International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 5, May - 2014

# Hazards Analysis & Evaluation in Steel Processing Plant

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***Abstract*— The working environment in steel processing plant is hazardous and characterized by multiple simultaneous chemical, physical and mechanical hazards exposure, which would lead to injuries of workers. The main aim of the paper is the analysis and evaluation of occupational hazards and risk associated in various jobs in Cold Roll Slitter sections which are being carried out in the Steel processing plant to reduce the hazard in order to make the working environment safe for the workers. So for this purpose we have used hazard analysis methodologies such as Job Safety Analysis for identifying hazards and its consequences by analyzing all the processes. And the Safety performance monitoring in the steel processing plant is done, monitoring or measurement helps us to identify the weakness in implementation of safety program in industries, with view to improve the safety system in future.**

***Keywords*— *Job Safety Analysis, Frequency Rates, Severity Rates, Incidence Rates.***



## I. INTRODUCTION

Our aim in this paper is to analyze the hazard associated in Cold Roll Slitter process which is being carried out in the steel processing plants and to minimize their effect in order to make the working environment safe.

The steel coil is processed in different section of plant which includes cold roll coil slitter, pickling, cold rolling, tube mill this is dispatched as per the requirement of the costumer. These hazards may be mechanical hazards, hazards due to human failure, hazards due to nature of processing materials or static electric hazards. So a great concern is needed to minimize the occurrence of these hazards and for this purpose it is very necessary to analyze the risk associated in the working area. In our paper we are performing the job safety analysis in order to make the work place safe, As workers and others have a right to be protected from harm caused by any kind of failure and also to take reasonable control measures which ever are necessary. For the purpose we have used hazard analysis methodologies such as Job Safety Analysis for identifying hazards and its consequences by analyzing all the processes**.**

## II. METHODOLOGY

Ha Job-related injuries and fatalities occur every day in the workplace. These injuries often occur because employees are not trained in the proper job procedure. One way to prevent workplace injuries is to establish proper job procedures and train all employees in safer and more efficient work methods. Establishing proper

Job procedures is one of the benefits of conducting a job safety analysis carefully studying and recording each step of a job, identifying existing or potential job hazards (both safety and health), and determining the best way to perform the job or to reduce or eliminate these hazards.

Job Safety Analysis: Job Safety Analysis (JSA) is a technique for the review of a job. Its purpose is to uncover inherent or potential hazards which may be encountered in the work environment. When properly used, the JSA will be an effective tool for training and orienting the new employee into the work environment. A JSA can also be used to retrain the older employee. A job safety analysis can be performed for all jobs in the workplace, whether the job task is special (non-routine) or routine. Even one-step-jobs such as those in which only a button is pressed can and perhaps should be analyzed by evaluating surrounding work conditions. To determine which jobs should be analyzed first, review your job injury and illness reports.

The work will develop safer job procedures and create a better working environment.

An analysis includes five steps:

1. Select a job.
2. Break the job down into steps.
3. Identify the hazards or determine the necessary controls of the hazards.
4. Apply the controls to the hazards.
5. Evaluate the controls

The Table I below shows the job safety analysis work sheet for cold roll slitter section in steel processing plant. In which the work or job steps have been described and potential hazards related to each work has been analysed to find out the corrective/control measures to eliminate or mitigate the hazard to minimum level.

Table I: Job Safety Analysis
Cold Roll Slitter

| No. | Work | Potential Hazards | Controls Measures |
|---|---|---|---|
| 1 | Loading coil on crane Hook | 1. Wire rope may break so coil and hook can fall on rigger (crane operator guide).<br>2. Swinging hook can hit and hurt the rigger. | 1. Periodic maintenance and checking of wire rope before operation.<br>2. Proper coordination between crane operator and Rigger |
| 2 | Loading coil on Coil Car | Coil can fall from the car. | Operator should be trained. |
| 3 | Loading coil on Uncoiler/ Decoiler, Snubber roll. | 1. Mandrel can break and coil may fall on operator's feet.<br>2. If snubber roll is lose coil can open suddenly. | 1. Operator should keep safe distance from uncoiler.<br>2. Hydraulic system should be checked. |
| 4 | Pinch Roll | Operator's hand can stuck at the nib of the pinch roll. | No ring, bangles should be wore by the operator. |
| 5 | Shear Machine | 1. Shearing blade can cut the operators hand.<br>2. Cutted strip can hit the operator. | 1. Sensor should be installed, if hand come under the blade then it should not be operated.<br>2. Fibre glass should be covering the shear blades. |
| 6 | Slitter Section | 1. Slitter head has circular blades which can cut the hand of the operator.<br>2. Operator's hand can stuck at the nib of the slitter.<br>3. Operator can fall in the scrap pit. | 1. Gloves should be worn by the operator.<br>2. No rings, bangles should be wearing by the worker.<br>3. Railing of the pit. |
| 7 | Scrap Baller | 1. Hand may be cut with the strip.<br>2. Scrap roll may move or rolled.<br>3. Lifting the scrap roll. | 1. Wear gloves.<br>2. Scrap roll should be kept on pallets.<br>3. lift the scrap rolls with belts |
| 8 | Loop table /loop pit | Fall in pit | Railing of the pit, |
| 9 | Recoiler | Mandrel can break and coil may fall on operator's feet | Operator should keep safe distance from uncoiler |
| 10 | Control desk | Electric shocks, burn, fire, static charge, damage push button, switch, and open wire. | Preventive maintenance of all electrical equipments. |



## III. PROPOSED MONITORING METHOD

The focus in this study is on safety performance monitoring in steel processing industry previous 5-year (2009–2014).The data presented in this paper were compiled as a part of a research project. Accidents, that occurred when employees performed industrial operations for the steel processing industry at the industrial site. Accident statistics may serve as an important feedback instrument to monitor safety performance. Accident statistics are commonly expressed as rates, per unit population or per unit time worked. Computation of rates requires number of injuries and exposure.

Frequency rates express injuries in terms of hours of exposure taking into account actual exposure to the risk, e.g. including overtime hours.

Severity rates express the number of days lost in terms of hours of exposure, taking into account the gravity of the injury.

Incidence rates express injuries in terms of number of persons exposed to the risk per year. Rates can either be computed for (insured) employees or for workers (insured and uninsured combined). In comparison do statistics of fatalities and serious injuries provide more reliable indices of safety performance. It also examines some of the general limitations of statistics on occupational accidents for the steel processing industry. The purpose is to provide a basis for an informed discussion on the safety performance of steel processing industry, with a perspective on limitations of the data available in the industry visitd.

## IV. ANALYSIS/CALCULATION

Now this data have taken from the steel processing industry.

Table II. Accidental Data

| S No. | Year (1 April To 31 March) | No. Of Accidents | No. Of Reportable Accidents | Average No. Of Employees | Man Days Lost Due To Reportable Accident | Total Man Hours Worked |
|---|---|---|---|---|---|---|
| 1 | 2009-10 | 7 | 2 | 76 | 46 | 186656 |
| 2 | 2010-11 | 9 | 3 | 89 | 28 | 218584 |
| 3 | 2011-12 | 12 | 5 | 138 | 70 | 338928 |
| 4 | 2012-13 | 8 | 2 | 227 | 18 | 557512 |
| 5 | 2013-14 | 7 | 1 | 236 | 28 | 579616 |

**Example (Calculation)**

As chosen sr.no.05 from Table II Year (2013-14), 1 April 2013 to 31 March 2014,

Details:-

- ∗ No. of Accident = **07**
  (Taken from accident register, form no.31 under factories Act)
- ∗ No. of reportable Accident = **01**
  (Taken from Accident register)
- ∗ Man days lost due to reportable Accident = **28**
  (Taken from Accident register)
- ∗ Man hours worked = **579616**
  (Taken from Attendance register)
- ∗ Avg. no. of employees present in one day = **236**
  (Taken from Attendance register)
- ∗ Total no. of working days in a month = **307**
  (Taken from Attendance register)

We know that—
Total man hours worked = Avg. no. of employees present in one day × No. of working day in a month × 8
⇒ Total man hours worked = 236 × 307 × 8

⇒ Total man hours worked = 579616

Now,

**Frequency Rate**: - It is define as number of disabling accidents per million man-hours worked by factory, in a year.

Purpose – To know how often disabling accidents occur.

$$F.R. = \frac{\text{No.of Accident} \times 10^6}{\text{Total Man\_hours worked}}$$

$$F.R. = \frac{7 \times 10^6}{579616}$$

Frequency Rate = 12.076 "in a calendar year"

**Severity Rate**: - It is define as number of man days lost per million man-hours worked.

Purpose – To know how serious the injuries are. .

$$S.R. = \frac{\text{Men day lost due to reportable accident} \times 10^6}{\text{total man hour worked}}$$

$$S.R. = \frac{28 \times 10^6}{579616}$$

Severity Rate = 4.237"in a calendar year"

**Incident Rates**: - It is ratio of number of accident to numberof employees.

$$I.R. = \frac{No.of\ Accident \times 1000}{\text{Average No. of persons employed}}$$

$$I.R. = \frac{1 \times 1000}{236}$$

Incident Rate = 4.237 "in a calendar year"

Table III. Calculations for F.R. , S.R. & I.R.:

| SN. | Year | Frequency Rate | Severity Rate | Incident Rate | Total Man-hour Worked |
|---|---|---|---|---|---|
| 1 | 2009-10 | 37.502 | 246.44 | 26.315 | 186656 |
| 2 | 2010-11 | 41.174 | 128.09 | 33.707 | 218584 |
| 3 | 2011-12 | 35.405 | 206.53 | 36.281 | 338928 |
| 4 | 2012-13 | 14.349 | 32.29 | 8.286 | 557512 |
| 5 | 2013-14 | 12.076 | 48.31 | 4.237 | 579616 |

## V. CONCLUSION

In The use of hazard analysis methodology Job Safety Analysis for identifying hazards and its consequences by analyzing all the processes. Job Safety Analysis contributes to the prevention of accidents and helps to make the system a safe place to work. Thus in this analysis Job Safety Analysis has been performed in every section of the plant. Potential hazards associated to in different section have been identified and proper control measures have been recommended by preparing Job Safety Analysis.

The purpose of safety performance monitoring or measurement to implementation of safety program in steel processing plant, with view to improve the safety system in future..

## REFERENCES

[1]. Safety at work - John Ridle.

[2]. The factory act 1948

[3]. M.C. Gerstenbergera, A. Christophersena, R. Buxtona, G. Allinson Integrated Risk Assessment for CCS, Energy Procedia **37**(2013) 2775 – 2782.

[4]. P.K. Marhavilas a,b,n, D.E. Koulouriotis, A combined usage of stochastic and quantitative risk assessment methods in the worksites: *Application on an electric power provider, Reliability Engineering and System Safety* **97** (2012) 36–46

[5]. Chunlin Liua, Chong-Kuan Tan, Yea-Saen Fang, Tat-Seng Lok, The Security Risk Assessment Methodology, *International Symposium on Safety Science and Engineering in China*, 2012.

[6]. James E Rauhten, Nathan cruthfield, workplace Hazard Analysis and Review of Associated Risk Job Hazard Analysis, 2008, Pages 39-56

[7]. P.K. Marhavilas, D. Koulouriotis, V. Gemeni , Risk analysis and assessment methodologies in the work sites: On a review, classification and comparative study of the scientific literature of the period(2000-2009), *Journal of Loss prevention in process industries.*

[8] Nenonen, S., 2010. Safety management problems encountered by industrial service providers. In: Proceedings of IEEM 2010, Conference on Industrial Engineering and Engineering Management, Macau, p. 7. (10.12.10).

[9] Blair, E. (2003). Culture & leadership: Seven key points for mproved safety performance. Professional Safety, 48(6), 18–22.