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HAZARD MAPPING IN STEEL MELTING SHOP

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ABSTRACT

Hazard is a source or situation that has the potential for harm in terms of human injury, ill health, damage to property or the environment, or combination of these factors. It has got a short or a long terms effect on the work environment with considerable human and economic costs. It has also got a great demoralizing effect on the work place. Hazard is a potential cause to generate a disaster. It has got the potential to cause. Serious harm to the individual or the environment. Harm, the severity of which depends on the extent and frequency of exposure to the hazard. Hazard exist in every workplace in different forms and required to be identified, assessed and controlled regarding the work processes, plant or substances.

They arise from

Work place environment
Use of plant and environment (steel plant processes)
Use of substance and materials
Poor work
Inappropriate management systems and work procedures
Human behaviour.
Categories major hazards like
Physical hazard
Chemical hazard
Radiation's hazard
Ergonomic hazard
Other hazards

Keywords: Hazard, Safety, Hazards Identification, Steel Sector and Indian Steel Industry

1. INTRODUCTION

Aiming at the safety first- it's a vital for the steel making industry to create a priority based environmental plan which is congenial and focused towards safety awareness in workplace, as steel melting and rerolling embraces hazards in each process activities. Industry becomes successful by not only meeting the production requirements but also should have high employee satisfaction by providing the safety requirements in the workplace. It is impossible to predict exactly when hazards will occur or the extent to which they will affect communities within the Work Area. However, with careful planning and collaboration, it is possible to minimize losses that can result from hazards. Mitigation of hazards adheres to appropriation of action taken, so as to minimize the loss of life as well as fixed assets by attenuating the impact of disasters. It is often considered the first of the four phases of emergency management; mitigation, preparedness, response and recovery. Characterizing the hazards involves determining hazards' causes and characteristics, documenting historic impacts, and identifying future probabilities of hazards occurring form occupational safety hazard to process to work environment hazard.

2. OBJECTIVE

The main objective is to identify the source of hazards, potential risks associated with it and disclosure of the mitigation measures. The focus of the study revolves around determination of damage due to major hazards

having damage potential to life and property and provides a scientific basis to assess safety level of the facility. The secondary objective is to identify major risk in manufacturing process, operation, occupations and provide control or mitigating measures and also to prepare general guidelines for the plans to control hazards.

These Safety Code aim to contribute towards:

Protecting workers in the iron and steel industry from workplace hazards and to preventing work-related injuries and incidents;

Assisting and facilitating the improved management of occupational safety issues at the workplace;

Improving knowledge and competence;

Promoting the implementation and integration of consistent OSH management systems with a view to improving working conditions.

3. LITERATURE REVIEW

3.1 HAZARD IDENTIFICATION AND MITIGATION MEASURES IN MINI

Industrial process and activities inherently pose hazards. There may be possible hazards to human beings, flora-fauna, all forms of property and the environment as a whole. Extreme care is essential in handling all of them in various stages of manufacturing. Vital element of industrial health and safety policy and implementation plan is the identification, evaluation, elimination and / or the control of hazards in the shop floor and place of work. Elimination of all hazards and its source is not possible; hence, the target is to eliminate and control the critical hazards with their emerging potential and to protect the interest of employees in the world of work. It is essential to minimize the other associated hazards to the lowest logical level to meet out the health and safety objectives of the organization. In Mini Steel Plant such as Induction Furnace and Rolling Mill Units, due to its complex nature of the operation, systems, procedures and methods it always involves some number of hazards. To improve the productivity of operation and labour it is essential to have a time bound risk assessment plan and technique. This paper deals in the study of Hazards identification and Mitigation Measures

3.2 RISK ASSESSMENT AND CONTROL MEASURES FOR CHEMICAL HAZARDS IN STAINLESS STEEL INDUSTRY

Chemical hazards are one of the most dangerous hazards occurring in any industries that uses them. Several devastating effects like explosion, environmental pollution, asphyxiation, acid burns, and skin disorders, chronic and acute conditions of several diseases might occur due to the leakage of the poisonous chemicals. This project deals in the control of the chemical hazards in a Stainless-steel Plant using Risk assessment technique (HAZOP) and ensuring proper Engineering Controls as proactive measures later.

3.3 A STUDY ON STEEL INDUSTRIES IN INDIA

The steel sector is one of the most significant and pivotal sectors in the prominence and growth of a nation. It has been considered as the spine of civilization in the universe. The level of per capita consumption of steel is an important determinant of the socio-economic growth of a nation. This research Study focuses growth and development of Steel industries in India. The Steel industry in India is growing in a rapid speed with demand increment and opportunity creation and attraction to the international players.

3.4 STUDIES ON GAS AND PIPELINE SAFETY IN STEEL INDUSTRY'S

This paper deals with, Identification of hazards present in the gas pipeline and storage of steel industries, to study about plant gas pipeline installation as per NFPA, OISD, norms, to study about available fire protection facilities, safety organization and safety system of the plant and to recommend better suggestions to enhance safety of the plant.

3.5 PREDICTING SAFE EMPLOYEE BEHAVIOR IN THE STEEL INDUSTRY:

Industrial safety is an important issue for operations managers — it has implications for cost, delivery, quality, and social responsibility. Minor accidents can interfere with production in a variety of ways, and a serious accident can shut down an entire operation. In this context, questions about the causes of workplace accidents are highly relevant. There is a popular notion that employees' unsafe acts are the primary causes of workplace accidents, but a number of authors suggest a perspective that highlights influences from operating and social systems. The

study described herein addresses this subject by assessing steelworkers' responses to a survey about social, technical, and personal factors related to safe work behaviours.

4. HAZARD MAPPING

4.1 HAZARD IN STEEL MELTING SHOP

The hazards mainly emanate from extremely high temperature process involving liquid metal, generation of by-product gases which have toxic and explosive constituents, large amount of material handling/ transporting and manpower intensive multi-unit operations. The hazardous chemicals, electricity, steam, working at height, working in confined space etc. in addition to project activities add to the risks, especially when they are carried out besides the existing operating units.

Below are the most common causes of injury in the iron and steel industry:

Slips, trips and falls on the same level
Falls from height
Unguarded machinery
Falling objects
Engulfment
Working in confined spaces
Moving machinery, on-site transport, forklifts and cranes
Exposure to controlled and uncontrolled energy sources
Inhalable agents (gases, vapours, dusts and fumes)
Contact with hot metal
Fire and explosion
Extreme temperatures
Radiation (non-ionizing, ionizing)
Noise and vibration
Electrical burn and electric shock
Manual handling and repetitive work etc.

The above safety hazards are associated with varying levels of risks which may lead to injuries. It has categories the types of hazards they are

Physical hazards
Chemical hazards
Ergonomic hazards
Radiations hazards
Others hazards

4.2 PHYSICAL HAZARDS

4.2.1 NOISE

Exposure to noise levels exceeding those set by the competent authorities may result in noise-induced hearing loss. Exposure to high noise levels may also interfere with communication and may result in nervous fatigue with an increased risk of occupational injury.

4.2.2 VIBRATION

Exposure of workers to hazardous vibration is mainly known as:

Whole-body vibration, when the body is supported on a surface that is vibrating, which occurs in all forms of transport and when working near vibrating industrial machinery; or

Hand-transmitted vibration, which enters the body through the hands and is caused by various processes in which vibrating tools or work pieces are grasped or pushed by the hands or fingers.

4.2.3 HEAT AND COLD STRESS

Risks arise in special conditions:

Temperature and/or humidity are unusually high.

Workers are exposed to high radiant heat.

High temperatures and/or humidity occur in combination with heavy protective clothing or a high work rate.

Temperature is unusually low.

4.2.4 LACK OF PROPER ILLUMINATION

Poor lighting affects the Occupational Safety & Working Conditions of people at work causing symptoms like eyestrain, migraine and headaches. Symptoms of this include headaches, lethargy, irritability and poor Concentration.

4.2.5 WORK EQUIPMENT AND MACHENIRY GUARDING

The use of work equipment, including machinery and hand and portable power tools, may result in accidents, many of which are serious and some fatal. Lack of guards or inadequate guards, interlocks, safety devices, improper maintenance, no adherence to SMPs etc. can lead to accidents caused by entanglement, sheering, crushing, trapping, cutting, etc.

4.2.6 CRANES AND HOISTS

All machinery used to lift and/or transport equipment, materials, molten metal or slag should be designed, constructed and erected, inspected, maintained and operated as specified by the manufacturer/ site specific SOPs/ SMPs which otherwise would lead to crane failure / overturning, failure of tools & tackles like slings etc. leading to material slippage, hitting nearby structures/ overhead line etc.

4.2.7 CONTROL OF HAZARDOUS ENERGY

The iron and steel industry regularly uses different sources of energy (electric, mechanical, hydraulic, pneumatic, etc.). The safe control of energy should be addressed by procedure and carried out by appropriately trained personnel in accordance with the nature of the energy source and the characteristics of the facilities.

4.2.8 FALLING OBJECTS

Failure to properly secure loose materials at height, maintaining proper stack heights, preventing unauthorized entry etc. leading to fall of objects and hitting a nearby person

4.2.9 SLIPS, TRIPS AND FALLS

Inadequate housekeeping, improper covers on opening, unsuitable platforms or walkways equipped with handrails and protective barriers etc. may lead slip & trip injuries.

Fall from height may occur due to non-usage of fall arrest equipment.

4.2.10 RAIL & ROAD TRANSPORT

Internal transport, such as road and rail vehicles, transfer cars etc. used in the transport of raw materials, intermediates, products, waste etc. has the potential to cause injuries to workers and other people. The hazards can be caused by interaction between vehicles, vehicles and other objects and personnel, or by loads falling off or from the vehicle.

4.2.11 FIRE & EXPLOSION

Steel Plants stores & handles number of flammable chemicals like tar, naphtha, benzol, fuel gases, oils, LPG, Propane, Oxygen etc. which possess potential fire & explosion hazards. Hot metal/ slag sparks, welding sparks, electrical short circuiting etc. can also lead to fire in surrounding areas if combustible materials are present.

4.2.12 CONFINED SPACES

Bin, silos, tunnels, ESPs, manholes, etc. examples of confined spaces where entry of persons & carrying out jobs requires special precautions. Toxic or flammable gases, oxygen displacement and engulfment are the principal hazards.

4.3 CHEMICAL HAZARDS

4.3.1 CHEMICALS IN THE WORKPLACE

These substances may present a hazard as the result of contact with the body or absorption into the body. Absorption can occur through the skin, by ingestion or by inhalation.

Chemicals can have acute (short-term) and/or chronic (long-term) Health effects.

Chemicals may present a safety hazard as a result of their chemical and physical properties.

4.3.2 INHALABLE AGENTS (GASES, VAPOURS, DUSTS AND FUMES)

The production of iron and steel involves the consumption and generation of a variety of inhalable agents including, but not limited to, gases, vapours, dusts, fumes, smokes and aerosols. These agents comprise a variety of toxicological hazards including irritants, chemical asphyxiants, fibrogens, allergens, carcinogens and systemic toxicants. The pulmonary system (lungs) can be affected by exposure to harmful agents through acute (short-term) injury to lung tissue, the development of pneumoconiosis, pulmonary dysfunction and the development of lung cancer. Certain harmful agents that are inhaled through the lungs can cause target organ damage and/or systemic toxic effects. Certain asphyxiants can cause death in a matter of seconds at high concentrations by displacing oxygen. Specific agents that may be found in the iron and steel industry include heavy metals (E.g. lead, chromium, zinc, nickel and manganese) in the form of fumes, particulates and adsorbates on inert dust particles. Acid mists from pickling areas can cause skin, eye and respiratory irritation.

4.4 RADIATION HAZARDS

4.4.1 IONIZING RADIATION

All exposure to ionizing radiation should be kept as low as possible, as there is evidence that damage caused by radiation may be permanent, and that there is a significant increase in the incidence of cancer and some types of malignancies, as a consequence of even low doses of ionizing radiation.

4.4.2 NON-IONIZING RADIATION

Non-ionizing radiation is usually referred to as ultraviolet (UV), visible and infrared (IR) radiation Absorption in the UV and visible portions of the spectrum produces photochemical reactions. In the IR region, all of the absorbed radiant energy is converted into heat. Exposure to some radio-frequency and microwave radiation can result in the formation of cataracts of the eye. Exposure of the eyes to visible and IR radiation can cause thermal injury to the retina and damage to the lens, which may result in the formation of cataracts. Exposure of the eyes to UV radiation can result in inflammation of the conjunctiva and cornea.

4.5 ERGONOMIC HAZARDS

These hazards are due to tool design, equipment design, job and task design, work station design, and manual handling etc.

4.6 OTHER HAZARDS

Oil and Lubricant Room (spillage)
Fine Coal Hoppers
Coal Gasifier
Coal Storage area,
Electrical Short circuit
Boiler
ESP
Spilled liquid metal coming in contact with water,
Pool fire / Fire ball may occur in case of direct contact of FO/LDO with flame

4.7 PREVENTIVE MEASURES

The five most common causes of safety incidents in Steel Industry worldwide and preventive measures have been identified as follows:

Moving machinery – Isolate, lock or pin all energy sources before any machinery is accessed.

Working at heights – Provide regular training, appropriate harnessing equipment and ensure checks are in place when working at height.

Falling objects – Ensure regular checks are in place to remove or secure objects in risk areas.

On-site traffic – Ensure all traffic on the site is operated safely, including road, rail and pedestrians, and remove all unnecessary traffic.

Process safety incidents – Identify potential process safety hazards that could cause explosions or fires and take adequate precautions.

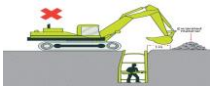
5. RESULTS AND DISCUSSION

5.1 HAZARD MAPPING IN STEEL PLANT

The various hazards along with the areas of their presence are enumerated in the table below-

S.NO	TYPE OF HAZARD / RISK	MAJOR AREAS WHERE HAZARD IS FACED
1	Toxic gases (rich in Carbon monoxide)	All over the plant
2	Explosive Gases (Rich in Hydrogen and Methane)	All over the plant
3	Harmful Chemicals	Coal Chemicals plant, CRM
4	Liquid metal/ slag (burn, explosions)	Blast Furnace, SMS, Continuous casting, Foundries
5	Extreme Temperature (-180 OC to 1700 OC)	Coke Ovens, Blast Furnace, SMS, Continuous casting, Foundries, Rolling Mills and Cryogenic Oxygen Plant
6	Fire	All over the plant
7	Electric Shock, Electrocution, Flash over	All over the plant and project sites
8	Rail/ Road Traffic Movement	All over the plant and project sites
9	Moving/ Rotating machines (Hit,Caught, pressed etc.)	All over the plant and project sites
10	Working at Height	All over the plant and project sites
11	Dust, noise, heat and Vibration	All over the plant
12	Material Handling	All over the plant and project sites
13	Confined Space (suffocation/ gas poisoning)	Oil cellar, Conveyor/ cable galleries, Silos, etc.
14	High pressure Steam, Water & industrial gases	All over the plant

5.2 NEAR MISS AT PROJECT SITE

TYPES	UNSAFE ACTS	UNSAFE CONDITIONS	NEAR MISS
EQUIPNMENT 	Operating ungirding equipment/ unauthorized operation	Equipment left unguarded/ poor guarding	Operator while operating had a slip and just escaped his hands from moving gears.
WORK AT HEIGHT 	Worker working without full body harness	Edge protection not available at work place	Worker slipped regained balance and escaped from major fall.
ELECTRICAL 	LOTO non-compliance by worker	No padlocks provided for power supply	Electrician while commencing maintenance noted someone switched on the supply then stopped activity.
EXCAVATION 	Work commenced without permit to work	Scaffold pipes stored at the edge of excavation	One scaffold pipe fell inside the excavation very close to worker
CONFINED SPACE 	Worker entered without permit	Ventilation not available/ inadequate	Worker after entering confined space felt suffocated and managed to come out
HOT WORK 	Worker on a pipe rack failed to use fire blanket which was provided for hot work	During hot work on pipe rack. No signboards/ area not barricaded at ground level.	Hot spatter fell from height and just landed close to a passer-by who was working under pipe rack

6.CONCLUSION

The first step for emergency preparedness and maintaining a safe workplace is defining and analysing hazards. Hazard identification and mitigation measures are essential to loss prevention in steel industry. It has become more challenging to conduct hazard identification as the depth of technology has increased, which hazard assessment heavily replies on. Nothing is more important than the safety and health of people who work in the steel making units. Protecting health and safety of everyone who works in or around the steel industry is of vital importance to steel makers. The duty of care and social responsibility demands that everyone is able to work in a safe and healthy work environment. For any industry to be successful, it is necessary to identify the hazards to assess the associated risks and to bring the risks to tolerable level.

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