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Hazard Identification and Risk Assessment in Automotive Industry

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Abstract : Hazard Identification and Risk Assessment or HIRA system can act as a 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 : Safety, Hazard, Identification, Risk, Control Measures.

1. 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. For any industry to be successful meet not only the production requirements but also maintain the highest safety standards for all concerned. The industry has to identify the hazards, assess the associated risks to tolerate level on a continuous basis, risk assessment has been performed using risk assessment guidelines and standards, such as [1-2].Risk Assessment is a systematic method of identifying and analyzing the hazards associated with an activity and establishing a level of risk for each hazard [1]. The hazards cannot be completely eliminated, and thus there is a need to define and estimate an accident risk level possible to be prevented either in quantitative or qualitative way.Hazard identification and risk analysis involves identification of undesirable events that leads to a hazard, the analysis of hazard mechanism by which this undesirable event could occur and usually the estimation of extent, magnitude and likelihood of harmful effects.In many industries there is legislative requirement for risk assessment to be undertaken for all hazardous equipment, machinery and operations taking into the account of the procedures used operation, maintenance, supervision and management.

2. Hazard Identification

Hazard identification is a vital part of the workplace safety process. This document is useful for those employers who don't have the time, expertise or knowledge to undertake the process. These simplify a thing that identify hazards, enter them in a Hazard Register, assesses the level of risk they pose and suggests ways of controlling them [2].Hazard identification is the process of identifying all hazards in the workplace. There is no set method for grouping accident injury and illness hazards. This is a process of examining the work area and

the work to be completed for the purposes of identifying all of the hazards inherent to the job or present at the job site [14]. Several things can help identify hazards in the work area and job site.

- Walking around the workplace to inspect what is in the general area.
- Asking other employees what they think about anything they have noticed.
- Reviewing a work instruction or job safety analysis.
- Inspecting an operator's manual.
- Reviewing previous incident reports.
- Looking at Occupational Safety and Health Administration (OSHA) or other regulatory book [14].

2.1 Hazard Identification (HAZID)

Hazard Identification (HAZID) is the process of identifying hazards, which forms the essential first step of risk assessment [2]. 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" [2].

2.2 Hazards factors

- Environments (light, noise, rain, heat, sun).
- Substances (pesticides, fuels, dusts).
- Workplace layout (parlor designs, cattle passes).
- Work organization (unnecessary manual handling).
- Equipment (ladders, squeeze chutes, crowd gates).
- Farm animals (that bite, kick, butt, crush, toss, infect).
- Heights (roofs, vertical and horizontal silos, manure pits).
- Electricity (switches, cables, leads, power tools, connections).
- Observation - use your senses of sight, hearing, smell and touch - combined with knowledge and experience.
- Material Safety Data Sheets (MSDSs) - obtain them from manufacturers and suppliers. Read them carefully to identify possible harm from hazardous substances and precautions that need to be taken [6].
- Hazard and risk surveys - conduct hazard spotting surveys of main work areas. Talk to others about their safety concerns [11].
- Children and visitors - include in your surveys areas and activities in which children or visitors could be at risk.
- Record analysis - keep records of identified hazards, near misses, injuries and workers' compensation claims to help identify possible trends [4].
- Safety audits - consider creating a safety committee to investigate safety and help prepare a management plan.
- Information - keep informed of hazards in the industry through the latest available information.
- Consumer information - carefully read and follow consumer guidelines on equipment and substances. Regulations and best practices.

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 [6]. 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.

2.3 The Hazard Management

- Identification of hazards.
- Determination of their significance.
- Control of significant hazards by Elimination, Isolation or Minimum.

- Training and advising staff of the control measures in place.
- 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.

3. 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 [1-2].Risk Assessment is the determination of quantitative or qualitative estimate of risk related to a well-defined situation and a recognized hazard.

- ***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.

There are certain logical steps to take when carrying out a risk assessment [2]

- Identify the hazard.
- Measure the harm level.
- Evaluate the risks arising from the hazards and decide whether existing precautions are adequate or move should be done.
- Record the findings.
- Inform colleagues of your findings.
- Review your assessment from time to time and revise it if necessary.

Risk Assessment is also defined as following explanation [13]:

- A Hazard is anything that may cause harm, such as chemicals, electricity, working from ladders etc.
- The Risk is the chance, high or low that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be.

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" [14].

If you have fewer than five employees you don't have to write anything down. A risk assessment is not creating huge amount of paperwork, but rather about identifying sensible measures to control the risks in your workplace.

4. Methodology

4.1 Process Study

The first step in the project is to gain a detailed knowledge about the process in which the project work is to be carried out. The detailed study includes individual activity carried out in the factory. [11-12]Adetailed study is made on the individual equipment or process that is studied. This study includes the working principle of the equipment, the working condition and the standards to be followed, the safety precautions taken, etc.

4.2 Listing and Ranking

The technique used for evaluating the risk level by calculating the Risk Priority Number (RPN) for each hazard. An RPN is the quantitative estimate of the risk associated with each hazards.

RPN is assigned to each hazard based on three factors:

- Probability of occurrence
- Severity rate
- Hierarchy of controls

Risk Score = Probability Rate X Severity Rate

4.3.1 Type/Conditions of the Job

During the risk assessment following type of jobs/situations/conditions was considered [14].

- ***Routine:***Done by Usual / Regular method of procedure.
- ***Non Routine:*** Unusual / Non-Regular of procedure.
- ***Normal Condition:*** Risks converted to tolerable conditions by way of engineering control or by using PPE [7].
- ***Abnormal Condition:*** Deviation from normal condition, which requires immediate attention.
- ***Emergency Condition:*** Hazards and Risks, which are contained or mitigated by invoking emergency procedures.

4.4 Probability of Occurrence

Table 1: Probability of Occurrence

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.

The probability of occurrence is an estimate of how often a hazard event occurs. It is defined as the proportion of favorable outcomes to the total no. of possibilities if these are indifferent or the proportion observed in a sample [8]. A review of historic events assists with this determination. Each hazard of concern is rated in accordance with the numerical ratings and definitions as below.

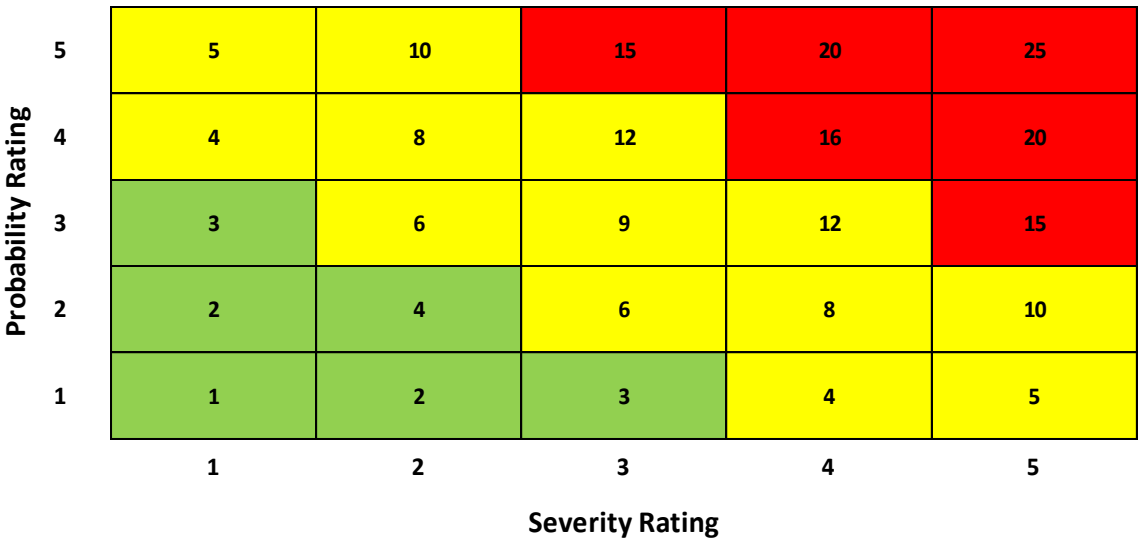
4.5 Severity Rate

Table 2: Severity Rate

Rating	Injury/Ergonomics Issues	Noise	Temperature/ Heat	Fumes / Vapour& Gases	Dust
1	First Aid causes	51 to 74 dBA	Frequent Perspiration at work	Odour, itching	Sneezing, Cough
2	Minor injury/ Cuts, Return back to work within 24 hours	75 to 84 dBA	Heat stroke (Mental or psychological strain or transient Heat Fatigue)	Suffocation, Respiratory tract damage, Eye irritation, sneezing, Temporary Headache	Prolonged exposure/ Temporary Headache, eye or Respiratory Tract irritation
3	Crush/Severe injury, Fracture, Back/ Lumbar pain, Exceed More than 24 hours Back to work	85 to 94 dBA	Heat Exhaustion (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 104 dBA	Heat Cramps, Throbbing, Headache, Sweating/ Perspiration)	Prolonged exposure, Chronic Respiratory failure or other occupational diseases	Major Health impact which leads to chronic Respiratory
5	Fatal or Death	>=105 dBA	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

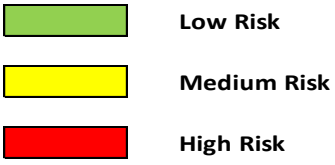
Severity rate is the number of lost work days experienced per 100 workers [8]. The injury severity rate shows the extent of safety anomalies by revealing how critical the injuries and illnesses. The employee who takes time to return to work after injury had a more severe problem than one who can return immediately.

4.6 Risk Evaluation Matrix



Categorization of Risk Level

Table 3: Risk Matrix



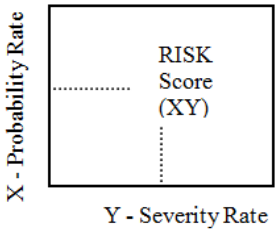


Table 4: Other Conditional Criteria to Evaluate the Risk

a)	The combined score (multiplication) is calculated for each hazard. If the score is 4 or less than it is considered as Low Risk. If the score is 6 to 12 than it is considered as Medium Risk. If the score is 15 or above than it is considered as High Risk. Also Emergency condition are considered as High Risk.
b)	In addition to this any of the risk having severity/ Probability ratings as 4 or 5 will be considered as Medium/ High Risk.
C)	All legal issues related to work are identified, listed and considered for all maintaining Required controls.

Criteria for Risk Assessment is developed through brain storming and discussion by core team. The scoring is based on [1-2]

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

5. Conclusion

Hazard Identification and Risk Assessment (HIRA) study were made on the various hazards of different equipment's and process were found and assessed. Recommendations are provided to avoid the occurrence of such hazards. Applicable legal requirements are studied and provided in detail. In this paper I performed Hazard Identification and risk assessment technique to assess all hazards and established priorities and so that the most dangerous situations will be addressed first and those least likely to occur major problems are considered.

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