

HAZARD IDENTIFICATION IN STEEL PLANT AND ITS MITIGATION MEASURES

NAVEEN JAIN^{#1}, Prof.T. DHEENATHAYALAN^{#2}

#1 PG Scholar Industrial Safety Engineering, Knowledge Institute of Technology, Tamilnadu, India.

#2 Assistant Professor, Department of Mechanical Engineering, Knowledge Institute of Technology, Tamilnadu, India.

#1Naveenjain084@gmail.com

ABSTRACT

This project deals in the control of the hazards in a Steel Plant using Hazard Identification and Risk Assessment (HIRA) technique and ensuring proper Engineering Controls as proactive measures later. The aim of the project is to identify the hazards of steel plant which is present in working as well as in non-working area. The necessity of hazard identification and risk assessment techniques for implementing safety in steel plant. Risk assessment tool which will assist users in identifying hazard and estimating risk involved in each identified hazard. This risk assessment tool will identify possible hazard involved in each task in departments. Once the hazard has been identified, risks involved will be estimated and categorized. If the estimated risk falls in a category, which is higher than the low risk category, then possible control measures will be recommended.

Hazard identification and risk assessment methodology is going to applied, in this project to identify the hazard, risk and to take proper mitigation measures for each hazard according to their severity.

Keywords—*Hazard, Risk, Safety, Steel Plant, Likelihood, Severity*

1. INTRODUCTION

1.1 Raw Materials for Steel Production.

S.No	Raw Material
1	Iron ore fines
2	Iron ore lumps
3	High silica lime stone
4	Low silica lime stone
5	High silica manganese ore
6	Coal indigenous
7	Coal imported
8	High silica Dolomite

Table 1: Raw Materials for Steel Plant

1.2 Steel Plant Production

1. Rail
2. Wire rod
3. Plate
4. Angle
5. Channel

2. LITERATURE REVIEW

2.1 Summary of The Literature Review

1. **M.Saravana Kumar, et al.,(2016)** published a paper on the title **Hazard Identification and Risk Assessment in Foundry.**

This study gives Control Measures for Foundry, helps to find out the Hazard present in foundry.

2. **Sheik Allavudeen, et al., (2015)** published a paper on the title **Hazard Identification, Risk Assessment and Risk Control in Foundry.**

This study gives the Methodology of Hazard Identification, Risk Assessment & Control Measure

3. **Nigam Mohit Singh, et al., (2013)** published a paper on the title **Desulphurization of Coke Oven Gas**

This study gives iron oxide process is very effective process for desulphurization of coke oven gas. This process removes 95-98% of the H₂S from the coke oven gas. Generally, the processes suitable for desulphurization of coke oven gas can be subdivided into different methods: Dry-oxidation processes, Wet oxidation processes, Absorption/stripping processes.

4. **Ukey Ujwala U, et al., (2015)** published a paper on the title **Occupational Injuries in Workers of Steel Plant at Visakhapatnam.**

This study gives details about 66 workers consideration which shows that the person whose age is above 49 are affecting more in occupational work.

Workers employed in basic steel factories are at greater risk for non- fatal injuries and illnesses than workers in other general industry jobs. Aims: To examine the role of different factors like age, job duration, education,

marital status, stress etc. in the causation of occupational injuries and to see the nature of injuries

5. **Sethupathy, et al., (2014)** published a paper on the title **Improvement of Fire Safety Measures in Steel Industries.**

This study gives description about fire and calculation for fire load. This paper deals with reducing the likelihood of fire and spread of fire. Providing an adequate means to escape from fire which should be accessible and functional whenever needed. Providing an adequate means of detection and warning of fire. Providing a suitable means of firefighting. Specifying the actions to be taken in the event of fire.

2.2 Conclusion from The Literature Review

The main goal of all industries should be reaching to the safety system that protect human and equipment the undesirable event increased the importance of risk assessment technique employed throughout the company. There are many techniques developed to perform the risk assessment to mitigate the condition of Environmental health and Safety. A hazard identification and risk assessment analysis are a systematic way to identify and analyses hazard to determine their scope, impact and the vulnerability of the built environment to such hazards and its purpose is to ensure that there is a formal process for hazard identification, risk assessment and control to effectively manage hazards that may be occur in the workplace.

3. PROBLEM IDENTIFICATION

In an integrated steel plant, the steel making process involves a number of hazardous processes starting from raw material handling,

melting of iron ore, and converting iron into steel till the finished products. Problem identified in each working area and categorized in different types of hazard such as;

1. Physical Hazard
2. Chemical Hazard
3. Biological Hazard
4. Ergonomical Hazard
5. Occupational Hazard

NATURE OF HAZARD	SOURCES
Fire Hazard	Release/leakage of Oxygen, Hydrogen, Acetylene, CO gas, BF gas, LD gas, Mixed gas, Benzene vapours, Fuel Oil, Coal Tar Fuel and Hot liquid metal. Fire in Acetone, Benzene, and Calcium carbide storage
Explosion Hazard	Release / leakage of Hydrogen, Acetylene, CO gas, BF gas, LD gas and Mixed gas.
Toxic Hazard	Release of CO gas, BF gas, Mixed gas, and Chlorine.
Asphyxiation	Release of Nitrogen, Argon, Oxygen, CO gas, BF gas
Fire/Explosions due to Spillage of Liquid Metal	Spillage / Transfer of liquid metal, liquid steel and hot slag
Heat Radiations due to Hot Metal	Spillage of liquid metal, liquid steel and hot slag

Accidents due to Material Handling Equipment	Connected with all Material Handling equipment
--	--

Table 2: Sources of Hazard

4. METHODOLOGY

4.1 Hazard Identification and Risk Assessment

Hazard identification and risk assessment provides the factual basis for activities proposed in the strategy portion of a hazard mitigation plan. An effective risk assessment informs proposed actions by focusing attention and resources on the greatest risks



Figure 1: Risk Assessment Process

Six-Step Process Includes in HIRA:

1. Identification of a hazard.
2. Identification of the associated risk.
3. Assessment of the risk, which includes:
 - The likelihood.
 - The severity.
 - Assigning a priority for correction.
4. Control of the risk, which includes:
 - Elimination.
 - Engineering a barrier.
 - Administration controls.
 - Personal protection equipment.
5. Documentation of the process.
6. Monitoring and review of the process

Severity (S)	Example	Rating
Catastrophic	Numerous fatalities, irrecoverable property damage and productivity	5
Fatal	Approximately one single fatality major property damage if hazard is realized	4
Serious	Non-fatal injury, permanent disability	3
Minor	Disabling but not permanent injury	2
Negligible	Minor abrasions, bruises, cuts, first aid type injury	1

Table 3: Severity Ranking Table

Likelihood	Example	Rating
Most likely	The most likely result of the hazard/event being realized	5
Possible	Has a good chance of occurring and is not unusual	4
Conceivable	Might be occur at some time in future	3
Remote	Has not been known to occur after many years	2
Inconceivable	Is practically impossible and has never occurred	1

Table 4: Likelihood rating table

4.2 List of Hazards Identified in Steel Plant: -

1. Splashing of metal in blast furnace
2. Leakage of co gas
3. Injury during hand handling tools like slip and trip
4. Respiratory problem due to dust
5. Rail line and other transport line accidents
6. Fall from the height during work on conveyer belt, conveyer control room
7. Struck by falling object
8. High noise level
9. Exposure to the hot surface of furnace or machineries

4.3 Hazards Outside the Working Area:

- Railways tracks
- Lack of barriers
- Unsafe conditions
- Noise
- Transportation of goods
- High speed driving
- Dust

5. SAFETY AND MITIGATION MEASURES AT STEEL PLANT

1. Emergency Action Plan
2. Risk Control Facilities at Steel Plant

3. Control Rooms / Emergency Control Centre
4. Fire Fighting Facilities Available at Steel Plant
5. Health & Safety Policy
6. Safety & Health Organization
7. Safety Budget
8. Accident Reporting, Investigation & Analysis
9. Safety Inspections
10. Safety Education & Training
11. Safe Operating Procedures / Work Permit System
12. Fire Protection / Emergency Preparedness / Plant Layout
13. Personal Protective Equipment (PPEs)
14. Accidents and Safety Measures
15. Accidents are categorized as follows:
 - Non- Reportable
 - Reportable
 - Dangerous Occurrences
 - Fatal Accidents
16. Accidents Evaluation and Reporting in Steel Plant
17. Safety Audits
18. Training on Safety Measures

Colour Coding of Pipelines

Colour	Name
Red oxide	Gas line
Yellow	Nitrogen
Yellow and blue	Mix gas
Green	Water line
Sky blue	Compressed air
Silver	Steam
Dark blue	Oxygen

Table 6: Colour Coding

CONCLUSION

Organizations are becoming increasingly aware of the need to provide a workplace that is not only free of common injuries but one

that also protects workers, facilities, and the environment from the consequences of more serious incidents involving safety, security, environmental, and other risks. Considering the human sufferings and economical loss due to accidents, it becomes imperative on the part of every one to prevent the accidents by removing or controlling the hazards in industries.

In all sets of safety, they fulfilled all the norms except the conditions of working and the housekeeping of the company which may leads to occur high risk and hazards. Recommendation for the company to work for the better working condition and housekeeping should be in proper manner.

REFERENCES

[1] D.L DOUSHANOV (2008) *Control of Pollution in the iron and steel plant.*

[2] Jamal Mohamed Ben Sasi (2013) *Air Pollution Caused by Iron and Steel Plants.*

[3] Keith Wright, "coke oven gas treatment, tar, liquor, ammonia". *The coke oven managers year book.2005;222-257*

[4] K. MITHUN, N. KARTHIKEYAN (2014) *Studies on gas and pipelines safety in steel industry.*

[5] Nigam Mohit Singh Randhir, Kumar Naveen and Upadhyaya Sushant (2013) *Desulphurization of Coke Oven Gas.*

[6] R.Santhosh Raj, N.Shivasankaran (2014) *Improvement of fire safety measures in steel industries.*

[7] SheikAllavudeen.S, Sankar.S.P (2015)Hazard Identification, Risk Assessment and Risk Control in Foundry.

[8] Technical EIA Guidance Manual for coke oven plants (govt.of India) 2010;317-323.

[9] Ukey Ujwala U., Chitre Dhruv S., DantuPadmasree, Dash Satyanarayan (2015) Occupational Injuries in Workers of Steel Plant at Visakhapatnam.

[10] Waqas Ahmed Khan, Talha Mustaq and Anmol Tabassum (2014) Occupational health, safety and risk analysis.

ANNEXURE

Hazard Identification	Risk Assessment			Risk Control
	L	S	R	
Splashing of metal in blast furnace	2	5	10	Regular inspection, proper guarding of pathway
Leakage of co gas	3	5	15	Proper ventilation, spark proof electrical equipment, co gas monitor
Injury during hand handling tools like slip and trip	2	2	4	Proper PPE's

Respiratory problem due to dust	5	2	10	Dust mask should be provided
Rail line and other transport line accidents	1	5	5	Speed limit and proper barrier system
Fall from the height during work on conveyer belt, conveyer control room.	3	3	9	Safety belt, safety net should be provided, training
Struck by falling object	2	2	4	Safety helmet, safety net
High noise level	4	4	16	Ear plug, ear muff should provide
Exposure to the hot surface of furnace or machineries	3	3	9	Regular inspection, maintenance
Trapping of body parts between the rolls. Potential for trapping of worker body parts and	4	5	20	Immediate -place warning signage. Longer term- erect the fixed guard/adjustable guard

crushing the worker.				
Unguarded rotating, reciprocating and similar moving parts. Potential for severe head injury and fatality.	3	4	12	Immediate-place warning signage. Longer term-erect the fixed guard/adjustable guard
Sheet strip (scarp material) release for side trimming unit. Potential for severe skin injury, cutting of worker body	4	4	16	Immediate-place warning signage. Longer term-erect the fixed guard/adjustable guard.

parts and trapping of worker.				
Crushing (crushed between one or more moving machine components) Potential for severe injury and fatality.	3	5	15	Immediate-place warning signage. Longer term-erect the fixed guard/adjustable guard.