



Confederation of Indian Industry

Safety

Excellence

Preparedness

A Study Report

**Occupational
Health and
Safety
Management
System**

S in design
A
F in behaviour
E
T in operation
Y

Disclaimer

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Introduction

Indian Industries are continuously evolving with respect to methods, processes and technologies to enhance the process of manufacturing and services. While doing so it is faced with the challenge to meet business sustainability. Key issues like safety and environments are now challenging the industries like never before. Failure in workplace safety is not only impacting well being of employees and the citizens at large but also impacting profitability, reputation and brand value directly. With the stricter regulatory regime and wider and faster media coverage the information are available across the world in least possible time. The cost of settling compensation and liability are much higher than the cost of prevention. Safety excellence preparedness is a step towards prevention of safety failures which includes the safety procedure, training and infrastructures.

Roadmap to Excellence provides the structure to meet these objectives through monitoring and survey.

This paper is an effort from Verde to have an overall notion about the current Occupational health and safety preparedness of various sectors of Indian industries.

Background

In this paper an effort has been made to unearth the major issues which are impacting the safety performance of Indian Industries in the Eastern region. A survey was conducted among thirty five industries with the help of a structured checklist covering twenty one elements. Organizations were evaluated by highly experienced safety professionals with respect to each of the twenty one elements and element wise score was assigned. The data was analysed and the elements causing major impacts were prioritized for study. Each of such elements was then examined in detail to find out the best available option to manage these elements and the associated risk and impact.

In the later part of the report, the analysis of the data, the diagnosis and the remedies are examined in detail.

Executive Summary

Today industry cannot even survive let alone grow without addressing the sustainability issues. One such important issues confronting industries in India and elsewhere is Industrial safety. This paper is the outcome of a study undertaken in the industries of Eastern India to understand and unearth the issues affecting the Industrial Safety.

Thirty five industries across manufacturing and services, large, medium and small were selected for this study. These Industries are volunteering for survey based award on Environment, Health and Safety organised by Confederation of Indian Industry and thus presumed to have a structured approach to take care of sustainability issues.

A survey questionnaire was specially designed with 21 selected elements like Hazard identification & Risk management, Incident reporting, occupational health and Hygiene etc. for this purpose and administered. Efforts were made to bring out the different critical causes of inadequate Occupational Health and Safety performance through this survey.

The survey was conducted on the eastern part of India. The different industries ranging from manufacturing to service, hazardous to non-hazardous, large scale to medium and small scale located in different states of the eastern region mainly Odisha, Jharkhand, Bihar, Chattisgarh and West Bengal.

It can be inferred that these elements if managed on a priority basis will go a long way to improve the overall safety scenario in the industries of eastern region. This will help the Industries to prioritize their action and use the available resources fruitfully in these areas for a better overall impact.

▪ **Training on safety awareness :** Training on safety is seems to be often ignored as it is essentially not required since

not related to productivity. Safety cannot be achieved unless the employees are involved in managing safety. But this needs a level of awareness in employees which is lacking to a large extent. 'Specific Safety Training' is therefore an important issue.

▪ **Contractor safety management :** Generally the trend across industry is that, most of the hazardous work is carried out by the contractors' workmen. In many cases they are untrained coming from a rural background and yet exposed to the grave hazards. The results are bound to be disastrous. A structured contractor safety management system is therefore indispensable.

▪ **General safety issues :** General safety concerns with safety in operation, safety in design, and safety in project. Safety in Design is anticipating hazards in operation and handling at the design stage and pre-empt the same by superior design. The same is true for safety in process which can be achieved by safe design of processes and safe operating procedures. Another important dimension of general safety is the human behaviour. Statistics show that 9 times out of 10 the accident is caused by unwanted human behaviour. Therefore, behavioural safety needs a much greater attention in improving general safety.

▪ **Hazard identification, risk assessment and control :** Hazards are associated with all activities, and situations, movement storage of hazardous material etc. One of the important elements of safety management which is often ignored is the thorough identification of all hazards and to assess their risk and to develop controls to bring down the risk to a manageable level.

▪ **Hierarchy of control :** Generally the controls are required to be commensurate to the risk. The important requirement here is to follow the hierarchy of control.

1. Elimination
2. Substitution
3. Engineering
4. Administrative
5. Personal Protective Equipment

That is if possible one should first try to eliminate the hazard and only when that is not possible one may think of substituting the existing hazard by something more manageable. Similarly engineering and then administrative controls should be considered. PPE should be the last resort.

■ **Injury and incident reporting :** One of the most important factors in managing safety is reporting of injury and incident including near misses. The reporting and analysing of incidents is not given the importance it deserves even though it is essential to managing safety. Unless reporting of all incidents are taken up seriously, analysed, communicated and the necessary lessons are learnt, the safety system can never be improved.

■ **Fire risk management :** Fire remains the single most important source of industrial accident. Often it is observed that based on the outcome of fire risk assessment lot of costly detection system and extinguishing systems and equipments are installed. However, effective maintenance and training on operation fulfils the utilisation in real situations and thus a fire management system that include fire drill, emergency preparedness and evacuation of people at the time of need have to be ensured.

■ **Journey risk management :** Personal safety while on road is essential and imperative. However, a large part of industrial accidents are related to movement of vehicles either movement of raw materials, finished products or scrap. In many cases the movement is by outsourced vehicles with not

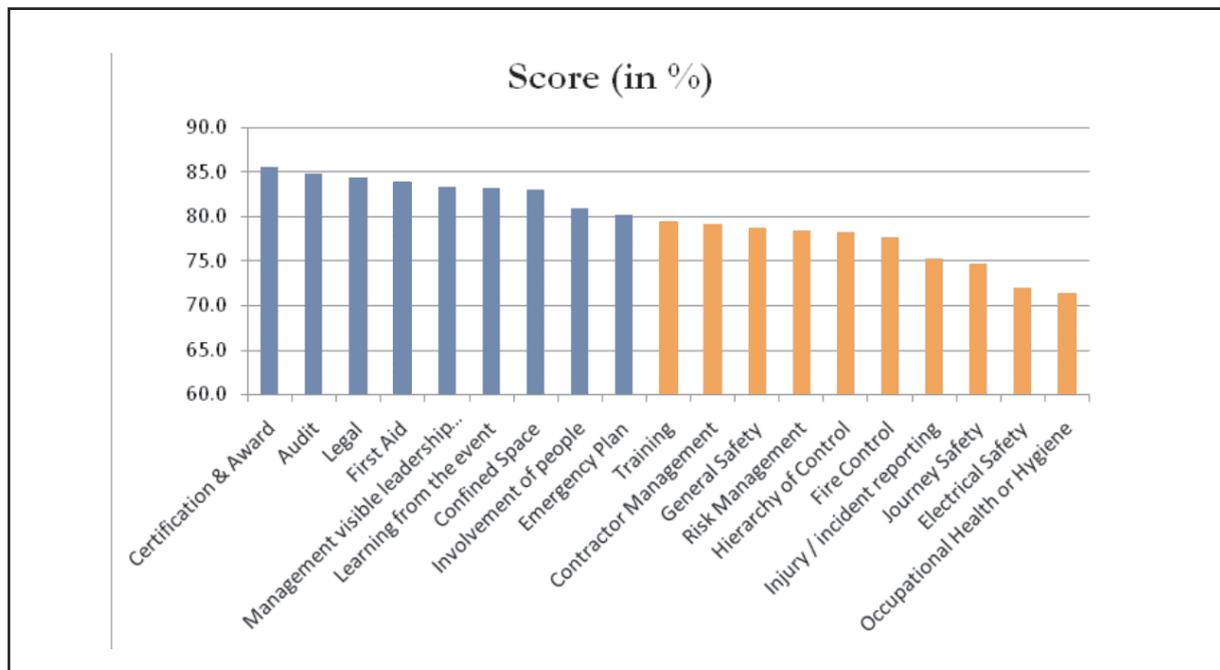
much record or other safety information. This area needs to be managed professionally and systems must be in place.

■ **Electrical safety :** Electrical safety is important on two counts, firstly, as a source of fire and secondly, as a source of electrocution. It has been seen that in most cases fire is actually caused by faulty electrical equipment or cable joints. In either case a sound electrical safety management system can only help. A regular electrical safety audit, training for immediate revival of a patient and an arrangement for emergency response system will have to be developed.

■ **Occupational health and hygiene :** For a long time occupational health and hygiene in industry has been the most neglected element. The impact of occupational health issues are felt only over a long period and not immediately. Perhaps that is why this area has been neglected so long. We do not even have adequate number of OHS specialist in many sectors of industry. Health and hygiene in industrial context must be given the same importance as safety. Along with safety hazard, Health hazards are also required to be assessed and controls are to be developed. Awareness programmes should also include occupational health issues.

Each of these elements have been considered in greater details in the later part of the report with an emphasis on putting forward ideas and their actual implementation. OHS management system should be given the priority it deserves and the necessary resources should be allocated. A meticulous planning should be followed up by rigorous implementation and follow up.

Segregation of the elements in two groups has been made considering the scores below 80 and above eighty and represented by colour, blue and orange.



Issues Element Wise

Less than 80% score on any element has been considered as priority areas for immediate action. Special emphasis has been given on these elements. These elements are training, contractor management, general safety, risk management, hierarchy of control, injury and incident reporting, journey safety, electrical safety and occupational health and hygiene.

The subsequent explanation will guide to the probable reasons which were a direct outcome of the survey. The detailed findings of the survey have been useful for this part of the exercise.

■ Contractor safety management :

Contractor safety management has always been critical element in the OHS preparedness. Nowadays every organisation, irrespective of their scale of operation, needs the support of the contractors in different areas mainly in the

context of uninterrupted workforce supply and management. With that the contractors bring lot of variables in the system affecting the already established standard practices leading to considerable abnormalities in the safety system.

The contractor workers are often inadequately trained to handle the latest technologies and industrial process leading to the increase in the changes of injuries. Many of the contractor work persons come from rural background being completely unaware of the typical hazards prevalent in an industry. The general educational standards of these persons also remain a lot to be desired. All these factors contribute to the somewhat improper contractor safety management system.

A structured contractor safety management system properly established in any organisation is probably the most important weapon to fight the menace of unsafe contract jobs.

The essential steps that are required for effective contractor safety management are :

- Contractor Selection
- Contract Customisation
- Contract Grant
- Contractor Handholding
- Managing the Contractors
- Post Contract Evaluation
- Contract Renewal or Termination

The purpose of the Post Contract Performance Evaluation (PCPE) is to provide a report card of a contractor's performance on any work site. The PCPE is a standardised tool to be used to encourage contractor(s) to improve their performance and eligibility for future assignment.

The contractor(s) will be evaluated on how they perform the work in the following five major categories:

- | | |
|---------------------|---|
| a. Safety : | Compliance with Laws & Industry Standards |
| b. Quality : | Compliance with Contract Standards & Specifications |
| c. Organization : | Work Plan and Management |
| d. Execution : | Work Performance |
| e. Administration : | Contractor Performance and Diligence |

■ Occupational health and safety risk management :

The next important element coming out from the study, which needs specific attention, is effective occupational health and safety risk management. Many organisations irrespective of their scale of operation and

regardless of the type of industry they belong, tend to lack in the practices of management principles of Occupational Health & Safety Management System

This may be attributed by improper choice of the method of risk management or inconsistency in the implementation of the system.

Occupational Health and Safety risk assessment starts with activity wise identification of OHS hazards, assessing the risk associated with those hazards through suitable risk assessment tool (3x3 or 5x5 matrix), evaluating the risk, categorising the risk for prioritisation of the management and taking suitable control measures following the hierarchy of control. The method of hazard identification and risk assessment is abbreviated and commonly known as HIRA. It is needless to mention that the foundation of OHS management system is HIRA.

Generally process hazards come from two sources :

- a. hazards that are characteristic of the materials and chemistry used
- b. hazards that are characteristic of the process variables and process plant

Either preventive or protective measures or mix of both could be used to reduce the risks. Traditionally these measures are classified into three types:

1. Passive: These measures the hazard by process and equipment design features. They reduce either the frequency or consequence of the hazard without the active functioning of any device. Examples include firewalls, orifice plates or narrow bore piping to control flow, etc.
2. Active: These measures use engineering controls, safety interlocks and emergency shutdown systems to detect process deviations and take appropriate corrective or remedial action.
3. Procedural: These measures include

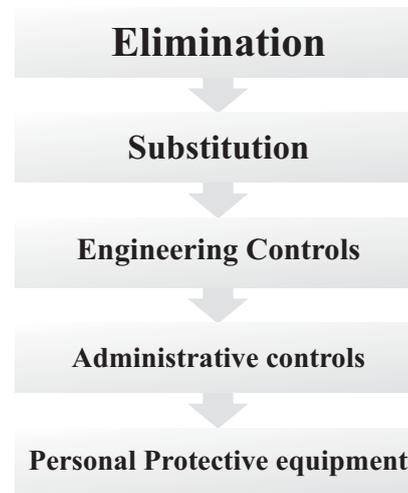
operating procedures, emergency response and other management approaches to prevent incidents or to minimise the effects of an incident.

OHS risk assessment should take into consideration the following factors

- All routine and non-routine activities;
- Contractors' and visitors' activities
- Behavioural aspects, capabilities
- Identified hazards originating outside the workplace which has the potential of adversely affecting the health and safety of persons under the control of the organization within the workplace.
- Hazards created in the vicinity of the workplace
- Hazards associated with the Infrastructure, equipment and materials at the workplace,
- Management of change i.e. changes or proposed changes in the organization, its activities, or materials
- Modifications to the existing OH&S management system, including temporary changes, and their impacts on operations, processes, and activities
- Any applicable legal obligations relating to risk assessment and implementation of necessary controls
- The design of work areas, processes, installations, machinery/equipment, operating procedures and work organization, including their adaptation to human capabilities.

Thus it can be said conclusively that the Implementation of an effective OHS management system following global standards will definitely address the issue of OHS risk management.

The hierarchy of controls need to be strictly followed while selecting the type of control measures for mitigating any risk.



■ **Fire control :**

We are aware that the biggest menace in the industry is fire. It is the single most reason for catastrophic loss in life and property. Over the years we have witnessed the tremendously adverse consequence of the outbreak of fire. Often fire protection measures are restricted to minimum statutory requirement. However, workplace need to be adequately fire protected. Much activity is taking place today regarding fire safe workplace design. The knowledge in the field of fire protection is undergoing development and recognition that will enable workplace to be designed for fire safety with more reliability and efficiency. The emphasis should be put on fire prevention and early detection of fire followed by fire mitigation. For prevention and early detection of fire, planning at the design stage is necessary. Both active and passive fire defences provide reasonable safety

from the effects of fire. Employees have



the right to feel safe and secure in the workplace. In order to uphold workplace safety the management should always keep the welfare of their employees in mind while creating a work environment. Mere compliance to the statutory requirements is not sufficient. Some of the rules have not been revised for years even though the ground realities have changed. Emergency Action Plans, rescue and evacuation process and escape routes are the core of safety & fire management system and require adequate resources during planning and execution. To assess the preparedness towards emergency response plan including evacuation and rescue process a system of regular drills are necessary.

While conducting this study one of the special objectives was to gauge the fire control activities, initiatives and preparedness of different organisations across industries. The result from the survey substantiates our anticipated concern regarding fire control. Fire safety remains a major area for improvement for the organizations. Fire control system accounts for various elements, starting from the hardware or infrastructural part like fire protection arrangement for both portable and fixed fire protection system, fire hydrant and water spray system, early fire detection and alarm system to the soft part i.e.



the management system consisting of emergency evacuation and preparedness, regular emergency drills, administrative controls etc.

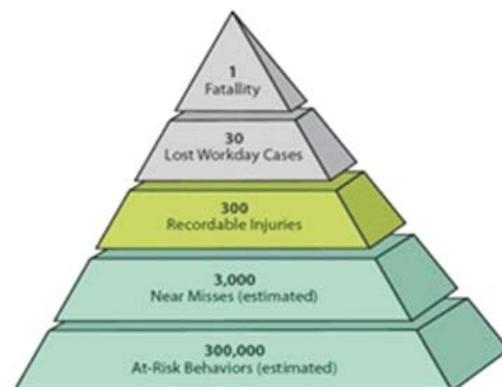
The undesired outbreak of fire can be efficiently managed through incorporation of design safety, process safety management, fire safety management system, behaviour based safety and training and awareness building.

Fire causes loss of Property and Life. The amount of damage to property is proportional to intensity of fire and duration. Life risk is predominantly posed by smoke and other toxic products of combustion which travel faster and farther than fire. The amount of combustion products and speed of their travel is directly proportional to the intensity of fire.

■ **Injury and Incident reporting :**

A robust Injury and incident reporting system speaks volumes about an effective OHS system well in the journey towards safety excellence.

The importance of this issue could be discussed in the backdrop of the safety triangle. One can well understand the importance of near miss and minor injuries in the ultimate result of fatality. One of the most important and crucial way of avoiding the unwanted occurrences of fatality is recording the near-misses and minor injuries. The obvious analogy is that if we can eliminate the near misses the situations of occurrence of fatalities should never arise. Most industries tend to ignore the system of incident reporting as it does not bring immediate returns. By virtue of incident reporting a lot of hidden hazards can be identified and eliminated which otherwise does not come into reckoning in normal course.



■ **Occupational health and hygiene :**

It is the backbone of any safety system. Occupational health and hygiene affects the wellbeing of the work person directly. Lack of adequate health and hygiene facilities leads to reduced productivity. Although it is an important factor it is most neglected especially in the developing countries like India. As it can be readily understood from the survey, a lot of work needs to be done in this area. Most of the initiatives should come from the top management. It should be a top down approach.

Right to healthy environment is one of the fundamental rights and also protection and safety of the health of workers enshrined under article 21 of the Indian Constitution.

Accident in Indian industry is under reported. Most industries do not hold data regarding non reportable injuries or near misses. The base line on accident or injury will help identifying the issues and eliminating them.

Most of the workers who die because of their work environment succumb to cancers and other work related diseases. This is contradictory to the belief that most work related deaths are caused by accidents. Occupational safety and health invariably means prevention of accidents as occupational diseases does not get the due attention. Only accident free workplace does not imply a safe workplace.

■ **Journey Safety :**

According to the World Health Organization (WHO) the low- and middle-income countries had higher road traffic fatality rates, which is in between 18.3 to 20.1 per lakh of population. India has estimated road traffic death rate of 18.9 per lakh (based on road fatality data 2010).

Journey safety has become one of the key elements of general safety. It includes onsite and offsite safety initiatives that an organisation needs to undertake. Vehicle and traffic safety, movement of any mobile equipment inside the premises for material handling purposes, road safety are part of the overall journey safety. It includes but not limited to:

- All types of journeys (e.g. air, rail, road)
- Business segments, functions and regions
- Road safety risk assessment
- Journey Risk Management Plans (risk mitigation plan and actions)
- Risk Management Plans across similar environments in the same geography
- Process to recognize any temporary hazards or review of appropriate route and inform drivers on a timely basis
- Enforcement driving safety rules and regulations on controlled site



Journey safety is mainly impaired by infrastructural constraint, lack of presence of traffic safety rules & regulations, procedures, inadequate training and awareness of the people concerned. Behavioural safety plays a very crucial role in the context of journey safety. State of the art infrastructure and facilities won't be able to contribute much in case behavioural aspects influence a driver or operator adopting an unsafe act or practice.

The importance of behavioural safety and its linkages with conventional safety have been discussed later.





Journey risk has two factors - vehicle conditions and road conditions along with related risk ratings. Vehicle condition is inspected by development of suitable vehicle inspection check list that include tyre conditions, brakes, lights, turn indicators, rear view mirror or camera etc. Road conditions should include road risk per leg of journey. Road risk consists of poor surface condition, bad berm, narrow bridge, busy intersections, steep gradients, cattle grazing fields, wild animal corridor, school, hospital, market place etc. This also includes helpines like police stations, repair stations, medical aids, hotels and eateries etc. Finally factors like Journey Start Timing and Duration, Terrain, Climate, Visibility, Security etc. are also assessed to determine the risk of journey.

■ **Electrical safety :**

Two main electrical hazards are:

- a. Shock or Flush over and
- b. Fire and Burn.

Inadequate preparedness in electrical safety aspects is one of the key contributors in industrial accidents. Exposed electrical parts are those that are not suitably guarded, isolated, or insulated. They are capable of being inadvertently touched or approached nearer than a safe distance by a person. Tools with insulation that is worn or that exposes

electrical parts create a shock hazard. If a worker contacts any exposed electrical components, it has severe consequences which might lead to fatalities.

Electrical reasons are also the main cause in the context of outbreak of fire .



Overloaded circuits create fire damage. Many organisations across industries lack in implementing proper safety system and features in this area. It can be easily substantiated from the survey across industries of different size. Tools and equipment that are not tested and approved by an Accredited Testing Laboratory or are not properly grounded may pose a hazard.



Hazards arising out from electrical safety related source, situation and act can be eliminated through design

safety, operational safety, behavioural safety and proper training and awareness.

People are injured when they become part of the electrical circuit. Humans are more conductive than the earth (the ground we stand on) which means if there is no other easy path, electricity will try to flow through human bodies. Do not work close to power lines. Recommended distances vary with both jurisdiction and electrical utility company when working, driving, parking, or storing materials closer to overhead power lines. Do not forget to isolate electricity from source. Practice Lock Out Tag Out (LOTO).

■ **Training and awareness :**

An enlightened mind can prevent a lot of abnormalities and mishaps. We all know in all facets of our life specially in the context of safety prevention is always better than cure . That is where the importance and relevance of training and awareness generation come into being. This is another area where one can find inadequate preparedness in different organisations. This is definitely a concern area and every organisation need to invest at least in training and awareness generation. We can understand there might be limitations in eliminating some of the hazards which may incur significant capital expenditure. Training can be given in different phases of workers work life cycle beginning from joining which is called an Induction Training. It can subsequently be given in phases including refresher training to keep them abreast of the changes and new developments in their area of operation.

Effectiveness of the training mechanism starts with person wise and activity wise training need identification thereby framing up a comprehensive training calendar. Then different training needs to be imparted as per the plan or following the training calendar. Finally the effectiveness of the training being imparted should be evaluated properly.

Effectiveness of a training programme is essential as the programme itself. Absence of the effectiveness would lead to incomplete capacity development of a person & thus giving rise to a vicious circle.

■ **General Safety :**

This is a bigger umbrella of safety. It gives us a panoramic view of the fundamentals of basic safety elements. General safety is a crucial indicator of the overall safety preparedness of an organisation. It mainly deals with unsafe act or practice and unsafe situation.

Behavioural safety or behaviour based safety is the single most influencer in the different

unsafe practices that surfaces often in the OHS parlance. Lack of proper training and awareness about different OHS hazards and the different risks associated with it also plays a vital role in adopting unsafe act of the work person.

Presence of robust Occupational health and safety management system greatly facilitates prevention of unsafe act and generation of unsafe situations in the industries. It acts as a checkpoint to the management to prevent unwanted situation.

Unsafe situation is greatly affected by design safety, engineering and its limitations. Some example of general safety are air receivers, boilers, lifting tools and tackles, platforms, structures, conveyors, machine guards etc. One should see that the design and material specifications are fulfilled as per Indian standards or other international standards. Locally fabricated non standard design and materials are strictly not allowed even to compromise on cost or taking short cuts.

Major Solutions of the Issues Discussed Above : The Detail Elements

■ **Occupational Health and Safety Management System :**

A structured and robust Occupational health and safety management system can be considered as the panacea of major OHS related shortcomings many of those mentioned above as inferred from the study which was conducted.

Occupational Health and Safety Management Systems (OHMS) are designed to manage health and safety issues to give

organisation best chances of having an incident-free workplace. Most organisations have elements of an OHSMS in place; however it is less likely for organisations to have a system in place that coordinates these elements to improve OHS. A systematic approach to OHS ensures that important health and safety issues are brought to attention to the person concerned so that they can be fixed. As all other management systems OHSMS also revolves around the Plan-Do-Check-Act (PDCA) approach.

There are 5 major elements to implementing a successful OHSMS. These include:

1. Management commitment and policy
2. Planning
3. Implementation
4. Measurement and evaluation
5. Review and improvement

The importance of an OHSMS should not be underestimated. It allows your workplace to systematically eliminate the possibility of accident, illness, injury or fatality caused by workplace hazards arising out of source, situation or act. Not only is this obviously beneficial for anyone working in the organisation, it is also beneficial for the organisation as a whole.

Employers have a legal responsibility to provide a safe workplace for employees. Having an OHSMS does not exempt you from your legal requirements; however it should help you to identify and comply with them. In case an organisation fails to meet the legal OHS requirements it is most likely to face prosecution. This will tarnish the brand to the stakeholders.

As well as legal ramifications, if a workplace lacks OHS protocols, standards, and practices in place it can decrease the morale of the organisation. An improvement of working methods and the working environment will lead to an increase in worker morale which in turn can lead to an increase in productivity. By improving OHS in

workplace, the risk of losing working days due to illness, injury or accident can also be greatly reduced.

Although they say, it takes time and money to implement an OHSMS, more than anything it takes true initiatives; it is well worth to protect employees and organisation.

It is notable that, management safety interventions are there in almost all the 21 elements which are covered in this study.

Involvement of managements through leadership - Visible Leadership

Safety leadership requires understanding of the leadership practices that can help promote better work health and safety behaviours among employees. The challenge for senior leaders is to not only improve safety but also develop skills and qualities that enhance management and worker capabilities. Research has shown strong links between safety leadership practices and safety compliance and safety participation. Safety leaders behave as role models, inspiring others, communicating their vision clearly, seeking creativity and innovation and empowering workers to take measures for making the workplace safe. This style represents specific qualities and attributes that are necessary for strong safety leadership and a positive safety culture.

Responsible safety leaders need to take ownership of ensuring safety and health of the employees leading by example. They should be Keen to adopt latest technologies for innovation by introducing a technology driven safety culture. The leaders must possess collaborative mindset in order to learn from good practices of others. They need to ensure access to the expertise and skills the company requires. Moreover, securing the commitment of the board and senior management to ensure the visible leadership through policies and resources regarding health and safety should be the top priority of the responsible safety leader.

Involvement of people through participation

Another crucial factor of effective management system is involving employees through participative approach. As workers or employees are the persons who actually encounter the hazards at the ground level it becomes imperative to take their view while designing and implementing an OHS management system. Suitable mechanism need to be devised for employee consultation and participation.

In the context of OH&S hazards and OH&S management system, the organization needs to establish, a system for internal and external communication with different stakeholders. It is desired that the organisation receive, document and respond to the relevant communications including suggestions from external interested parties.

Employee involvement is particularly important for hazard identification, risk assessments and determination of controls also in the case of incident investigation. As the employees/workers will eventually materialise the organisational target and objectives their involvement in the development and review of OH&S policies and objectives at the first place is absolutely paramount. This process needs to be further facilitated through management of change whenever such situation occurs.

Improving safety cultures

Safety means freedom from unacceptable risk, injury and ill health. Safety culture is the ways in which safety is managed in the workplace, and often reflects the attitudes, beliefs, perceptions and values that employees share in relation to safety. Any Culture takes time to develop. It cannot be developed overnight. So an organisation has to invest its time and patience in developing a safety culture.

An unsafe workplace can affect an

organisation in a number of ways. Quite often these effects result in direct or indirect losses with its adverse impact on the bottom-line. There are instances where companies went bankrupt because of absence of safety culture leading to unsafe situations and its disastrous outcome to the larger society.

An inadequate safety management system in an organization may lead to various losses which include:

- Loss of skilled manpower through death, injury and disablement
- Loss of property, equipment or other resources
- Loss of employee morale and productivity
- Higher insurance cost and compensation cost
- Legal liability
- Loss of company's image and reputation
- Loss of business to more sensitive customers (e.g. selected overseas buyers)

An attempt to reduce the losses would eventually bring higher return to the organisation directly and indirectly. To combat these losses or adverse impacts on the bottom-line it is essential to inculcate an effective safety culture throughout the organization.

Allocation of all types of resource

Through the OHSMS the top management need to ensure the availability of resources essential to maintain and improve an effective OH&S management system. Resources broadly include human resources and specialized skills, organizational infrastructure, technology and financial resources.

Unsafe Conditions & Unsafe Acts

Every accident, including the minor injury accident is a potential lesson to be learned by management. An accident investigation is a

systematic effort to establish all relevant facts and interpretations regarding how and why an accident occurred. Preventing recurrence is the true objective of the accident investigation. Experience has shown that most accidents result from unsafe acts and unsafe conditions.

→ Unsafe conditions involve the general work environment, equipment and work place

This could be eliminated by considering Safety in Design and Safety in Operation.

Both the aspects have been enumerated further considering the criticality of the same.

→ Unsafe acts are activities and/or job performance which employees are involved in and may include: workers practices

This could be eliminated by considering Safety in BBS

This aspect has also been enumerated further considering the criticality.

■ **Safety in design :**

Safety in design aims to prevent injuries and disease by considering hazards at early stage during the planning and designing of process, which includes design of plant, structures, substance as well as the work itself. Designs for Safety reduce equipment damages and injuries.

In order to manage work health and safety risks during the design stage, designers should consider

- Designing Physical Product(machinery, equipment)
- Designing Safe Process
- Designing Workplace and Work Layout
- Designing Work

Safe design refers to the inclusion of hazard identification and risk assessment methods early in the design process to eliminate or minimise the risks of injury throughout the life

of a machinery or equipments and structures or workplaces being designed. It encompasses all designs including equipment, products, hardware, systems, facilities, layout and configuration.

Globally a number of countries have included the requirements of Safe Design in their health and safety legislation. This is to ensure that hazards and risks that may exist in the design of a workplace are eliminated or controlled at the design stage as far as is reasonably practicable. Incidentally India does not have any such legislation where designing safe equipment, workplace or work itself has been guided through or asked for. Despite the fact whether it is legally required or not, the designs that are safe and without risks as far as reasonably practicable will take an organization on the journey towards safety excellence.

Designing physical product

An important step while considering safety as part of physical design of machinery, equipment or tools is right understanding of the scope.

- a. What the product is being designed to deliver?
- b. How do raw materials get into the machine and finished parts get out of the machine?

Safety in design is critical to the machine's end products as well as profitability, whether the equipment is designed to deliver compressed air; compressed liquid, cutting

or shaping metal parts, used for assembling of parts or makes widgets. Safety in





design includes an evaluation and understanding of the machine throughput and in-feed and out-feed requirements. It is equally important to determine during the design phase the method (manual or automatic) of machine loading and unloading process.

Floor space requirements can best be determined during the design stage as well. One has to map the machine footprint, such as how much space is needed for the machine, the operator, material handling access. Often this could be attributed to the directions of machinery installed so that the high risk components like electricity panel, rotary parts etc. are placed towards less human exposure or interference side. Another important approach to machine design and adjusting floor space is front-end loading system, which can help bring to mind everything that needs to be considered.

Machinery, equipment or tools designing might include ergonomics during the design phase. Adjustable equipment should be able to be operated by any person. Adjustability may be considered to be designed into the operator's panel and input stations allowing for risk-free and efficient operation of the equipment.

Designing Safe Process

The management of hazards and risks during the design process is essential for any industry that can be built safely and maintained safely. Designers are required to assess the risks

implicit in their designs to carry forward with its prevention. The hierarchy of control increases the effectiveness and sustainability until elimination or substitution of process is implemented through its process design. This is to eliminate a hazard completely or to reduce its magnitude sufficiently to avoid the need for elaborate safety systems and procedures. Hazard elimination

or reduction can be done by means of changing to a process or materials which are non-hazardous or less hazardous. Reduction of hazards in this way is inherently safer processes. By definition, they are permanent and inseparable from it. Such an approach leads to what are called inherently safer process or plant. It is easier to consider inherently safer process or plant at the earliest stages of process development.

The four main methods for achieving inherently safer design are:

- Minimize: Reducing the amount of hazardous material present at any one time, e.g. by using smaller batches
- Substitute: Replacing one material with another with lesser hazards, e.g. cleaning with water and detergent rather than a flammable solvent
- Moderate: Reducing the strength of an effect, e.g. having a cold liquid instead of a gas at high pressure, or using material in a dilute rather than concentrated form
- Simplify: Eliminating problems by design rather than adding additional equipment or features to deal with them. Only fitting options and using complex procedures if they are really necessary

Risk control based on inherently safer concepts and passive protection measures is more reliable. This is

because it depends on the physical and chemical properties of the system rather than the successful and correct operation of instruments, devices, procedures or people.

Designing Workplace and Work Layout

Designing workplace contributes significantly to reduce work related serious non-fatal injuries. Safe by Design should be applied to structures used as workplace. These structures are not limited to:

- Buildings or structures used as occasional workplaces
- Parts of the building or structure including fixtures integral to its use as a workplace
- Temporary structures

'The Factories Act 1948' describes the legal requirements for the followings as a general guideline to design the work lay out. They are:

- The emergency response plans to evacuate effectively like, emergency access, egress, exits, assembly point and emergency response signage, etc.
- Size of exit doors and routes
- The layout and spread over of First aid fire fighting equipment like manual call points, fire extinguishers, water buckets, fire beaters etc.
- If the machine has running or moving parts that would require guarding
- Illumination of work place and surroundings
- Temperature, Humidity, Ventilation and flow of fresh air
- Wash area and Ablution areas
- Elimination of high noise and dust& fumes in air

Certain specific laws are also there to provide clear guideline to design areas of potential hazard like,

- Storage of inflammable materials
- Storage of hazardous or toxic chemicals

- Lay out of power distribution and transformer area
- Segregation and disposal of hazardous wastes

Besides, all operating hazards must be identified during design so that interlocking guards can be included to protect those who will operate the machine and require access for maintenance activities. Stoppers also need to be designed and labelled so that equipment can be immediately shut down if an out-of-control situation were to occur. Lockout and tag out (LOTO) of hazardous energy source like, as air, electricity, water, vacuum, etc. Finally allotting and designing movement area for material handling by forklifts or other vehicles.

Designing Work

Designing Work or Work Design is effective to minimise the risks to workers. Creating healthy and safe work requires jobs and tasks be designed to accommodate the abilities, diversity and vulnerabilities of workers, including those returning to work following injury or illness. Some of the works that could be designed to safe allocation to workers and also meet the requirements of task are:

- Manual loading and off loading
- Excavation
- Work at height
- Hot work
- Confined space

Work design is the work arrangement and rearrangement of jobs in order to satisfy technological and organizational requirements on one side and the social and personal requirements of workers on the other side. Its simple philosophy lies in the crux of how the nature of a person's job affects their attitudes and behaviour at work, particularly relating to characteristics such as skill, independence and physical ability. The modern BBS has the technique to map individual's characteristic based on the above characteristics.



Managing safety during the work design can also make a big difference to the lives, health and well-being of those who work on the buildings and other structures that they are involved with. It affects construction workers, maintenance workers, the building users and members of the public.

For existing site or workplace, the effective design could be taken up out of risk assessment and thereby setting engineering control which safeguards or arrest the risk. The control could be implemented through management of change focussing safety. Small on- spot changes to workplace or work layout might be taken up by Kizen Group. However, for administrative control, management system could introduce procedures for work, permit to work and job safety analysis.

Management of change

Change management is one of the most important though little bit subdued aspects of an effective OHS Management System. It does not get the kind of importance and attention what it actually deserves. Understanding the nuances of management of change is absolutely imperative in the process safety point of view.

In any organisation, changes are inevitable for and part of continual progress. The progress might be on productivity, quality, and efficiency. But it can also increase risks that, if not properly managed, create conditions that may lead to injuries or property damage. Ineffective management of change is one of the major contributing factors in many of the incident investigations. Changes or proposed changes in the organization, its activities, or materials, modifications to the OH&S management system, including temporary changes, and their impacts on operations, processes, and activities leads a work person to an unknown territory fully exposed to new and hidden hazards. Now, this work person needs to be

adequately briefed about the type of changes happened in the workplace, machinery or equipment, which are the new type of hazards associated with change so that he/she can be aware of the same and can take suitable preventive actions. Before contemplating any changes to process it must be evaluated to assess their impact on employee safety and health

Summary

Making sure that work, work processes and systems are designed to reduce the risk to workers is an important part of a work health and safety management system. One of the best ways to prevent and control workplace injuries is to design out or minimise hazards early in the design process.

■ Safety in operation :

Operation has a risk of safety if left unidentified frequently known as Process safety. The quantum of such risk is devastating and time and again leads to major accidents in industries.

Process safety might be discussed through:

- Process Safety Information
- Process Hazard Analysis
- Operational control
- Management of change

After adequate precautions considered in design safety the next step towards the journey for safety excellence is definitely safety in operation. Safety in operation starts with inbound logistics material handling i.e. the input of raw materials into the plant premises then processing the raw materials towards realisation of the desired end product. Safety in operation deals with all the preventive measures throughout the chain of operation irrespective of the type of industries.

The major areas of concern in the safety scenario as coming out from our survey can be adequately addressed through safety in operation.

Process Safety is a blend of engineering and management skills focused on preventing catastrophic accidents, particularly explosions, fires, and toxic releases, associated specially with the use of chemicals and petroleum products

Process safety needs to be considered separately from general occupational health and safety. Accidents involving personal safety that tends to occur frequently often have little consequence in contrary to process safety incidents which happen more frequently can have catastrophic results when things go wrong. Some typical examples of process safety incidents include rapid overpressure events in process plants arising from dust, gas and vapour explosions, detonation of highly energetic materials, rapid decomposition of thermally unstable substances or mixtures and runaway exothermic chemical processes. The results of these unfortunate events going out of control may range from insignificant to catastrophic consequences. Furthermore, they can result in fatalities or serious injuries, loss of assets, resentment in stakeholders, unwelcome media attention and large financial losses.

Process Safety Information

Process Safety Information refers to the information related to the Hazards of the Chemicals Used in the Process. Complete and accurate written information concerning process chemicals, process technology and process equipment is essential to an effective process safety management program and subsequently to a process hazard analysis.

An employer is required to develop and maintain written safety information before conducting any process hazard analysis.

PSI or process safety information might be considered the key element of a PSM Program. It tells you the dealings with both from the equipment and the process standpoint. The process safety information

should include information pertaining to the hazards of the highly hazardous chemicals used or produced by the process, information pertaining to the technology of the process and information pertaining to the equipment in the process.

Information pertaining to the hazards of the highly hazardous chemicals in the process should consist of at least the following:

- Toxicity information
- Permissible exposure limit
- Physical data
- Reactivity data
- Corrosively data
- Thermal and chemical stability data
- Hazardous effects of inadvertent mixing of different materials that could probably occur.

Information pertaining to the technology of the process should include at least the following:

- A block flow diagram or simplified process flow diagram
- Process chemistry and its properties
- Maximum intended inventory
- Safety upper and lower limits for such items as temperatures, pressures, flows or compositions
- An evaluation of the consequences of deviations, including those effecting the safety and health of the employees.

Information pertaining to the equipment in the process should include following:

- Materials of construction
- Piping and instrument diagram (P&ID's)
- Electrical classification
- Relief system design and design basis
- Ventilation system design
- Design codes and standards employed
- Safety system (for example interlocks, detection or suppression systems)

The employer should document that

equipment complies with recognized and generally accepted good engineering practices (RAGAGEP).

Process Hazard Analysis

This is arguably the most important and critical phase of process safety management program which leads any organisation towards excellence in safety eventually.

Process hazard analysis includes the identification of a suitable basis of safety to prevent or mitigate process safety hazards and therefore a pre-requisite for safe operation. However, realising and implementing the proposed basis of safety involve an in-depth knowledge of the materials in use, the process operations, equipment specifications and the facilities that house the processes. The ability of having thorough understanding of all the hazards is critical in developing a suitable basis of safety. Process hazards analysis is performed by the Process Safety Management (PSM) team. It requires significant time and effort.

Key steps of the process hazards analysis include:

- Developing a block diagram of the total process
- Developing a detailed P&ID
- Numbering each and every process equipment following a suitable protocol
- Developing a comprehensive list of equipment elements
- Choosing an appropriate PHA method

Some of the commonly used methods are What-If analysis, Checklist, Hazards and Operability Study (HAZOP), Failure Mode and Effects Analysis (FMEA), Fault-Tree analysis etc.

The PHA must address the following

- Equipment in the process
- Hazards of the process
- Identification of previous incidents
- Engineering and administrative controls

- Consequences of failure
- Facility siting
- Human factors
- Qualitative evaluation of S and H effects
- Consequences of deviation
- Steps required to correct or avoid deviation

Operational control

Operational control can very well feature in either of the segments i.e. management system or safety in operation. The importance of operational control in this segment has been discussed herein.

Operational control is particularly essential to those operations and activities that are associated with the identified hazards and where the implementation of controls is necessary to manage the OH&S risks.

It is an authority over normal business operations at the operational level, as opposed to the strategic or tactical levels. Operational control includes control over how normal business processes are executed, but does not include control over the strategic business targets or high-level business priorities.

Operational control is particularly applicable to the

- Controls, as applicable to the organization and its activities
- Controls related to purchased goods, equipment and services
- Controls related to contractors and other visitors to the workplace

The operational controls are typically documented procedures to cover situations where their absence could lead to deviations from the OH&S policy and the objectives. Selection of operational control has to be based on OHS risk assessments. It is as per the hazard which has significant OHS risks associated with it. The existing ones should be integrated to the OHS management system

and OHS Manual. Operational control can be achieved by a variety of effective methods such as training, engineering specifications, preventative maintenance programs, and work instructions. One of the most important and effective methods is documented operating procedures. Documented procedures ensure that the necessary steps and activities for mitigating risks effectively, at the right time, by the right people, and the same way every time. Conformance to OHS Manual will help to ensure that an organization will use the information gathered during the Hazard and Risk assessment to identify those activities that contribute to the significant impacts and establish effective controls on the most critical activities. These impacts could be identified through regular monitoring, review and third party inspections.

Operational controls may include:

- Electronic or mechanical technology to reduce emissions
- Routine preventive maintenance programs to reduce wear and breakdown of equipment
- Monitoring and observation of equipment performance

Different common types of operational Controls include:

- Standard Operating Procedures
- Contract Language
- Signage
- Log Books
- Check Lists etc.

Operational controls also include the management of change discussed earlier.

The Journey towards Process Safety Excellence

It is now clear that the process safety events take the toll on the lives of our loved ones and property. What are some ways we can

proactively take steps toward achieving process safety excellence?

Leadership

What does being a process safety leader mean? It means realizing everyone in the organization plays a critical role in preventing process safety incidents. This can be through management of change, incident investigations or even through participating in audits of the process safety management system. Process safety leaders hold themselves and their peers accountable for executing these tasks correctly each time. Through time the process safety culture in an organization may be challenged with the normalization of deviance think of this as someone saying, That's the way we've always done it and nothing bad has ever happened. So why change how we do things now? Process safety leaders are quick to identify these situations and diffuse them before complacency sets into the organization.

Work force engagement

Process safety excellence is achieved when employees and contractors across the organization are working in sync with one another. Each subset of employees in the organization may have developed a niche set of skills over time and it is easy for folks to build a comfortable silo to work within. The biggest hurdle to process safety excellence is crossed when employees consistently break down these silos and engage folks in other areas of expertise.

Knowledge

A key step in achieving process safety excellence involves growing the knowledge base within the organization. The basic tools for conducting incident investigations lead us to answer for who, what, where, when and whys of process safety events. An organization that communicates these aspects of an incident with the work force heightens awareness and helps maintain a



sense of vulnerability for future process safety events. A deeper knowledge base can be developed by actively participating in industry event sharing workgroups.

Metrics

Process safety excellence isn't achieved through hope. Instead it is achieved by the timely response to leading indicators prior to experiencing a significant process safety event. The organization's leading indicators should include some data pertinent to the small leaks and spills that could result in bigger events. Programs should be established to drive down these smaller incidents in order to prevent the likelihood of a significant process safety event.

Auditing

An indicator of a strong process safety culture is the timely closure of recommendations from audits. The organization should implement a process safety audit protocol that is balanced in the review of management systems and tactical execution of policies. For example, an organization may have world-class process safety policies sitting in binders. However, there may be a significant gap between these policies and what is actually executed in the field. An audit protocol that balances these two areas is effective in preventing process safety events.

Celebrate!

Finally, an organization must take the time to reflect on how far they have come in the journey to process safety excellence. The organization will realize excellence was achieved through everyone's contribution. Celebrating the fact every employee and contractor played a vital role in the journey is a powerful way to keep folks engaged in continuous improvement.

■ **Safety in behaviour :**

Safety approach to a work aborts many risk that otherwise prevails and could happen repeatedly if right and safe approach is not

practised while attempting such works. Psychological observation and intervention plays important role in developing behaviour that is safe. This could be achieved through:

- Changing Attitudes Can Change Behaviour
- Physical mapping, Social life mapping and Hazard perception mapping

Psychology of Behavioural Safety

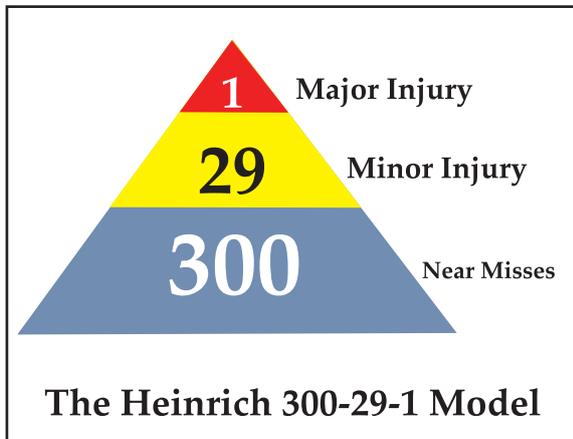
After spending on resource, time and effort for improving safety, usually by addressing hardware issues and implementing safety management systems and regular monitoring of the system by conducting safety audits, over years these contributes to reductions in accident rates.

However, a number of minor incidents remain that appears to be stubbornly resistant to all efforts to eliminate them. Although many of these are attributed to peoples' carelessness or poor safety attitudes, most of these are triggered by deeply ingrained unsafe behaviours. Behavioural Safety addresses these by making use of proven management techniques which almost always results in a positive step change in safety performance and safety attitudes.

Although difficult to control, approximately 80-95 percent of all accidents are triggered by unsafe behaviours, which tend to interact with other negative features (termed as Pathogens) inherent in workflow processes or present in the working environment. Habitually inadvertently introduced by the implementation of strategic plans, every entity has its fair share of accident causing pathogens. These pathogens lie dormant and are relatively harmless, until such time as two or more combine and are triggered by an unsafe behaviour to produce an accident.

Why Do People Behave Unsafely?

People often behave unsafely because they have never been hurt before while doing their



job in an unsafe way: 'I've always done the job this way' being a familiar comment. This may well be true, but the potential for an accident is never far away as illustrated by various accident triangles. Heinrich's triangle, for example, suggests that for every 300 unsafe acts, 29 will result in minor injuries and 1 in a major or lost time incident. Over an extended period of time, therefore, the lack of any injuries for those who are consistently unsafe is actually reinforcing the very behaviours that in all probability will eventually lead them to be seriously injured. The principle being illustrated here is that the consequences of behaving unsafely will nearly always determine future unsafe behaviour, simply because reinforced behaviour tends to be repeated.

Although it is not unusual to find the continuation of unsafe behaviours being supported by more than one type of reinforcers, some will exert stronger effects on people's behaviour than others. This is particularly the case for reinforcers that are soon, certain and positive. Smokers, for example, find it hard to stop because the consequences of smoking are soon (immediate), certain (every time) and positive (a nicotine top up), whereas the negative consequences (e.g. lung cancer) are late (some years away) and uncertain (not every smoker contracts or dies from lung cancer). In

exactly the same way, employees will find it hard to follow certain safety rules and procedures if they are consistently (certain) rewarded by an immediate (soon) timesaving that achieves extra production (positive) by behaving unsafely.

How To Stop People Behaving Unsafely?

Comments on accident reports often say 'So and so should take more care. With better attitudes and safety awareness, this accident would not have happened'. Where this occurs, attempts to change unsafe behaviour usually hinge upon the belief that attitudes determine behaviour. An additional factor that enhances attitude change by focusing on behaviour is the positive reinforcement brought about by peer pressure. Psychologists have known for some time that group membership demands conformity to the groups 'behavioural and attitudinal norms'. If a workgroup adopts the 'norm' that 'thinking and behaving safely' is best for all concerned, the group as a whole will tend to apply social 'sanctions' to the individual who deviates from this norm and behaves unsafely.

Changing attitudes can change Behaviour

Focusing on people's safety behaviour will bring about the desired changes and that attitude changes follow behavioural changes. The social approval and encouragement can bring about positive changes in safety 'norms'. The workforce is best placed to redefine their safety 'norms', as they control their own behaviour. Accordingly, behavioural safety approaches are very much driven and shaped by the workforce, in conjunction with line management. In this way, the workforce is given responsibility and authority for identifying, defining and monitoring their own safe and unsafe behaviours, as well as setting their own 'safety improvement' targets. As a result, workgroups are able to redefine their own safety related 'norms' in an enabling atmosphere.



Employers that introduce BBS programs are trying to say that, all have equal responsibilities when it comes to health and safety. The following exercises are designed for management and other members to ask themselves about who does share the responsibilities on health and safety.

- Responsible Person in terms of Safety: The Aim of this exercise is to draw a picture of who is responsible for what in the workplace.
- Decision Makers: BBS programs get workers observing each other with the aim to encourage workers to make different decisions about how they work.
- Lost time injury: Many workplaces have a sign up listing the numbers of days since a 'Lost time Injury'
- A health and safety Map: This exercise is sometimes called "mapping". By answering these questions you can get a snap shot of where the holes are in your organisation around health and safety or what immediate risks need to be addressed.

Physical mapping

What's hurting you?

- Substances - vapours, liquids, fumes, mists, solvents, dusts
- Environments - noise, vibration, radiation, dry, wet, hot, cold, ventilation, indoor air quality
- Job design - control, stress, bullying, ergonomics, work pressure, insecurity, harassment, discrimination, violence
- Welfare - toilets facilities, cleanliness
- Accidents - trips, falls, slips, cuts, scalds, burns, lifting, reaching
- Work patterns - overtime, long hours, piecework, shifts, homework, call centre work, rest breaks, rush jobs

How Body Mapping can help

As Health and Safety Reps, you can use Body Mapping find out "what's hurting members", to collect information about workers' health, such as:

- diseases
- illnesses
- injuries
- aches and pains
- stress symptoms
- fatigue/impairment
- reproductive problems
- other related problems

Body Mapping is a way of identifying common patterns of health problems amongst workers in a particular workplace, doing the same or similar job. (Different groups within a workplace are likely to identify different problems.) It means that when all the workers doing a particular job pool their information about health problems (past or current) that are unexplained or just might be related to the job, patterns can quickly emerge.

Not all the identified common health problems may be work-related, but doing the Body Mapping exercise means that these all merit further investigation at the very least.

Social life mapping

Often we fail to recognise the impact that work has on our families, our ability to participate in social activities, and on our relationships. Work is central to our lives because it takes up so much of our time, our thoughts, and our energy even when we are not physically at work. Usually we can't leave our aches and pains and stress at work when we go home after work. Our fatigue and injuries and health problems often stay with us sometimes for years after our work has finished. Injuries, illnesses and stresses caused by poor working conditions and the lack of basic security can have a profound effect on our quality of life.

How "Your World" Mapping can help

Your World Mapping looks at the impact of the job on your whole life. Your World Mapping is a do-it-yourself research tool, a complement to Body Mapping and Hazard Mapping. It's a way of examining all those niggling, hurting, irritating problems arising out of the job, and assessing how they impact on your entire life.

The approach is very simple, but it (like the other mapping tools) gives a visual picture of how problems inside work cause problems outside of work. Instead of negotiating health and safety improvements piecemeal, the real underlying issues can be identified and tackled.

Using "Your World" Mapping can help you collect information about the effects of working conditions on workers':

- family lives
- social lives
- communities
- neighbour hoods
- mental and emotional health.

Hazard Mapping

Where and what are the hazards causing problems in your workplace?

- Physical Hazards: Noise, radiation, vibration, temperature, more.
- Chemical Hazards: Cleaning agents, solvents, exhaust fumes, asbestos.
- Biological Hazards: Infectious diseases, bacteria, needle sticks, body fluids, working with animals.
- Work design Hazards: Ergonomic hazards, working alone, violence and aggression from third parties.
- Stress Hazards: Workload, hours of work, shift work, harassment, and discrimination.

After completing the three mapping exercises Body, Hazard and mapping "Your World" the next step is to take the results and prioritize the hazards and plan what action to take. Once

again, this should be done with the whole group, with everyone participating in the activity.

This activity will help an organization and its employees to develop a plan to change your work environment. It is unlikely that we can change the root causes of many problems without a much larger movement in society, but every step we take in our individual workplaces to change the immediate causes builds towards this broader goal.

In the meantime, however, health and safety representatives can address problems in their own workplaces and ensure that the risks associated with hazards are eliminated or reduced as far as practicable.

■ Conclusion :

Safety scenario in Indian industries is far from satisfactory. In this write up as attempt has been made to identify and isolate the issues which impact the safety preparedness of Indian Industries. Albeit the samples of industries were drawn mostly from eastern part of India we believe the issues are confined to the eastern region only. A general direction therefore can be derived from these findings.

The paper presents the larger issues facing industries in managing safety at work places and the areas where the organisations should focus.

Some ideas are presented to overcome the situation. As is known to every safety professionals the biggest stumbling block in this endeavour is the successful implementation.



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About CII

About CII

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