RISK ASSESSMENT FOR MACHINERY SHOP IN AUTOMOBILE INDUSTRY

T.Sathiyamoorthy[1], R.Isaac[2] S.Kamalakannan[3]
1 PG Scholar, Department of Mechanical Engineering, Knowledge Institute of Technology, Tamilnadu, India.
sathiyadhivya1985@gmail.com
2,3 Asst. Professor, Department of Mechanical Engineering, Knowledge Institute of Technology, Tamilnadu, India.

Keywords—*Automobile industry, Workplace Hazards, Machine, Risk, Welding, Assembly, Manual Handling.*

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 carriers with them workplace hazards, the hazards and risks connected with welding operation ns, assembly operation by machine or manual in frame body shock absorber and muffler 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.

1. INTRODUCTION

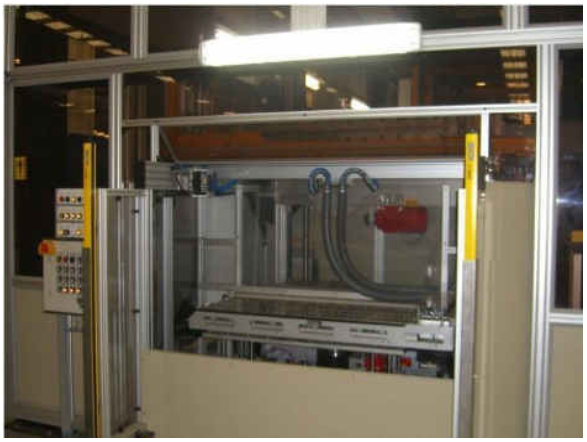
The auto mobile manufacturing industry is a wide range of companies and organizations involved in the design development manufacture, marketing, and selling of motor spare parts. It is one of the world's most important economic sectors by revenue. It is one of the hazardous industries. Hence it contains hazardous nature of process, activities, locations, equipment and substance. In the same way the Shock absorber and frame body manufacturing process being a hazardous operation 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 loads to prevention of injury. For most, that means simple. Cheap and effective measures to ensure your 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. This project tells you how to achieve that with a minimum of activity

1.1 DYNACHROME OPERATIONS

Grinding, hardening, polishing operation has carried out before the chrome plating operations. The operator inserts the rods into the openings of position one in the turn table. After all 40 rods have been inserted, the operator activates the clamping mechanism for the rods. The rods are clamped pneumatically. The turntable indexes 180 degrees which presents the rods to the pickup position where they are clamped in the flight bar ready for collection by the transporter. Once the table has indexed the operator is able to load the second

position with the next 40 Rods. Unloading procedure will be carried out by an identical table but operated in reverse.



The roads will take in to the Mother tank for dosing for chrome process and transfer pumps for chrome and etch process Anodes for hard chromium bath Cathode 1 Cathode for etching bath. The roads have handling by using Transport equipment. In addition to the proximity switches, mechanical actuated safety switches are used for each transporter which provides anti-collision protection limitation for vertical movement. When these switches are actuated the corresponding drive is interrupted.

The lowering movement is interlocked; simultaneously a functional test is affected in order to preclude double occupation of a bath by means of a sensor via the control system. The transporter is moving on a rail which is mounted on the sub structure. Installation of a titanium tray below the complete Dyna Chrome line except in the loading and unloading area. The titanium tray will be installed with a slope in direction to the collecting tank. The main part of the splashes will be collected in the titanium tray. In case of a leaking or overflow of a tank the fluid will be caught in the tray and will flow by gravity in a collecting tank which is part of the supply from HEIL. Contaminations with chrome acid have to be rinsed out. The road will be unloaded and the road will be loaded to the oven. The rods will be heated in the four stages in 300 degree temperature then the rods will be cooled by using the fan and send to the polishing process.

1.2 SAFETY STANDARDS

EMSEC (Engineering Machine Safety Exposure Control) the primary purpose of these International Standards is to provide designers with an overall framework and guidance for decisions during the development of machinery to enable them to design machines those are safe for their intended use. European standards for the Safety of machinery form the following structure:

Type-A standards (basic safety standards) giving basic concepts, principles for design and General Aspects that can be applied to machinery.

Type-B standards (generic safety standards) dealing with one safety aspect or one type of Safeguard that can be used across a wide range of machinery

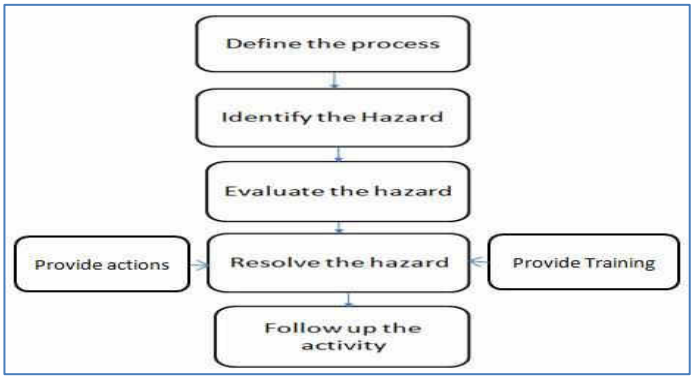
Type-B1 standards on particular safety aspects (for example, safety distances, surface temperature, noise) for example: EN ISO 13849-1, EN ISO 13857

Type-B2 standards on safeguards (for example, two-hand controls, interlocking devices, pressure sensitive devices, guards).

Type-C standards (machine safety standards) dealing with detailed safety requirements for a Particular machine or group of machines. When a type-C standard deviates from one or more technical provisions dealt with by this International Standard or by a type-B standard, the type-C standard takes precedence.

2.1 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.

3.1 **Identify the Hazard**

The techniques used here to find out the hazard by Risk Matrix, It used here to categories the level of risk factor. At initially checklist has to be frame to locate the hazards.

3.2 Check List

Equipment Control Systems

No.	QUESTIONS	YES	NO	N/A	REMARKS
1.	All switches & indicators are clearly marked, readily visible, obvious, understandable and in the local language? All communications between machine and operator must be in the local language. All push buttons, readouts, instructions, and on lights, etc.				
2.	All switches & indicators as well as LOTO devices are located outside the danger area. Machine power controls, such as power disconnect (on-off switch) are capable of being locked in the OFF position, but are not capable of being locked in the ON				
3.	All switches & indicators can be operated safely. The operator must not be exposed to additional hazard, stepping up, reaching over, or entering the danger zone to operate control switches and buttons.				
4.	The system is designed to stop safely in an emergency.				
5.	The control system is designed so that failure or bypass of a component will prevent starting or recycling.				
6.	The controls are situated or guarded so that they cannot be accidentally initiated				

7.	Two handed controls are self-checking so that if one				
	Button fails or is wedged close, the system will not operate.				
8.	All visible / audible alarm signals are clear				

3.1 Risk matrix

Risk Matrix is used at some stage in risk assessment to characterize the various levels of risk as the product of the harm probability categories and harm severity categories. This simple mechanism to increase visibility of risks and leads to provide the solution.

This methodology has seven stages as listed below; Likelihood has the possibility to occurrences of the event in six states are practically impossible, very unlikely, unlikely, likely, very likely and imminent or certain.

The action priority of the risk has been calculated in five levels are no action required, can be deal with as convenient, deal with as soon as possible, needs resolving quickly and immediate action required.

Table: likelihood

The exposure level of the risk has been calculated in six levels are very rare, rare, unusual, occasionally, frequently and continuous

Table: Exposure

The injury intensity of the risk has been calculated in six levels are loss time, minor injury, major injury, single fatality, multiple fatalities and many fatalities.

Table Extent of Injury

The property damage level has been calculated in six states are from zero to crore and above.

Table Property Damage

The possible consequences of the risk has been calculated in six levels are noticeable, important, Serious, very serious, disaster and catastrophe.

Table Possible Consequences

The action priority of the risk has been calculated in five levels are no action required, can be deal with as convenient, deal with as soon as possible, needs resolving quickly and immediate action required.

Table Risk Factor

The risk rating has been calculated in five levels are trivial or low risk, low risk, medium risk, high risk and very high risk.

Table Risk Rating

RESULTS AND DISCUSSIONS

This process used here to determine the likelihood that people exposed to injury, illness or disease in the workplace arising from any situation identified during the hazard identification process prior to consideration or implementation of control measures. Risk occurs when a person is exposed to a hazard. Risk is the likelihood that exposure to a hazard will lead to injury or health issues. It is a measure of probability and potential severity of harm or loss.

Totally 31 critical machines has taken for the assessment, by using the check sheet for every machines the hazards can be established, then the below keys are used and give the code for it. The risk has been categorized finally as trivial or low risk, low risk, medium risk, high risk and very high risk, for the medium risk, high risk and Very High risk has given the first priority to resolve the problem. From the evaluations the recommendations and control measures has given

Trainings

Duration	Department	Position	Training covered topic
March`16	Welding section	Operator	1.) Material handling, 2.) 2 Hand power switch, 3.) PPE necessary, 4.) Trolley handling 5.) SOP 6.) Fire 7.) Near miss reporting etc.,
March`29	Welding section	Operator	1.) Material handling, 2.) 2 Hand power switch, 3.) PPE necessary, 4.) Trolley handling 5.) SOP 6.) Fire 7.) Near miss reporting etc.,

RECOMMENDATIONS

LOCATION	HAZARD TYPE	HAZARD IDENTIFIED FROM THE ASSESSMENT	RECOMMENDATIONS
Front & Rear welding shop	Working Environment - Manual Handling	**Falling object & Collision of objects** - Operator losing the parts that leads to minor injury like as burn injury, abrasion injury, cut injury etc.,	Full hand gloves to be worn by all the operators working in the Welding operations. Training to be provided and display the SOP clearly to view by the operator in the machine
Front & Rear welding shop	Working Environment - Physical Hazards	**Hit by moving object-** Having the more probabilities to hit with the parts by the conveyor(Not guarded), that may leads to minor injury like as burn injury, abrasion injury, cut injury etc.,	All Conveyor's to be guarded to avoid hitting the parts to the operator or persons who moving in the egress
Front &Rear welding shop	Working Environment - Chemical Hazards	**Suffocation** - Persons may Suffocated due to lack of oxygen if Co2 & Argon leakage	Sensors to be installed to Identify the leakage of co2 and Argon gas
Front & Rear welding shop	Working Environment - Physical	**Fumes environment** - Welding	Exhaust ventilation system should be fix for every

	Hazards	exposed fumes making the environment hot and inhalation of metal oxide leads to lung diseases eye irritate and fatigued	welding machines to avoid heat and fume atmosphere contains fumes

LITERATURE SURVEY

Incorporating human factors into a simplified ‘‘bow-tie” approach for workplace risk assessment

Antoni’s Targoutzidis et al (2010) provided a simple methodological tool for the incorporation of human factors in the process of risk assessment. It is based on the classical Event Tree Analysis (ETA), i.e. the analysis of a situation to all its possible mutual exclusive subsequent steps. Therefore, it starts with a Fault Tree Analysis (FTA), where potential incidents are analyzed backwards, by means of necessary pre-conditions. ETA and FTA are very useful tools for risk assessment as they offer a structured analysis and identification of all possible outcomes. The human error supplement will be included and the formula is: p = Po (2^u - 0.5). These factors are intuitively marked by the analyst, based on context-specific information to adjust the initial probabilities of accident by databases or historical data. Intentional risk-taking is considered to be a product of risk perception and risk motivation that includes economic, social or other benefits. Through a simple formula, the initial ‘Nominative” failure probability is adjusted in order to take these influences into account. The simple tool that can help incorporating human factors and situation specific conditions in workplace risk assessment.

CONCLUSION

This project has provided an excellent opportunity and experience in making safety control measures for task like material handling, Machine operation, working near the machineries , loading, unloading and housekeeping in welding and assembly machinery shop. 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 avoid. The recommendations are provided to avoid the occurrence of such hazards. From the awareness training to the operator had become the effective method for them to awake and control the hazards and the self-awareness for work in the shop, Induction training only will not sustain the workers to functioning near or with the machineries.

REFERENCES

1. Antonis Targoutzidis, 2010, “Incorporating human factors into a simplified „„bow-tie” approach for workplace risk assessment” Safety Science, 48 145–156.
2. Baba Md Derosa, 2015, A Study on Ergonomic Awareness among Workers Performing Manual Material Handling Activities” Social and Behavioral Sciences, 195 1666 – 1673.
3. Darren M. Roffey et al., 2010, “Causal assessment of workplace manual handling or assisting patients and low back pain: results of a systematic review, The Spine Journal” 10 639–651.
4. Elizabeth Bluff, 2014, “Safety in machinery design and construction: Performance for substantive safety outcomes” Safety Science, 66 27–35.
5. J. Sammarco, 2012, “A visual warning system to reduce struck-by or pinning accidents involving mobile mining equipmen”, Applied Ergonomics, 43 1058 - 1065.
6. James M. Antonini et al, 2015, “Effect of short-term stainless steel welding fume inhalation exposure on lung inflammation,

injury, and defense responses in rat" Toxicology and Applied Pharmacology, 223 234–245.
7. Jozef Zurada et al, 2012, "Classifying the risk of work related low back disorders due to manual material handling tasks" Expert Systems with Applications, 39 1125–11134.
8. Karin Reinhold et al, 2015, "Practical tool and procedure for workplace risk assessment: Evidence from SMEs in Estonia" Safety science, 71 282–291.
9. Kogler Robert et al., 2015, "Analysis of occupational accidents with agricultural machinery in the period 2008–2010 in Austria" Safety Science, 72 319–328.
10. Manay Kifle et al, 2014, "Work related injuries and associated risk factors among iron and steel industries workers in Addis Ababa, Ethiopia" Safety Science, 77 211–216.
11. Margaret McCallig et al., 2010, Evaluating worker vibration exposures using self-reported and direct observation estimates of exposure duration" Applied Ergonomics, 42 37 – 45.
12. Jan hovden et al., (2009), "Is there a need for new theories, models and approaches to occupational accident prevention?" Dep. of Safety Research, 66 233-246.
13. Mitchell Dinham, 2013, "Autonomous weld seam identification and localisation using eye-inhand stereo vision for robotic arc welding" Robotics and Computer-Integrated Manufacturing, 29 288–301.
14. O.N. Aneziris et al, 2013, "Quantification of occupational risk owing to contact with moving parts of machines" Safety Science, 51 382–396.
15. Odile Heran-Le Roy et al, 1999, "Manual materials handling and related occupational hazards: a national survey in France" International Journal of Industrial Ergonomics, 24 365 – 377.
16. Michael F. Hilton et al (2010), "Associations between psychological distress, workplace accidents, workplace failures and workplace successes Int Arch Occupation Environmental Health " Renewable and Sustainable Energy Reviews, 37 509–516.
17. Pascal Poisson et al., 2015, "Observation and analysis of 57 lockout procedures applied to machinery in 8 sawmill" Safety Science, 72 160–171.
18. Gerard I.J.M zwetsloot et al(2013), "The case for research into the zero accident vision The Netherlands Foundation for Applied Scientific Research" Computers & Industrial Engineering, 63 135–149.
19. Simo Salminen, 2015, "Workplace Safety and Health" Finish Institute of Occupational Health, 2 727–732.
20. Yuvin Chinniah, 2015, Analysis and prevention of serious and fatal accidents related to moving parts of machinery, Safety Science, 75 163–173.