

# Ergonomic Evaluation of Work Environment In steel

## Industry – A case study

Mr. Dnyaneshwar R.Thawkar

M.Tech.(Final year)

B.c.y.r.c.Umrer College of Engineering, Umrer

### Abstract

The Work environment refers to the conditions which are prevalent around the workplace where the worker perform his work. These conditions have significant effect tin the well being and efficiency of workers. Bad working conditions will increase strain of workmen, reduce their efficiency and ultimately result in lower productivity. With these considerations, an attempt is made in this paper to appraise the work environment on the basis of case study in steel Industry in Maharashtra. The appraisal is made in respect to thermal conditions (Temperature, Humidity and Air Velocity), Illumination, Noise and Pollution Agents in House Keeping and Safety for the steel Industries engaged in the processing of steel.

**Keyword:-Thermal condition, Noise and vibration, illumination.**

### 1.0 Introduction

The traditional steel Industry in India is more than a century old. In steel Industries, the physical and chemical agents that are sources of potential health hazards are present in the raw materials, in the processing of raw materials or as by-products of the manufacturing process. In view of this a vast majority of the traditional steel industries in Maharashtra have labour turnover problems. The author has examined the role of physical stress agents on workers in steel industries.

A close observation of the traditional steel industries reveals that the skilled and unskilled, male and female workers of different age groups will be working in a hostile environment that is composed of Air Pollution, Noise Pollution, Poor illumination inadequate ventilation and high temperature, all through the production line. Further, the management's insistence on good house keeping and safety practices is also at its bare minimum. Though several environmental laws are enacted by the Government, the situation in traditional steel industry has not improved over the decades of its existence. The foregoing discussion on the work environment in steel Industries reveals that all sorts of job stress over are present in these industries to make the job severely straining to workers. This highlights the need for ergonomic appraisal of the work environment in steel

industries.

### 1.2 Methodology

The evaluation of work environment is a respect to the following factors:

- Noise & Vibrations.
- Illumination.
- Thermal conditions. (Temperature, Humidity, Air Velocity)
- House Keeping and Safety.

### 1.3 Evaluation Noise

#### 1.3.1 Introduction

Investigations on environmental noise have shown that exposure to high noise levels over extended periods cause harmful effects such as increase in muscular tension which on the other hand increases energy and makes the workmen get fatigued, nervous and irritant. Also, it is identified that unexpected, irregular and infrequent noises will irritate the workers more than the continuous noise of the same intensity. Considering noise as a barrier to worker

productivity, every attempt should be made to evaluate noise levels on a time basis.

The noise levels observed in the steel industries under study are presented in Table - 1. It observed that as much as 75% of the noise

sources in these industries produce intermittent noise of high amplitude. The normal period of exposure to noise in case of these industries spans over the full shift period. Noise is found almost every where in a steel plant from the quarry or mine to packing and loading of cement. The noise levels in the kiln area are fairly large. Scale breaking and WLP and finished sections are the additional sources of noise in a steel Industry. Most of noise sources form an integral part of steel coil production. The noise levels in steel Industry are usually larger than those in case of porcelain manufacturing units,

ceramic industry and of intermittent character.

### 1.3.2 NOISE AND VIBRATION IN STEEL INDUSTRY

In any unwanted sound can be defined as noise.

If decibel level of noise is above the acceptable value (85 db) .

**Effect on man** It causes noise included hearing loss, increases in blood pressure, headache irritation etc. to the people. Permanently damage nerve of inner ear.

#### OSHA standard limit for noise explore

Duration	DB
8 hour	90
4 hour	95
1 hour	105
25 min	115

Steel industry (Equipment name)	Noise Level(DB)
• Coil car	60-116
• Crop shear	69-108
• Shear welder m/c .	72-125
• Wet loop Pit	69-123
• Acid pickling Tank	60-108
• Side trimmer	72-125

#### Evaluation of Noise & Vibration

Table 1

(Sound level measurement)

#### 1.3.3 Recommendation for Prevention of Noise effect

- Where noise is present, identified and reduced at source.
- The use of baffle , sound absorber and acoustic treatment of walls ceiling and floors.
- Noise situations provided personal protective device earplug, earmuffs, & Helmets.

#### 1.4 Evaluation of illumination

##### 1.4.1 Introduction

Natural day light is considered best for working and it should be employed as far as possible. However, it varies from time to time in a day and day to day in a year. Also, it depends upon weather conditions. In order to judge the adequacy of natural lighting in steel

industries, the window area to floor area ratio is taken as an index. Hence, this ratio is calculated for the case study units and the data is presented in Table - 2. The data in Table -2 reveals that in none of the case study units, the natural lighting will be adequate. The steel Industry under study, processing Units do not seem to have paid attention to illumination aspect. Though, the managements replied that they also provided artificial lighting depending upon requirement, the power points and the wattages of bulbs do not suffice the requirement. Further, the number of power points, the wattages of bulbs their number and the distance between them are not fixed on any scientific basis. This only reveals lack of awareness and attention of managements towards this important aspect.

**Evaluation of illumination****Table 2(Measurement of luminance)**

Steel industry (Equipment name)	Luminance (LX )
• Coil car	60-116
• Crop shear	69-150
• Shear welder m/c .	72-125
• Wet loop Pit	175-250
• Acid pickling Tank	69-123
• Side trimmer	60-108

**1.4.3 Recommendation for Prevention of illumination effect**

- Provision of artificial lighting depending upon work.
- Number of power points requirement.
- Number of high wattage bulbs.
- Minimum Distance from work

**1.4.2 Illumination standard**

cat g.	Range of luminance(LX)	Type of activity
A	20-30-50	Public area with dark surrounding.
B	50-75-100	Simple orientation for short temp visit .
C	100-150-200	Working space where visual task of high contrast or small size.
D	200-300-500	Performance of visual task of high contrast or large size reading (printing material, ordinary inspection )
E	500-750-1000	Performance of visual task of medium high contrast or small size.
F	1000-1500-2000	Performance of visual task of low contrast or very small size.
G	2000-3000-5000	Performance of visual task of high contrast or very small size over a prolong period.
H	5000-7000-10000	Performance of special visual task of extremely low contrast or small size.

**Table 3 Evaluations of Thermal Conditions**

Sr. No	steel industry equipment Name	Temp. °C	Humidity (%)	Air Flow Vel. (m/sec)
1.	Coil car	18-45	20-37	3-5
2.	Crop shear	18-45	26-37	1.5-3.2
3.	Shear welder	18-55	25-30	5-8
4.	m/c	18-50	25-38	5-7
5.	Wet loop pit	18-50	25-38	1.5-7
6.	Acid pickling tank	16-40	31-72	1.5-3
	Side Trimmer			

### 1.5.1 Introduction

Human physiology needs a condition of constant temperature for comfortable and satisfactory performance, Heat and humid conditions produce strain in the employees and decrease their ability to concentrate, dexterity of the members of the

### 1.5.3 Recommendation for prevention of effect of thermal condition

- Shielding, isolating heat resource to reduce direct transmission
- Installation & Provision for ventilation.
- Permit rest pause in cool, extreme hot condition.

## 1.6 Evaluation House Keeping and Safety

### 1.6.1 Introduction

The data is generated from the industry. As regards the house keeping and safety practices, basic information is elicited by administering a questionnaire to the managements and workers of the industry. Also they are supported by observations made during follow up personal visits. The qualitative information so collected is normalized by factor analysis method. For this

## 1.5 Evaluation of Thermal Conditions

(Temperature /humidity/air flow)

### 1.5.2 Evaluation of thermal condition

body and their efficiency.

Generally, a working temperature of 18-30 °C is considered optimum; although it depends upon the nature of the work (e.g. sedentary work requires higher temperature while heavy manual work requires lower temperatures). Similarly, a humidity value of 30-70% and air velocity of about 9 mt/min are considered as optimum values.

The data of thermal conditions pertaining to the case study units rerecorded and presented in Table - 3. This Table reveals that the average temperature in steel Industries are always on the higher side. Heat stress in steel industries is primarily a combination of convection and radiation from the scale breaking and from chemical operation. Owing to very high processing temperatures found in these systems, the recorded humidity is also on the discomfort side. The lower values of air flow velocities denote poor ventilation design in these units.

purpose, the following factors, which influence house keeping and safety practices, are assigned weights, on the basis of their relative importance to steel Industries, under study Provision of machine guards and guards on rotating units

### 1.6.2 Recommendation for Prevention of house keeping and safety

- Provision of basic amenities to worker including protective gear.
- Provision of raw material storage and waste material disposal.
- Cleanliness of floor at different areas.
- Display of Do's and Don'ts regarding safe practices
- Periodical colorings of walls,
- Placement of items at right place.

### 1.7. Conclusions

- To evaluate strategy for control of work environment.

With the help of study carried out in steel industries, it is established that the workers in these industries are subjected to hostile environment that is composed of poor illumination, noise pollution, inadequate ventilation, high temperature, and atmospheric pollution. Though, the environmental laws and factory legislation's envisaged the importance of atmospheric control, it appears that the implementation in steel industries calls for a more detailed investigation into the related matters. A dependable statistical record of accidents and their systematic analysis usually helps steel industries to evolve strategies for control of work environment. However, it is observed that the steel industries under case study, could not maintain such as information base, because the work environment in these industries would exhibit damaging effects on workers only in the long run (except silicosis), but not in a readily foreseeable future. Under these circumstances, the managements should implement the technologies with a human fact, for the safety of operatives, rather than viewing at work environment control as a legislative measure

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