ISSN (Online): 2456-5717

International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Vol.3 Issue.5 May 2017

Hazard Identification & Risk Assessment in Gear Manufacturing Unit

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Abstract- **The purpose of this particular work is to systematically identify all the risks associated with wind mill gear manufacturing process in a particular company, and put appropriate controls in place to eliminate or reduce the risks associated with that activity. The methodology used in this project is Hazard Identification and Risk Assessment (HIRA) system. It is 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. This work has been carried out in a gear manufacturing unit, Coimbatore. Henceforth possible control measures are recommended.**

Index terms: **Hazards, Risks, Risk Priority Number.**

I. INTRODUCTION

Hazards are the sources or situations which have the potential to cause undesired events. Risks are the combination of likelihood which creates a chance for the undesired events. All the Industries and workplace consists of Hazards and Risks which creates and cause the chances of accidents. In order to reduce those hazards and risks, the hazard identification and risk assessment have to be performed periodically. The priority risk assessments are the effective methods to prioritize the hazards which have to be mitigated in a sequential order. In order to provide the control measures in proactive manner than a reactive manner the Hazard Identification and Risk Assessment by priority methods plays a vital role.

II. PROCEDURE FOR HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA)

The sequence / Flow chart of hazard Identification and Risk assessment is as follows.

1) Classify the Work activities, Identify the Hazard, Determine Risks, Determine existing control measure, Assess the risk considering probable failures in the existing risk control measures, Decide whether the risk is tolerable, Decide the Risk control Plan.

2) Classification of work activities: Department heads in association with the core team member shall list out routine and non-routine activities, activities of all having personnel access to the workplace in the respective department and gather the following information wherever possible, for each work and activity.

- Tasks being carried out: their duration and frequency.
- Location where the work is carried out.
- Who normally carries out the tasks?
- Others who may be affected by the work
- Training, those personnel have received, about the tasks.
- Work permit system for the job.
- Size, shape, surface characteristics of, and weight of materials, that might be handled.
- Utility services such as compressed air, steam, water, electricity, PNG etc.
- Substances used or encountered during the work
- Physical form of substances used and recommendations as per MSDS.
- Legal and other requirements.
- Records of accident(s) & incident(s) and their analyses.
- Communications from employees and other interested parties.
- Work place monitoring data
- Control measures to be in place
- Safety committee reports.

3) Identify hazards and determine risks. Hazard Identification and risk assessment to pro-active rather than reactive. The broad categories of hazards are Mechanical, Electrical, Substances, Fire/Explosion, Radiation, Toxic Release, Natural Calamities, and Biological Hazards.

4) The following three questions enable hazard identification:

   a) Is there a Source of harm?
   b) Who (or what) could be harmed?
   c) How could harm occur?

5) while identifying the hazards and determining the risks, the following factors shall be considered:

   - Human behavior, capabilities and other human factors.
   - Hazards originating outside the workplace capable of adversely affecting the health and safety of personnel under the control of the organization within the workplace.
   - Hazards created in the vicinity of the workplace by work related activities under the control of the organization.
   - Infrastructure, equipment and material at the workplace, whether provided by the organization or others.
   - Changes or proposed changes in the organization: its activities and materials.
   - Modification to the OH&S Management system including temporary changes

- Applicable legal obligations relating to risk assessment and implementation of necessary controls.
- Design of workplace, processes, installations, machinery/equipment, operating procedures and work organization, including their adaptation too human capabilities.

6) However, Hazard identification and risk assessment shall be reviewed before implementing changes to the activity/process/equipment/existing risk control measures. Review of risk assessment shall be carried out during the following situations.
   - During changes from normal operation, new or modified process/installation, changes in raw materials, chemicals etc.
   - During expansion, reduction or restructuring.
   - New or modified legislation.
   - New information/inputs from interested parties.
7) The significant OH&S Risks identified by all departments are to be taken as OH&S objectives of the organization. In addition to this, the individual departments may identify OH&S objectives in a proactive manner. These are reviewed in the management review meeting.
8) Hierarchy of Risk Control Measures: While determining risk controls or considering changes to existing controls, consideration shall be given to reducing the risks according to the following Hierarchy:
   a. Elimination/Substitution
   b. Engineering control
   c. Signage/Warnings and/ or Administrative Controls
   d. Personal Protective Equipment

III. Evaluations Of Occupational Hazards & Associated Risks To The Health And Identification Of Significant Occupational Health Hazards & Risks

Criteria for risk assessment are developed through brainstorming and discussion by core item. The scoring is based on

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

ISSN (Online): 2456-5717

International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
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TABLE-I PROBABILITY/ SEVERITY RATING

Rating	Severity of Risk (S)			Probability (P)
	Noise	Injury	Ill Health	
1	<40 dB	Injury like Small cut / abrasion which requires treatment in department itself	Momentary discomfort / nuisance	Most Unlikely - Never known before
2	40 to 74 dB	Injury which requires treatment only in Occupational Health centre and immediately returning to duty	Prolonged discomfort / nuisance	Unlikely - May happen occasionally (Once in a Year)
3	75 to 89 dB	Injury which requires treatment only in Occupational Health centre as a result of any incident and immediately returning to duty and leading to suspension of work for more than 3 hours	Minor health illness requiring self doctors attention	Likely - May occur in a certain amount of time like in every 6 months.
4	90 to 104 dB	Incident causing major injury requiring Nurse / Doctor attention (may be outside) leading to suspension of work for more than a day or two	Major health illness (temporary disability)	Most Likely - May occur within a short period of time (Monthly)Known to have occurred on this site in the past
5	>= 105 dB	Major incident like disability, amputation or fatality.	Permanent disability	Repetitive - Possible during every time execution

TABLE II RISK MATRIX

Severity (S)						
	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 (P)					

IV. CRITERIA FOR SIGNIFICANCE

Hazard and associated risks are categorized as significant when

(i) The risk having a score equal or more than 12

(ii) Severity equal or more than 3 irrespective of the total rating

(iii) All Emergency (No rating given)

(iv) Any Legal applicable (No rating given)

V. NOT ACCEPTABLE RISK CATEGORIZATION

TABLE III NOT ACCEPTABLE RISK CATEGORIZATION

S.No	Area	Work Platform	PPE	Knurling Tool	Oil absorbent mat	Ergonomics Issue	Stoppers for Air Guns
1	Housing	0	1	2	0	3	3
2	Planet Carrier/Torque Arm	1	1	1	1	2	2
3	Ring Wheel	0	1	2	1	3	3

VI. RISK PRIORITIZATION

TABLE IV RISK PRIORITIZATION TABLE

S.No	Area	P1	P2	P3	Total
1	Housing	0	2	2	4
2	Planet Carrier/Torque Arm	0	1	2	3
3	Ring wheel	0	2	3	5
Total		**0**	**5**	**7**	**12**

VII. CONCLUSION

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 various hazards of different equipment's and operations were found. Recommendations are provided to avoid the occurrence of such hazards. Applicable legal requirements are studied. Safety Instructions, Extract of Material Safety Data Sheet, Personal Protective Equipment's Matrix and Safe operating procedures were studied.

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