Hazard Identification, Risk Assessment and Risk Control in Foundry

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Abstract

Foundry work is the process of producing metal castings by melting the metal into a liquid state then pouring the metal into a mould which contains a hollow cavity of desired shape. A pattern is used to make the mould of the required article. Sometimes, the core inside the mould determines the internal cavity's dimension. Foundries are of two types. Ferrous foundries produce steel and iron castings. Non ferrous foundries produce copper based alloys casting, aluminium-based alloys casting and other alloys. Foundry industry is considered to be a high risk area since it contains the hazardous operations. Assessing the risk and controlling the risk according to the aspects of occupational health and safety is very hard in foundry. The motive of this project is identifying the hazard and risk associated with the various steps involved in each process and taking all the possible measure to control the risk.

Keywords – Industrial Safety, Foundry, Hazard Identification, Risk Assessment, Control Measures

I. INTRODUCTION

The purpose of this project is to identify the hazards and risk by analyzing each steps involved in various activity in the foundry and to give suggestion in order to eliminate or reduce the risk using the tool Hazard Identification and Risk Assessment (HIRA).

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. The hazards and risk assessment should be done and actions to be taken to convert the risk to a tolerable level on regular basis.

II. HAZARD IDENTIFICATION AND RISK ASSESSMENT

Hazard Identification Risk Assessment (HIRA) involves a critical sequence of collecting information and application of decision making process. It assists in finding what could possibly cause a major accident, and the consequences, and what options are there to prevent and mitigate the risk. It also assists in reducing the occurrence of incidents and near misses. It is a process of defining hazards by determining their probability, frequency and severity and evaluating the risk, including injuries and potential loses. A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Risk assessments must provide sufficient information to enable the authority to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

III. OBJECTIVES

Keeping the previously mentioned problems in mind, the project work is planned with the following objectives:

- Identification of hazards associated with each steps involved in an activity.
- Evaluating the risk associated with each steps activity involved in an activity.
- Developing action plan to reduce the risk in order to convert it to tolerable level.
- Reviewing the literature on Hazard Identification and Risk Assessment.
- Study of methodologies of risk assessment.
- Applying the Hazard Identification and Risk Assessment tool to improve the workplace safety in foundry.

IV. HAZARD IDENTIFICATION

Hazard Identification requires the employer, in consultation with the employees should identify the following:

- All reasonably predictable hazards which has the potential to cause an incident / accident.
- Likelihood, Severity and Consequences of the accident / incident.

The Hazard Identification process is to identify hazards that could cause a potential major accident for the full range of operational modes, including normal operations, start-up, and shutdown, and also potential upset, emergency or abnormal conditions. Reassessment for Hazard Identification to be done whenever a significant change in operations has occurred or a new substance has been introduced. The results of the hazard identification process are to:

- Identification of major incident / accident which could possibly occur at the workplace.
- Create awareness among the employer and workers about the causes of major incidents to prevent and deal with them.

- Provide a method to identify, evaluate, define and justify the selection of control measures for reducing or eliminating the risk.
- Depict the links between hazards, causes and major incidents.
- Give a systematic record of all the hazards identified and major incidents, together with any assumptions.

At the commencement of the Hazard Identification, the complete system of machines, equipment, human activities and process involved in the operations within the boundaries of the study should be clearly defined, taking the consideration of the original design, subsequent changes, Material Safety Data Sheet (MSDS) and current conditions. The system should be classified into different sections to enable manageable quantities of information to be handled at each stage.

The Hazard Identification (HAZID) should move progressively through the system, applying the Hazard Identification tools to each component or section. All the hazards identified and incidents should be recorded in some way.

The following should be considered while conducting Hazard Identification technique:

- Operating history and conditions of the equipment for potential scenarios.
- Any deviation from design intent or critical operating parameters.
- Routine and Non routine operations, startup, shutdown and process upsets.
- Construction, operations or maintenance activities which could or contribute towards hazards or accidents.

MSDS is a useful source of information to identify the hazards associated with the storage and handling of hazardous materials. It is also good to refer the technical details provided by the supplier of materials on their products. Workplace safety requires identification of hazards, assessment of risk and control of significant risk.

Steps involved in Hazard Management are as follows:

- Identify the hazards.
- Determine its significance.
- Control of significant hazards by the process of Elimination, Substitution, Isolation or Minimization.
- Educating the staff by giving training regarding the hazards associated with the activities which are carried out in the industry.

A Hazard Management system contains:

- A systematic process to identify the hazards which are exists in the workplace.
- A systematic process to identify new hazards which exists in the workplace.

- A systematic process to review hazards to determine their significance and state of control.
- A process to ensure that the selected controls in place are not only adequate but the controls are in keeping with industry standards.

V. RISK ASSESSMENT

A. Identification of Occupational Hazards and Risk to Health

- i. Hazards & Risks Analysis is conducted for all activities considering followings:
 - Listing out task/ activities/ processes in the company.
 - Involving right people (skilled / regular / contract workers) participated depending upon the activities.
- Studying their activities / behavior / reactions.
- Whenever a significant change in operations has occurred / a new substance has introduced / new processes has introduced /. In addition once a year HIRA is reviewed to identify the changes.
- iii. While identifying Occupational Health hazards and risks following issues are considered.
 - All the activities which are carried out in routine & non routine basis.
 - Activities of all the workers who has access to the work place including visitors.
 - Human capabilities, behaviour and other human factors towards the activity.
 - Hazards which are identified as originating outside the workplace which is capable of affecting the health and safety of person within the workplace.
 - Hazards which are created within the surrounding of the workplace by work related activities.
 - Machines, equipment and materials used in the workplace whether provided by the organization or others.
 - Any alteration or proposed alteration in the organization, its activities or material.
 - Modifications which includes temporary changes and its impact on operation, processes and activities.
 - Legal requirements which are related to the activities carried out and related controls.
 - Workplace design, process, installation, machinery / equipment, operating procedures and activities performed including their adaption to human capabilities.
 - Record of previous incident, accidents investigation report.

• Feedback and suggestion from workers or any other person.

B. Type /Conditions of the Job

During the risk assessment following type of jobs/situations/conditions was considered.

- *Routine:* A sequence of action which is regularly followed for an activity.
- *Non Routine:* A sequence of action which is not regularly followed for an activity.
- *Normal Condition:* Activity is considered to be safe where risks can be converted to tolerable condition by way of engineering control or by using PPE.
- *Abnormal Condition:* Requires immediate attention due to deviation from normal condition.
- *Emergency Condition:* Risks which are avoided or reduced by using emergency procedures.

C. Evaluation of Occupational Hazards & Associated Risks to Health and Identification of Significant Occupational Health Hazards & Risks

Criteria for Risk assessment is developed through brain storming and discussion by core team. The scoring is based on three factors:

- Probability of occurrence
- Severity rate

•	Hierarchy of controls	
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Ratin g	Description
5	Severe
4	Significant
3	Moderate
2	Minor
1	Negligible

Table I: Severity Rate

Rating	Description	Examples of Description
5	Almost certain	Can be expected to occur in most circumstances and constant exposure to hazard. Probability of damage is Very High.
4	Likely	Will probably occur in most circumstances and known history of occurrence. Frequent exposure to hazard. Probability of damage is High.
3	Possible	There is a possible chance that the risk will occur and history of single occurrence. Regular or occasional exposure to hazard. Probability of damage is Moderate.
2	Unlikely	Risk is unlikely to occur. Infrequent exposure to hazard. Probability of damage is Low.
1	Rare	Risk is extremely unlikely to occur. Probability of damage is Very Low.

Table II: Probability of Occurrence

a)	The combined score (multiplication) is calculated for each Hazard. If the score is 6 or less then it is considered as Acceptable risk Area / Activity . If the score is above 6 it is considered as Unacceptable risk Area / Activity .
b)	In addition to this any of the risk having severity / probability rating as "4" or 5 will also be considered as Unacceptable risk Area/Activity.
C)	All legal issues related to work are identified, listed and considered for all maintaining required controls.

Table III: Other Criteria for Conditions to Evaluate the Risk

VI. CONCLUSION

Hazard Identification and Risk Assessment (HIRA) study was conducted on the foundry process and also on the equipment, machines used to identify various hazards (Temperature, Electricity, Ergonomic, Noise, Gases, Chemicals, Dust). Recommendations are given to prevent and mitigate the possible occurrences of such hazard in future. All the applicable legal regulation are referred and suitable measures are taken to comply with the regulation wherever the deviation occurs. One Point Lesson, Safe Work Instruction, Safety & Maintenance Checklist were updated.

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