



HAZARD IDENTIFICATION RISK ASSESSMENT AND CONTROL MEASURE FOR MACHINE SHOP IN AUTOMOTIVE INDUSTRY

Gopal A ^[1] & Venkatraman R ^[2]

[1] PG Scholar in Industrial Safety Engineering, Department of Mechanical Engineering, Knowledge Institute of Technology, Salem, Tamilnadu, India

[2] Assistant Professor, Department of Mechanical Engineering, Knowledge Institute of Technology, Salem, Tamilnadu, India

ABSTRACT

The automotive industry occupies a significant place in the Indian economy. The well-developed industry acts as a catalyst and gives energy to the economic growth of the country and also increased accidents to the workers due to work place hazards. In the manufacturing of auto components carries with them workplace hazards, the hazards and risks connected with welding operations, Cleaning and Machining operation in manufacturing industry was identified and controlled using risk matrix techniques.

The findings reveal that major tasks were associated with the events of material handling, machine operation, maintenance of any machinery, packing and housekeeping. Hazards of varying degrees were identified and the associated risk was classified with trivalent risk, Low risk, Medium risk, High risk, Very high risk. The tasks carried out with those hazards and risks are suggested with control measures and recommendations.

Keywords: Safety, Hazard, Identification, Risk, Control Measures.

1. INTRODUCTION

The automotive manufacturing industry is a wide range of companies and organizations involved in the Design, development, manufacturing, marketing and selling of motor spare parts. It is one of the world's most important economic sectors by revenue. It is one of the hazardous industries.

1.1 About the Project Area

In HL Mando there different process like assembly, machining, plating shop to produce Brakes, Steering and

Suspension for passenger cars. Hence it contains hazardous nature of process, activities, locations, equipment and substance.

Has considerable safety risk to workers. Unsafe conditions and practices in automotive industries lead to a number of accidents and causes loss and injury to human, material damages, loss, cases, interrupt production etc. It may lead frequent personal injury in order to control those happenings risk assessment an important step to protect the workers as well as complying with the law, for that risk

matrix technique is used in this project. It helps you to focus on the risks that really matter in the industry the ones with the potential to cause real harm.

In many instances, straight forward measures can readily control risks.

For example, ensuring machine guards punctually so

People do not hurt or injured, or cables and objects are kept away from gang way to ensure people do not trip, or safe operation in work place leads to prevention of injury. For most, that means simple. Cheap and effective measures to ensure your most valuable asset your workers protected.

2. LITERATURE SURVEY

Guohua Chen, Yunfeng Yang -" Safety Research Related to Chemical Industrial Parks -2021") - In Chemical Industries Hazard identification and risk assessment can be used to establish priorities so that the most dangerous situations are addressed first and those least likely to occur and least likely to cause major problems can be avoid.

P. Eriyanbu, M. Anbalagan, R. Prabhu, I. Sirajudeen, P. Satheeshkumar, Selvam College of Technology -2017," Hazard Identification & Risk Assessment with Human Error Analysis Method in Automotive Industry" - The primary purpose of the HIRA tool is to assess the risks and prioritize the risks in order to eliminate the hazards in the prioritized order.

Asmalia Che Ahmad, Ida Nianti Mohd Zin, Muhammad Kamil Othman, Nurul Huda Muhamad-2016," Hazard Identification, Risk Assessment and Risk Control (HIRARC)Accidents at Power Plant") - Hazard identification, risk assessment and control is an on-going process. Therefore, regularly review the effectiveness of hazard assessment and control measure is needed.

T. Sathiyamoorthy, R. Isaac, S. Kamalakannan-2018," Risk Assessment for Machinery shop in Automobile Industry" - Hazard identification and risk assessment can be used to establish priorities so that the most dangerous situations are addressed first and those least likely to occur and least likely to cause major problems can be avoiding.

Devdatt P Purohit, Dr. N A Siddiqui, Abhishek Nandan & Dr. Bikarama P Yadav ,2018-" Hazard Identification and Risk Assessment in Construction Industry" - The first step for emergency preparedness

The law does not expect you to eliminate all risk. But you are to protect people as far as is reasonably practicable. This project tells you how to achieve that with a minimum of activity.

This project focus on Prevention of Accidents , Injuries and avoiding unsafe conditions by hazard Identification and Risk Assessment and providing control measures for the identified risks and hazards. "The tasks are conducted with the utilization of deep learning and previous incident studies".

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. Hazard identification and risk assessment can be used to establish priorities so that the most dangerous situations are addressed first and those least likely to occur and least likely to cause major problems can be considered later.

Asmalia Che Ahmad, Ida Nianti Mohd Zin, Mohamad Nasrin Rosli, Abdul Muhaimin Ab Wahid, and Izatul Farrita Mohd Kamar1-Hazard and Risk of Highway Maintenance Works: Case Study of PLUS Expressways-2016 - The aim for this research is to identify the hazards and determine the risk level of highway maintenance works. This research has identified the hazards occupies during highway maintenance works. Subsequently, the levels of risk for hazards during highway maintenance works are determined. The scope of this study is along the northern PLUS Expressway specified from Southern Ipoh to Bukit Kayo Hitam and focused on the maintenance workers of Project Penyelenggaraan Lebuhraya Berhad (PROPEL). Eighty (80) sets of questionnaires survey on likelihood and severity of highway maintenance hazards have been distributed to highway maintenance workers. The data were analyzed by using Excel to compose weightage average index (WAI) in order to compute the risk level of those hazards. The result concluded that the extreme level of hazard that occurred during maintenance of highway are hazards related to electricity, hazards that engage with scaffolding, hazards while using crane and hazards involve fire and explosion.

3. INTRODUCTION ABOUT COMPANY

The Company HL Mando Anand India Pvt Ltd is one of the largest manufacturers of advanced hydraulic brakes, Steering, shock absorbers and struts for cars and sports utility vehicles. Our products comply with the international standards set down by Mando and are aligned with customer specifications. Consequently, we have made a name for ourselves thanks to our advanced high-performance product. Set up in 1997, HL Mando

3.1 Products manufactured and its application with process flow

3.2 Brake Systems

- Drum Brake - Master Cylinder & Booster.

3.3 Steering Systems

- Steering Gear System - Manual Steering Gear - Hydraulic Power Steering Gear - Intermediate shaft - Steering Column - Electric Steering.

3.4 Suspension Systems

- Damper Spring Module - Shock Absorber - Suspension Strut & Self-Levelizer - Semi-Active Suspension.



4. OBJECTIVE

The main objective is to identify, to assess, and to recommend control measures for the hazards and risk identified in auto component manufacturing industry. Some activities in the industries are material handling, machine operation and maintenance of typical industrial machinery,

Anand India Private Limited is a joint venture between the ANAND Group and Mando Corporation of Korea. Apart from manufacturing brake systems, the company also manufactures struts and shock absorbers. Manufactured in India, our products are developed using proven Korean technical expertise. A technical license agreement with Continental Teves of Germany reinforces our capabilities when it comes to meeting the requirements of globally-renowned customers.

Machines contain hazards of different nature and exposure to those hazards can result in injuries or deaths. Different types of machinery hazards are listed. These are structural, mechanical, physical, ergonomic, slip/trip/fall, end use conditions and biological. Since workers intervene on machinery in all the phases of its life cycle, i.e. installation, operation, maintenance, troubleshooting, repairs, adjustments, set up, handling production disturbances, cleaning and dismantling, they are exposed to hazards.

4.1 Objective of Risk Assessment

A risk assessment is simply a careful examination of what, in your work, could cause harm, to people, so that you can weigh up whether you can take enough precautions or should do more prevent harm. Workers and other have a right to protect from harm caused by a failure to take reasonable control Measures. A HAZARD is anything that may cause harm, such as chemical, electrical, working from ladder, etc., A RISK is the chance, high or low, that somebody could be harmed by these and other hazards, together either an induction of how serious the harm could be.

1. Identify the hazards.
2. Decide who might be harmed and how.
3. Evaluate the risks and decide on precautions.
4. Record your findings and implement them

packing, housekeeping. Machineries such as auto welding, fork lift, stacker, Power press, forging etc., and substances such as CO₂, Argon, Nitrogen etc. Successful health and safety management in the engineering workshops is about identifying the most frequent and serious risks and adopting the right precautions, taking account of time, money and resources. A machine is defined as an assembly fitted with or

intended to be fitted with a drive system consisting of linked parts or components at least one of which moves, and which are joined together for a specific application.

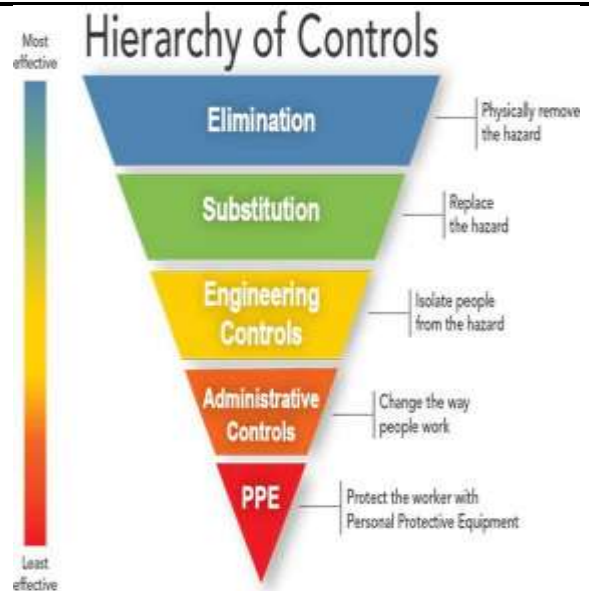


Fig 1 Hierarchy of Control

4.2 Objective of HIRA Study

The objective of the Hazard Identification Risk Assessment (HIRA) is to identify and assess the hazard associated during the Machine shop activity and thereby controlling the risk by implementing mitigation measures to avoid the incident. HIRA helps to become proactive rather than just reactive.

4.3 Effectiveness

- Present Risk reduced to Acceptable Risk.
- Reduction of incident.
- Reduction in repetitive observation.
- Improvement in Behavior safety

5. PROBLEM IDENTIFICATION

Machining and metalworking shops can be dangerous places to work, with a wide variety of potential accidents waiting for workers who are unaware, unalert, or unprepared. From chemical spills and fires to severe lacerations and even possible amputations, the list is quite long.

Proper workplace design and maintenance can prevent many accidents, but no one can plan for everything. It makes sense to focus on some of the most common injuries, to mitigate or eliminate them.

In many instances, straight forward measures can readily control risks. For example, ensuring machine guards punctually so people do not hurt or injured, or cables and objects are kept away from gang way to ensure people do

not trip, or safe operation in work place leads to prevention of injury. For most, that means simple. Cheap and effective measures to ensure our most valuable asset your workers protected. The law does not expect you to eliminate all risk. But you are to protect people as far as is reasonably practicable.

5.1 Case Study

Accident description:

While the OE operates the m/c, he adjusted the part while clamping. That caused his Right-hand middle finger to be pressed by a Top Clamp pad and injured.

Root cause of this Incident:

1. Operating Engineer Operated (Adjusted the fallen part) the part while clamping. Unsafe Act tried by OE.
2. No safety sensor is available in this machine.
3. Caliper casting has fallen while side clamp butting time due to extra material in the parting line

Preventive Action:

1. Safety sensor to be provided
2. OPL is displayed, awareness is given to all OE (Do's and Don'ts to be followed by the O.Es)
3. Casting quality to be improved to avoid part falling while clamping.

5.2 Injury Trend: Before control Measure

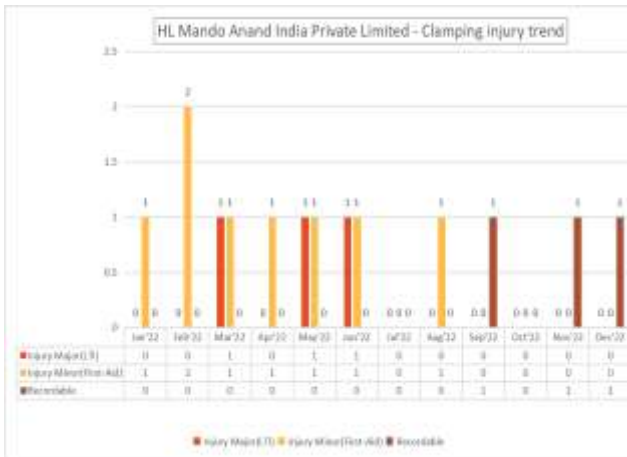


Fig 2- 2022 Injury Trend

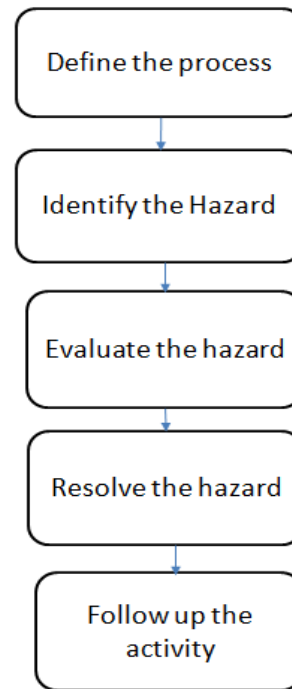
6. METHODOLOGY

Risk assessment is carried out in series of related activities which builds up a picture of the hazards and vulnerabilities which explain disaster events. The following step has followed in the risk assessment. Risk is the likelihood that exposure to a hazard will lead to an injury or a health issue. It is a measure of the probability and potential severity of harm or loss. Risk assessment forms crucial early phase in the disaster management planning cycle and is essential in determining what disaster mitigation measures should be taken to reduce future losses. Any attempt to reduce the impact of disaster requires an analysis that indicates what threats exist, their expected severity, who or what they may affect, and why. Knowledge of what makes a person or a community more vulnerable than another added to the resources and capacities available determines the steps we can take to reduce their risk.

Fig 3 – Steps in Risk Assessment

6.1 Define the process:

In the shock absorber and struts manufacturing process has the following major process. Shock absorbers are placed between the road wheels and the body. When the wheel comes across a bump on the road, it rises and



machine and firewall station are the process in the base assay section. Those process mentioned below as carried out by auto MIG welding, Manual MIG welding, Manual assembly, Projection welding, seam welding, manual assembly process are included. Those machines are secured by double hand switch, guarding, interlock guarding, automatic guarding, and sensors, warning alarms, warning lights, sop etc., are followed.

6.2 HIRA Process:



Fig 4 – HIRA Process

deflects the shock absorbers, there by storing energy there in. On releasing, due to elasticity of the shock absorber material, it rebounds there by expanding the stored energy. In this way the shock absorber starts vibrating, of course, with Amplitude decreasing gradually on account of internal shock absorber material and friction of the suspension joints, till vibrations die down. At Primarily

the outer tube as taken in the base assay, the name of the customer will be mode on the Outer tube by Name rolling Machine. Then base cup fixing and welding, knuckle bracket fixing and welding, spring sheet fixing and welding, Knuckle bracket hole Spearing, connecting rod fixing and welding, Leak testing

HIRA Process it consists of four steps as follows:

- I. Hazard identification
- II. Risk assessment
- III. Risk analysis
- IV. Monitor and review

6.3 HIRA Identification Sources:



Fig 5– HIRA Information

7. CONTROL MEASURE

7.1 Guidelines for rating the hazards identified in Significant Risk Assessment:

7.1.1 Scale:

- 1 - Within work station
- 2- Within Department
- 3- Within factory building
- 4- Within factory premises
- 5- Outside factory premises

7.1.2 Severity

- 5- Accident causing fatality leading to suspension of activity for more than a week / leading to permanent disability
- 4- Accident causing Injury requiring self / nurse/ doctor attention leading to suspension of activity for more than a day or two / Temporary disability
- 3- Injury requiring self-attention causing suspension of

activity for more than two hours and less than a day

- 2- Injury requiring self-attention causing suspension of activity for more than half an hour/Prolonged Discomfort.

1-Injury such as small cuts/ Momentary Discomfort

7.1.3 Probability of Occurrence:

- 5 - Continuous
- 4 - Several Times a Day
- 3 - Once a Day
- 2 - Once a Week
- 1 - Once a Month or Less Frequent

7.1.4 Present Control:

- 5 - Absent or Ineffective control
- 4 - Mechanism in place, but not reliable
- 3 - Control needs human intervention
- 2 - Has inbuilt secondary control
- 1 - Available and effective

7.1.5 Control Methodology:

1. Operation control -OCP
2. Occupational Management Programs -OMP
3. Emergency preparedness and Response Plan - ERP
4. Monitoring & Measurement -MMP
5. Personal Protective Equipment Plan - PPEP & Training Plan -TP

7.1.6 Emergencies are significant by default and is not rated. The following are some of the common emergencies:

1. Fire hazard
2. Uncontrolled release of toxic / hazardous / flammable substances into atmosphere / Land / Water
3. Electrical Short circuit
4. Failure of control equipment

7.1.7 Criteria for Significance Hazard:

1. Severity = 4 or > 4.
2. Multiplication score = 20 or > 20
3. All Emergency Situation (Rating not needed)
4. Any Legal Applicable (Rating not needed)
5. Control not available (i.e. =5)

8. IMPLEMENTATION

Before		After																
IND SAFETY MANAGEMENT SYSTEM																		
Doc.No : TP/ECHSC/01																		
Rev.No : R3																		
Rev.Date : 20.01.2023																		
Page.No.1																		
Problems: <input checked="" type="checkbox"/> No Safety sensor in machine																		
Improvement: <input checked="" type="checkbox"/> Safety sensor provided																		
Benefits: 2023																		
Sl.No	Training Needs	MCM-1	MCM-2	MCM-3	MCM-4	MCM-5	CCM-1	CCM-2	CCM-3	CCM-4	CHM-1	CHM-2	CHM-3	CHM-4	PLATING	SHOX	REMARK	
1	Behaviour Based Safety	Apr'23	Apr'23	Apr'23	Apr'23	Apr'23	May'23	May'23	May'23	May'23	May'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	
2	Material Handling Safety	Apr'23	Apr'23	Apr'23	Apr'23	Apr'23	May'23	May'23	May'23	May'23	May'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	
3	Machine Safety	Apr'23	Apr'23	Apr'23	Apr'23	Apr'23	May'23	May'23	May'23	May'23	May'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	
4	Electrical Safety & LOTO	Apr'23	Apr'23	Apr'23	Apr'23	Apr'23	May'23	May'23	May'23	May'23	May'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	
5	Fire Fighting Operation System	Apr'23	Apr'23	Apr'23	Apr'23	Apr'23	May'23	May'23	May'23	May'23	May'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	
6	Personal Protective Equipment (PPE)	Apr'23	Apr'23	Apr'23	Apr'23	Apr'23	May'23	May'23	May'23	May'23	May'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	
7	Waste Handling	Apr'23	Apr'23	Apr'23	Apr'23	Apr'23	May'23	May'23	May'23	May'23	May'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	Jun'23	
Prepared by		Reviewed by				Approved by												
Mr.Aswin		Mr.Komahan				Mr.Sureshkumar.K												
Note	Plan																	
	Actual																	



9. CONCLUSION

Hazard identification, risk assessment and control is an on-going process. I have identified machine shop area Hazard and Risk for Machine operation, Machine maintenance work, Machine cleaning work and Machine related all the activities by using HIRA tool.

This project has provided an excellent opportunity and experience in making safety measures for task like material handling, Machine operation, Maintenance of a typical industrial machinery, loading, unloading and housekeeping in welding and assembly machinery shop. 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. Hazard identification and risk assessment can be used to establish priorities so that the most dangerous situations are addressed first and those least likely to occur and least likely to cause major problems can be avoiding.

Control Measures given by using Guidelines of HIRA tool and Implementation of risk control done. Effectiveness need to check periodically.

Table 1 Safety Training Plan
8.2 Material Handling Equipment Training - 30.07.2023



Fig 6 – Material Handling Equipment Training

B

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