions, principles of action and aspirations with respects to health, safety and environment</td>
</tr>
<tr>
<td>Organisation, resources and documentation</td>
<td>Organisation of people, resources and documentation for sound HSE performance</td>
</tr>
<tr>
<td>Evaluation and risk management</td>
<td>Identification and evaluation of HSE risks, for activities, products and services and development of risk reduction measures</td>
</tr>
<tr>
<td>Planning</td>
<td>Planning the conduct of work activities, including planning for changes and emergency response</td>
</tr>
<tr>
<td>Implementation and monitoring</td>
<td>Performance and monitoring of activities, and how corrective action is to be taken when necessary</td>
</tr>
<tr>
<td>Auditing and reviewing</td>
<td>Periodic assessment of system performance, effectively and fundamental suitability</td>
</tr>
</tbody>
</table>
1.14 Traditional Safety Management VS Modern Safety Management

The systematic and planned top management driven activity that aims at controlling the health and safety hazards of its employees is called safety management (Booth and Lee 1995). The primary objective of safety management is to intervene in the causation process that leads to accidents but as per the modern concept safety management is more than just a hazard identification system. It is an overall system for ensuring that safety activities such as risk analysis, arrangement of safety training, accident and near-miss investigation, safety promotion and assessment of human reliability. In an effective safety management system, those activities are assigned to all the different hierarchical levels of the organisation (Booth and Lee, 1995; (Grimaldi and Simmonds,1975).

The form of safety management followed by most of the industries, called as ‘traditional safety management’, has the following characteristics (Smith 1996; Weinstein, 1996; Hensen, 1993).

- Top/ down communication
- Minimal employee participation
- Dependence on discipline to influence safety behaviour
- Centered on technical requirements aiming at short-term results
- Safety techniques are used after accidents and injury
- Safety programme is not integrated with the rest of functions of an organisation
- Safety director is responsible for safety programme, but does not have the authority to make changes

In spite of these efforts to promote health and safety of employees, some major industrial disasters took place between 1970 and 1990 in various parts of the world. Scientific investigations into these
accidents by researchers pointed out some major deficiencies in the existing safety management system. Powell and Canter (1985) observed that “more than half of the industrial accidents are attributable to deficiencies in the human and management components than to unforeseeable weaknesses in the technical components.”

These findings prompted further studies to improve safety management. After studying more than 200 companies, Dumas (1987) discovered that programmes of quality and programme of safety have similar components. He concluded, “Safety is a dimension of quality, after everything, the elimination of defects includes the elimination of practices of unsafe work.” According to Minter (1991), “if one looks at safety as a consequence of making things well, then the programme will undoubtedly bear quality.”

Recognizing the need of ensuring quality in safety management, many companies deviate from traditional safety management to embrace a new system approach to safety management in the 1990s. This method, according to Pearson (1994), with philosophies of quality in conjunction with safety, has the following salient features:

- Safety becomes a system, more than a programme
- Progress is not measured by injury ratios
- Statistical techniques drive the efforts of continuous improvement
- Investigation of accidents and following up corrective actions
- Technical principles and tools for statistical control of process are used
- Emphasis is placed on improving the system
- Benefits are provided for people who discover illegal situations
- Participation of workers in problem solving and decision making
- Ergonomic well-being is projected inside the place of work
- The traps within the system that causes human errors are eliminated

1.15 Safety management in Oil and Gas Industries and role of safety manager

Different safety management practices are adopted in industries by management in advanced countries to promote health and safety of workers. Not all of them are universally adaptable due to social and cultural factors prevailing in each country. However, levels of these safety management practices need to be assessed especially in high hazards industries. It can be argued that these are predictive measures enabling safety condition monitoring (Flin, 1998), which may reduce the need to wait for system to fail in order to identify weakness and to take remedial actions. This can also be conceptualized as a switch from ‘feedback’ to ‘feed forward’ control (Falburch and Wilpert, 1999). This shift the focus has been driven by the awareness that organizational managerial and human factors rather than purely technical fairly or prime causes of accidents in high reliability industries (Weick et al, 1999).

Safety and health management is one of the vital constituents of **Oil and Gas industry** activities because most of the operational conditions, chemicals and end products (hydrocarbons and other compounds) associated with Oil and Gas production are well-known to pose serious safety and health threats to the workers.
Figure: Segments of Oil and Gas Industry
Motor Vehicle Accident
- Often the roads leading to well sites lack firm shoulders and other safety features
- Fatigue due to long driving distance and long working shifts

Contact Injuries
- Workers being struck by, entangled, or crushed by tools, machinery or other objects

Fire and Explosions
- Presence of highly combustible hydrocarbons
- Presence of oxygen/ignition source

Slips, Trips and Falls
- Frequent need to work at elevations
- Uneven Surface
- Improper use or non-availability of fall protection systems

Confined Space
- Limited opening for entry and exit
- Unfavorable natural ventilation
- Not designed for continuous employee occupancy
There is huge risk in oil and gas industry. So the role of safety management has been increased. Health and safety managers are the persons who use their knowledge and skills to promote a positive health and safety culture in the workplace. The major responsibilities of safety manager are to ensure that employees and employers are complying with safety provisions. Safety policies and practices are adopted and adhere to. They are also help in planning, implementing, monitoring and reviewing protective and preventive safety measures. Safety managers work in partnership with employers, employees, directors and trade unions to minimize:
A. Injuries
B. Occupational health problems
C. Accidents
D. Operational losses

The primary role of the safety manager is to advice the directors and managers on all safety, health and welfare matters to ensure the complies with its statutory obligations and also ensure that there is an effective company policy for health and safety and all the workers, contractors and temporary workers are made aware of their individual responsibilities. The following are the responsibilities of safety manager:

1. To assist and advice for the health and safety programs and establishing a suitable organisation to put them into effect.
2. To interpret and advice on the implementation of health and safety legislation and in particular, the management of health and safety at work regulations 1974 and 1999, keep up to date the current changes in current legislation and to being to the attention of the
directors responsible for health and safety any relevant new legislation.

3. To advice on the implementation of council standards, codes of practice and safe system of work.

4. To advise on safety aspects in the design and use of plant, equipment and system of work.

5. Investigating the causes of accidents, the circumstances leading to them and compiling the necessary reports ad giving advice to prevent recurrence.

6. To conduct training of health and safety as required by directorates and appropriate external bodies.

7. Conduct health and safety inspections and prepare reports of all the company’s operation.

8. Contact with director immediately who is responsible for health and safety if situations are found, that in the opinion of safety manager, require immediate rectification.

9. To carry out investigation into all accidents and to record the findings on the relevant forms.

10. Advice the company secretary of all incidents reportable under R.I.D.D.O.R.

11. To bring new techniques for improving health, safety and welfare management.

12. To set personal example by wearing appropriate personal protective clothing, equipment and observing all safety requirements and procedures.
References:

1. The Economic Times, November, 1992


3. The Economics Times, March 1995

4. The Occupational health and safety group. OHSAS 18000 occupational health and safety toolkit.


