

AN EMPIRICAL STUDY ON INDUSTRIAL ACCIDENTS & PREVENTION OF ACCIDENTS IN TI CYCLES OF INDIA, AMBATUR

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Abstract: *This study highlights the most normal accidents experienced by assembly laborers working in TI Cycles of India. Models of human damage mechanics were especially all around created and required just simple types of errand examination to control the advancement of more secure working conditions. The general models of the accident procedure were connected widely in the reviewed application techniques. The examination instrument utilized as a part of our study is primarily Questionnaire. The sample size is 200. Descriptive research is received in leading this study. The simple percentage is used in the investigation, chi square examination and undertaken and t – test. In any case, models of human blunder and dangerous conduct were connected just in an extremely simple structure. This to some extent seems to clarify certain inadequacies in conventional peril examination.*

Key Words: *Types of industrial accidents, accidents measurement, accident analysis, various steps to prevent industrial accidents.*

INTRODUCTION

Hundreds of years passed, it is evident humankind has created in numerous fields particularly industry and numerous. These improvements additionally required the requirement for security as there continues the ever threat of risk possibilities in any modern setup that might make debacle human life, materials and hardware which will affect the efficiency of the country all in all over the long haul. Life of mechanical specialists is turning out to be more risky as modern foundations are turning out to be more in number, size and complexity. Each year lakhs and lakhs of laborers are harmed in industrial facilities, mines and workshops prompting wounds, perpetual impediment and now and then even to passings. Supervisors, Engineers and Psychologists are working persistently to diminish, if not, anticipate mischances inside and out and give a protected workplace. Administrators are

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taking enhancements to enhance choice procedure to pickup right kind of laborers and give them sufficient preparing and supervision to minimize such setbacks. Modern specialists are concentrating their consideration towards enhancing the outlines of work environment, the format choice of types of gear and machines. Analysts are locked in with the hypothetical thought concerning causation of mishaps and understanding the mental attitude of individual specialists who are included in mishaps every now and again and recognizable proof of “clumsy” laborers. Sociologists consider mishaps as a social issue and they investigate ecological components like financial, religio-social and demographic variables which impact the rate of mischance to locate their individual and joined effect on individual laborers to create to right mentality and work society which can diminish mishaps eventually.

Objectives of the Study

- Identify the causes of accidents.
- Analyse the causes of accidents.
- Analyse previous three-year accident records.
- Suggest possible measures to prevent accidents.

Industry Profile

TI CYCLES OF INDIA is one of the largest bicycles in Asia, which manufactures High quality bicycles for both domestic and international markets. It was set up in 1949 at Ambattur in collaboration with the Tube Investments Limited; (now known as TI Group) This pioneering venture has grown into a multi-unit company. TI Cycles manufactures and Markets the Hercules, Philips and BSA Brands of bicycles. Great care is taken at the Manufacturing and to ensure the highest standards of product quality and performance, for which TI Cycle is known; with all this and more Cycles Plant II is the only bicycles plant in India, and third such in the world to have received ISO 9002 certification a tribute to its quality Control systems and procedures.

REVIEW OF LITERATURE

Meaning of Accident

The term mishap is characterized as “a unintended event emerging out of and over the span of livelihood of a man bringing about harm”. The mishap is “a spontaneous and uncontrolled occasion in which an activity (or) Reaction of an article, a substance, a man, (or) a radiation results in individual harm.

The significance of mishap has fluctuated after some time. Before all else of human advancement mishaps were considered as being from the divine beings (Grimaldi and Simonds 1984 p. 27; Hale 2003 p. 330; Kjellén 2000 p. 3; Loimer et al. 1996). They were for the most part reasons for nature or associated with them. Mechanical mishaps – as we now comprehend them – are connected to work. Before the Industrial Revolution mischances were uncommon events, for the most part including laborers and not outside individuals (Heinrich 1959 p. 423). In the first place of the Industrial Revolution the quantity of mischances expanded: mechanical mishaps and passings were regular (Anton 1989 p.372-376; Loimer et al. 1996) in the meantime, the nature of mischances changed: mishaps were more genuine furthermore harmed or killed persons who were not straightforwardly joined with the working circumstance (Kjellén 2000).

Despite the fact that mischance is a straightforward word the significance of it fluctuates in various settings (Harms-Ringdahl 2001 p. 13). Mishap is a more extensive idea than mechanical mischance, which is one and only sort of mischance (Heinrich 1959 p. 3). Mishap is something a man does not for the most part consider, but rather the likelihood of it is available (Hollnagel 2004 p. 3). Mischance is a word which has numerous implications, contingent upon the setting. Mishap can be, e.g. mechanical mischance, modern mishap, (modern) harm, car crash, home and relaxation mischance. In the wellbeing field a mishap is commonly comprehended as an event which prompts damage (Heinrich 1959), or different misfortune and hurt (Hollnagel 2004).

There are two sorts of mishap: individual mischances and hierarchical mishaps. Singular mischances are more normal, while authoritative mishaps are similarly uncommon, yet frequently calamitous. Hierarchical mishaps are occasions which happen inside of complex current advances and have various reasons. In an individual mischance the individual is normally both the specialists and the casualty of the mishap. (Reason 1997 p. 1) Nevertheless, mischances have been characterized in a few ways. Taylor (1976) isolated diverse definitions into four classes, as takes after:

1. Definition by outcome: modern mishap measurements are normally in light of this definition.
2. Definition by predecessor: past occasions are characterized.
3. Definition by expectation: targets and intentions of the activity are characterized.
4. Definition by defense: more often than not there is an endeavor to discover the reasons or individual who is in charge of the mishap. In light of legal operation.

Hollnagell (2004 pp. 5-6, 10) characterizes mischance as a short, sudden and unforeseen occasion that is specifically or in a roundabout way the consequence of human movement instead of, e.g. a characteristic occasion like a tremor. A mishap is short as opposed to gradually creating, and sudden all of a sudden. The result must be negative. Leaving from the customary depiction of mischance, Hollnagell (2004 p. 7) incorporates both surprising occasion and undesirable result as a component of a mischance (Figure 2.1). Normally, mischance is characterized as the consequence of a surprising occasion prompting an undesirable result coming about because of the mishap.

Significance of Industry

By area 2 (j) as substituted the Amendment Act of 1982, industry Means, “any deliberate action carried on by co-operation between a business and his Workmen. The laborers might be utilized straightforwardly (or) through any offices, including a Contractor.

Significance of Industrial Accidents

By Factories act, 1948 characterized mechanical mischances is “an Occurrence in a modern foundation bringing about substantial harm to a man which makes him unfit to resume his obligations in the following 48 hours”.

A mechanical mishap is, similarly as a mischance, an undesirable, spontaneous and uncontrolled occasion influencing individuals, the work environment and society. It is additionally an even which has been utilized as the premise for sorted out security work in organizations from not long after the Industrial Revolution (Grimaldi and Simonds 1984 p. 8). The term mechanical mishap and its importance fluctuate from nation to nation. There is no broad understanding about its definition (Boyle 2003 p. 263; Loimer et al. 1996) and a definition for it is elusive. The Oxford Dictionary of English and the Oxford American Dictionary of Current English don't characterize the term mechanical mischance or damage. Collins English Dictionary characterizes mechanical mischance and modern harm as synonymous. Different equivalent words are: mishap at work, mechanical mischance and working environment mishap.

All the time is felt that mechanical mischances might include a few wounds and/or other damage in associations. The International Labor Organizations (ILO) characterizes modern mishap as an event which brings about a lethal mechanical harm and/or non-deadly modern damage. This definition along these lines incorporates just individual damage as a piece of modern mischance. The definition does exclude different misfortunes. Definitions can likewise be found where modern damage is comprehended as a more extensive idea than

mechanical mischance (Andersson p. 17). Hurts Ringdahl (2001 p. 13) proposes that mechanical wounds can happen in an assortment of ways. By, mechanical wounds can be isolated into three classes:

1. Industrial mishaps – mischances happening in the working environment.
2. Industrial infection – hurtful impacts of work that are not because of a mishap, for example, over-effort wounds, hypersensitivities or listening to grumblings.
3. Commuting mishap – mischance happening while in transit to or from the working place.

TYPES OF INDUSTRIAL ACCIDENTS

Reportable Accidents

Any accident for which the victim is not able to report to duty within 48 hours from the time of accident.

Non-Reportable Accidents

Any accident for which the victim is able to report to duty within 48 hours from the time of accident.

Serious Accidents

Accidents, which prevent the victim from reporting to duty not less than 21 days from the day of accident.

Fatal Accidents

Accidents causing disaster to an employee's life is termed as fatal accidents, which may lead to death them.

ACCIDENT MEASUREMENTS

Frequency Rate

Frequency rate is the relationship between the total numbers of accidents Per million hours to the total number of man-hours worked.

Formula:

$$\text{Frequency Rate} = \frac{\text{Total number of accidents} * 1000000}{\text{Total number of man-hours worked}}$$

Severity Rate

Severity rate is the relationship between total numbers of man-days lost per Million hours to the total number of man-hours.

Formula:

$$\text{Severity Rate} = \frac{\text{Total number of man-hours lost* worked } 1000000}{\text{Total number of man-hours worked}}$$

ACCIDENT ANALYSIS FROM 2012 – 2015

Year Wise Accidents

| S. No. | Details | 2012 – 2013 | 2013 – 2014 | 2014 – 2015 |
|--------|--|-------------|-------------|-------------|
| 1 | Total Accident | 198 | 218 | 112 |
| 2 | Reportable Accidents (more than 48 hours) | 67 | 87 | 32 |
| 3 | Serious Accidents (more than 21 days away from the work) | 7 | 10 | 4 |
| 4 | Man hour worked | 7644839 | 7870095 | 6158034 |
| 5 | Average number of men worked | 3215 | 3005 | 2726 |
| 6 | Frequency Rate | 8.76 | 12.37 | 5.2 |
| 7 | Severity Rate | 156.73 | 116.89 | 67.3 |

RESEARCH METHODOLOGY

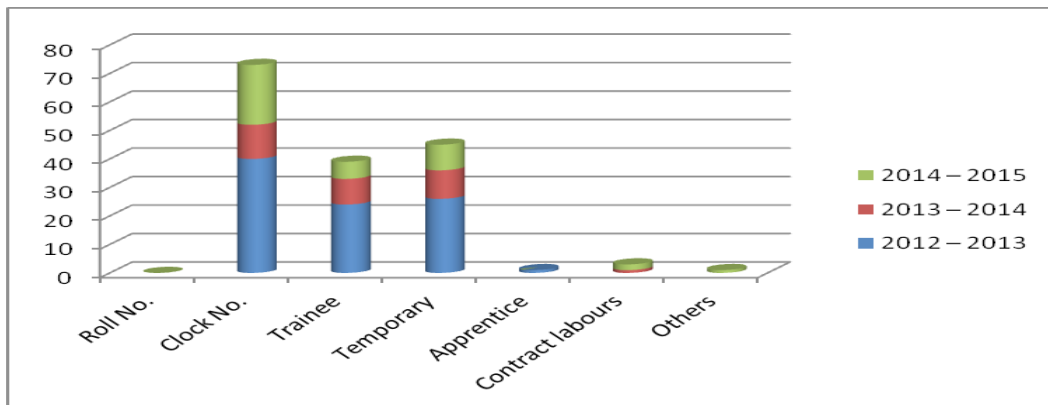
- i) **RESEARCH TYPE** - Descriptive research Studies often involve the description of the extent of association between two or more variables.
- ii) **RESEARCH AREA** - The study was conducted for the employees in TICI, Ambatur.
- iii) **SAMPLING TECHNIQUE:**
SAMPLING DESIGN - Convenience Sampling, We confined our study using Convenience Sampling. Due to the population is very large; we took some samples only and collected data.
SAMPLE SIZE - NUMBER OF RESPONDENTS: 200
- iv) **RESEARCH INSTRUMENT** - *Questionnaire*.

- v) **CONTACT METHOD** - The contact method used in our study is *personal* method.
- vi) **DATA SOURCES** - Data collection methods used for the study are primary and secondary.
- vii) **STATISTICAL TOOLS:**
 - **Percentage Analysis**
 - **Chi-square test**
 - **Student's – t test**

DATA ANALYSIS AND INTERPRETATION

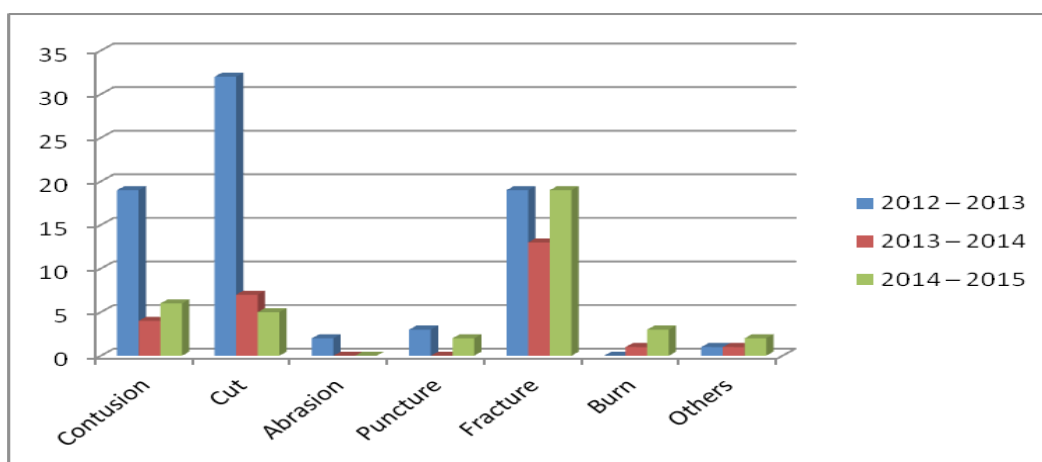
Accident Analysis – Category Wise Reportable

| Category | 2012 – 2013 | 2013 – 2014 | 2014 – 2015 |
|------------------|-------------|-------------|-------------|
| Roll No. | 0 | 0 | 0 |
| Clock No. | 40 | 12 | 21 |
| Trainee | 24 | 9 | 6 |
| Temporary | 26 | 10 | 9 |
| Apprentice | 1 | 0 | 0 |
| Contract labours | 0 | 1 | 2 |
| Others | 0 | 0 | 1 |

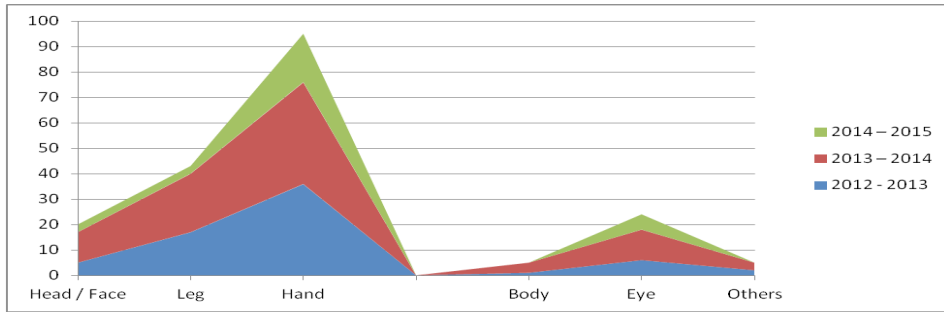


ACCIDENT ANALYSIS – NATURE OF INJURY WISE

| <i>Nature Wise</i> | <i>2012 – 2013</i> | <i>2013 – 2014</i> | <i>2014 – 2015</i> |
|--------------------|--------------------|--------------------|--------------------|
| Contusion | 19 | 4 | 6 |
| Cut | 32 | 7 | 5 |
| Abrasion | 2 | 0 | 0 |
| Puncture | 3 | 0 | 2 |
| Fracture | 19 | 13 | 19 |
| Burn | 0 | 1 | 3 |
| Others | 1 | 1 | 2 |

**ACCIDENT ANALYSIS – PART OF BODY WISE (REPORTABLE)**

| <i>Part of Body</i> | <i>2012 - 2013</i> | <i>2013 – 2014</i> | <i>2014 – 2015</i> |
|---------------------|--------------------|--------------------|--------------------|
| Head / Face | 5 | 12 | 3 |
| Leg | 17 | 23 | 3 |
| Hand | 36 | 40 | 19 |
| Body | 1 | 4 | 0 |
| Eye | 6 | 12 | 6 |
| Others | 2 | 3 | 0 |

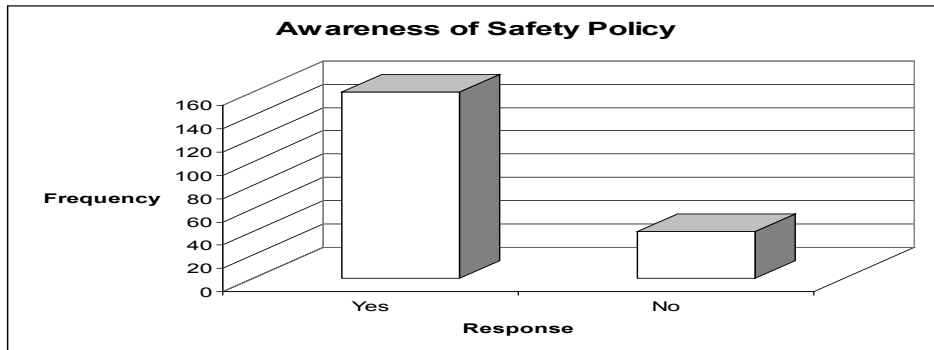


PERCENTAGE TEST

1. Do you know that your company has aware safety policy?

| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|-----------------|------------------|-----------------------|
| Yes | 160 | 80 |
| No | 40 | 20 |
| Total | 200 | 100 |

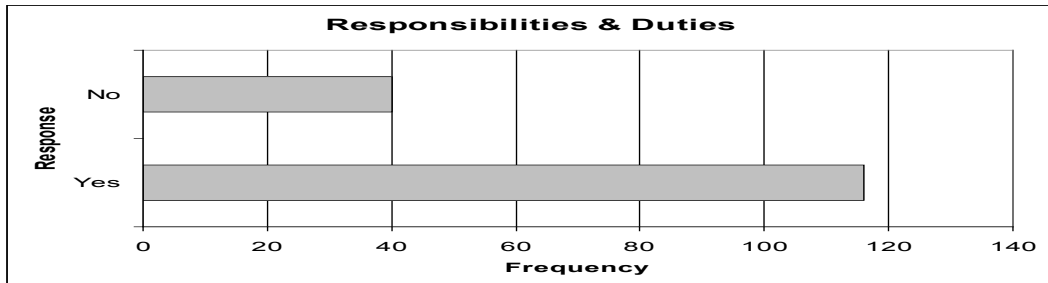
Inference: Most of the employees aware of safety policy.



1(a). If “yes”, employees responsibilities and duties clearly set out in the organization.

| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|-----------------|------------------|-----------------------|
| Yes | 116 | 72.5 |
| No | 40 | 27.5 |
| Total | 160 | 100 |

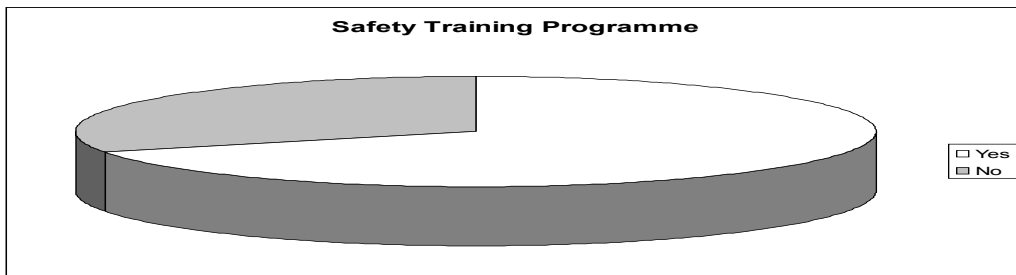
Inference: Most of the employees are clearly known the duties and responsibilities set out in the organisation.



2. Have you attended any safety training programme previously?

| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|-----------------|------------------|-----------------------|
| Yes | 138 | 69 |
| No | 62 | 31 |
| Total | 200 | 100 |

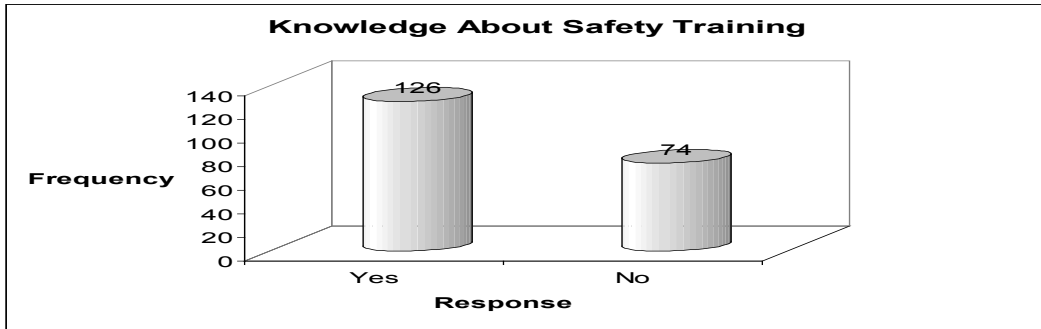
Inference: Majority of the employees attended the safety training programme.



3. Have you gained knowledge after attending safety training programme?

| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|-----------------|------------------|-----------------------|
| Yes | 126 | 63 |
| No | 74 | 37 |
| Total | 200 | 100 |

Inference: Most of the employees have gained knowledge after attending safety training programme.



3(a). If "yes". The skills gained by

| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|---------------------------|------------------|-----------------------|
| Accident Prevention Skill | 43 | 34.13 |
| Accident Management Skill | 37 | 22.77 |
| Safety Awareness Skill | 33 | 26.19 |
| Not Gained Anything | 13 | 10.31 |
| Total | 126 | 100.0 |

Inference: Majority of the employees gained the accident prevention skill.



4. In last three years have you ever met with an accident in your place?

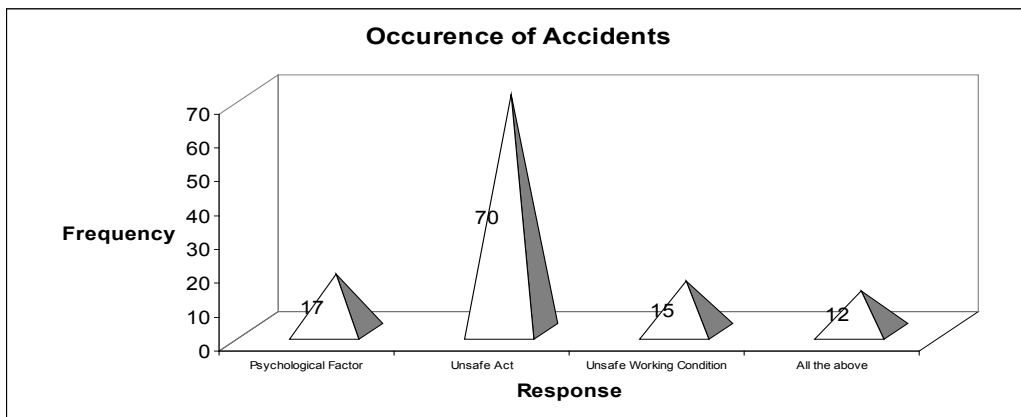
| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|-----------------|------------------|-----------------------|
| Yes | 114 | 57 |
| No | 86 | 43 |
| Total | 200 | 100 |

Inference: Most of the employees have ever met with an accident.

4(a). If “yes”, the accident occurs due to

| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|--------------------------|------------------|-----------------------|
| Psychological Factor | 17 | 14.91 |
| Unsafe Act | 70 | 61.40 |
| Unsafe Working Condition | 15 | 13.16 |
| All the above | 12 | 10.53 |
| Total | 114 | 100 |

Inference: From the above table majority of the accidents occur due to unsafe act.

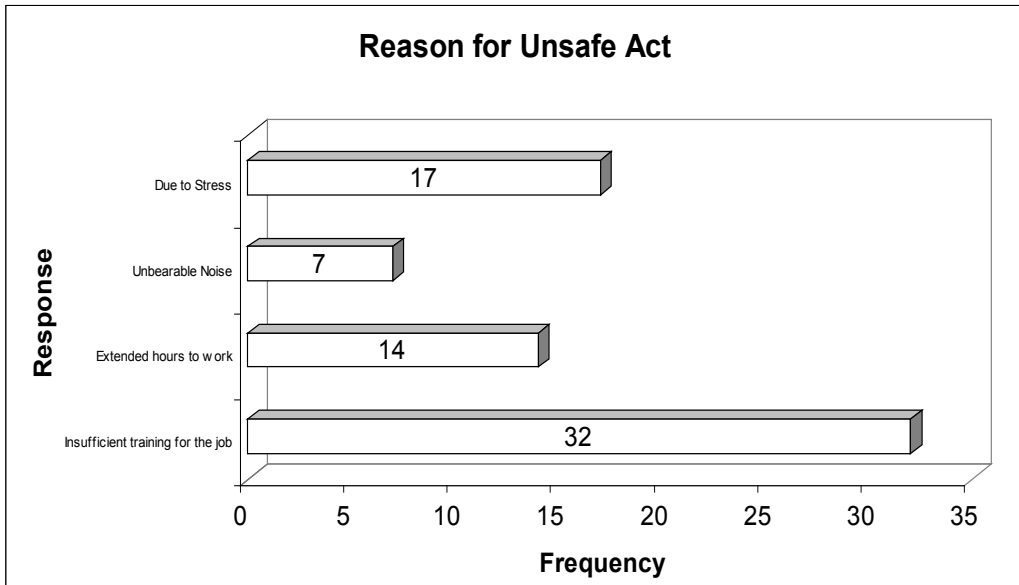


4(b). If the accidents are due to unsafe act, the reason is due to

| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|-----------------------------------|------------------|-----------------------|
| Insufficient training for the job | 17 | 24.29 |
| Extended hours to work | 14 | 20 |

| | | |
|------------------|-----------|------------|
| Unbearable Noise | 7 | 10 |
| Due to Stress | 32 | 45.71 |
| Total | 70 | 100 |

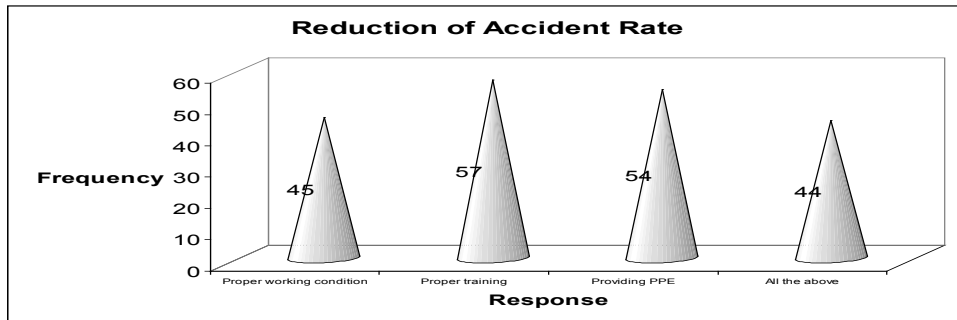
Inference: Most of the accidents are occurred due to stress.



5. How can you reduce the accident rate?

| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|--------------------------|------------------|-----------------------|
| Proper working condition | 45 | 22.5 |
| Proper training | 57 | 28.5 |
| Providing PPE | 54 | 27 |
| All the above | 44 | 22 |
| Total | 200 | 100 |

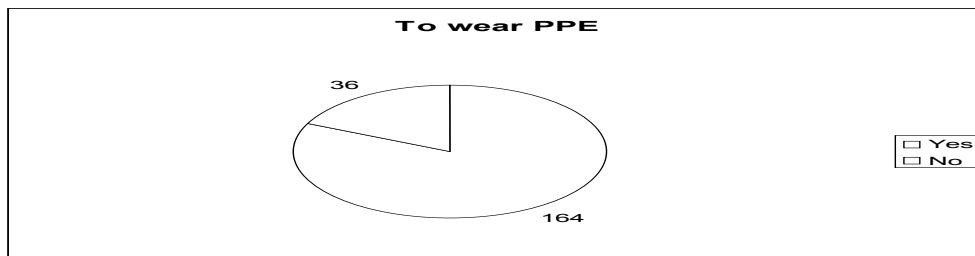
Inference: The accident rate is reduced due to proper training.



6. Do you wear Personal Productive Equipment (PPEs) to prevent accidents?

| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|-----------------|------------------|-----------------------|
| Yes | 164 | 82 |
| No | 36 | 18 |
| Total | 200 | 100 |

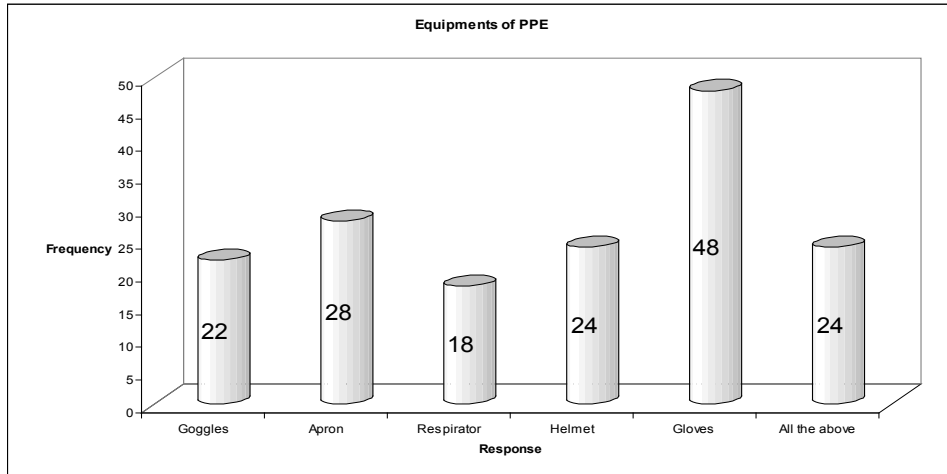
Inference: Majority of the employees wear Personal Productive Equipment.



6(a) If "Yes", what are the equipments are use in the working place?

| <i>Response</i> | <i>Frequency</i> | <i>Percentage (%)</i> |
|-----------------|------------------|-----------------------|
| Goggles | 22 | 13.42 |
| Apron | 28 | 17.07 |
| Respirator | 18 | 10.98 |
| Helmet | 24 | 14.63 |
| Gloves | 48 | 29.27 |
| All the above | 24 | 14.63 |
| Total | 164 | 100 |

Inference: Most of the employees use gloves in the working place.



I. CHI – SQUARE TEST

Null Hypothesis (H_0): There is no significant difference between salary and safety policy.

Alternative Hypothesis (H_1): There is a significant difference between salary and safety policy.

| Safety Policy / Salary | <5000 | 5001-10000 | 10001-15000 | >15000 | Total |
|------------------------|-----------|------------|-------------|-----------|------------|
| Awareness | 17 | 68 | 52 | 21 | 160 |
| Not Awareness | 8 | 16 | 12 | 6 | 40 |
| Total | 25 | 84 | 64 | 27 | 200 |

Calculation of Chi-Square

| Salary | O.F (O) | E.F (E) | (O – E) | (O – E) ² | (O – E) ² / E |
|---------------|------------|------------|----------|----------------------|--------------------------|
| <5000 | 25 | 50 | -25 | 625 | 12.5 |
| 5001 – 10000 | 84 | 50 | 34 | 1156 | 23.12 |
| 10001 – 15000 | 64 | 50 | 14 | 196 | 3.92 |
| >15000 | 27 | 50 | -23 | 529 | 10.58 |
| Total | 200 | 200 | 0 | 2506 | 50.12 |

Therefore Calculated of $X^2 = \Sigma (O - E)^2 / E = 50.12$

$$\begin{aligned} \text{Degrees of freedom} &= (R-1)(C-1) \\ &= (2-1)(4-1) \\ &= 3 \end{aligned}$$

The tabulated value of X^2 for 3 d.f. at 5% level of significance = 7.815

Since Calculated of $X^2 >$ Tabulated value of X^2 .

Therefore we reject the null hypothesis.

Hence, there is a significant difference between salary and safety policy.

II. STUDENT'S T – TEST:

Null Hypothesis (H_0): There is no significant difference between before and after attending the safety training programme.

Alternative Hypothesis (H_1): There is significant difference between before and after attending the safety training programme.

| <i>Safety Training / Module</i> | <i>Home Welded Module</i> | <i>Standard Module</i> | <i>Dispatch Module</i> | <i>Brazed Special Module</i> | <i>Total</i> |
|-------------------------------------|-------------------------------|----------------------------|----------------------------|----------------------------------|--------------|
| Before attending safety training | 16 | 19 | 20 | 17 | 72 |
| After attending safety training | 36 | 32 | 29 | 31 | 128 |
| Total | 52 | 51 | 49 | 48 | 200 |

Calculation of t – test:

| X | $X - \bar{X}$ | $(X - \bar{X})^2$ | Y | $Y - \bar{Y}$ | $(Y - \bar{Y})^2$ |
|-----|---------------|-------------------|-----|---------------|-------------------|
| 36 | 4 | 16 | 16 | -2 | 4 |
| 32 | 0 | 0 | 19 | 1 | 1 |
| 29 | -3 | 9 | 20 | 2 | 4 |
| 31 | -1 | 1 | 17 | -1 | 1 |
| 128 | 0 | 26 | 72 | 0 | 10 |

$$\bar{X} = 128/4 = 32$$

$$\bar{Y} = 72/4 = 18$$

$$N_1 = 4 \text{ \& } N_2 = 4$$

Degrees of Freedom (d.f.) = $N_1 + N_2 - 2 = 4 + 4 - 2 = 6$.

Tabulated value for 6 d.f at 5% LOS = 2.45

Since calculated value of $t >$ Tabulated value of t .

Therefore, we reject the null hypothesis.

(i.e) There is significant difference between before and after attending the safety training programme.

CONCLUSION

The methodology of TI Cycles of India Management is empowering towards security. Almost 72% of Regular workers got essential security preparing till date, which is sulting in a superior wellbeing mindfulness and lessening in mischance. Some limitations for mishaps event, which could be controlled by one or different means. Toward the end every one of the reasons are intricately examined in a different section with their outcomes. The discoveries of the study demonstrate that lion's share of the reasons are preventable. Henceforth, to finish fill the need of the concentrate some conceivable and handy suggestions are made which will be financially an in fact reasonable to the association.

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