

# Evaluation of Safety Training in a Thermal Power Station

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**Abstract** – Training is regarded as an important aspect of occupational health and safety (OHS) programs and it is delivered with the sole purpose of enhancing the knowledge, skill and competency of the worker. Since, an untrained professional is himself the greatest hazard for any operational industry, the investment made by the companies on safety training of the such professionals returns not in monetary terms but in terms of self-satisfaction of the worker during the job and improved working efficiency without any unsafe act by the workers. This paper attempts to identify the problems in training and development of workers in a thermal power station and then the training data collection is analyzed to find out the gap. Later, by using a survey questionnaire an attempt has been made to evaluate the training provided to the workers on the basis of their responses.

**Key Words:** Safety Training, Training evaluation, Training Survey

## 1. INTRODUCTION

### 1.1 Training Overview

In the present competitive worldwide market, industries now consider employees as their valuable asset who drives them forward and assist them to achieve their organizational goals in the existing industrialized world. Industries now devote a significant amount of time and money on the training of their employees in order to empower them with the latest technical skills, knowledge and to develop an optimistic work attitude. The financial amount spent on training covers all the different types of trainings like on-the job as well as off-the-job training touching the formal and informal aspects. Upon the huge investment on training and development of workers, industries are eager to know the outcome and returns on their investments.

According to the Human Development Report (HRD) 2020 by UN, only one in five labour in India is 'skilled'. [1] The report also ranked India 129th among the pool with a total of 162 countries. The report points out the state of labour in Indian industries struggling with the skill development and training of workers. It is a disappointment that a country with abundant workforce still not able to utilize it fully.

Businesses are funding millions in training courses to get a competitive lead. They invest in training mainly because learning builds knowledge and very often, it is this particular knowledge that separates successful businesses and workforces from the rest. Many researches have explored the connection between training and outcomes of

human resource, organizational & financial performance and have concluded that enterprises that conduct training are most likely to have a positive outcome in human resource and better performance outcomes whereas it gives a financial toll to the organization. Training evaluation offers a means to comprehend the investments that training yields and delivers information necessary to improve the existing training. There is a dreadful need of undertaking the problem of attrition in the Indian industries and for this worker's health and safety training has been selected as an effective tool. In order to curb the cumulative attrition rate in Indian industries, an innovative development or concurrent strategic method has to be developed to improve the employees' attitude.

The objective of this research is to evaluate the effectiveness of training provided to the workers involved in construction of thermal power station using descriptive analysis and survey questionnaire.

## 2. LITERATURE REVIEW

Andrews (1966) [3] discusses the importance of proper evaluation and assessment of training to understand more about its impact on achieving the organizational targets. The author also assents with the inadequacy of evaluating questionnaires circulated amongst the employees and discusses about the favorable but insignificant outcome from such practices.

Agrawal and Ananthkrishnan (1980) [4] studied about the facilities and supports for training in Indian industries by collecting the training data from Indian industries for in-depth analysis to determine the trend and to provide recommendations to improve the existing training facility and services. Few comparative findings include the following:

- (i) PSUs having better training facility and support as compared to private sector companies.
- (ii) Training budget of PSUs being more than the private companies.
- (iii) Limited use of audio-visual assistances for training in both public and private sector.

On the basis of the above findings the authors recommended some suggestions to raise the training and development facilities in Indian industries.

Pagey (1981) [5] developed a quantitative approach to determine the "Return on Training Investment (ROTI)" by using the principals of cost benefit analysis. The research by the author also discusses on the applicability of the technique developed in different training domains.

An attempt was made by Kohli (1997) [6] to determine the competence of the prevailing training and development labors for the personnel, engaged in organized sectors (Industry, mining, government, banks, PSUs etc.), unorganized sectors, self-employed (agriculture, household, small industries, professionals), unemployed but seeking service or self-employments, individuals in general, in relative to the needs, captivating the instance of India, and recommendations have been made concerning a hands-on strategy to meet the training necessities.

Noe et al., (1986) [7] inspected the impact of trainee's characteristics on training effectiveness focusing specifically on the ability essential to acquire training content. The research showed that motivational and ecological impacts on training effectiveness had acquired diminutive attention. The objective behind the study was to examine an investigative model relating the influence on trainee's profession and job attitudes on training results (performance improvement, learning and behavioral change). Outcomes of the research put forward that job participation and career development are antecedents of learning and behavior changes.

Vojtecky et al., (1986) [8] carried out a national survey with the help of self-administered questionnaires to evaluate the health and safety training and to determine whether they are effective or not. The outcome of the research showed that most of the assessments led by the sample cannot determine whether the health and safety training delivered is effective.

Cohen (1984) [9] evaluated the effectiveness of safety training program using work sampling approach. The training program was specifically for 96 industrial lift truck operators working at two warehouses. Different training approaches were adopted for the two warehouses. The outcome of the research reveals that

- Training on the basis of task/hazard analysis is effective and sustain for a longer period for any operationally distinct unsafe work practices
- The cause for training sustainability is continued practice in the reformed safe work techniques, together with a redefinition of cluster standards continued through informal influences like peer modelling of preferred behaviours and constant organization support of the program.
- A behavior based work sampling procedure can be used efficiently together for the development as well as evaluation of a safety training program.

Many research findings empirically support the concept of sense of fear/unpleasant feeling being the motivating factor for acting in a way to diminish the fear or feeling by acquiring proper knowledge and training in our case. [16]-[20]

### 3. METHODOLOGY

While reviewing the relevant literatures, a lot of analytical tools and techniques were identified to evaluate the effectiveness of training provided to employees. To begin with, a short visit to a coal powered thermal power

plant was scheduled to get the real insights about the safety training.

#### 3.1 Detail of Site Visit

To understand the safety and training culture site visit was conducted at the construction site of a Thermal Power Station in, Jharkhand, having a planned capacity of 1980 MW (3x660 MW). Due to the COVID spread the project got delayed and only the first unit is scheduled to be working soon. The construction site of the first unit of Thermal Power Station having a capacity of 660 MW was subjected to study.

Figure 1 to Figure 4 shows the descriptive images captured during the site visit. The images captured covers the hazardous activities like working at height, working on scaffolding and the unsafe acts & unsafe conditions.

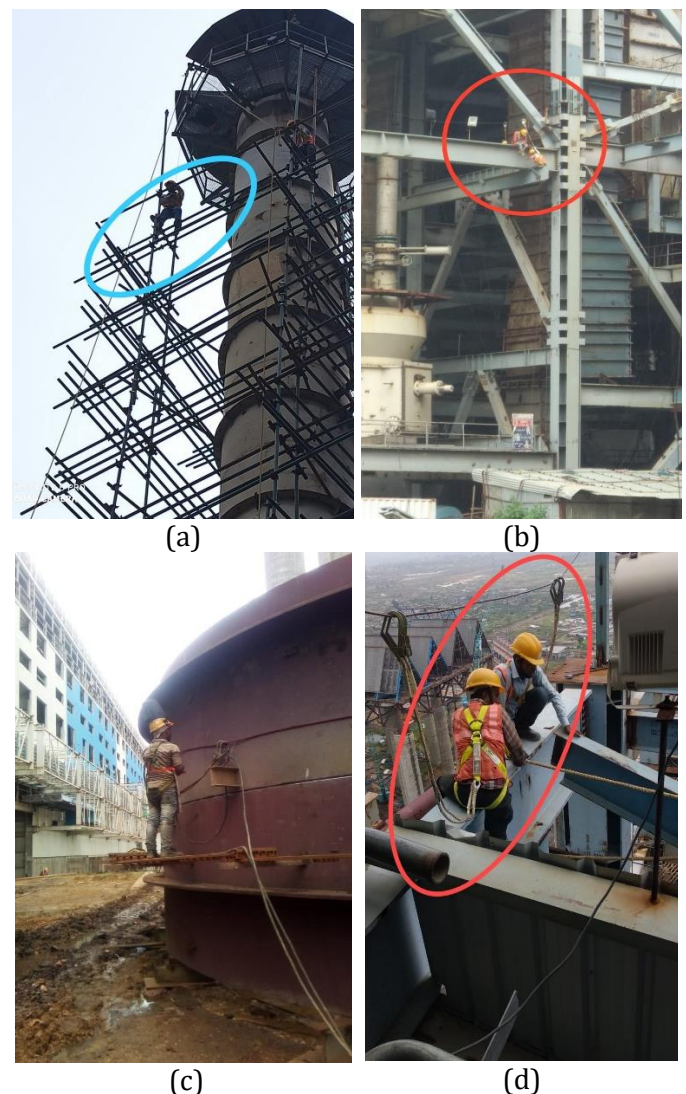


Figure 1 Working at height



(a)



(b)



(c)

Figure 2 On-site safety training of workers



(a)



(b)



(c)



(d)

Figure 3 Inappropriate behaviour of worker while working at height



(a)



(b)



(c)

Figure 4 Internal Safety Inspection

### 3.2 Training & Development Statistics

Apart from the observation of hazards present on site, training records and insights were also collected during the visit to power plant. The objective behind the data collection is to determine and analyze the effectiveness, contents, mode of delivery, frequency and pattern of training given to the workers in the past four years since the commencement of construction of first unit of power plant. The collected data will provide the foundation to work further on the determination of training effectiveness.

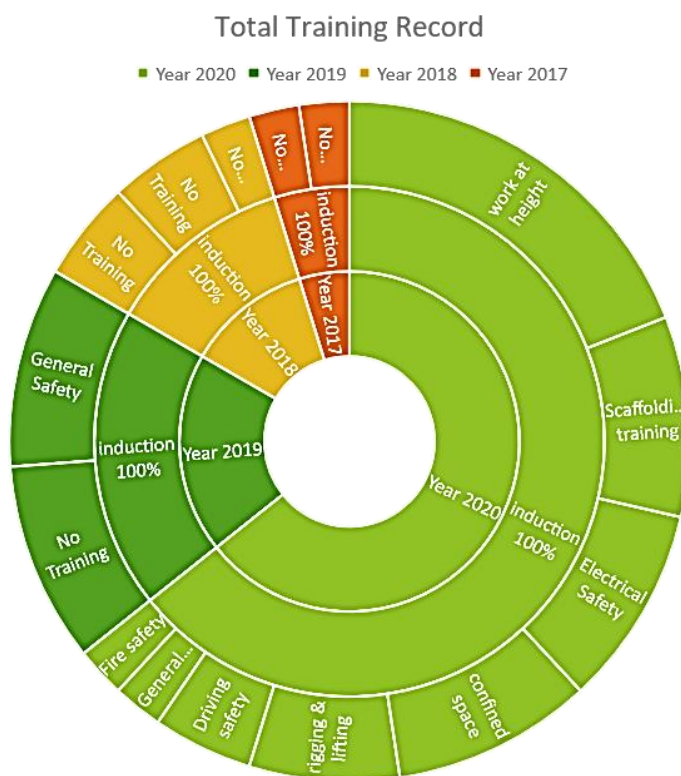


Figure 5 Comparative detail of training record for the year 2017,2018, 2019 and 2020

### 4.2 Research Design

The nature of proposed investigation for research is exploratory. The investigation strives to mark out the, impact of safety training and employees’ attitude towards the work. In order to shortlist the workers who were working on the construction of first unit of thermal power plant for further investigation, stratified random sampling technique has been implemented.

### 4.3 Data Pooling Methods

The investigation proposed in this research involves the collection of two different types of data which are primary data and secondary data.

#### 4.3.1 Primary Data

Primary data is the set of stats and details collected from first-hand-experience. In the proposed research, the

primary data is collected from survey questionnaires covering the diverse opinion and views of 114 labours involved in the construction of first unit of thermal power plant at Chatra district, Jharkhand. With the help of Human Resource Department and Safety Department, the drafted survey questionnaires were distributed among the labours for the collection of primary data.

#### 4.3.2 Secondary Data

The purpose of collecting secondary data is to supplement the primary data procured from the survey. The sources to gather secondary data includes web-portals of ASSOCHAM, OSHA, SIMA and other case study publishing online sources. The secondary sources where extensively used for drafting the introduction chapter and most importantly for the identification of research gap in the relevant domain of the research.

### 4.4 Sampling

In sampling, the target domain and target audience is determined upon which the whole investigation is focused. The domain selected in the research is the safety training of labours. In the current research, all the labours who are working in the construction of first unit of thermal power plant at Chatra district, Jharkhand is under investigation which emphasis on the training and development. The answerable persons for the investigation are those who are working in construction of first unit of thermal power plant. The investigator has justly beleaguered all the levels of workforces from this thermal power station; in other arguments, the answerable persons involve workforces from all hierarchy level in thermal power station. Since the entire workforce is subjected to general safety training. Therefore, the target population is homogeneous in nature.

### 4.5 Questionnaire Design

The investigator has tried by all means to identify the appropriate well-thought-out questionnaire settled by the training and safety experts of visited power station in the selected research topic, although there are huge organized questionnaires existing in the preferred research range, however none of the organized questionnaires fit in to the selected research theme context in thermal power station. The developed questionnaire is in the native language of region so that it can be clearly understood by the local and uneducated labours. The administration of questionnaire can be done in group or individually also. By keeping the respondent isolated while responding to the questionnaire, one can impart a sense of security among the respondent to answer freely without any pressure. The objective of the questionnaire is to determine the impact of safety training among the workers in construction of thermal power station. The questionnaire used for the present research is attached in Annexure -I.

### 4.6 Data Processing and Analysis

After accumulating the survey questionnaires from all the respondents, data has to be processed before performing any kind of analysis. The processing stage involves checking and editing the data in order to identify and remove any weird or unusual response. Every set of

filled questionnaire is to be checked, counted and numbered to distinguish it from other responses. During the processing stage, the left over or omitted question must be identified and the completed questionnaire is to be removed.

The research used descriptive analysis to elucidate and describe the physiognomies of the variables of concern in a circumstances (Sekaran and Bougie, 2010). Besides, Zikmund described descriptive analysis as an elementary alteration of data in a manner that exemplify the fundamental specific, such as dominant propensity and capriciousness. Mean, median, mode, variance, range and standard deviation are most extensively smeared in unfolding the descriptive statistics. The benefit of adopting descriptive analysis is summarization of the sample and extent. It also arranges rudimentary quantitative data analysis through simple graphics analysis.

## 4. RESULTS

### 4.1 Descriptive Analysis

In this analysis, the survey questionnaires data obtained from 53 employees working in the construction of thermal power station is subjected to descriptive statistics to understand the demographic characteristics of the respondents.

Demographic characteristics of the respondents include their age, marital status, gender, qualification, experience and training details. Dissemination of data based on the above stated demographic characteristics is specified in the following tables

**Table 1** Sample distribution on the basis of age

Age (in Years)	Frequency	Percentage
Below 20 years	15	28.30
21 - 30 years	25	47.17
31 - 50 years	9	16.98
Above 51 years	4	7.55
Total	53	100%

It can be clearly deduced from Table 1, that the majority of the respondents' (47.17%) belongs to the age group of 21 to 30 years. This age group is shadowed by the age group under 20 years (28.30%), 31 to 50 years (16.98%) and above 51 years (7.55%).

**Table 2** Sample distribution on the basis of gender

Gender	Frequency	Percentage
Male	53	100
Female	0	0
Total	53	100%

From Table 2, it can be clearly observed that all of employees under investigation working in the construction of thermal power station are male (100%).

**Table 3** Sample distribution on the basis of marital status

Marital Status	Frequency	Percentage
Single	24	45.28
Married	29	54.72
Total	53	100%

The data from Table 3 shows that 45.28% of the respondents under investigation are single, whereas 54.72% of the respondents were married.

**Table 4** Sample distribution on the basis of qualification

Educational Qualification	Frequency	Percentage
Secondary	27	50.94
Graduation	15	28.30
Post-Graduation	0	0.00
Others (ITI / Diploma)	11	20.75
Total	53	100%

It can be inferred from Table 4 that majority of the respondents were just having secondary education (50.94%) followed by Graduation (28.30%) and lastly ITI' and Diploma holders (20.75%).

**Table 5** Sample distribution on the basis of work experience

Experience (in years)	Frequency	Percentage
1 - 5 years	21	39.62
6 - 10 years	18	33.96
11 - 15 years	9	16.98
16 - 20 years	4	7.55
21 - 25 years	1	1.89
More than 25 years	0	0.00
Total	53	100%

Table 5 shows the distribution of work experience of respondents. The table clearly shows that majority of the workers have 1 – 5 years of work experience (39.62%) followed by 6 – 10 years of experience (33.96%).

**Table 6** Sample distribution on the basis of designation

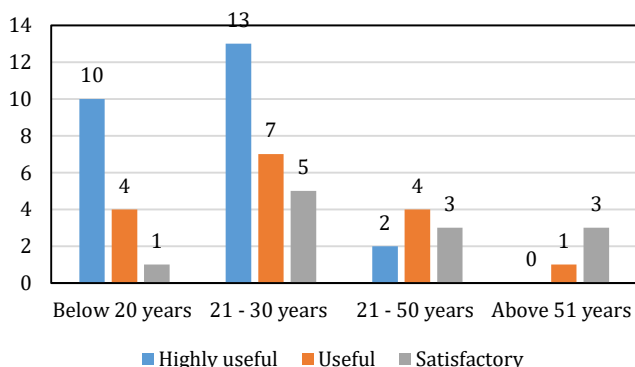
Designation	Frequency	Percentage
Supervisor	2	3.77
Worker	5	9.43
Contract worker	19	35.85
Sub-contract worker	27	50.94
Total	53	100.00

Table 6 shows that most of the respondents (50.94%) were sub-contractual workers hired by different companies involved in the construction followed by contractual workers (35.85%). Workers (9.43%) and supervisors (3.77%).

**Table 7** Responses regarding the usefulness of training on the basis of age

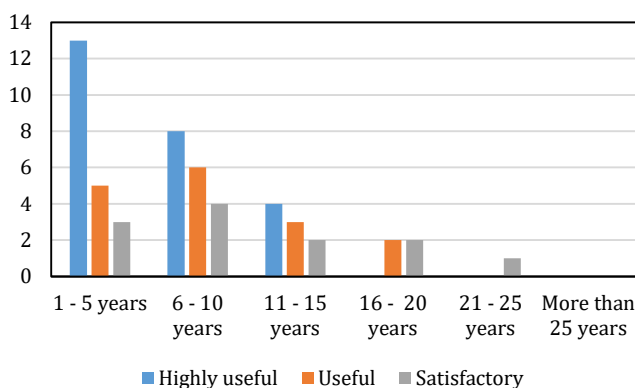
Age	Highly useful	Useful	Satisfactory
Below 20 years	10	4	1
21 - 30 years	13	7	5
21 - 50 years	2	4	3
Above 51 years	0	1	3
Total	25	16	12

Usefulness of training on the basis of age of respondents



**Figure 6** Responses against usefulness of training on the basis of age

Usefulness of training on the basis of work experience



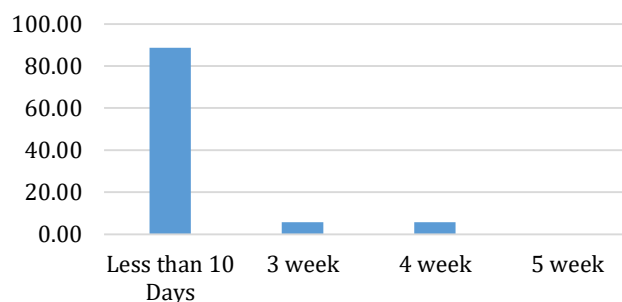
**Figure 7** Responses against usefulness of training on the basis of experience

Figure 6 and Figure 7 shows the responses of the respondents under investigation against the usefulness of

training provided to them on the basis of age of and work experience.

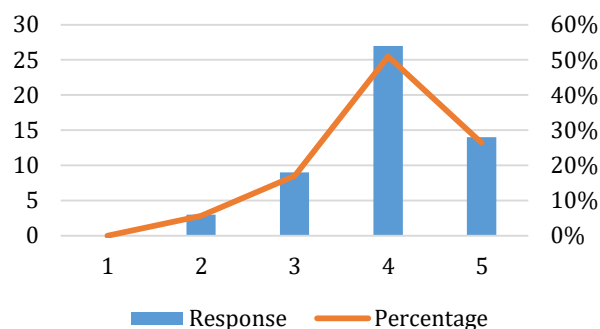
It can be clearly observed from the Figure 6 and Figure 7 that the opinion of respondents differ significantly on the evaluation of training based on their age and experience. The age group below 20 years is highly satisfied with the training provided to them as compared to the other age group. A similar pattern can be observed with the training satisfaction from the group of respondents having 1-5 years of experience.

Preferred duration of training



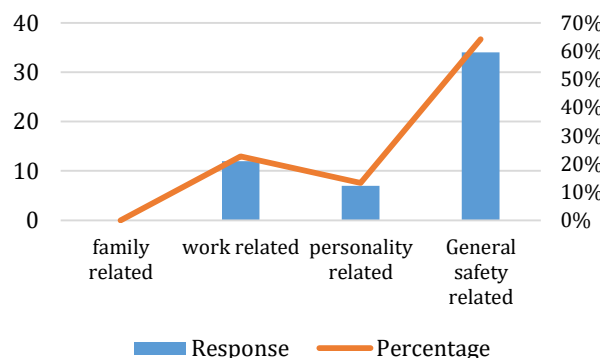
**Figure 8** Responses against Question 9.

Usefulness of trainign programs attended



**Figure 9** Responses against Question 12.

Training theme preference



**Figure 10** Responses against Question 13.

Do you believe that training helps to acquire new skills

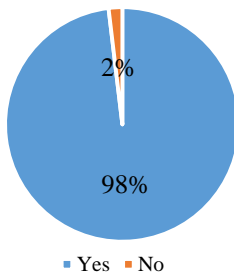


Figure 10 Responses against Question 14(i).

Do you believe that training helps to improve technical skills

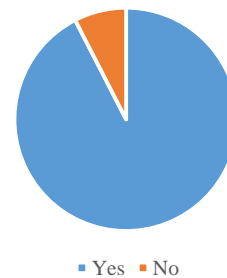


Figure 14 Responses against Question 14(v).

Do you believe that training helps to raise awareness

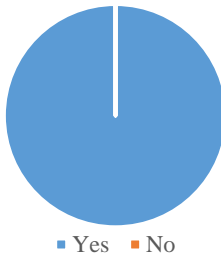


Figure 11 Responses against Question 14(ii).

Do you believe that training helps to improve decision making skills



Figure 15 Responses against Question 14(vi).

Do you believe that training helps to enhance organizational culture



Figure 12 Responses against Question 14(iii).

Do you believe that training helps to increase creativity

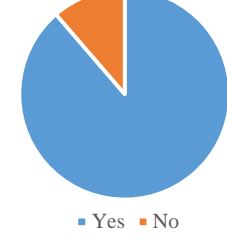


Figure 16 Responses against Question 14(vii).

Do you believe that training helps to develop and manage oneself

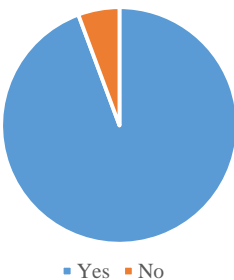


Figure 13 Responses against Question 14(iv).

Communication Skills Effectiveness Happened Through Training Program

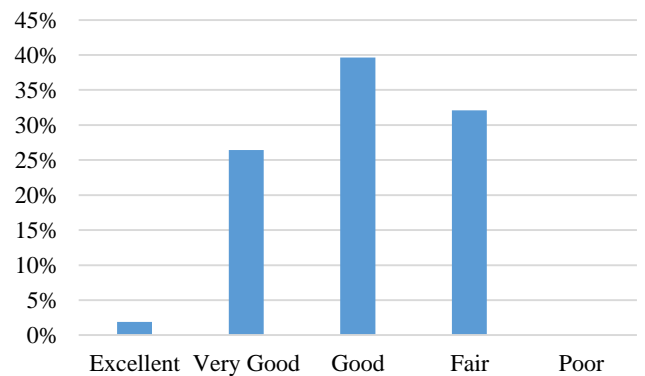


Figure 17 Responses against Question 15

There is an improvement in the level of confidence through the training program

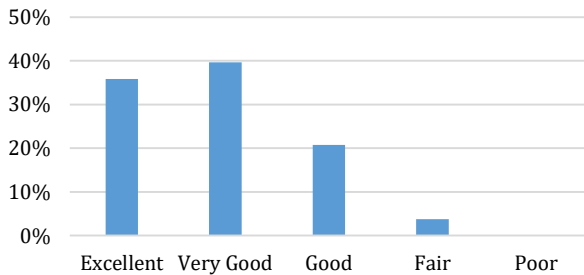


Figure 18 Responses against Question 16

Interpersonal skills and team building effectiveness through training program

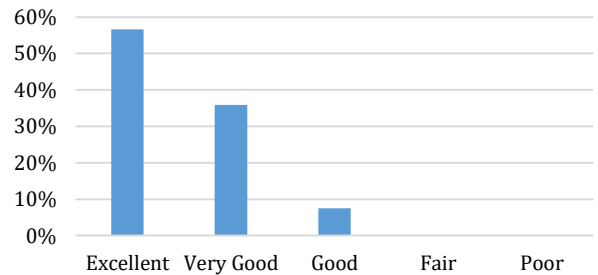


Figure 22 Responses against Question 20

Technical skill development through training program has been effective

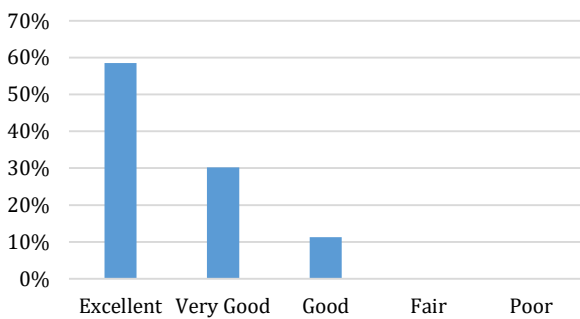


Figure 19 Responses against Question 17

Ways to assess training needs in your organization

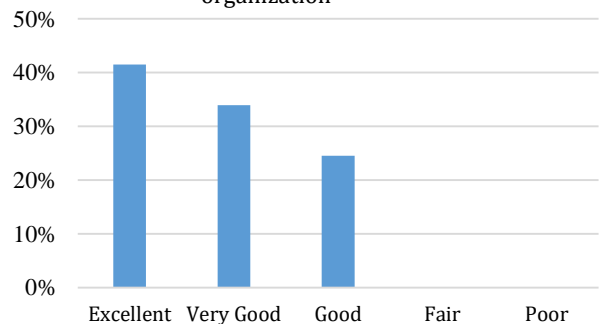


Figure 23 Responses against Question 21

Decision making skills have been effectively achieved through the training program

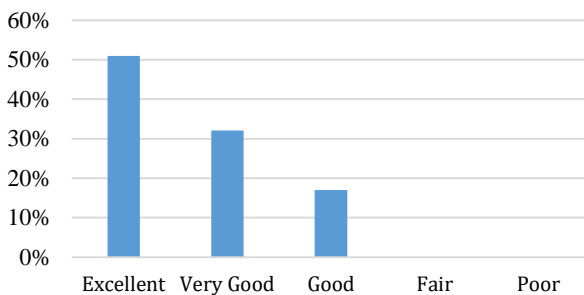


Figure 20 Responses against Question 18

The importance given to employee training and development in your organization

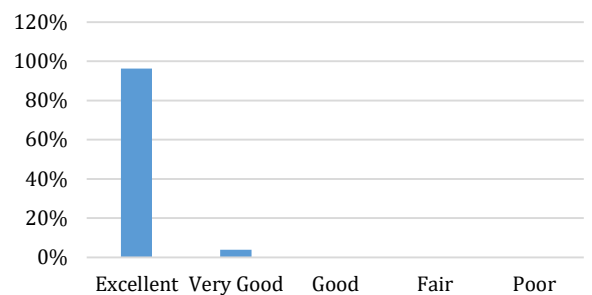


Figure 24 Responses against Question 22

Effectiveness of safety awareness through training program

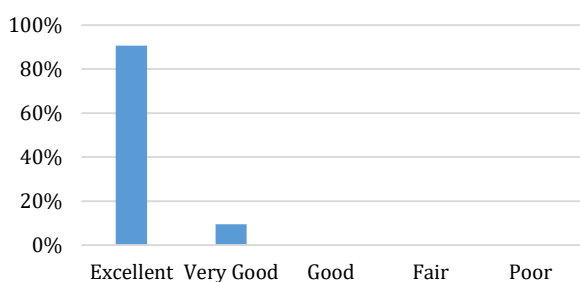


Figure 21 Responses against Question 19

Methods of training employees in your organization

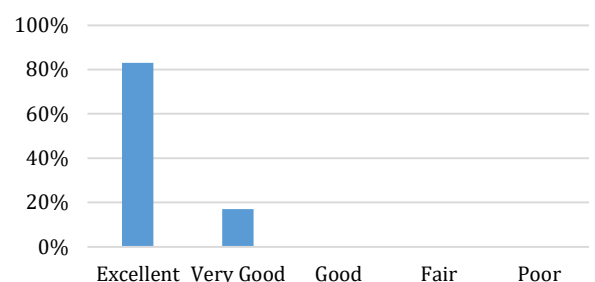


Figure 25 Responses against Question 23





Figure 26 Responses against Question 24

Figure 8 to Figure 26 shows the responses of the workers who had undertaken the survey questionnaire. Upon simple observation of the data collected through this questionnaire one can easily determine the effectiveness of the training provided to the workers. Different statistical tools and techniques can also be used further to analyze the data gathered in order to analytically compute the percentage of training effectiveness.

### 5. CONCLUSIONS

The research tried to assess the impact of safety training provided to the workers involved in construction of thermal power station

The first methodology includes the application of descriptive analysis on the training data of the past four years. The descriptive analysis involved analysis using tables, charts and later through the survey data collected using questionnaire. Few conclusions which can be drawn from the analysis using the survey questionnaire are:

- Majority of the respondents fondled that work specific training is required for the workers working in the construction of thermal power station.
- It also showed that the training program delivered to the workers were not meeting several aspects faced in the construction industry especially housekeeping and Vehicle/ Driving safety.
- Most of the Respondents felt that the training programmes should be available on a continuous basis.
- Safety training contents should cover all the hazardous aspects to which the workers are exposed during work. But, it was observed that while designing the safety training programmes, no adequate care is taken in scheming the contents of the programmes.

As the construction comes under unorganised sector, the parent company should give proper care while designing and conceiving the safety training programmes. Administrators who are accountable for providing training for the workforces should analyse the usefulness of such training programmes. It is established that satisfactory steps are not available to take care of the effectiveness of such training programmes.

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**Annexure-I: Questionnaire for the employees**

1.	नाम	:	
2.	आयु		
	Below 20	(___)	31-50 (___)
	21-30	(___)	Above 50 (___)
3.	लिंग		
	पुरुष	(___)	महिला (___)
4.	वैवाहिक स्थिति		
	अविवाहित	(___)	विवाहित (___)
5.	शैक्षिक स्तर		
	माध्यमिक	(___)	स्नातकोत्तर (___)
	स्नातक	(___)	अन्य (___)
6.	कार्य की प्रकृति	:	
7.	अनुभव		
	1-5	(___)	16-20 (___)
	6-10	(___)	21-25 (___)
	11-15	(___)	Above 25 (___)
8.	पद		
	सुपरवाइजर	(___)	कॉन्ट्रैक्ट वर्कर (___)
	वर्कर	(___)	सब-कॉन्ट्रैक्ट वर्कर (___)
9.	प्रशिक्षण की पसंदीदा अवधि।		
	10 दिनों से कम	(___)	4 सप्ताह (___)
	3 सप्ताह	(___)	5 सप्ताह (___)
10.	प्रशिक्षण कार्यक्रमों की उपयोगिता।		
	अत्यधिक उपयोगी	(___)	
	उपयोगी	(___)	
	संतोषजनक	(___)	
11.	क्या प्रशिक्षण पदोन्नति (Promotion) के साथ जुड़ा हुआ है?		
	हां	(___)	नहीं (___)
12.	मान लीजिए कि आपने अब तक 5 प्रशिक्षण कार्यक्रम किए हैं, तो कितने उपयोगी थे?		
	1	(___)	4 (___)
	2	(___)	5 (___)
	3	(___)	
13.	आप किस प्रकार का प्रशिक्षण पसंद करते हैं?		
	परिवार संबंधी	(___)	व्यक्तित्व संबंधित (___)

	कार्य संबंधित (____)	सामान्य तौर पर और सुरक्षा से संबंधित (____)				
<b>14.</b>	क्या आप मानते हैं कि प्रशिक्षण मदद करता है?			हां	नहीं	
				(____)	(____)	
(i)	नए कौशल हासिल करने के लिए			(____)	(____)	
(ii)	जागरूकता बढ़ाने के लिए			(____)	(____)	
(iii)	संगठनात्मक संस्कृति को बढ़ाने के लिए			(____)	(____)	
(iv)	रचनात्मकता को बढ़ाने के लिए			(____)	(____)	
(v)	निर्णय लेने के कौशल में सुधार करने के लिए			(____)	(____)	
(vi)	तकनीकी कौशल बढ़ाने के लिए			(____)	(____)	
(vii)	स्वयं को विकसित और प्रबंधित करने के लिए			(____)	(____)	
		Excellent	Very Good	Good	Fair	Poor
<b>15.</b>	प्रशिक्षण कार्यक्रम के माध्यम से संचार कौशल (communication skill) प्रभावशीलता हुआ है	(____)	(____)	(____)	(____)	(____)
<b>16.</b>	प्रशिक्षण कार्यक्रम के माध्यम से आत्मविश्वास (confidence) के स्तर में सुधार है	(____)	(____)	(____)	(____)	(____)
<b>17.</b>	प्रशिक्षण कार्यक्रम के माध्यम से तकनीकी कौशल (technical skill) विकास प्रभावशीलता हुआ है	(____)	(____)	(____)	(____)	(____)
<b>18.</b>	प्रशिक्षण कार्यक्रम के माध्यम से निर्णय लेने के कौशल ( decision-making skill ) प्रभावशीलता हुआ है	(____)	(____)	(____)	(____)	(____)
<b>19.</b>	प्रशिक्षण कार्यक्रम के माध्यम से सुरक्षा जागरूकता की प्रभावशीलता आई है	(____)	(____)	(____)	(____)	(____)
<b>20.</b>	प्रशिक्षण कार्यक्रम के माध्यम से पारस्परिक कौशल (interpersonal skill) और टीम निर्माण (team building)की प्रभावशीलता आई है	(____)	(____)	(____)	(____)	(____)
<b>21.</b>	आपके संगठन में प्रशिक्षण आवश्यकताओं का आकलन करने के तरीके	(____)	(____)	(____)	(____)	(____)
<b>22.</b>	कर्मचारी प्रशिक्षण और विकास को आपके संगठन में दिया गया महत्व	(____)	(____)	(____)	(____)	(____)
<b>23.</b>	आपके संगठन में कर्मचारियों को दिए जाने वाले प्रशिक्षण के तरीके	(____)	(____)	(____)	(____)	(____)
<b>24.</b>	आपके संगठन में उपलब्ध प्रशिक्षण कार्यक्रमों के संचालन के लिए सुविधाएं	(____)	(____)	(____)	(____)	(____)