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Challenges in Safety Hazard Identification and Risk Assessment in Foundries

Deepu C V[1], K.Vijay Babu M.E[2], S.P.Venkatesan M.E[3]
II[nd]Year M.E student (Industrial safety Engineering) [1], Associate Professor[2, 3]
Department of Mechanical Engineering
Excel College of Engineering and Technology, Komarapalayam, Tamil Nadu, India

Abstract:
The work in foundry deals with a number of hazards. The hazardous areas in the foundries have been classified into high risk areas for the last 15 years.There are many hidden hazards which are present in the foundries. It is very difficult to identify and calculate the risk in the foundry process.There are many processes which are taken place in the foundries,where the safety associated with each problem should be dealt separately. The motive of this project is to identify the hazard associated with each process in the foundry thereby calculating and defining the risk and suggestions to liquidate or minimise the risk associated with each hazard.

Key words: Industrial Safety, HSE policy, Hazard Recognition, HIRA.

I. INTRODUCTION

This project aims to find out the various challenges for maintaining safety in foundries. It also aims to find out various hazards (including hidden hazards) in the foundries. Any successful industry should have a very healthy safety culture along with very sound HSE policies. The company's reputation will also increase with an increase in safety standards in the company. HIRA should be conducted periodically inorder for a company to achieve a good safety culture.

Foundry operation has been considered as a high risk activity for the last 15 years. Any unsafe act or unsafe condition in the foundry operation can result into major accidents and can result to the damage and loss to the humans, property, environment, production time etc.

In this project Hazard Identification and Risk Assessment (HIRA) is used to find out hazards and the risk associated with each hazards. Hazards are analysed by assuming the probable and possible damages that it can produce. Risk is then calculated by considering the probability, severity and the number of persons affected by the possible accidents or incidents. Risk assessment is very important for the safe operation in foundries as well as in any industry.

HIRA on a periodic interval can eliminate or mitigate the major hazards which have a very high potential to cause accidents or incidents thereby eliminating or mitigating the high risk factor present in the foundries.

II OBJECTIVES

The main objectives of this project are the following

- Identify the process in foundry.
- Identify the Hazard associated with each process.
- Analysing the Hazards and the persons affected by each hazards.
- Taking account of Risks associated with each hazard by considering its probability and severity
- Implying control measures.
- Recuperate the safety culture in foundry by using HIRA as a tool.

III HAZARD IDENTIFICATION

Hazard Identification or Hazard recognition is the process of identifying or recognising all the possible hazards. This is done by

- Dividing the foundry based on foundry process.
- Identify each process and breaking down the whole process into steps.
- Analyse each step and find out the Hazards (both visible and hidden).
- Rate the hazard based on its possible outcome by considering its severity and probability of occurrence
- Identify the persons affected.
- Analyse the possible damage to property and environment.

Hazard identification should be conducted with the help of competent person or a senior safety executive, in order to have an explanation about how things are done and why certain safety standards are not maintained. Factors like ergonomics are also considered during hazard identification. Negligible hazards are usually not considered during hazard analysis

Hazard recognition or Hazard identification should be done whenever

- A major change in the process or operation has been made.
- Introduction of a new product or procedure

Before doing hazard identification the following things should be considered

- Study about the foundry operation
- Data collection of incident/accident reports
- Listing out activities based on their periodicity and difficulty

Study of Material Safety Data Sheet and current control measures.

IV RISK ASSESSMENT

Risk assessment is done after the completion of Hazard Identification. Risk for each hazard should be calculated considering the following factors

- Persons affected by each hazard. This include the company staff, service providers, trainees,

Visitors, public, contract workers etc..

The table for the persons affected by the hazard is shown below

Persons at risk	
Employees	Yes/No
Contract Workers	Yes/No
Trainees	Yes/No
Service Providers	Yes/No
Visitors	Yes/No
Public	Yes/No

Table 1: Persons affected

- Probability of occurrence

Probability of occurrence means the rate at which a particular hazard tends to reappear when it is mitigated. The table for the probability of occurrence is shown below.

Rating	Description
5	Almost certain
4	Likely
3	Possible
2	Unlikely
1	Rare

Table 2: Probability of occurrence

There are some important points to be noted when we are looking at the probability of occurrence. They are

- If the rating is 5, then the hazard tends to occur repeatedly, the probability of damage is very high.
- If the rating is 4, then it will probably occur in most circumstances and has a known history of occurrence. The time between each occurrence is low Probability of damage is high**.**
- If the rating is 3, then there is a possibility that the risk may occur and has a history of single appearance. Probability of damage is Moderate.
- If the probability of occurrence rating is 2, then risk is not likely to occur. Probability of damage is Low.
- If the probability of occurrence rating is 1, then the risk is extremely rare. Therefore the probability of damage is Very Low.

- Severity Rate

The severity rate is the degree of severity that a possible hazard can cause if it happens. The severity rate table is shown below

Rating	Description
5	Severe
4	Significant
3	Moderate
2	Minor
1	Negligible

Table 3: Severity Rate

There are some other criteria for evaluating the risk. They are

- 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.
- The number of persons involved is more than 20 then that hazard is considered as unacceptable activity.
- Any of the risk having severity or probability rating as 4 or 5 will also be considered as unacceptable risk or activity
- All the activities and control measures should have legal compliance.

Risk Calculation is done by using the basic formula

Risk = Severity * Probability occurrence considering the number of persons at risk.

Based on the following calculation a risk matrix has been developed which is shown below .In this project Risk has been classified into three based on the level of risk. They are

- High Risk Activity
- Moderate Risk Activity
- Low Risk Activity

SEVERITY						
	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
		PROBABILITY				

Table 4: Risk Matrix

This is the risk matrix which we consider for doing hazard identification and Risk Assessment in foundries.

Some of the points to be considered while considering the risk matrix are the following

- The risk number from 1 to 8 as shown in green is the Low risk area.
- The risk number from 9 to 15 in yellow is the moderate risk area.
- The risk number from 16 to 25 in red is the High risk area. The red area hazards are called unacceptable hazards

V RESULT AND DISCUSSION

The proposal is the application of HIRA to all the components, activities and jobs related to the foundry. Hazard Identification and Risk Assessment is a collective term that composes all the activities involved in identifying hazards and evaluating the risk associated with each hazard during their whole life cycle in order to prevent the workers, contract staff, service personals, trainees, public and the environment.

HIRA is applied on the foundry on about 54 processes which are located in different sectors of the foundry. Hazard associated with each step in the different process is identified. Risk is then calculated based on the severity and probability of occurrence of the particular hazard. The persons which are danger due to the particular hazards are also considered during the risk calculation.

A sample is shown below

Activity	Pouring
Department	Mould shop

Here we are considering the foundry mould shop, where pouring process is taking place.

The hazards associated with pouring process are considered at first, then the severity and probability of occurrence and also the persons at risk is taken into account.

Current Control Procedures	
1	PPE
2	Safety supervisory presence

Persons at risk	
Employees	Yes
Contract Workers	Yes
Trainees	No
Service Providers	No
Visitors	No
Public	No

No	Hazard
1	Burn injury due to metal splash
2	Eye injury
3	Inhalation of smoke/vapour
4	Fall from height
5	Inhalation of powder while APL adding
6	Burn injury while thermax addition
7	Burn injury while potential mould leakage
8	Potential explosion
9	Potential explosion

These are the hazards associated with pouring activity in the mould shop.

No	Severity (A)	Probability (B)	Risk=A*B
1	3	2	6
2	2	3	6
3	3	2	6
4	2	3	6
5	2	2	4
6	3	2	6
7	3	2	6
8	2	3	6
9	4	2	8

The risk associated with each hazard is identified now by using the risk matrix; risk can be classified as Low, Moderate or High Risk. The table showing the risk levels are shown below.

No	Risk Category	Risk Number
1	Low	MS-06
2	Low	MS-07
3	Low	MS-08
4	Low	MS-09
5	Low	MS-10
6	Low	MS-11
7	Low	MS-12
8	Moderate	MS-13
9	Moderate	MS-14

Specific prevention and protection measures in case of significant risk		
Risk Number		
	MS-12	MS-14
Elimination	NA	NA
Substitution	NA	NA
Engineering Control	NA	NA
Signage,Warning	YES	YES
PPE	YES	YES

Suggestions

- Periodical Inspections
- Presence of fire man
- Ensuring proper PPE
- Sign boards
- Periodical safety inductions

VI CONCLUSIONS

For every industry to become successful, a sound safety culture should be implemented. This can only be achieved by periodical risk assessments and implementation of control measures. Hazard Identification and Risk Assessment is one of the ways in which risk can be calculated. In this project HIRA is performed in such a way that priority is given to the high and moderate risk activities HIRA was performed on the all the processes in the foundry, equipment and machinery to identify various hazards .By taking account to the persons affected, probability of occurrence and severity rate risk

levels is calculated. Suggestions are given to eliminate and mitigate the hazards. All suggestions are given in a way that it is within the limit of legal compliance.

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