Assessment Of Occupational Injuries And Illness Among The Workers In Foundry Environment

[1]N.Nandakumar, [2]M.Arularasu

[1]Asst. Professor, Government College of Technology, Coimbatore, Tamilnadu, India
[2]Principal, Thanthai Periyar Govt. Institute of Technology, Vellore, Tamilnadu, India

Abstract

Occupational safety and health is a very imperative issue and is defined as the condition of being safe and ensuring that occupational accidents and work-related ill-health is prevented as much as possible and safe working environment is promoted. A detail occupational injuries and illness among foundry workers were studied during the period 2012 and 2013 in the small scale foundry industries and the findings were analysed. The variation of accident incidence risks prevailing in different industries or occupational and other such groups can be measured by taking the number of accidents as a proportion to the number of employees in each branch. When this is done, the ratios gained can be regarded as the "risk figures" of a certain occupation or industry. In practice, accident proneness also varies within the same occupation or industry. Many of the workplace and worker characteristics that are associated with injury and illness are inter-related. Risk assessment provides logic and qualitative and/or quantitative bases for analyzing scenarios that can lead to mishaps and accidents. The incident rate, Lost time case rate and DART were calculated for the data's collected and the findings were analyzed.

Keywords: Foundry environment, occupational injuries and illness, Safety performance, Physical hazard.

1. Introduction

The foundry industry is the backbone of other industries and the growth of industrialization and industrial prosperity can be measured by the growth of the foundry industry. The working environments in foundries are characterized by a combination of mechanical, chemical, physical and environmental hazards to mankind. Occupational safety is an important aspect of industries, to protect the workers, supervisors, management and staff employed in them apart from improving productivity by reducing the losses that may arise due to occurrence of accidents. Some are major, with injuries to workers and damage to property, but most are minor and don't involve time lost, medical care or repairs to property. Accidents are described as occurrences and their causes that may lead to property damage or work injuries. Certainly every worker has the right to expect a safe and healthy environment in which to work and most companies provide a safe and healthful work environment for their employees.

2. Review of Occupational Injuries and Illness

The Occupational Injuries and Illness (OII) reviews state that the World Health Organization (WHO) [10] noted that physical and chemical agents generated by man's activities may have various effects on human being. Though some substances may not produce adverse effects, others may be liable, for growth and development. The iron and steel industries have foundries consisting of oven and furnaces; which involve heat, noise, vibration, and dusty environments. Therefore, iron and steel workers are especially prone to occupational health problems and experience more sickness absenteeism [15]. The heavy physical workloads are occurred when pouring, moldings as well as fettling process are done by manually.

These chemicophysical characteristic linked to various disease [11] and the heavy physical workload increased risk of fatal injury [12] According to the data of year 2009 for National Programme for Control and Treatment of Occupational Diseases there are 100 million occupational injuries in India causing 0.1 million deaths. It is also estimated that in India, 17 million occupational nonfatal injuries (17% of the world) and 45,000 fatal injuries (45% of the total deaths due to occupational injuries in world) occur each year. Out of 11 million cases of occupational diseases in the world, 1.9 million (17%) are contributed by India; and out of 0.7 million deaths in the world, 0.12 million (17%) is contributed by India.[16] The prevalence of occupation-related injuries in the present study was 18.75% of which majority (94.66%) were in group A. The maximum number of cases were seen due to electric flash (78 cases or 28.9%) and slag burn (70 cases or 25.9%). Flame burn (39 cases or 14.4%), electrical contact (30 cases or 11.1%), gaseous burn (20 cases or 7.4%), scald (18 cases or 6.7%), and chemical burn (15 cases or 5.6%) were accounting for the rest.[17]

Safe Work Australia (2009-2010) mentioned that out of 3,226 employees of construction site, 306 (9.5%) were suffering from injuries. Boiler makers and welders suffered 16.0% of construction eye injuries. In broader terms, being hit

(by moving and falling objects) was the mechanism involved in 241 cases (78.7%). [18]

3. Materials and method

The research was conducted by an intricate study and collection of data on occupational injuries and illness among workers in small-scale foundries by research design. It includes problem definition, data collection; data analysis and interpretation of results. The survey is a non-experimental, descriptive research method. It is also a form of ex-post facto research in which the researcher collects data about certain sociological or psychological characteristic of a sample that represent a known population. These data are based on Occupational Safety and Health Administration (OSHA) recordkeeping requirements, which are a set of definitions and explanations used by employers to maintain workplace safety records for their establishment.

The Occupational Safety and Health Act of 1970 (the OSH Act) requires employers selected to maintain these records, which are used by employers to complete the annual Survey of Occupational Injuries and Illnesses (SOII). Occupational injuries and illness data collection form were given to twenty industries having more than twenty workers. The data's were collected for two consecutive years and the findings were analyzed.

4. Injuries and Illness calculation

Incident rates are indication of how many incidents have occurred, or how severe they were from the work-related injuries and illness. An incident rate is the number of recordable injuries and illness occurring among a given number of workers, usually one-hundred workers over a given period of time usually one year. These are measurements of past performance or lagging indicators.

Incident rates are one of many items that can be used for measuring performance, most of which are optimistic in nature; incident rates tend to be viewed as an indication of something is wrong with the safety system, rather than what is positive or right about the system. In spite of this, for many companies, incident rates remain the prime indicator of safety performance measurement. This is primarily because incident rates are fairly suitable to figure out, and can be easily compared between one company and another, and are used throughout the industry.

The standard base rate for the calculations is based on a rate of 200,000 labor hours. This number (200,000) equates to 100 employees, who work 40 hours per week, and who work 50 weeks per year. Using this standardized base rate, we can calculate the rate(s) and get a percentage per 100 employees.

4.1 Recordable incident rate (IR)

Recordable incidents include all work related deaths, illnesses, and injuries which result in a loss of consciousness, restriction of work or motion, permanent transfer to another job within the company, or require some type of medical treatment or first-aid. Companies with ten or more employees need to report their incident rates, types of incidents and lost/restricted work days and should maintain the record. The incident rate is calculated from the formula,

$$IR = \frac{N \times 200{,}000}{EH}$$

N - Total number of recorded injuries and illness
EH - Total hours worked by all employees during the calendar year
200,000 - Base for 100 equivalent workers (working 40 hours   per week, 50 weeks per year)

4.2 Lost Time Case Rate (LTC)

Any recordable occupational work-related injury or illness which results an employee being unable to work a full assigned work shift on the next day is termed as LTC. Lost time cases result when there are no reasonable circumstances under which the injured employee could return to meaningful work. Once a decision has been made that an injury or illness should be considered as a Lost Time Case (LTC), the number of days charged to that case is the number of days an employee lost work because of the incident. The lost time case rate is calculated using the formula,

$$LTC = \frac{LT \times 200{,}000}{EH}$$

LT - Total number of recorded lost time cases
EH - Total hours worked by all employees during the calendar year

4.3 Days Away, Restricted or Jog Transfer Rate (DART)

It is basically a safety metric that shows how many workplace injuries and illnesses caused the affected employees to remain away from work, restricted their work activities or transferred to another job as they were unable to do their usual job within a calendar year. Calculating the DART rate allows executives, supervisors and safety personnel to identify safety issues in the workplace. The formula for calculation is,

$$DART = \frac{DT \times 200{,}000}{EH}$$

DT = Total Number of DART incidents

EH = Total hours worked by all employees during the calendar year

A detail study was conducted to calculate the incident rate from twenty foundry industries for the year 2012 and the recordable Incident Rate (IR), Lost Time Case Rate (LTC) and Days Away, Restricted or Job Transfer Rate (DART) were shown in the Table 1

5. Findings and discussion

Table. 1 Results of occupational injuries and illness

Industry involved	N	LT	DT	EH	IR	LTC	DART
C1	11	3	2	107800	20.4	5.6	3.7
C2	14	2	4	132864	21.1	3.0	6.0
C3	7	1	0	110400	12.7	1.8	0.0
C4	17	5	3	143936	23.6	6.9	4.2
C5	13	3	2	94944	27.4	6.3	4.2
C6	9	3	2	100548	17.9	6.0	4.0
C7	6	4	1	111936	10.7	7.1	1.8
C8	12	7	3	163404	14.7	8.6	3.7
C9	16	11	5	120384	26.6	18.3	8.3
C10	13	6	2	134940	19.3	8.9	3.0
C11	18	2	0	113568	31.7	3.5	0.0
C12	11	7	1	109440	20.1	12.8	1.8
C13	8	2	0	113520	14.1	3.5	0.0
C14	17	9	7	129792	26.2	13.9	10.8
C15	21	13	5	151164	27.8	17.2	6.6
C16	14	7	3	97944	28.6	14.3	6.1
C17	13	3	1	132096	19.7	4.5	1.5
C18	19	9	5	155456	24.4	11.6	6.4
C19	12	4	2	151606	15.8	5.3	2.6
C20	8	5	3	104972	15.2	9.5	5.7

N - Total number of recorded injuries and illness

EH - Total hours worked by all employees during the calendar year

LT = Total number of recorded lost time cases
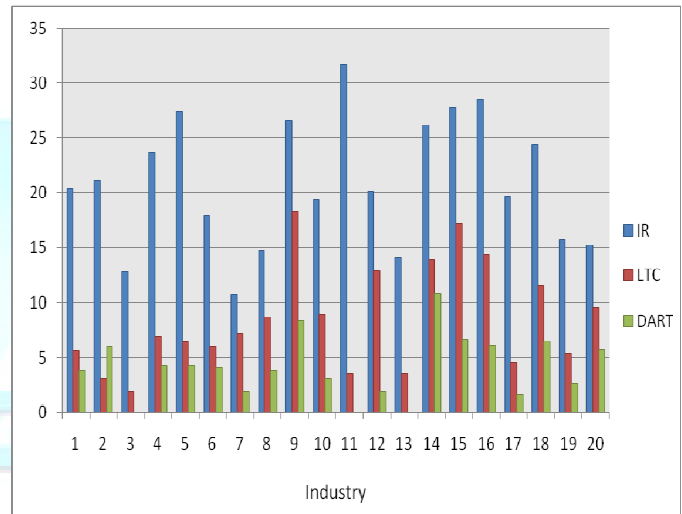
DT = Total Number of DART incidents

Fig. 1 Injuries and illness statistics

From the above calculated results shown in figure 2, for the company C1, the findings shows that the incident rate, for every 100 employees, 20.4 employees have been involved in a recordable injury or illness, 5.6 employees have suffered lost time case rate because of a work related injury or illness. 3.7 percent of employees have workplace injuries and illnesses caused the affected employees to remain away from work, restricted their work activities or transferred to another job as they were unable to do their usual job within a calendar year.

Table 2. Results of OII

Industry involved	N	LT	DT	EH	IR	LTC	DART
C1	14	9	5	107184	26.1	16.8	9.3
C2	12	8	2	132096	18.2	12.1	3.0
C3	11	5	2	108800	20.2	9.2	3.7
C4	14	6	5	143520	19.5	8.4	7.0
C5	15	7	2	94392	31.8	14.8	4.2
C6	11	3	3	99960	22.0	6.0	6.0

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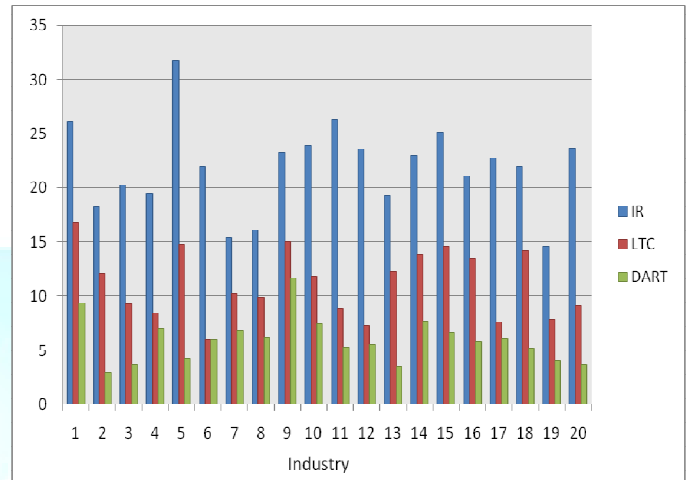|							
C7	9	6	4	116864	15.4	10.3	6.8
C8	13	8	5	161568	16.1	9.9	6.2
C9	14	9	7	120384	23.3	15.0	11.6
C10	16	8	5	134160	23.9	11.9	7.5
C11	15	5	3	114240	26.3	8.8	5.3
C12	13	4	3	110080	23.6	7.3	5.5
C13	11	7	2	114180	19.3	12.3	3.5
C14	15	9	5	130560	23.0	13.8	7.7
C15	19	11	5	151164	25.1	14.6	6.6
C16	11	7	3	104104	21.1	13.4	5.8
C17	15	5	4	131328	22.8	7.6	6.1
C18	17	11	4	154560	22.0	14.2	5.2
C19	11	6	3	151164	14.6	7.9	4.0
C20	13	5	2	109480	23.7	9.1	3.7

Fig. 2 Injuries and illness statistics.

From the above calculated results for the company C1, the findings shows the incident rate, that for every 100 employees, 26.1 employees have been involved in a recordable injury or illness, 16.8 employees have suffered lost time case rate because of a work related injury or illness. 9.3 percent of employees have workplace injuries and illnesses caused the affected employees to remain away from work, restricted their work activities or transferred to another job as they were unable to do their usual job within a calendar year. The calculated relative occupational injuries and illness for the year 2012 and 2013 is shown in table 3.

The calculated results for the year 2012 shown in table 2, the company C1, the findings shows that the incident rate, for every 100 employees, 26.1 employees have been involved in a recordable injury or illness, 16.8 employees have suffered lost time case rate because of a work related injury or illness. 9.3 percent of employees have workplace injuries and illnesses as shown in figure 2 caused the affected employees to remain away from work, restricted their work activities or transferred to another job as they were unable to do their usual job within a calendar year. From the findings it shows that the safety practice in all the hazardous areas should be strictly followed to reduce the occupational injuries and illness.

Table. 3 Results of relative injuries and illness (Year 2012 -2013)

Industry involved	Year 2012			Year 2013			Year 2012			Year 2013		
	N	LT	DT	N	LT	DT	IR	LTC	DART	IR	LTC	DART
C1	11	3	2	14	9	5	20.4	5.6	3.7	26.1	16.8	9.3
C2	14	2	4	12	8	2	21.1	3	6	18.2	12.1	3
C3	7	1	0	11	5	2	12.7	1.8	0	20.2	9.2	3.7
C4	17	5	3	14	6	5	23.6	6.9	4.2	19.5	8.4	7

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C5	13	3	2	15	7	2	27.4	6.3	4.2	31.8	14.8	4.2
C6	9	3	2	11	3	3	17.9	6	4	22	6	6
C7	6	4	1	9	6	4	10.7	7.1	1.8	15.4	10.3	6.8
C8	12	7	3	13	8	5	14.7	8.6	3.7	16.1	9.9	6.2
C9	16	11	5	14	9	7	26.6	18.3	8.3	23.3	15	11.6
C10	13	6	2	16	8	5	19.3	8.9	3	23.9	11.9	7.5
C11	18	2	0	15	5	3	31.7	3.5	0	26.3	8.8	5.3
C12	11	7	1	13	4	3	20.1	12.8	1.8	23.6	7.3	5.5
C13	8	2	0	11	7	2	14.1	3.5	0	19.3	12.3	3.5
C14	17	9	7	15	9	5	26.2	13.9	10.8	23	13.8	7.7
C15	21	13	5	19	11	5	27.8	17.2	6.6	25.1	14.6	6.6
C16	14	7	3	11	7	3	28.6	14.3	6.1	21.1	13.4	5.8
C17	13	3	1	15	5	4	19.7	4.5	1.5	22.8	7.6	6.1
C18	19	9	5	17	11	4	24.4	11.6	6.4	22	14.2	5.2
C19	12	4	2	11	6	3	15.8	5.3	2.6	14.6	7.9	4
C20	8	5	3	13	5	2	15.2	9.5	5.7	23.7	9.1	3.7

The calculated relative incident rate for the occupational injuries and illness during the year 2012 and 2013 is shown in the figure 3. Industries which follow the safety norms and insist the workers to adopt the safety practice will have the chances of reduction in occupational injuries and illness. The relative calculated findings revels that the maximum possibilities of accidents are above the threshold limit.
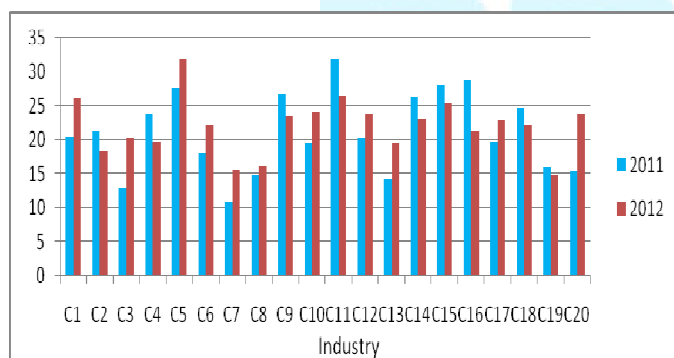
2013 is shown in the figure 4. The findings from the calculated study shows that young workers had higher incidence rates of work-related injury than older workers, with the difference between the incidence rates of young and older workers greatest in the manufacturing,
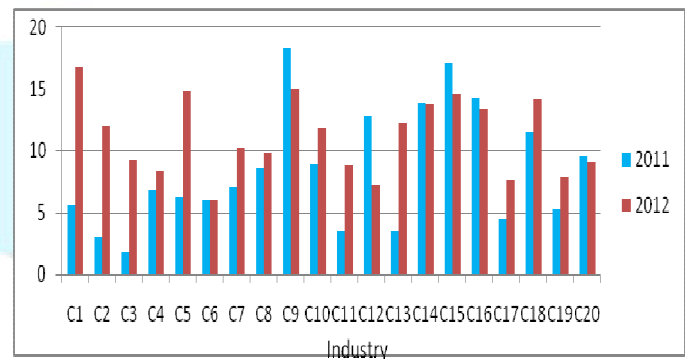

Fig. 3 Relative Incident rate

Fig. 4 Relative lost time case rate

The calculated relative lost time case rate for the occupational injuries and illness during the year 2012 and
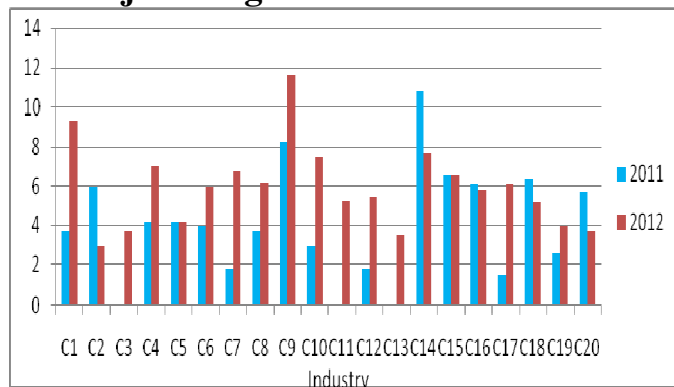
Fig. 5 Relative DART rate

6. Conclusions

Foundry workers may be exposed to a variety of numerous health hazards and accidents, owing to inherent hazardous conditions in foundries including chemical, physical and mechanical agents. The four surveyed foundries for chemical and physical hazards and accidents records in the present work were different mainly in applied technology and capacity and workload. The results of the present study revealed that the majority of the assessed occupational hazards were not within threshold limit. The physical hazard was exceeding the threshold limit values and shows that enforcement in safety activities and trainings must be given for some companies.

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