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"DOES SAFETY TRAINING TO EMPLOYEES & SAFETY OBSERVATIONS ROUNDS REDUCE INCIDENTS" - CASE STUDY. EMPLOYEES PERCEIVE IMPROVED MORALE FOR PRODUCTIVENESS AT WORK PLACE.

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Keywords: Safety Trainings, Safety Incidents, Safety Culture, Safety observations, Employee morale

Abstract
At the plant understudy, before introduction of the new safety management system, employees including management had a belief that having zero injuries may not be possible. The attitude towards safety was more reactive in nature and mainly major incidents were reported and reviewed for taking necessary preventive action and adhere to legal compliance. The accountability for safety was mainly delegated to the safety professionals with line management playing a minimal role. There was a belief that most injuries result from design of equipment, unsafe conditions prevailing at the workplace or behavior of the employee.

Introduction
The background
At the plant understudy, before introduction of the new safety management system, employees including management had a belief that having zero injuries may not be possible. The attitude towards safety was more reactive in nature and mainly major incidents were reported and reviewed for taking necessary preventive action and adhere to legal compliance. The accountability for safety was mainly delegated to the safety professionals with line management playing a minimal role. There was a belief that most injuries result from design of equipment, unsafe conditions prevailing at the workplace or behavior of the employee.
The training related to safety was given to SHE (Safety health and environment) professionals and line management exposure to safety related training was limited. The initiatives of spreading awareness were taken by safety department during National safety day, organizing a poster or an essay competition etc. SHE was considered as high priority among line management and SHE professionals were held responsible for it.
Off the job safety was a personal matter and not many paid attention to it. Also, management focus on contractors' safety was limited. There were hardly any consequences for violation of safety rules. Incident investigations were carried out by safety professionals without much involvement of line management. Minor incidences and near misses were a part of life and not reported. The standard operation procedures (SOPs) of most processes did not address safety. Safety standards for critical activities did not exist. Accidents were a part of workplace and a regular phenomenon.
What changed?
DuPont was hired as a consultant by Tata Motors to implement Safety Management System across its different manufacturing plants and help improve the safety culture over a three years' journey. Along with Safety Management system and various initiatives implemented in their partnership was identification and delivering of safety trainings across employee grades. This included in house development of classroom, online and on site trainings programs with DuPont's help. Employees and area owners were selected through various processes before they could become Trainers. Emphasis was laid on as many senior people as possible to become trainers so that message for seriousness about trainings get percolated down the line too. Through this journey of transformation this Manufacturing Plant unit moved from compliance to commitment mode with respect to safety.
The new Safety Management System introduced had one of its main initiative as influencing the top leadership about safety and teaching them all the aspects of the system.
'Training Data' and 'Safety observation data' was analyzed for the year 2012-13 for the manufacturing plant under study with respect to safety incidents. A structured process of Training was implemented for all levels of employees and associates. The involvement of senior leaders in safety observation process set a good example to employees of the commitment of leaders.

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Limitations:
The two important initial initiatives in the very first year of and Safety Journey with DuPont were 1) Safety Trainings to employees and 2) Safety Observations carried out by Leaders and Managers. In the later part of journey that is from second year onwards more initiatives and implementation strategies were added on. Therefore, the correlation of these two aspects Trainings & Observations with safety incidents is only in the scope of this paper

Overview of safety trainings

An employee must undergo different safety trainings in a logical chronological order during his lifecycle. These safety trainings can be grouped together according to their occurrence in the employee's life cycle as:

[1] Induction (within 3 months)
[2] Orientation (before working in the factory)
[3] Job-Specific (before performing the particular job performing the particular job)

Induction training:
Imparted to each employee within 3 months of his joining. The Induction training plan will be different for each type of employee:

[1] Leading Safety Efforts (LSE)- LSE training is given to all the executive grade employees.
[2] Safety Management Fundamentals (SMF): Shop / Line Managers
[3] Incident Investigation: the employees who are a part of Incident investigation

Orientation training
Safety Observations Training
The company has identified and laid down relevant, significant, safety procedures and
standards. Safety standards specify the materials and detail the test methods that are relevant in recognizing, assessing, and controlling the physical, chemical, and environmental hazards involved in the workplace that could disrupt worker's health and well-being. These standards include guides for the proper handling, transportation, and storage of specified substances and equipment, and specifications for proper protective clothing, workplace ergonomics, and ventilation design. Some such standards are: -

[1] Personal Protective Equipment
[2] Lock out and tag out standards
[3] Vehicle and Traffic Safety Standards
[4] Working at Height Standards
[5] Electrical Safety Management

Job specific training:
Each employee must be trained on the job he has to perform. This training has to be given before any employee is allowed to perform the job. This training has been termed as Job Qualification at Tata Motors for example Defensive Driving Training

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[1] Bus driver
[2] Forklift
[3] Two wheeler
[4] Chassis driver
[5] Four wheeler

Overview of safety observation

Safety observation is a structured and planned pro-active two-way safety conversation with people at their work place to achieve positive change in people's behavior towards safety in order to:

[1] Recognize and reinforce positive safety behavior
[2] Identify and correct behavior at risk
[3] Engages in conversation regarding safety concerns or issues

Safety Observations focus on all behaviors that have the potential for injuries. Results from previous injury investigations, from previous near miss investigations, and from previous observations are used to focus the effort.

The following observation categories have been developed to assist in the identification of unsafe acts and behaviors. Safety Observations are conducted using these categories to stimulate thought about the different types of safe/unsafe behaviors present in the area.

[1] Reactions of people (RP) – Are people modifying their behavior (unsafe to safe) when they see a Leader/Manager in the area? Employees may sometimes react to being observed and change their body position, adjust their PPE, switch to the correct tool, grab the handrails, wind up a loose hose, put seatbelt on etc. This generally indicates the employee is aware of the correct/safe work practice which, for some reason, they were not using prior to being observed.
[2] Positions of people (PP) – Are people positioning their body in a way that reduces the potential for injury? This includes Ergonomics in office and operating/maintenance environments
[3] Personal protective equipment (PPE) – Are people utilizing the appropriate PPE, using it correctly, and is it in good condition?
[4] Tools and equipment (TE) – Are the proper tools being used? Are they being used correctly? Are they in good condition? Are "homemade tools" being used?
[5] Procedures (PRO) – Are adequate procedures in place? Are they understood and being followed?
[6] Orderliness Standards or Housekeeping (HK) – Is the work area orderly?

All observed unsafe acts, behaviors, and conditions in any area or location are addressed and acted on immediately.All leadership model the safe behaviors that they expect from their employees. This is in line with the proverb "You get the level of safety that you demonstrate you want".

Safety observation: The six step process

[1] Observe, decide how to approach the employee, stop the unsafe act (safety)
[2] Comment on safe acts/behavior.
[3] Discuss any unsafe/at risk behavior observed.
[4] Discuss consequences (possible injury) of the unsafe act/behavior.
[5] Encourage the employee to discuss safer ways to do the job.
[6] Get agreement to work safely.
[7] Invite the employee to discuss other safety issues in the work place.
[8] Thank the employee.

Data Collection, Data Organizing and Analysis

The employees identify safe &unsafe situations and Condition

Unsafe situation:

is defined as any unsafe act or condition

Unsafe act:

are activities and/or job performance which employees are involved in and may include: Unauthorized use or operation of equipment. Operating equipment without, qualification or authorization, Lack of/or improper use of PPE, Operation equipment at unsafe speeds, Failure to warn,Bypass or removal of safety devices,Using defective equipment

Unsafe condition:

A condition in the work place that is likely to cause property damage or injury. Defective tools, equipment or supplies, Inadequate supports or guardsm, Congestion in the workplace, Inadequate warning systems, Fire and explosion hazards, Poor housekeeping & Hazardous atmospheric conditions

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Data Collection

The data for various trainings and safety observations for the year 2012-13 is collected and the analysis is done based on the following inputs:

Trainings:

The following inputs per month were taken to analyze the impact of trainings on incidents:

[1] Cumulative training man-hours (CT)
[2] Cumulative training man-hours per million man-hours worked (CTFR)

Safety observations:

The following inputs per month were taken to analyze the impact of trainings on incidents

[1] Cumulative safety observation rounds (CSOR)
[2] Cumulative safety observation rounds per million man-hours worked (CSOR-FR)
[3] No. of unsafe situations per hour i.e. US/hour (= safety observation rounds per month / No. of safety observations per month)

Combined effect of trainings and safety observations using multiple regression

Now, the incident trend is observed in terms of:

[1] Frequency rate of the total incidents per month i.e. total incidents (including TRC and FAC) per million man-hours worked - TIFR
[2] -6 month moving average of Total Recordable Cases (TRCs) and First Aid Cases (FACs) - TI6. For example, to measure effectiveness of training done till April 2012, average monthly incidents from May to October are considered

The analysis is first done for Lucknow plant and then similar analysis is carried out for all the other CVBU units at Tata Motors.

Effect of Trainings on Incidents 2012-13 :

The training man-hours for March (8929) for Lucknow plant are taken as input for the trained manpower available in April. Its effect is observed on:

[1] Frequency rate of the total incidents per month i.e. total incidents (including TRC and FAC) per million man-hours worked – TIFR
[2] 6 month moving average of Total Recordable Cases (TRCs) and First Aid Cases (FACs)- TI6. For example, to measure effectiveness of training done till April 2012, average monthly incidents from May to October are considered

2012-13	Training ('1000 Manhours)	CT (Cum. Training)	TRC	FAC	TRC + FAC	Manhours worked	TIFR (Total Incident FR)	TI6 =TRC + FAC (6 Month Avg.)
April	4.412	8.928	2	22	24	1446642	16.59	18.00
May	3.963	13.34	3	8	11	1293775	8.50	16.00
June	5.908	17.303	2	13	15	1355922	11.06	15.67
July	5.691	23.211	1	23	24	1381441	17.37	14.17
August	5.04	28.902	5	13	18	1482628	12.14	11.33
September	4.199	33.942	2	14	16	1588368	10.07	10.00
October	3.231	36.8174	2	10	12	1485630	8.08	8.17
November	2.026	38.8595	4	5	9	1179439	7.63	7.40
December	10.608	39.1131	2	4	6	1099380	5.46	7.00
January	5.433	48.0138	0	7	7	1237520	5.66	7.33
February	2.135	51.9348	6	4	10	1093148	9.15	7.50
March	5.665	52.8101	3	2	5	1149275	4.35	5.00

Table : Data for Lucknow Plant,FY12-13

The Training man-hours for the month of March (8928) are taken as input for the Cumulative Training(CT) which is a representation of the trained manpower available. Every month of trained manpower is then added

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cumulatively in the frequent months as depicted in the table. This cumulative training man-hour is then mapped with the incidents and incidents frequency rate. The terminology used for incidents is explained below :

TIFR = (TRC+FAC)*1000000/Man-hours worked

e.g. TIFR for April = 24*1000000/1446642 = 16.59

TI6 = AVERAGE(TRC+FAC) for next 6 months

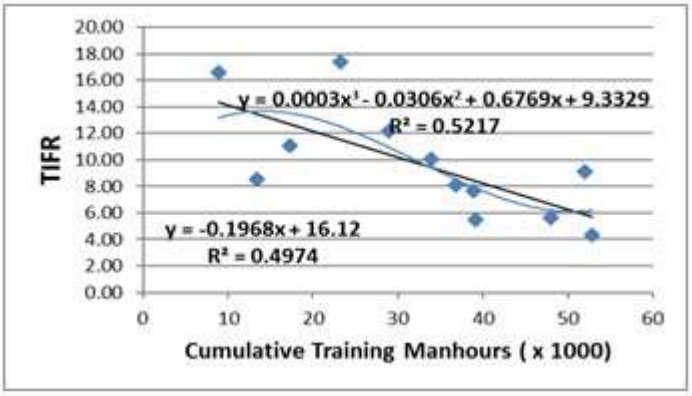
e.g. TI6 for April = (24+11+15+24+18+16)/6 = 18

[1] Linear and cubic relations are plotted for the above data using regression
[2] R square value is also calculated for each of the plots.

Manufacturing Unit at Lucknow:

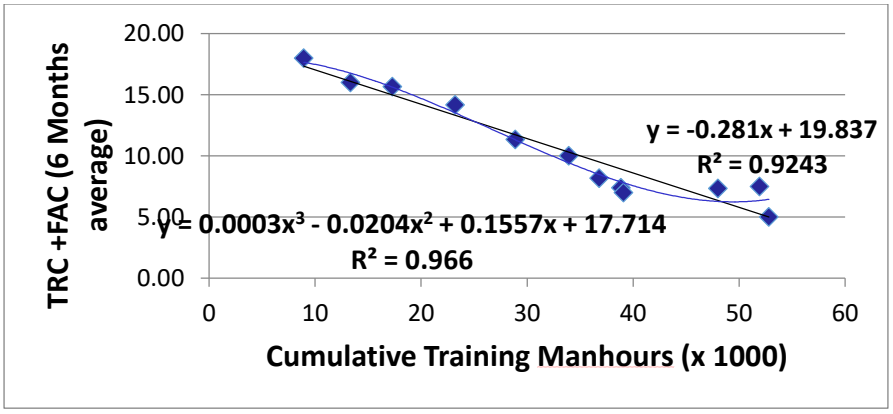
When the cumulative training man-hours are plotted against the incidents frequency rate and the 6 months moving average of the incidents, the following curves are obtained:

1) CT Vs. TIFR



The curve shows a decrease of 0.196 FR per thousand training man-hours during 2012-13 (Apr 12- Mar 13). R squared value of around 0.5 is obtained.

2) CT Vs. TI6 :



There has been a decrease of 0.28 incidents per thousand training man-hours during 2012-13 (Apr 12- Mar 13). R squared value of 0.92 is obtained which signifies a very good correlation i.e. training has a significant effect on incidents.

The trend line is plotted both as a linear and a cubic polynomial function. The cubic polynomial has a better "R square" value and seems to better explain the correlation. Now, the effect of Cumulative Training per million man-hours is mapped with:

3) 6 month moving average of Total Recordable Cases (TRCs) and First Aid Cases (FACs)-

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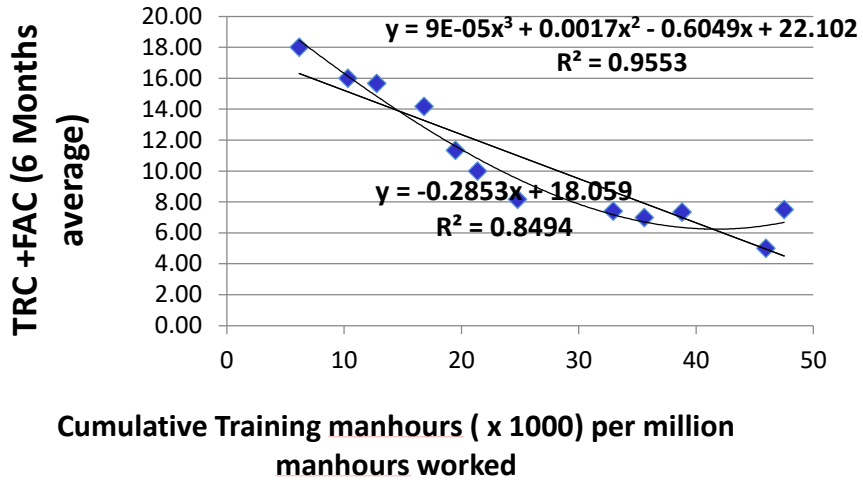
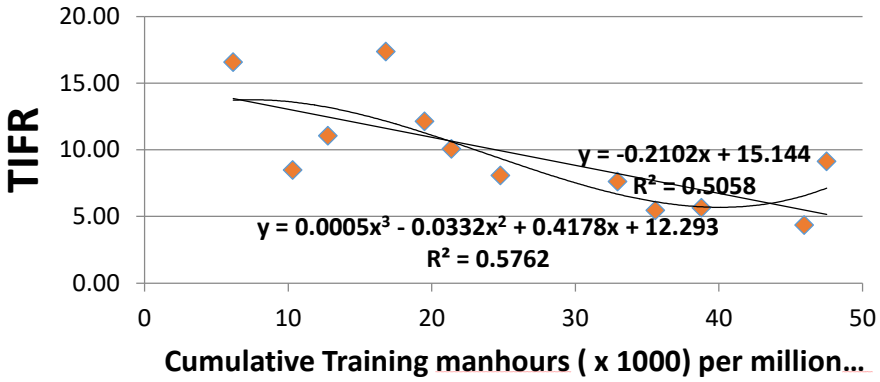


The curve shows a decrease of 0.285 incidents (TRC + FAC) per thousand training man-hours per million man-hours worked. R squared value of 0.85 is obtained which signifies a significant correlation.

4) Frequency rate of the total incidents per month i.e. total incidents (including TRC and FAC) per million man-hours worked – TIFR



Here, a decrease of 0.21 incidents FR is observed per 1000 training man-hours per million man-hours worked. Similar analysis is carried out for other Manufacturing plants and results tabulated in section 4.4.

Effect of safety observations on Incidents: 2012-13

At the Lucknow plant

The safety observation rounds for March (670) for Lucknow plant are taken as input for the trained manpower available in April. Safety observation rounds for each month are then added cumulatively and taken as input. Its effect is observed on:

[1] Frequency rate of the total incidents per month i.e. total incidents (including TRC and FAC) per million man-hours worked – TIFR

[2] 6 month moving average of Total Recordable Cases (TRCs) and First Aid Cases (FACs)- TI6.

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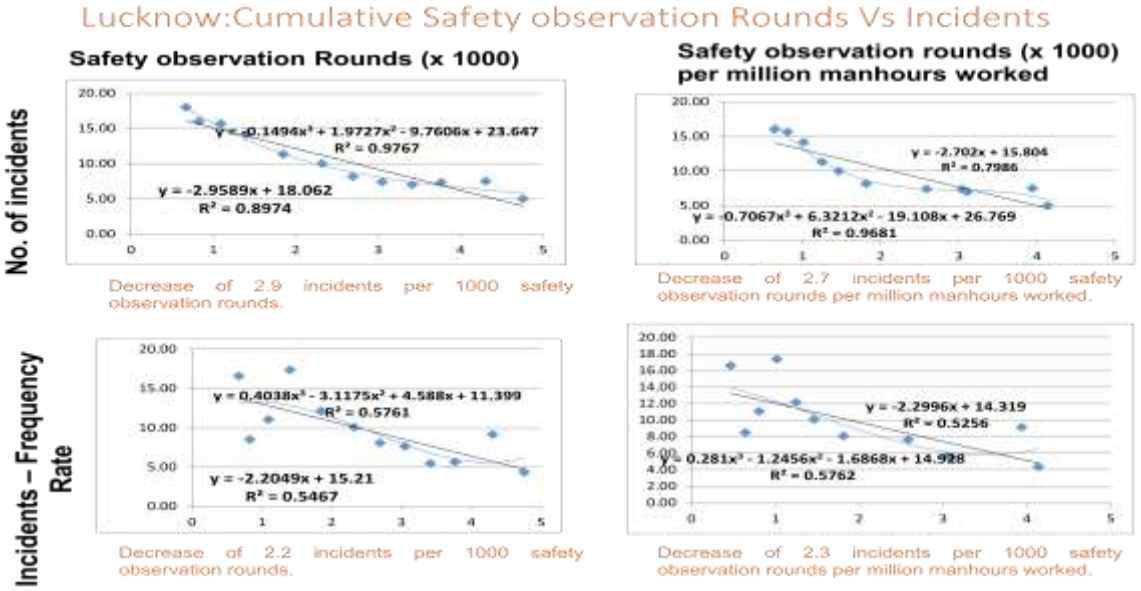
2012-13	Safety Observation Rounds	Cum. SO Rounds (CSOR)	TRC	FAC	TRC + FAC	Manhours worked	TIFR	TI6 =TRC + FAC (6 Month Avg.)
April	157	670	2	22	24	1446642	16.59	18.00
May	267	827	3	8	11	1293775	8.50	16.00
June	308	1094	2	13	15	1355922	11.06	15.67
July	446	1402	1	23	24	1381441	17.37	14.17
August	471	1848	5	13	18	1482628	12.14	11.33
September	373	2319	2	14	16	1588368	10.07	10.00
October	357	2692	2	10	12	1485630	8.08	8.17
November	364	3049	4	5	9	1179439	7.63	7.40
December	351	3413	2	4	6	1099380	5.46	7.00
January	542	3764	0	7	7	1237520	5.66	7.33
February	450	4306	6	4	10	1093148	9.15	7.50
March	441	4756	3	2	5	1149275	4.35	5.00

Table Lucknow Plant FY 12-13



There has been a decrease in both the incidents and the frequency rate with increase in safety observation rounds and SO rounds frequency, as depicted in the curves. The R squared values have been indicated in the curves.

Combined Effect of Trainings and Safety Observations on Incidents:

Now, the combined effect of Cumulative Trainings (CT) and Cumulative Safety Observation Rounds (CSOR) is observed on the incidents (TI6) and the incidents frequency rate (TIFR) using multiple regression tool in Minitab. The relationships obtained are expressed below:

At Lucknow Plant

(1) Effect on incidents: The following equation is obtained using Minitab:

TI6 = 19.7 - 0.263 CT - 0.019 CSOR

Predictor	Coef	SE Coef	T	P
Constant	19.741	1.239	15.93	0.000
CT	-0.2635	0.1469	-1.79	0.106
CSOR	-0.0190	0.1570	-0.12	0.906

R-Sq = 92.4% R-Sq(adj) = 90.8%

P = 0.000

Inference:

The equation shows a decrease in incidents with increase in both trainings and no. of safety observation rounds. The p-value determines the confidence level for the prediction to be valid. A p value close to 0.05 is desired for a confidence level of 95%.

In the above table, only constant term has a p value of close to zero which means that it has a significant effect on the overall equation. CT (Cumulative Trainings) also have a significant p value (0.1) which shows the decrease of incidents with increase in trainings. However, CSOR (Cumulative Safety observation rounds) have an insignificant p value of 0.9 which means confidence level is low.

The overall equation has a significant p value of 0.000 which indicates a good confidence level. Also, the R squared value is around 92% which indicates a good fit.

(2) Effect on Incidents Frequency Rate:

TIFR = 14.0 + 0.182 CT - 4.12 CSOR

Predictor	Coef	SE Coef	T	P
Constant	14.048	2.852	4.93	0.001
CT	0.1823	0.3381	0.54	0.603
CSOR	-4.121	3.613	-1.14	0.284

R-Sq = 56.1% R-Sq(adj) = 46.3%

P = 0.025

Inference:

The equation shows a decrease in incidents with increase in no. of safety observation rounds but no such correlation is obtained for trainings. This may be because of several other factors affecting the incident rate which are not accounted for in this relationship.

In the above table, only constant term has a p value of close to zero which means that it has a significant effect on the overall equation.

The overall equation has a significant p value of 0.025 which indicates a good confidence level. Also, the R squared value is around 56%.

Similar analysis is carried out for all the other plants and the results are tabulated as below:

LOCATION	Training Coeff.	R Sq.	SO Rounds Coeff.	R Sq.
Lko PLANT	-0.281	92.4	-2.958	89.7
PLANT 2	-0.165	68.6	-1.112	90.5
PLANT 3	0.394	77	11.6	81.8
PLANT 4	-0.3	31.3	-2.347	38.1
PLANT 5	-0.131	71.4	-2.31	76.7

Focused Group Discussion: -

In an effort to understand the impact of safety training and safety observation focused group discussion of two groups was carried out of **61 employees in a set of 25,15,21**. Employees from different departments, age group, grade, and tenure in the company were selected for the focus group discussion. The group was briefed about the intention of the group discussion and were asked to give their opinion and point of view about the impact of safety observation safety training on improving safety performance and reducing incidents in the plants. Various responses were categorized into five to six category groups to analyze the answers. Also an overall perception was enquired about the impact of safety observation and safety training on safety culture in the plant.

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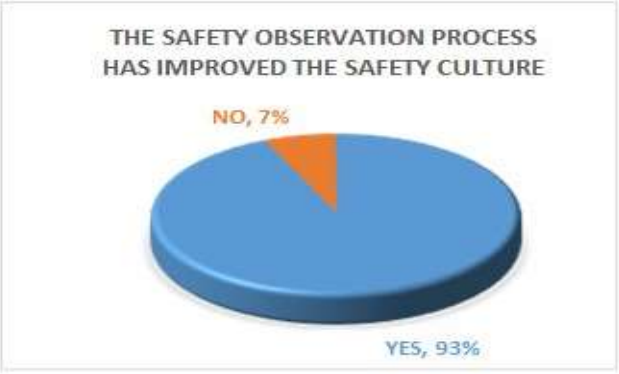
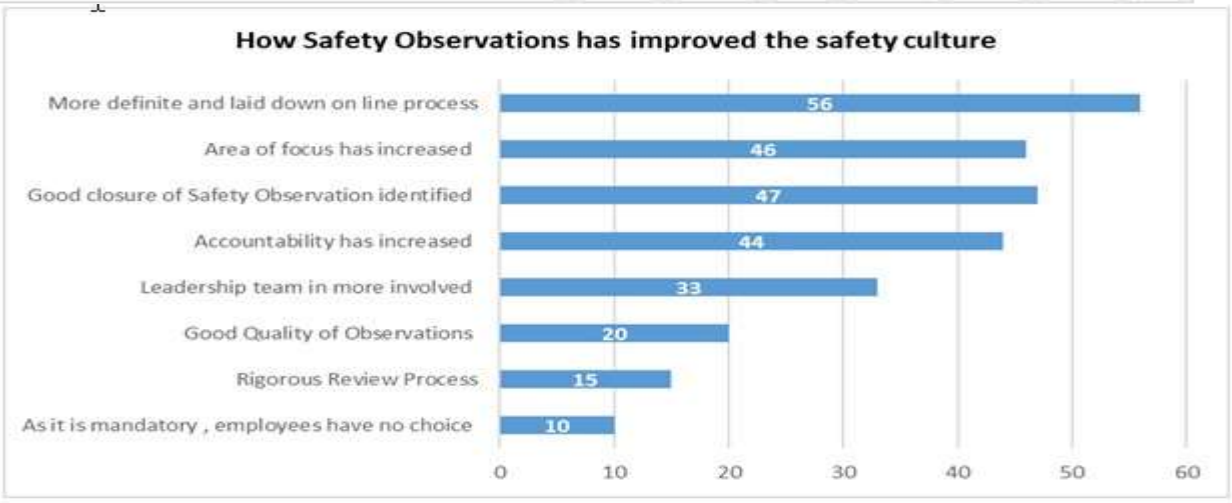


92% participants showed positive response on the impact of safety training and 93% participants showed positive response on the impact of safety observations.

On discussion of safety training the four major areas which were deliberated and discussed were increase in Accountability, Good closure of safety observation, increase in area of focus and more definite laid down process.On discussion of safety observation, the four major areas which the participants brought out were clear and detailed safety processes, greater awareness, Consequence and impact of training, involvement of leadership team. The focused group discussion brought out that majority of the participants had a perception that the safety culture and intern safety performance has undergone a positive change as a result of safety observation and safety training.



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The three Groups were also asked to discuss the impact of safety training and safety observation on morale and productiveness of employees. 95 % of the employees said that morale has improved as employees are more safe at work place or morale has improved as employees have safe environment to work at. 92 % employees also confirmed that employees are more productive at work as they feel safer or employees are more productive as they fell more confident with respect to safety.

Conclusion from data:

Training has a positive impact in reducing no. of incidents

[1] The number of incidents have gone down at 4 plants of Tata Motors .Plants with increase in trainings
[2] In Plant 3, the trainings could not be effectively related with incidents. However, there has been a decrease in permanent and temporary employee incidents with increase in employee trainings. For contract employees, an increase in incidents has been observed with increase in trainings.

Increase in Safety observations has resulted in increased number of observations which is also showing a positive impact in reducing number of incidents.

[1] The number of incidents have gone down at 4 Plants with increase in trainings on safety observations.
[2] Plant 3, safety observations could not be effectively related with incidents. However, there has been a decrease in permanent and temporary employee incidents with increase in safety observations. For contract employees, an increase in incidents has been observed with increase in safety observations.

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Conclusion from focused group discussion

[1] On discussion of safety training the four major areas which were deliberated and discussed were increase in accountability, Good closure of safety observation, increase in area of focus and more definite laid down process.

[2] On discussion of safety observation, the four major areas which the participants brought out were clear and detailed safety processes, greater awareness, Consequence and impact of training, involvement of leadership team. The focused group discussion brought out that majority of the participants had a perception that the safety culture and intern safety performance has undergone a positive change as a result of safety observation and safety training.

Safety Performance From 2012 till 2015 :

The safety performance for Tata Motors has improved over the past three years , the year under study 12-13 showed maximum impact and in the subsequent years the performance has improved .

Safety Performance	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Lost time injuries	200	122	59	31
Lost time injury rate (per million man hours)	1.08	0.68	0.39	0.2
Total recordable cases (Nos)	NA	448	228	295
Total recordable cases (Freq rate)	NA	2.49	2.23	1.91

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