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Modification of Plant Layout to Upgrade the Safety through the Risk Assessment in a Wire Cable Manufacturing Industry

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Abstract:
The project is carried out in the leading Wire and cable manufacturing Industry, V-Guard. Manufacturing the Copper wire cables in different grades and different size are carried out in the industry. Plant and premises have been inspected which include Power house, Raw material Godown and Scrap unit. A detailed risk assessment has carried out to find out the hazards and remedies which can lead to achieve higher safety. The accident history of previous Three years has been reviewed thoroughly. As a result of detailed risk assessment and study of near misses, found that the accident rate increased 4.3% by a year. There is a scope for modifying the plant layout to achieve more safety to the plant and Employees. This project has been concentrated on the layout modification in accordance with the risk assessment. The structural layout has to be modified to obtain the maximum level of safety. The qualitative risk assessment technique have to be used to analyze the severity of the noticed issues, and even follows the OSHA standard risk assessment procedures for the detailed risk analysis. The method followed is Baseline Hazard Identification and Risk Analysis. It is used to priorities action programs for issue-based risk assessments. The project results in upgrade the safety of the cable and wire manufacturing plant and employees. The scope of this project, is subjected to the up gradation of following safety culture to high and providing the maximum safety to the premise, plant, process and persons.

Key words: Industrial Safety, HSE policy, Risk assessment, plant layout modification

I. INTRODUCTION

This project is intended to modify the existing Layout so as to make the working environment safe and hazard free. On making a thorough and detailed inspection of the entire plant, we got a clear idea of the safety measures and steps that have been instated to avoid accidents and hazards. The entire area carrying production, assembly and others were found to have sound measures for safety, excluding power house, raw material godown and scrap unit. Further we carried out our study on these areas to improvise the existing layout which were as per the old standards and regulations. The process involved application of latest standards followed in OSHA. The new proposal was developed including safety devices as per the latest National Building Codes of India. Altering an environment for safety reasons might require a good expense, but in the long run it will turn as a valuable asset.

II. OBJECTIVES

The main objectives of this project are the following

- Review of literature on Hazard Identification and Risk Assessment
- Review of accidents in wire manufacturing industries and their analysis.
- Study of risk assessment methodology
- Application of Hazard Identification and Risk analysis for improvement of workplace safety in mines.
- Following the OSHA's international standard methods for risk assessment other than ISO standard.
- Inspect the various units of the industry making sure that the each and every area is covered for risk assessment.
- For safety gain, even the plant layout can be change and redesign for a safe environment.

III. HAZARD IDENTIFICATION

Hazard Identification or Hazard recognition is the process of identifying or recognising all the possible hazards. This is done by reviewing previous accident history, visual inspection, interviewing the workers.

(i) Review of accident history:
As a part of the modification of the plant layout for the up gradation of safety, previous accident history was studied. It is found that there is decrease in the percentage of accidents. Still, there is an increase of 4.3% in registered near miss cases.

Accident history		Total No of Employees: 300	
Year History	2014-2015	2015-2016	2016-2017
Fatalities	0	0	0
Major Injuries	6	6	5
Minor Injuries	29	26	19
Shock / Trauma	25	23	21
Near miss	49	34	47
FWI*	**.87**	**.845**	**.70**

(ii) Accident history profile (2014-2017):
It is observed that, there is a less number of accidents in manufacturing unit. So, that the project is focusing on the remaining three locations such as raw Materials Godown,

Power House , Scrap Unit. The observations are taken in credit and feasible remedies would be advised.

Total No of Employees: 300				
Accident history	**RM Ware house**	**Power House**	**Scrap Unit**	**Man ufact uring**
Fatalities	0	0	0	0
Major Injuries	4	3	7	3
Minor Injuries	21	18	27	8
Shock / Trauma	8	44	12	5
Near miss	30	18	58	24

(iii) Hazards Identification- RM Warehouse, Power House &Scrap Unit:

HAZARDS IDENTIFIED
Slip/ trip/ fall Inappropriate floor surface. Smooth floor. Poor housekeeping - e.g. Spills not cleaned up immediately Poorly lit stairwells
Shock Electrical shock from heavy transmission lines. Failure insulation of wires. Machine abuse.
Falling objects Poor access to storage racking Unloading the goods in improper ways
Fire No-proper ventilation on the roof. High heat generation due to the metal Roof. Packing cardboard is kept at the top floor. Electrical spark from heavy transmission lines Flammables fuels spillage
Hazardous substances Chemical Powders like chalk powders. PVC insulation materials Inhalation of hazardous Substance
Ergonomics Continues manual handling Over reaching to stock rack.
Cut injury Sharp edges of the scrap materials. Sharp edges of the cupboard screens.

HAZARDS
IDENTIFIED Other Hazards The height level of the second floor and the crane moving beam height level is same. Due to this same height the worker may hit by the crane or the entanglement, drawing in risks possibilities are there.
Ergonomics In adequate lighting. Manual Loading and unloading.
Smoke Smoke from the generator exhaust.

IV. HAZARD ANALYSIS

Hazard analysis is the process of recognizing hazards that may arise from a system or its environment, documenting their unwanted consequences and analyzing their potential causes.

(i) Typical risk assessment matrix - qualitative method

A Risk Assessment Matrix (RAM) is a tool to help you determine which risks you need to develop a risk response for. The first step in developing a RAM is to define the rating scales for likelihood and impact. In a qualitative analysis, likelihood or probability is measured using a relative scale.

RISK ASSESMENT MATRIX - QUALITATIVE METHOD					
Severity / Probability	Fatalities	Major Injuries	Minor Injuries	Shock/ Trauma	Near Miss
Frequent	High	High	High	Serious	Serious
Probable	High	High	Serious	Serious	Medium
Occasional	High	Serious	Serious	Medium	Low
Remote	Serious	Serious	Medium	Medium	Low
Improbable	Serious	Medium	Medium	Low	Low
Eliminated	Eliminated				

(ii) Risk assessment matrix – RM warehouse

HAZARD	LEADING CONDITION	RISK MATRIX
Slip	Inappropriate floor surface. Smooth floor.	Serious
	Poor housekeeping.	Low
Falling Objects	Poor access to storage stacking	Medium
	Unloading the goods in improper ways	Low
Repetitive work	Continues manual handling	Medium
	Regular usage of stairs without regular intervals	Serious
Fire	High heat generation due to the metal Roof.	Medium
	Packing cardboard is kept at the top floor.	Low
Hazardous substances	Chemical Powders like chalk powders.	Serious
	PVC insulation materials	Low
	Inhalation of hazardous Substance	Medium
Ergonomics	Continues manual handling	Medium
	Over reaching to stock rack.	Low
Other Hazards	The height level of the second floor and the crane moving beam height level is same. Due to this same height the worker may hit by the crane or the entanglement, drawing in risks possibilities are there.	Eliminated

(iii) Risk assessment matrix – Power house

HAZARD	LEADING CONDITION	MATRIX
Slip/ trip/ fall	Inappropriate floor surface.	Serious
	Poor housekeeping - e.g. Spills	Low
Fire	Electrical spark from heavy transmission lines	Medium
	Excess heat from generator	Serious
	Flammables fuels spillage	Medium
Shock	Electrical shock from heavy transmission lines.	Medium
	Failure insulation of wires.	Serious
	Machine abuse.	Low
Smoke	Smoke from the generator exhaust.	Medium

(iv) Risk assessment matrix – Scrap unit

HAZARD	LEADING CONDITION	RISK MATRIX
Slip/ trip/ fall	Inappropriate floor surface.	Medium
	Smooth floor.	Low
	Poor housekeeping.	Low
	Shattered materials.	Medium
	Cables trailing on the floors.	Medium
Cut Injury	Sharp edges of the scrap materials.	Serious
	Sharp edges of the cupboard screens.	Serious
Repetitive work	Manual opening and closing of the shutters.	Medium
Fire	No ventilation on the roof.	Medium
	Heat generation due to the metal sheet roofs.	Low
	Stacking of oxygen cylinders.	Low
Substances	Waste of PVC insulating materials	Serious
Ergonomics	In adequate lighting.	Medium
	Manual Loading and unloading.	Low

V. CONTROL MEASURES

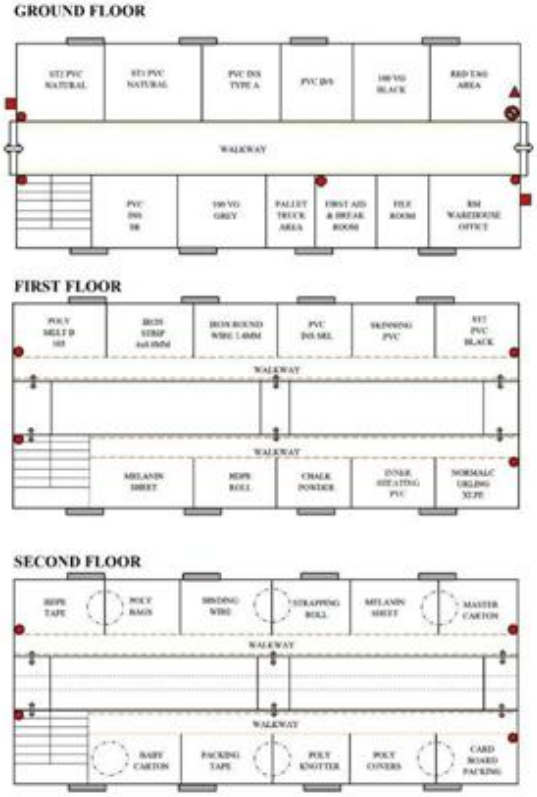
Hierarchy of hazard control is a system used in industry to minimize or eliminate exposure to hazards. It is a widely accepted system promoted by numerous safety organizations

- Elimination
- Substitution
- Engineering controls
- Administrative controls
- Personal protective equipment

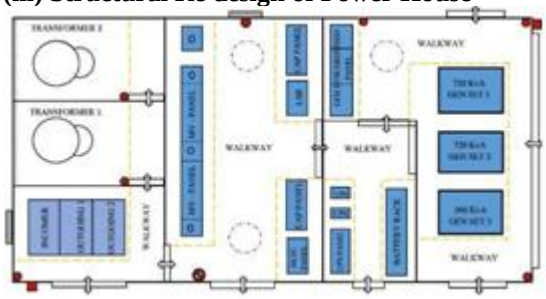
( ) Engineering control - Modification of Structural Design:

The project is prioritized on three locations, such as RM Warehouse, Power house and Scrap Unit. The modifications are prepared onj the basis of the acciudent history and its probabilitty i.e Risk analysis matrix. As per the NBC, there are certain codes to be followed in generally a workplace during construction according to the activities taken place

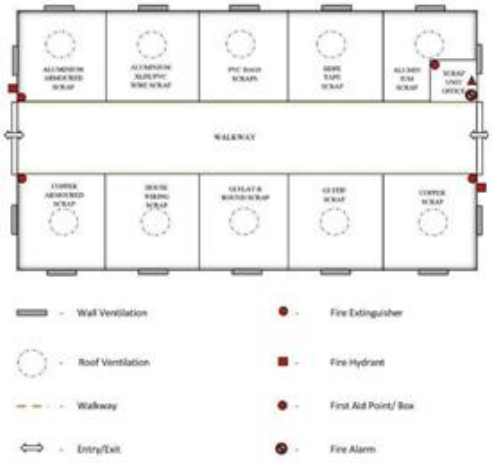
(ii) Structural Re design of RM Ware house



(iii) Structural Re design of Power House



(iv) Structural Re design of Scrap Unit



VI. RESULT

Risk profile charts made for individual units on the basis of hazard identification respective to the previous accident history. Hazards were identified through a) Vision b) Surveying and c) Reviewing the previous records. It is evident from the charts that the company upgrades its safety year to year. The study of near misses proved that there is some lack of safety in particular area. The major number of near misses are spotted on the RM Warehouse, Power house and Scrap Unit. Identified all the hazards in each place. After this, the identified hazards analised by using the qualitative method.The hazards are prioritized on basis of identification through probability vs severity. On appying the control measures, the chances were higher on structure and design modification to reduce the incidents. On taking credit of the legislative instructions, the structure has been redesigned in focus of reducing hazards. Sufficient number of safety devices were allocated in the modified design. There is a scope to upgrade it on accordance with the necessity, as safety is a day to day practice. Reviewing the system by time is most important.

VII. CONCLUSION

The plant consists several hazards. It is important to rectify the situations to ensure safety. The conclusion of this project leads to modification of the plant layout for upgrade the safety. The risk assessment has been conducted at each and every place of the entire unit such as Power house, inventory storage yard and scrap unit. The buildings are aged and need improvements to match with legal norms.

- A new modified structural design has developed with focusing on the hazard rectification and legal compliance.
- A number of safety devices are provided as required and a proper maintenance chart is introduced.
- There should be a qualified person to monitor all these process and the changes has to implement within no time.
- In future, they can change the process according to the developments and production required. The advised plant layout can redesign according to the changes.

VIII. REFERENCE

[1].Aikaterini D.Baka,NikolaosK. Uzunoglu," Protecting Workers from Step Voltage Hazards", IEEE Technology and Society Magazine (2009), (Volume: 35, Issue: 1pp.25-1).

[2]. Charles F. Dalziel,"Controlling electrical hazards", Electrical Engineering Journal (2009), (Volume: 66, Issue: 8 pp. 36-41).

[3]. F. Redmill, "An Introduction to the Safety Standard IEC 61508," Journal of the System Safety Society, (1999), (Volume 35, No. 1, pp. 21-25).

[4]. F.Redmill "Exploring subjectivity in hazard analysis", Engineering Management Journal (2011) (Volume: 12, Issue: 3, pp. 23-27).

[5]. G.B.Menon "Commentary on National Building Code"– Fire and Life Safety(Part 4)(2016),(pp.45-79)

[6]. Kent J Neilsen "Improving safety culture through the health and safety organization" (2013) (Volume: 1, Issue 2, Title no.2.3).

[7]. "National building code of India" Part 8 building services Section 2, "Electrical and allied installations" (2015) (Chapter No.12, pp 142-150)

[8]. Vern Putz Anderson & Heekyoung Chun, "Workplace Hazards and Prevention Options" International Journal of Occupational Safety and Ergonomics, (2014) (Volume 20:1, pp. 181-195).

[9].W.E.Anderson," Risk analysis methodology applied to industrial machine Development", IEEE Transactions on Industry Applications (2011) (Volume: 41, Issue: 1)

[10]. Xindong Liu , Mohammad Shahidehpour ,Yijia Cao , Zuyi Li , Wei Tian," Risk Assessment in Extreme Events Considering the Reliability of Protection Systems", IEEE Transactions on Smart Grid (2018) (Volume: 6, Issue: 2)

[11].http://www.chambers.com.au/glossary/ha zard_analysis. php# Hazard%20Analysis% 20Objectives

[12]. http://www.hse.gov.uk/risk/controlling-risks.htm

[13]. https://www.osha.gov/laws-regs/standardinterpretations/ publicationda te/currentyear