IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e-ISSN: 2278-1684, p-ISSN: 2320-334X
PP 33-37
www.iosrjournals.org

Hazard Identification and Risk Assessment in Foundry

M.SaravanaKumar[1], Dr.P.SenthilKumar[2]
[1](*Industrial Safety Engineering, K.S.R, College of Engineering / Anna University, Chennai, India)*
[2](*Department of Mechanical Engineering, K.S.R. College of Engineering/Anna University, Chennai, India)*

ABSTRACT: *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. At the same time, the user can add new work plan, task, and control measures into the system to update existing information system.*

Keywords – *Control Measures, Foundry, Hazard, Identification, Risk*

I. INTRODUCTION

Hazard Identification Risk Assessment (HIRA) is a process of defining and describing hazards by characterizing their probability, frequency and severity and evaluating adverse consequences, including potential loses and injuries. A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. The risk assessment shall include:

- A description of the type, location, and extent of all hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
- For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

II. HAZARD IDENTIFICATION

Hazard identification (HAZID) is "the process of identifying hazards, which forms the essential first step of a risk assessment. There are two possible purposes in identifying hazards:

- To obtain a list of hazards for subsequent evaluation using other risk assessment techniques. This is sometimes known as "failure case selection".
- To perform a qualitative evaluation of the significance of the hazards and the measures for reducing the risks from them. This is sometimes known as "hazard assessment".

During the hazard identification stage, the criteria used for the screening of the hazards will be established and possible hazards and accidents will be reviewed. For this purpose, the facility will be divided into several sections. Furthermore, the identified hazards will be classified into critical and non-critical hazards. It is of great importance that the hazards considered non-critical are clearly documented in order to demonstrate that the events in question could be safely disregarded. This failure case selection will be executed by generating check lists, accident and failure statistics, hazard and operability Studies (HAZOPs) or by comparison with detailed studies and experience from previous projects.

The outcomes of the hazard identification process are to:

- Identify all major incidents which could occur at the facility (irrespective of existing control measures)
- Provide the employer and workers with sufficient knowledge, awareness and understanding of the causes of major incidents to be able to prevent and deal with them.
- Provide a basis for identifying, evaluating, defining and justifying the selection (or rejection) of control measures for eliminating or reducing risk
- Show clear links between hazards, causes and potential major incidents
- Provide a systematic record of all identified hazards and major incidents, together with any assumptions.

The operator must base the hazard identification process on a comprehensive and accurate description of the facility, including all necessary diagrams, process information, existing conditions, modifications and material safety data sheets (MSDS). Prior to conducting the hazard identification, the operator should collect all relevant information, compile it and then check it for accuracy. The hazard identification may be supported by past risk assessments and historical incident data. The operator should refer to previous hazard studies, if they are relevant to identifying major incidents, and consider all the issues discussed in this guidance note. However, the operator must ensure that any existing studies:

- Are fully understood by the hazard identification participants
- Are still relevant for the current operating conditions and condition of the facility
- Were conducted to an acceptable standard
- Addresses identified gaps.

The operator should review its own plant operating history and conditions (eg corrosion, breakdowns and maintenance) for potential scenarios. However, major incidents are rare and historical incidents are unlikely to represent the full range of potential incidents. Incident data should be used to supplement more systematic hazard identification techniques. Another useful source of information on the hazards associated with storage and handling of hazardous materials are MSDS. It is also worth referring to the technical literature provided by material suppliers on their products. Workplace safety requires effective identification, assessment and control of significant workplace hazards.

The Hazard Management steps are:

- Identification of hazards
- Determination of their significance
- Control of significant hazards by Elimination, Isolation or Minimization
- Training and advising staff of the control measures in place

A Hazard Management system contains:

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

III. RISK ASSESSMENT

Identification of hazards present in any undertaking and evaluation and the extent of the risks involved, taking into account whatever precautions are being undertaken.

There are certain logical steps to take when carrying out a risk assessment

- Look for the hazard.
- Decide who might be harmed and how.
- Evaluate the risks arising from the hazards and decide whether existing precautions are adequate or more should be done.
- Record the findings.
- Inform colleagues of your findings.
- Review your assessment from time to time and revise it if necessary.

There are two types of risk assessments:

- *Qualitative:* Object probability estimate based upon known risk information applied the circumstances being considered.
- *Quantitative:* This type is subjective, based upon personal judgment backed by generalized data risk.

The two types of risk assessment (qualitative and quantitative) are not mutually exclusive. Qualitative assessments are easier to make and are the ones required for legal purposes. When there are types of work, whose hazards and risks are similar in different workplaces or physical areas, a general risk assessment can be made.

To enable control measures to be devised.

- To gain an idea of the relative importance of risks.
- To take decisions on controls which are cost effective and appropriate?

According to the Health and Safety Executive:

"Risk assessment is not end to itself. It is a means to better management of safety. It is a thinking process which enables management of determined priorities and allocates resources in a way which will better control or eliminate risks to health and safety at work". Risk assessments will help the mine operators to identify high, medium and low risk levels. Risk assessments will help to priorities risks and provide information on the probability of harm arising and severity of harm by understanding the hazard, combine assessments of probability and severity to produce an assessment of risk and it is used in the assessment of risk as an aid to decision making. In this way, mine owners and operators will be able to implement safety improvements. Different types of approaches for the safety in mines various tools and appropriate steps have to be taken to make mining workplace better and safer. A Hazard Identification and Risk (HIRA) analysis is a systematic way to identify and analyze hazards 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 occur within the workplaces.

IV. METHODOLOGY

1.1 Identification of Occupational Hazards and Risk to Health:

A) Activity / Hazards & Risks Analysis is conducted for all activities considering followings :

- Listing of activities/ processes in the company.
- Involving skilled / regular / contract workers depending upon the activities.
- Studying of their activities / behavior / reactions.

B) Whenever new processes / activities are introduced or any of the existing process / activities is to be altered then the impact of the change is reviewed before incorporating the change. In addition once a year HIRA is reviewed to identify the changes.

C) While identifying OH&S hazards and risks following issues are considered.

- All routine & non routine activities.
- Activities of all personnel having access to the work place (including subcontractors and visitors).
- Human behavior, capabilities and other human factors.
- Identified hazards originating outside the workplace capable of adversely affecting the health and safety of person in the organization / within the workplace.
- Hazards created in the vicinity of the workplace by work related activities.
- Infrastructure, equipment and materials at the workplace whether provided by the organization or others.
- Changes or proposed changes in the organization, its activities or material.
- Modifications , including temporary changes and its impact on operation, processes and activities.
- Legal requirements related to activities performed and related controls.
- Design of work areas, processes, installation, machineries / equipment, operating procedures and activities performed including their adaption to human capabilities.
- Investigation results of previous incident, accidents.
- Feedback, suggestion, observation from workmen or any person.

4.2 Type /Conditions of the Job:

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

- *Routine:* Done by usual / regular method of procedure.
- *Non Routine:* Unusual / non-regular method of procedure.
- *Normal Condition:* Risks converted to tolerable condition by way of engineering control or by using PPE.
- *Abnormal Condition:* Deviation from normal condition, which requires immediate attention.
- *Emergency Condition:* Hazards and Risks, which are contained or mitigated by invoking emergency procedures.

4.3 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

- *Severity to health/safety:* Type of injury or the effect of injury on the persons and type of intervention required / expected duration.
- *Probability:* Chances / likelihood of occurrences or past data on when it had occurred.
- *Control Ranking:* type of control and issues related to implementation / adherence.

Rating	Description	Examples of Description
5	Almost certain	Event occurs often and constant exposure to hazard. Very high probability of damage.
4	Likely	Event might probably occur and known history of occurrence. Frequent exposure to hazard. High probability of damage.
3	Possible	Event could occur at some time and history of single occurrence. Regular or occasional exposure to hazard. Moderate probability of damage.
2	Unlikely	Event is not likely to occur and known occurrence. Infrequent exposure to hazard. Low probability of damage.
1	Rare	Event may occur occasionally and no reported occurrence. Rare exposure to hazard. Very low probability of damage.

Table 1: Probability of Occurrence

RATING	INJURY/ERGONOMICS ISSUES	NOISE	TEMPERATURE/HEAT	FUMES/VAPOUR & GASES	DUST
1	First aid cases	51 to 74dBA	Frequent Perspiration at work	Odour, itching	Sneezing, cough
2	Minor injury/Cuts, Return back to work within 24 hours	75 to 84dBA	Mental or psychological strain or transient Heat Fatigue.	Suffocation, Respiratory tract damage, Eye irritation, Sneezing, Temporary Headache	Prolonged discomfort / Nuisance/ Temporary Headache, eye or respiratory tract irritation
3	Crush/Severe injury, Fracture, Back/Lumbar pain, Exceed more than 24 hours to return back to work	85 to 94dBA	Unconsciousness or Fainting , Eye disorder , Nausea & vomiting	Unconsciousness, Faint or collapse, Vomiting	Unconsciousness, Faint, Eye disorder , Vomiting
4	Laceration, Permanent Damage, Burn injury	95 to 104dBA	Heat Cramps, Throbbing Headache, Sweating/ perspiration	Prolonged exposure , Chronic Respiratory or Dermatory illness or other occupational diseases	Major Health impact which leads to chronic Respiratory, Dermatory Illness
5	Fatal or Death	>=105dBA	Heat Stroke / Exhaustion lead to death or permanent damage	Over exposure which may lead to immediate death	Over exposure which may lead to immediate death

Table 2: Severity Rate Table

Table 3: Other Conditional Criteria to Evaluate the Risk

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

V. CONCLUSIONS

The first step for emergency preparedness and maintaining a safe workplace is defining and analyzing hazards. Although all hazards should be addressed, resource limitations usually do not allow this to happen at one time. So in this project I will perform Hazard identification and risk assessment technique to assess all hazards and will establish priorities so that the most dangerous situations will be addressed first and those least likely to occur and cause major problems will be considered later.

REFERENCES

[1] Bell, R. and Glade, T., Quantitative risk analysis for landslides- Examples from Bildudalur, NW-Iceland, Natural Hazards and Earth System Sciences, Vol.4, 2003, pp. 117-131.
[2] Carpignano, A., Priotti, W. and Romagnoli, R., Risk analysis techniques applied to floating oil production in deep offshore environments, International Society of Offshore and Polar Engineers, Vol.1, 1998, pp. 253- 258.
[3] Duijm, N. J., Hazard analysis of technologies for disposing explosive waste, Journal of Hazardous Materials, A90, 2001, pp. 123–135.
[4] Fratczak, M. and Markowski, A. S., Journal of Loss Prevention in the Process Industries, Vol. 19, 2006, pp 399-408.
[5] Khan, F. I. and Abbasi, S. A., Techniques and methodologies for risk analysis in chemical process industries, Journal of Loss Prevention in the Process Industries, Vol. 11, 1998, pp. 261-277.
[6] Khan, F. I. and Abbasi, S. A., Risk analysis of a typical chemical industry using ORA procedure, Journal of Loss Prevention in the Process Industries, Vol. 14, 2001, pp. 43-59.
[7] Frank, T., Brooks, S., Creekmore, R., Hasselbalch, B., Murray, K., Obeng, K., Reich, S. and Sanchez, E., Quality Risk Management Principles and Industry Case Studies, 2008, pp. 1-9.,
[8] Hazard Identification, Risk Assessment and Control Procedure, 2008, University of western Sydney.
[9] Hazard identification and risk assessment of industries proceesings http://www.uws.edu.au/data/assets/pdf/0020/12917/ Hazard Identification Risk Assessment and control Procedure 2008.pdf.
[10] Jeong, K., Lee, D., Lee, K. and Lim H., A qualitative identification and analysis of hazards, risks and operating procedures for a decommissioning safety assessment of a nuclear research reactor, Annals of Nuclear Energy 35, 2008, pp.1954–1962.
[11] Jelemenesky, L., Harisova, J. and Markos, J., Reliable risk estimation in the risk analysis of chemical industry case study: Ammonia storage pressurized spherical tank, 30th International Conference of the Slovak Society of Chemical Engineering, Vol. 58, 2003, pp. 48-54.
[12] Khan, F. I., Husain T., and Abbasi S. A., Safety weighted hazard index (Swehi) - A new, user-friendly tool for swift yet comprehensive hazard identification and safety evaluation in chemical process industries, Institution of Chemical Engineers Transactions, Vol. 79, 2001, pp. 65- 80.