Improving safety, health & environment in steel industry

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Improving safety, health & environment in steel industry

Steel manufacturing is an industry where safe working procedures are important, as workers face many risks due to the nature of the job. The work environment is often hot and noisy, and work tasks regularly heavy and demanding on the body, and there is an always present risk for crushing injuries and burns. Steel companies have significantly improved their safety performance over the last 10 years, but many have reached a plateau where further progress is more difficult to achieve. To proceed from the plateau, it is necessary to go beyond our traditional methods of approach and to challenge the implicit acceptance that we operate in a potentially dangerous industry where some accidents are inevitable. The new thinking states clearly that all accidents are avoidable and "Accident-Free" steel is a practical goal for the future. Anyone who has ever worked in the steel industry is aware of the high level of risk to which employees are exposed. Yet, many steel companies have demonstrated that an accident-free environment is a practical and achievable goal. This evolution is not only the result of a greater awareness of a moral obligation but also the fact that the legal requirements have become more and more stringent. Another strong reason is the realization that safety excellence will act as a catalyst for better overall corporate performance.

Steel is one of the most important structural materials in the world. It is used in virtually all sectors, from automotive, construction, mechanical engineering and shipbuilding to household appliances, computers and consumer electronics. Infrastructure projects such as road, bridge or rail construction would be impossible without steel.

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Employee health and safety is one of the top risks impacting the metal industries in India, particularly the iron and steel industry which is largest ferrous metal sector and key to Indian economy. Historically, steelmaking was a dangerous process and accidents were inevitable. But that world changed long back. Today many steel industries across the world have achieved no lost time injuries and zero fatality marks. However, Indian iron and steel industry is still a death-trap. Poor health and safety conditions at work places also reflect overall poor performance of the sector. The outdated equipments, below standard operation & maintenance and compromised pollution control measures ultimately risk health & safety of lives. It is only with the increasing number of people killed and injured at work that the significance of the problem has been realised.

Workers in the steel-manufacturing industry face many safety risks due to the nature of the job. How well safety procedures and regulations are followed within an organization is considered to be influenced by the reigning culture of the organization. The protection of

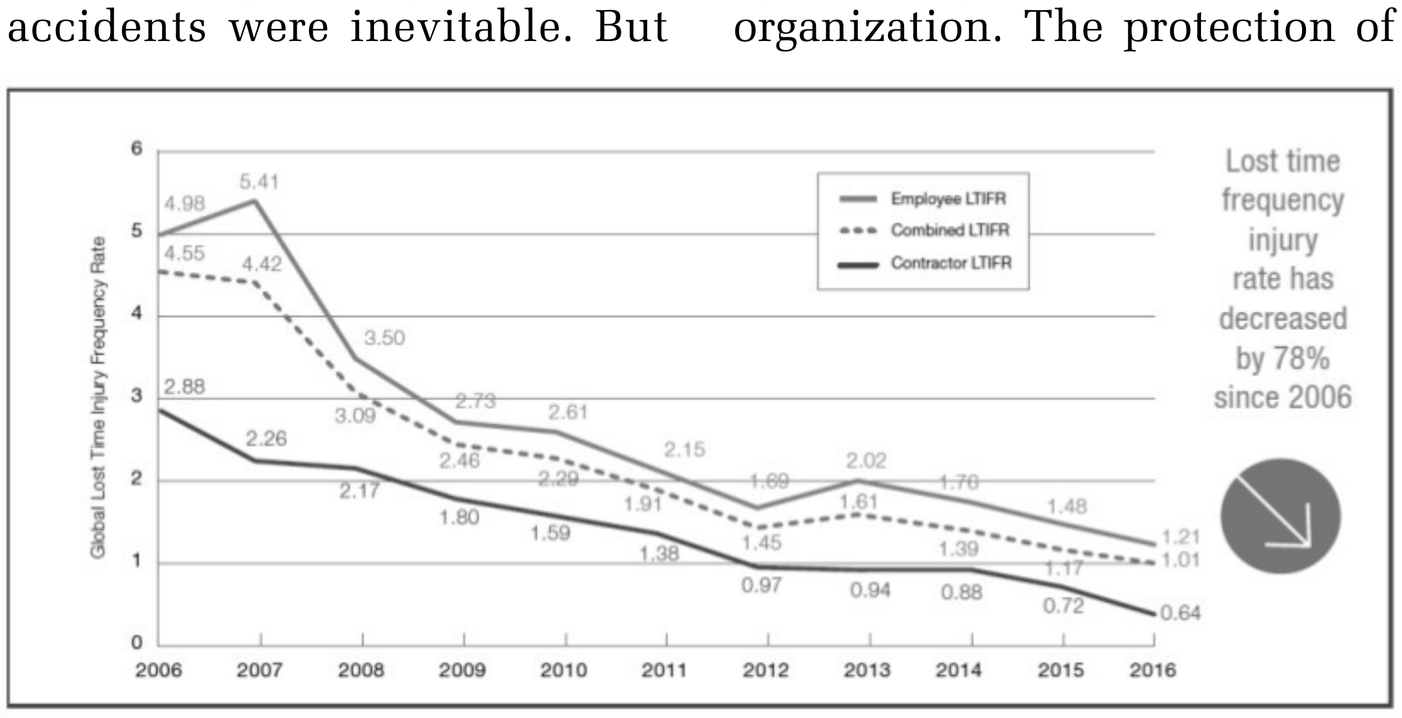

Fig.1 Lost Time Injury Frequency Rate (LTIFR) over the past decade

people and physical assets is the concern of the health and safety professionals. Working environment factors such as chemicals, noise, psychosocial, layout, ergonomic etc., play a major role in assessing health and well-being of the employees. They also contribute significantly to the outcome of an organization. Thus risk management of the working environment is a major concern to every manager, health and safety professionals in the organization. Workplace environmental stressors in the iron and steel industry are large in number and typically they include, physical hazards (noise, vibration, extreme temperatures, ionizing and non-ionizing radiation, inadequate illumination), inhalable agents (vapours, gases, dusts and fumes), exposure to pathogens (e.g. legionella), exposure to carbon monoxide (CO) gas, skin contact with chemicals (irritants, solvents, sensitizers, volatile organic carbon), working in confined spaces, ergonomics, exposure to asbestos, slips, trips, falls from height and same level, falling objects, electric shock, burns related to electrical and accidental contact with hot molten metal, inadequate ventilation, unguarded machinery, fire and explosion, workplace violence, odor pollution, inadequately trained health and safety professionals, lack of effective supervision on usage of personal protective equipments (PPE), manual handling and repetitive work, inadequate workplace inspections and accident/incident prevention programs, inadequate emergency rescue facilities, inadequate occupational safety and health training and lack of effective communication and coordination among the various professional groups.

Safety and health in steel industries: Global scenario

Historically, steelmaking was a dangerous process and accidents were inevitable. Today, many steel companies recognize that this is no longer appropriate for a modern and technically advanced industry. There is no area, process or type of work that cannot be accident-free. Safety and health requires a permanent 100% commitment from everyone. Most importantly, it requires a strong commitment from senior management of steel companies, which should set the culture in which safety and health is the number one priority and must not be compromised for any other objective.

Steel companies are improving their safety and health performance and some businesses have gone without any lost time injuries or fatalities for many years. These companies know that such performance requires excellence in all aspects of their operations. This excellence also produces superior business performance - the most successful steel companies are also the safest. As reported from World Steel safety data from 2006 to 2016 shows that the steel industry has seen a steady and notable reduction in the Lost Time Injury Frequency Rate (LTIFR) over the past decade, decreasing from 4.55 in 2004 to 1.01 in 2016, a reduction of 78%.

Different hazards in steel industry

Iron and steel industry is a heavy industry, involving a whole range of processes-chemical, metallurgical, mechanical, electrical, construction, road and rail traffic, materials handling, earth moving, nucleonic and many others. Each of these processes has many in-built hazards, falling broadly into three categories. An integrated steel plant can be divided in three zones as follows:

1. Iron zone comprising of

- Raw materials storage, preparation and handling yard, coke ovens and by-products plant, sintering plant, blast furnaces, gas holders and pipe lines.

2. Steel zone comprising of

- Steel melting shop, continuous casting shop, oxygen plant, slag and scrap yard, gas holders and pipelines

3. Rolling mills zone comprising of

- Different rolling mills, gas booster stations and pipelines, loading bays for dispatch of finished materials, electrical cable tunnels and oil callers.

Table 1: Shopwise different hazards in a steel plant

Coke Oven & By Product Plant	:	Heat, Smoke, Dust, Mobile Equipment Chemicals, Fire And Explosion etc.
Blast Furnace	:	Liquid Metal, Gas, Dust, Conveyors, Loco Movement etc.
Steel Melting Shop	:	Liquid Metal, Explosion, Cranes, Other Mobile Equipment etc.
Rolling / Mills	:	Metal Under Rolling, Heat, Splinters, Cobbles, Hydraulics, Cranes etc.
Power Plant	:	Ht Elec. Equipment, Gas Lines, Heat, Dust Noise Vibration etc.
Foundries	:	Heat, Dust, Explosion, Chemicals etc.

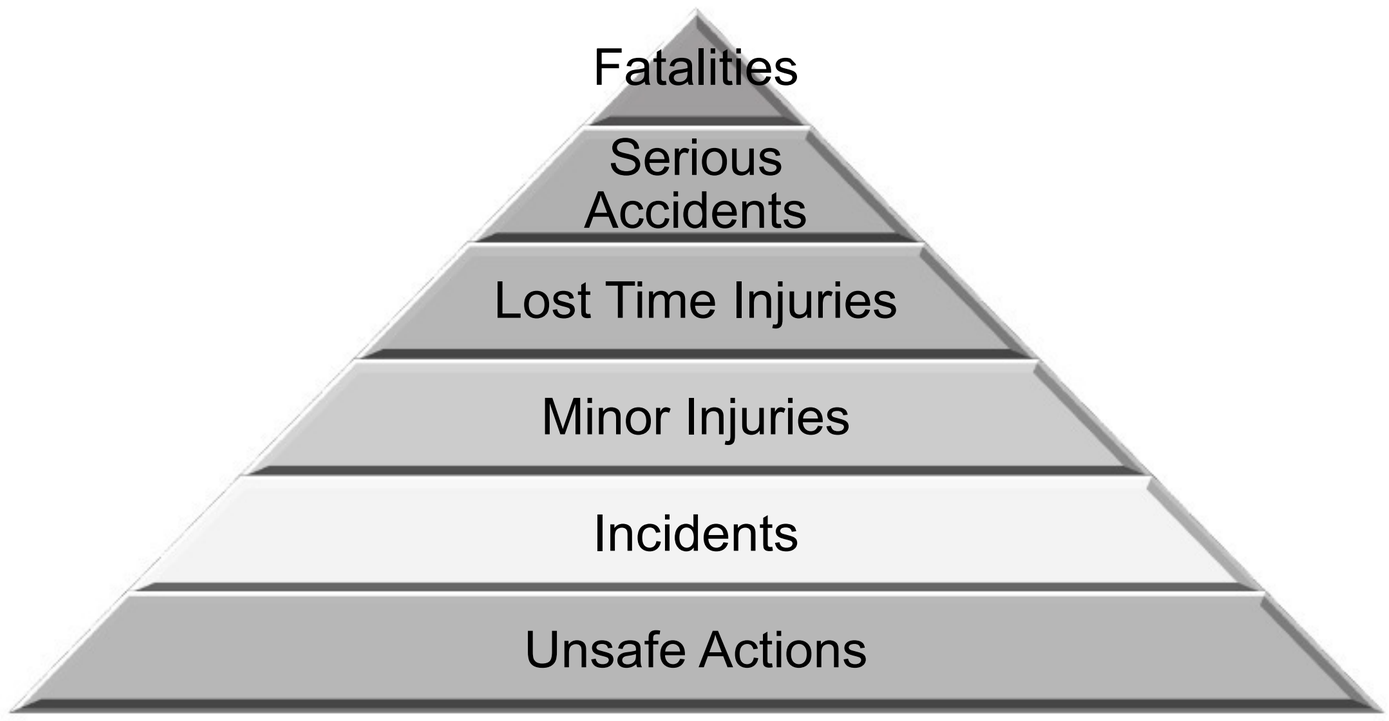

Fig 2 The iceberg of accidents

Zonewise different hazards

In the iron and steel industry, large amounts of materials are processed, transported and conveyed by massive equipment. Steel works typically have sophisticated safety and health programmes to address hazards in an environment that can be unforgiving. An integrated approach combining good engineering and maintenance practices, safe job procedures, worker training and use of personal protective equipment (PPE) is usually required to control hazards. In this paper it has been tried to classify the various hazards present in the steel plant according to the different zones as shown in table 1.

Improving safety, health & environment in the industry

There are three imperatives for adopting safety practices. They are ethical, legal and financial. There is a moral obligation placed on the steel plant management to ensure that the work place and the work activities are safe. There are legal requirements defined for safe working. Safe working also reduces down time, improves workman's morale and promotes systematic working, resulting into substantial reduction in the cost of production and financial savings.

The nature of various types of accidents is shown by an iceberg of incidents (Fig 2). They are unsafe actions, incidents, minor injuries, lost time injuries, serious accidents and fatalities.

Every steel plant should aim at zero accident atmosphere. To aim for an accident free working environment in a steel plant is every one's responsibility. It is possible to reduce dramatically the number of accidents at work by assigning necessary priority to the safety since a safe way of working is a quality and efficient way of working. The pyramid of the overall of zero accidents is depicted in Fig.3.

The following three aspects are important for progress of safety in a steel plant:

- The condition of the work place environment e.g. means of access, physical plant safety, house-keeping, and safe place of work etc.
- The training and competence of the employees which include ability to understand apply and respond to safe systems of work.
- The development of motivational and behavioural influences of employees. This includes the use of more direct strategies to identify unsafe behaviour and attitudes and to motivate employees.

Many companies have developed, over the years, occupational health and safety programmes that concentrated in particular on: a) the problems peculiar to the steel industry b) the steelmaking processes; and c) the nature of the materials being processed. From these were developed safety programmes that dealt systematically with:

- Identification of potential hazards including potential new risks from new technology.
- Assessment of risk.
- Establishment of physical protection.
- Development of safe systems of work.
- Development of audit procedures.
- Provision of personal protective equipment.

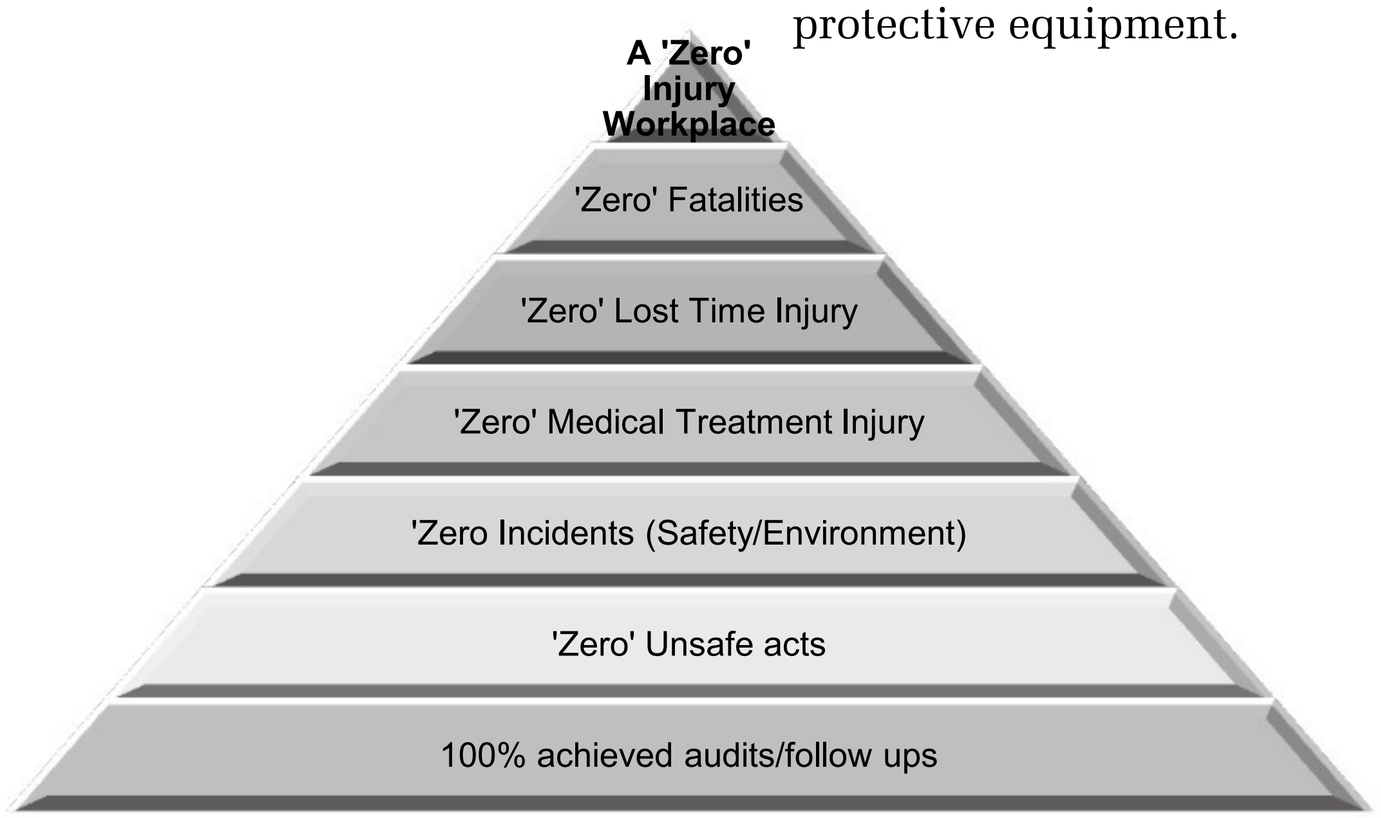

Fig 3. The pyramid of overall goal of zero accident

1. Production	*1.* Safety (a priority)	*1.* Safety
2. Costs	*2.* Production	*2.* Costs
3. Quality	*3.* Quality	*3.* Quality
4. Safety issues following an accident (Corrective)	*4.* Customers	*4.* Reliability
		5. Customers
Day before yesterday	Yesterday	Today

- Investigation procedures.
- Standards for new plant and process modification.
- Fire fighting programmes.
- Provision of firefighting equipment etc.
- Training of employees.

In addition, health programmes were developed considering the health aspects of employment in the steel industry. The challenge is to go beyond the current safety status and achieve zero accident status. The perception of steelmakers has changed and now the most prior thing in steel production in people's safety as shown below:

How to implement safe workplace practices

Safety is good for business. A safe and healthy workplace is one of the keys to business success. By establishing good health and safety practices in the workplace, a business is likely to have more motivated and productive employees, lower absenteeism rates, fewer business disruptions and reductions in the costs of sick pay and temporary replacement staff.

This will help to reduce the sometimes serious impacts of injury and illness on employees, families and the wider community – and improve the business's reputation both in the business world and as an employer of choice.

Health and safety improvement cycle

The Health and Safety Improvement Cycle is a roadmap to reducing workplace injuries and illnesses. It is a guide for building comprehensive workplace health and safety systems. The Health and Safety Improvement Cycle provides a continuous process of improvement. By working through the cycle, we can set up and support the comprehensive health and safety systems required to keep workplaces safe.

There are three key steps involved in health & safety improvement cycle

1. Review 2. Plan 3. Action

The three steps of 'review', 'plan' and 'action' keep you working in a cycle of continuous improvement. The 'action' step includes all the key activities of a comprehensive health and safety programme. Commitment and communication are needed throughout. Implementing health and safety systems is an ongoing process that requires constant monitoring and adjustment, with a goal of continuous improvement. The review should lead to a plan that is then translated into actions, and these actions may in turn be reviewed and lead to new plans and actions.

Management commitment towards health & safety improvement

To make health and safety a day-to-day part of business practice, managers and supervisors need to be committed to health and safety.

These steps can be followed to improve, the management of health and safety in our workplace:

- Assign safety responsibilities for all levels of business, from employees on the work floor to senior managers. Write them into the job descriptions.
- Regularly share the performance in health and safety improvements. Measure things such as the quality of the incident investigations carried out and the number of safety improvement suggestions received. Report

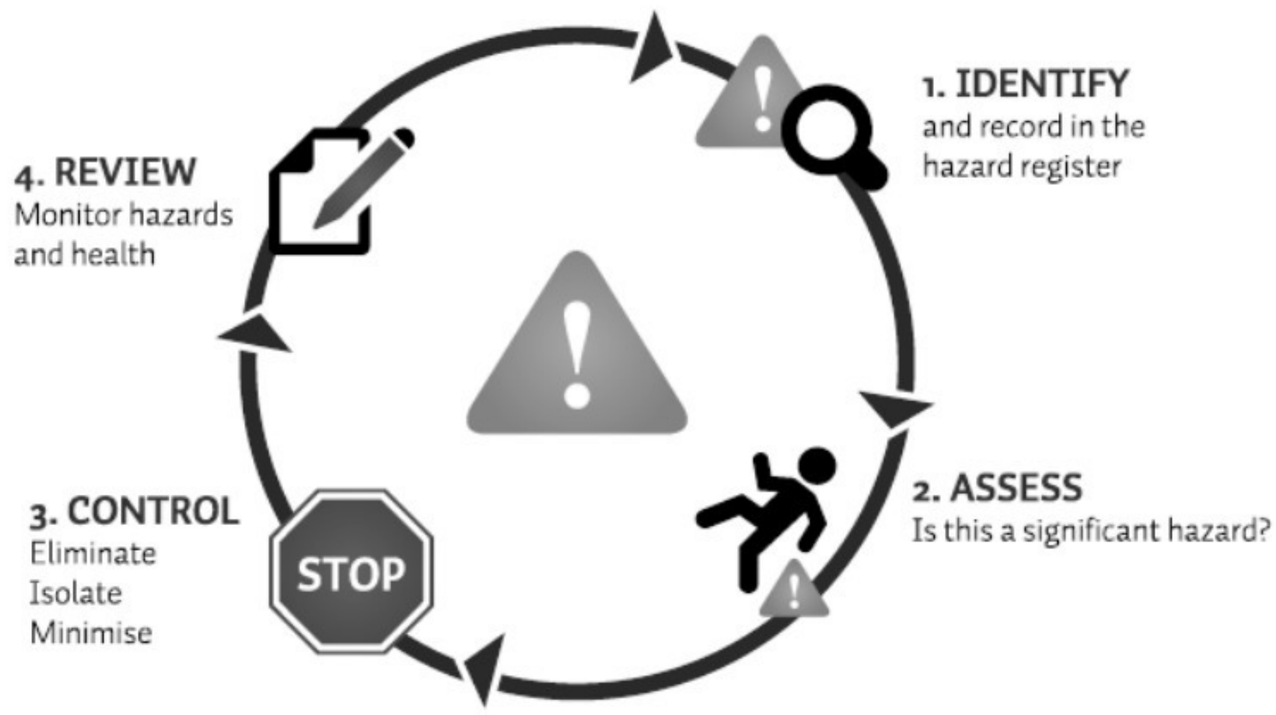

Fig. 4 The hazard management process

back to employees on how things are going.

- Build a shared vision of health and safety goals among the managers and supervisors. Be clear about the priority of health and safety among other important business priorities.
- Make managers and supervisors accountable for being seen to be involved, setting a proper example and leading business's health and safety improvements.
- Create a health and safety committee. Ensure it functions well e.g. meetings are well attended, responsibilities/ functions are shared, and the committee is authorized to make decisions.
- Provide employees with ways to participate and contribute suggestions – able to raise concerns or problems. Encourage them to share these and ideas for improvement with supervisors and managers accountable for their responses.

Hazard management

There are four steps needed to follow to manage the hazards in business effectively and continually. The steps are:

1. Identifying hazards – identifying the things that may cause injury or harm to health
2. Assessing the hazards – evaluating whether any are significant (as defined by the HSE Act), and how likely and serious the injuries or harm would be if workers were exposed to the hazards
3. Controlling the hazards – taking all practicable steps to eliminate, isolate or minimise the significant hazards
4. Monitoring hazards and any exposure to a hazard that has been eliminated, isolated or minimised.

While Personal Protective Equipment (PPE) may help in minimising hazards, injury and health hazards are more reliably eliminated, isolated or minimised through new design or safer or mechanised processes.

Under the Health Safety & Environment act main aim is to eliminate significant hazards. If this is not practicable, it is needed to control them through isolation or minimisation. Elimination is the best employee protection you can provide – and designing or redesigning facilities, equipment or processes offers the greatest opportunity to do this. When it is not possible to remove a hazard or replace it with a less hazardous alternative (sometimes called substitution), the next best control option is enclosure. Enclosing a hazard usually means employees are not exposed to it during normal operations, although they could be during maintenance or if the enclosure system breaks down

The following steps take you through the decisions needed for each significant hazard you identify.

Good safety practices

Good safety practices include the following:

- Assigning and publishing the responsibility and duties of the employees associated with the management of the safety in the steel plant.
- Investigation of all the accidents whether small or big and the implementation of corrective measures.
- Studying the significant safety incidents which have happened in other steel plants and learning from the same.
- Registration and control of safety standards and maintaining a register of the significant incidents.
- Internal and external publication of safety investigation results and the obtained experiences.
- Conducting regular shop review meetings regarding status of safety in the shop as well as monthly review meeting at the chief executive level.
- Conducting training as well as refresher safety training programs amongst the employees where investigation of various incidents are also to be discussed.
- Conducting emergency safety drills.
- Conducting of regular safety audits to locate unsafe areas and practices and to ensure that the corrective actions have been taken. Safety audits can also help in early detection of the equipment deterioration and the deviations and/ or procedures that can degrade or deteriorate then safety levels.

Conclusion

Steel is everywhere in our daily lives. It provides us with energy, food, shelter, security and transport; from food cans, kitchen appliances, safety equipment to cars, planes and vessels and even our computers (approximately 25% of your average computer is made of steel). Steel can be re-used over and over again and is also 100% recyclable without loss of quality. The steel industry directly employs more than 2 m people worldwide, with a further 2m contractors and an additional 4m people in supporting industries. But considering steel's position as the key product supplier to industries such as automotive, construction, transport, power and machine goods, the steel industry is at the source of employment for more than 50 million people.

In the past steelmaking was considered a dangerous process and accidents were thought to be inevitable. Today the industry spends more than $12 bn globally every year on improving the manufacturing process, new product development and technology and, as a result, it is today a highly automated industry with most manual handling, heavy lifting and many operational activities mechanized. This has removed staff exposure to hazards and reduced safety risks in the working environment.

Each incident can be avoided and industry leaders think that continuous improvement in safety is the responsibility of the management teams, which should make sure measures are in place to manage the risks that cause injuries and employees are trained to carry out their jobs safely. The following are the essential elements which are necessary for implementation of safety culture in a steel plant.

- Safety consciousness is to be ingrained amongst the workforce as well as among the top management of the steel plant.
- There is to be a communication plan and a participatory way of working from the maximum number of employees which will confirm that the commitment towards the safety is real.
- There is to be recognition of best practices in safety and there should be exchange of the safety related ideas both within and between the departments.
- There is to be an appropriate safety organization structure, which is well defined by the management and well understood by everyone. The safety organization is to have well defined role and responsibilities.
- There are to be ambitious goals for the improvement of safety and measurement of progress by the collection of appropriate statistics.
- There is to be a change in the attitude and behaviour of individuals and working groups with respect to safety.
- Management should put into place mechanisms which have influence on behaviour of the employees towards safety. For example that the safety performance of the employee is to be recognized towards career development.
- Through training programs, management should demonstrate that attitude and behaviour to safety is an essential part of the professionalism of every employee and everyone should accept his responsibility not only for his own safety but also for his fellow employees. After all, employees work in steel plant not as individuals but as a part of a team.
- There is elimination of a two tier approach to safety. Contract workers working in steel plant should attain the same level of safety consciousness as the steel plant's own employees and use the same methods to achieve this.

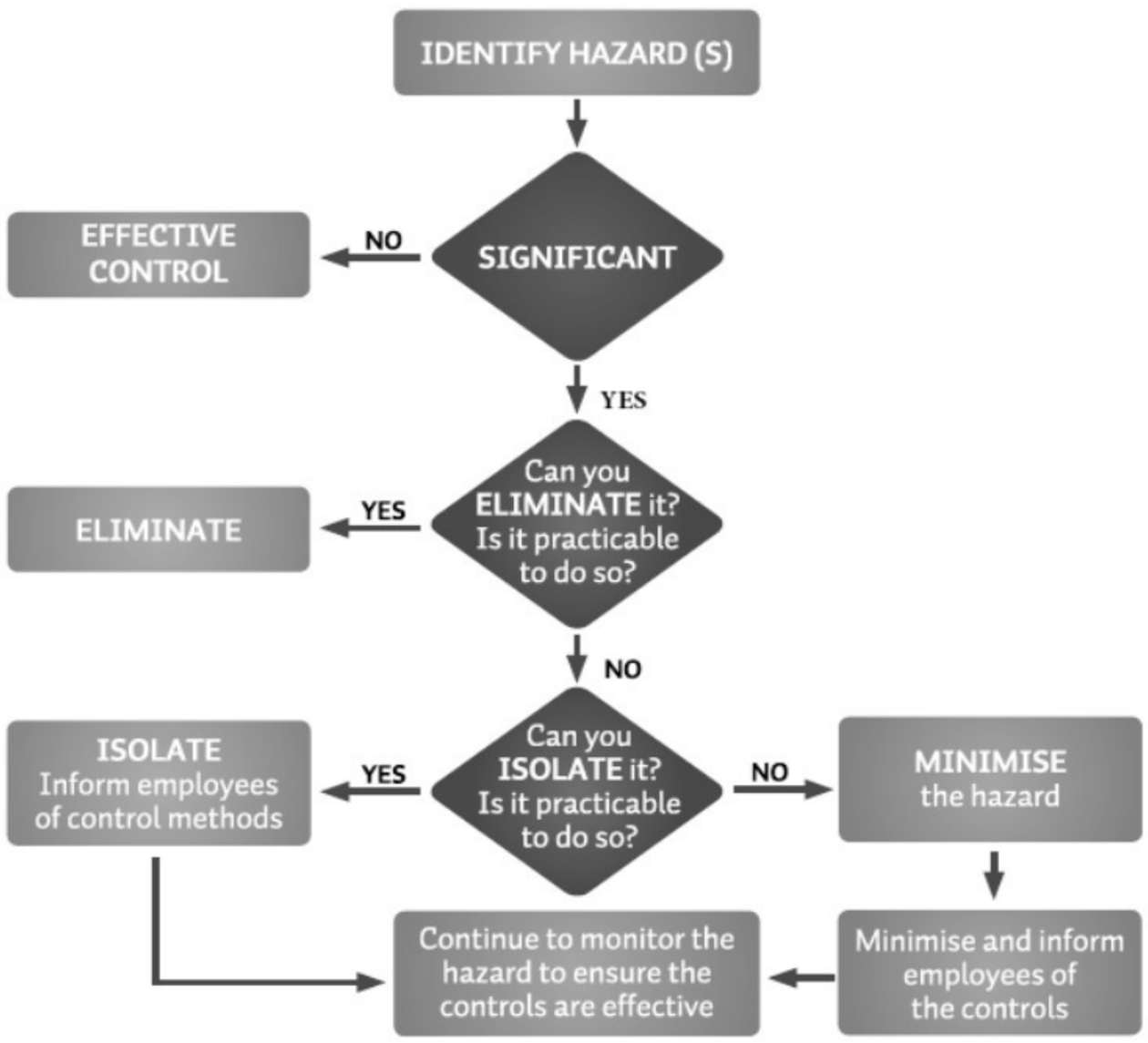

Fig 5: A hazard control process

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