

# Hazardous Processes and Their Risk Mitigation Techniques in Iron and Steel Industry Emission in CFB Boiler- A Review

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## **Abstract**

Steel manufacturing industries are one of the major industries in the world where number of hazards are being involved in Daily work practices. While working in such steel industries safe operating/work procedures are too much significant as employees are exposed to various threats due to nature of job and work operations. For any industry labour is considered as a great asset which follows the work as trades. As per the New Occupational Safety and Health CODE – Hazardous Process is mentioned in two ways (i) consequence in toxic waste of universal atmosphere or (ii) reason material injury to health of a worker occupied [1]. The working environment in steel industry is too much noisy with excessive heat. In today's world most of the steel industries are using new technologies where control systems are used in various steel manufacturing industries to control number of incidents and accidents and have precise control over steel composition addition which reflects the quality. As the safety is being considered paramount in today's working environment, so regardless the hazardous process of various steel manufacturing industries achieving an accident free environment is achievable. Several Risk Assessment Techniques like Hazard Identification and Risk Assessment (HIRA) Techniques/Job Safety Analysis are used to reduce the work place injuries i.e. Frequency rate, severity rate and incident rate statistically and statistics of several years has been studied on the various mentioned process and injuries resulting in ill-health is mitigated [2].

**Keywords:** Hazards, Wastes, Effluents, HIRA Techniques, Hazardous Process.

## **1. INTRODUCTION**

The activity of making car bodies is significant. Automobile body builders, who are provided by automobile manufacturers, construct the chassis's body. The most popular type of public transportation vehicle is the truck [1]. In our nation, buses are also operated by private bus operators, travel companies, etc. On-road and off-road vehicles are the two main categories of vehicles. On-road vehicles are primarily made for driving on paved roads and highways. Trucks that go on unimproved roads or cleared land need off-road vehicles. Some truck bodyworks are made to fit trucks used in the construction, agriculture, and mining

industries. Others fasten to delivery vans and vehicles, water sprayers, cable and telephone trucks, and repair tools in addition to tow trucks and wreckers [2-4]. The construction of an automobile's body requires a variety of structural designs, wood and metal-working techniques, surface protection techniques, fastening methods, and the placement of electrical and safety equipment [5-6]. Such a factory needs a wide variety of tools and machines for working with metal and wood, testing and treating equipment, a crew that is highly productive and focused on quality, and many other amenities [7]. Body building is a labor-intensive industry where all types of employees and diligent workers are valued as assets [8].

## **2. LITERATURE REVIEW**

Like other branches of science many words and term are now well defined in safety science, some terms are defined by statutes from legal point of view. It is most important to understand these words as they clarify many concept of philosophy, safety science and safety law [2]. Steel industry are the most hazardous considered workplace where the employees working may occur minor to major injury or even fatal accident may occur. Various hazards including physical, chemical and electrical hazard may occur at workplace while working with machinery on automated or non-automated system [7]. The major hazard in iron and steel industry considered is high intensity noise, dust and Heat Stress mostly in Foundry [8] which can result in chronic disease in human being for long period of time.

In the analysis which was being done in Steel manufacturing Industry. It was noticed that before use of risk assessment techniques the rate of injuries in mentioned hazardous process were occurring on monthly basis i.e. once in 22 days. In the investigation it was seen various flaws in hazard mitigation like use of improper techniques, inappropriate personal protective equipment's and diversion of safe work process, all these were the leading causes of the workplace accidents.

The frequency and severity of the incidents occurred were studied and prima focus was given on the improvement of proper procedure with the use of risk assessment techniques like HIRA techniques of defined work activity and JAS technique was used prior carrying out work, the risk mitigation technique primary focused on substitution, elimination, managerial controls engineering controls and lastly the individual defensive equipment's [9,10].

### 3. METHODOLOGY

Risk Mitigation in the various processes which are used in steel industry carries various tools like HIRA and JSA. The most effective and widely used tool to mitigate the hazard present at workplace is HIRA. The uses of various tools have its own advantages in their own processes and activity. These risk mitigation tool provides its own advantage considering the aspects like Impact of the unsafe conditions and unsafe acts, Engineering controls, Administrative controls, complying to legal requirements, use of effective personal protective equipment's and additional controls. By using this risk mitigation tool hazard observed leads to check the various parameters like extent of physical injury control, extent of injury happened, Near misses occurred, Recurrence of same hazard, Probability and severity of incidents and accordingly the Risk rating by use of Risk Matrix Table, Occurring of Occupational Diseases as Notified in "Factories Act, 1948" [1].



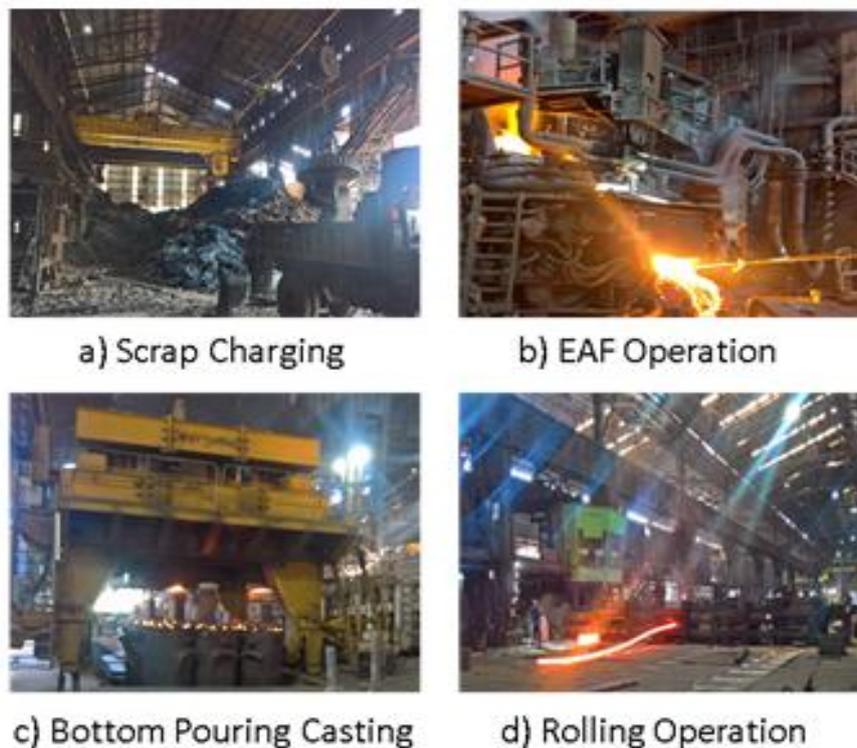
**Figure 1.** RA Process

As shown in Figure 1. Risk Assessment Process tool starts with

- Identification of hazard at workplace
- Persons causing harm of that hazard
- Identifying the risk level of hazard
- Identifying control measures
- Implementation and Documentation
- Measuring Effectiveness [6]

#### 4. ANALYSIS AT WORKPLACE

In Iron and steel industry there are numerous number of hazards at workplace in analysis of various operations, It has been observed that during various process operations the intensity of hazard present at work place gets reduced by implementation of tools like HIRA and JSA. In traditional methods there wasn't any concept of pre risk assessment techniques nor these tools were used, traditionally the method was used to detect hazard was Hazard Analysis (HAZAN), this method is used to Quantify the risk and then implement the control measures [10].



**Figure 2.** Process Operations

Referring to the Figure 2 of images (a), (b), (c) and (d) Analysis on the above operations in steel industry was being compared without using Risk Assessment techniques and by using Risk Assessment techniques. Analysis being done without using any Risk Assessment Techniques i.e. Quantitative Method [9]

**Table 1:** Reported Injuries (2005-2010)

<b>Work Place Injuries (2005-2010)</b>				
<b>Injuries Occurred</b>	<b>Scrap Charging</b>	<b>EAF Operation</b>	<b>Bottom Pouring</b>	<b>Rolling Mill Operation</b>
First Aid Injury	15	22	11	7
Lost Time Injury	7	10	5	3
Occupational Diseases	0	1	0	0
Fatal Accident	0	1	0	1
<b>Total</b>	<b>22</b>	<b>34</b>	<b>16</b>	<b>11</b>
	<b>83</b>			

Table 1 Shows the types of injuries occurred in different hazardous operation during the year 2005 to 2010. With the use of proper tools like HIRA and JSA. Hazards and risks at workplace can easily be reduced and mitigated with facts and records.

**Table 2:** Reported Injuries (2011-2020)

<b>Work Place Injuries (2011-2020)</b>				
<b>Injuries Occurred</b>	<b>Scrap Charging</b>	<b>EAF Operation</b>	<b>Bottom Pouring</b>	<b>Rolling Mill Operation</b>
First Aid Injury	5	6	2	2
Lost Time Injury	2	1	0	1
Occupational Diseases	0	0	0	0
Fatal Accident	0	0	0	0
<b>Total</b>	<b>7</b>	<b>7</b>	<b>2</b>	<b>3</b>
	<b>19</b>			

**Table 2.** Shows the types of injuries occurred in different hazardous operation during the year 2011 to 2020



**Figure 3.** Year-wise Statistics

As shown in Figure 3, It was seen 62% reduction in work place injuries by use of risk mitigation tools like HIRA and JSA. This included following the legislation, providing appropriate PPEs, Stand safe operating procedures and job oriented trainings.

## **5. CONCLUSION**

The objective of Study is to analyze the Potential hazards causing injuries at workplace and accordingly the fruitfulness of the use of risk assessment techniques which mitigates the occupational injuries resulting in Liabilities. This research completely integrates the study of HIRA and JSA. This analysis helps to identify the effectiveness of the used tools which directly helps to mitigate the hazards present in various hazardous processes which are being widely used in steel industries. More over such use of tools helps to reduce the workplace injuries and create a safer work environment. In Broader way such tools helps in improving the health and safety performance at work place.

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### **Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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