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6th National Conference on Advancements in Mechanical, Environmental, Safety and Health Engineering (AMESHE) On 11th May 2019 Organized By

Department of Mechanical Engineering, Knowledge Institute of Technology, Salem, Tamilnadu



ENHANCING EHS IMPLEMENTATION TO CREATE A POSITIVE SAFETY CULTURE IN AN AUTOMOTIVE FRICTION MATERIALS MANUFACTURING INDUSTRY

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Abstract:

Safety culture is considered as a vital factor in accidents which is revealed in many industrial accident investigations, and it is now accepted that organizations with a strong safety culture which is more effective in preventing workplace accidents and injuries. Also, a positive safety culture improves employee morale and brings trust over the management commitment towards Environment Occupational Health & Safety. In this concept of enhancing safety culture, I have taken lagging indicator as a buzzword to improve safety practices in a friction material manufacturing industry which is established in the year of 1964. This concept follows 5 sequential steps as follows, a. Study about current safety practices b. Identifying the lagging indicators c. Adhering the lagging indicators by appropriate control measures d. Implementing the control measures e. Monitoring & reviewing. To identify the lagging indicators current practices are studied and lagging indicators are identified and suitable control measures are given by incorporating best engineering practices and as per legal compliances, then implementing the same in the workplace to achieve generative safety culture with continual improvement.

Key Words: EOHS, Safety Culture, Lagging Indicators, Friction Materials & Incident control

1. Introduction:

Occupational injuries & diseases associated with industrialization has declined markedly by following developments in science and technology, such as engineering controls, protective equipments, inherently safer machinery and processes, and greater adherence to regulations and labor inspections. Although the introduction of health and safety management systems has further decreased the incidence of occupational injuries and diseases, these systems are not effective unless accompanied by a positive safety culture in the workplace. The characteristics of work in the 21st century have given rise to new issues related to workers' health, such as new types of work-related disorders, non communicable diseases, and inequality in the availability of occupational health services. Many organizations that have introduced new occupational health and safety management strategies have failed to show improved effectiveness because these strategies did not consider the impact of the organizational culture.

Safety Culture and Organisation:

Safety culture reflects the attitudes, beliefs, perceptions and values that employee's share in relation to safety. Safety culture is often seen as a subset of organizational culture and it is a multi-dimensional concept. External forces do not dictate safety performance, namely organizational culture, climate, and organizational performance and proceeds to explain the relationship among safety culture, climate, organizational practices, and the prediction of safety outcome variables. An occupational safety and health management system is not effective unless it is accompanied by a positive safety culture in the workplace. Many organizations that have introduced new occupational health and safety management strategies have failed to show improved effectiveness because these strategies did not consider the impact of the organizational culture. The first time the term 'safety culture' appeared in literature was when the International Atomic Energy Agency (IAEA) introduced the term in its 1986 Chernobyl Accident Summary Report to describe how the thinking and behaviors of people in the organization responsible for safety in that nuclear plant contributed to that accident. In 1993 the Advisory Committee on Safety of Nuclear Installation (ACSNI) investigated disasters such as the Chernobyl meltdown, the Kings Cross fire, the Piper Alpha explosion, concluding that safety systems in these workplaces had broken down. These breakdowns were not caused by the method of managing safety, but by problems with the "safety culture" of the responsible organizations. The lesson drawn from these disasters was that "it is essential to create a corporate atmosphere or culture in which safety is understood to be and is accepted as the number one priority."

2. Literature Survey:

In 1993, the ACSNI Human Factors Study Group defined safety culture as "the product of individual and group values, attitudes, perceptions, competencies and patterns of behavior that can determine the commitment to, and the style and proficiency of an organization's health and safety management system. A safety culture has psychological, behavioral, and situational components. The psychological component consists of shared values, attitudes, perceptions, and beliefs that drive decisions and behaviors regarding safety. The behavioural component can be defined as the methods regarding safety in the workplace, and the situational component as the policies, procedures, regulations, organizational structures, and management systems related to safety.

- The IAEA has described five characteristics of a positive safety culture.
- First, leadership is the highly visible commitment to safety by top management, a characteristic vital for providing a positive safety culture.

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Figure 1: Safety Culture

- Second, safety should be clearly communicated as a value, not as a priority that can be traded off against cost and schedule.
- Third, decentralized decision-making and accountability of key groups responsible for safety is important for creating and maintaining a positive safety culture.
- Fourth, all employees should learn about safety and contribute ideas on improved safety. A positive safety culture is achieved when employees learn from insight and intuition rather than incidents and change their ways of thinking and acting by sharing their experiences and addressing shared problems.
- Finally, a positive safety culture is one in which safety is a top priority and is integrated into every aspect of the company. In particular, among the five characteristics, the leadership of employers are the key to developing a positive safety culture.

Single organizations have unique organizational cultures and safety cultures. The following diagram shows the positive and negative safety culture differences.

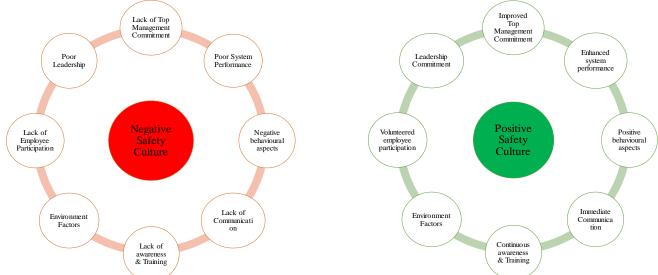


Figure 2: Negative Safety Culture

Figure 3: Positive Safety Culture

As per professor Patrick Hudson, Safety culture can be divided into five levels of development, from "Pathological", to "Reactive", to "Calculative", to "Proactive" to "Generative". In a "Pathological" safety culture, employers and workers do not care about violating safety rules; this is often termed a "No care" safety culture. In a "Reactive" safety culture, safety becomes important only after an accident; this is often called a "Blame safety culture". In a "Calculative" safety culture, systems are in place to manage all hazards; this is often called a "Planned safety culture". In a "Proactive" safety culture, workers do not work on problems they find, but avoid problems in advance to improve the work environment.

A "Generative" safety culture is a dynamic safety culture, in which safety is built into ways of working and thinking. Thus, a poor or pathological safety culture can develop into a positive or generative safety culture when a change in culture is properly managed. Dupont Bradely curve defines safety culture with incident rates are taken as a model for this project work.

Sergey Sinelnikov, Joy Inouye and Sarah Kerper on their paper titledUsing leading indicators to measure occupational health and safety performance, This study argues for continued effort to improve access to research and practical knowledge among OHS professionals as well as their executive leaders who seek to demonstrate continuous improvement of performance measurement strategies.

Siti Fardaniah Abdul Aziza & Fadzil Osman on their paper titled does compulsory training improve occupational safety and health implementation? The case of Malaysian this paper describes that Safety training is very important as a part of safety climate. Occupational safety and health literature shows that occupational accidents and injuries could be controlled by providing positive safety climate; one of the climates is to equip employees with related OSH training.

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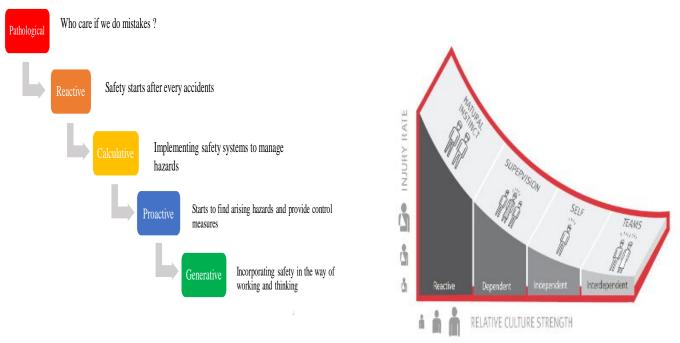


Figure 4: Safety Culture Development Criteria

Dr. Shiney Chib & Dr. Medha Kanetkaron their paper titledSafety Culture: The Buzzword to Ensure Occupational Safety and Health describes that corporate safety culture has been considered as a contributory factor in accidents by many industrial accident investigations, and it is now generally accepted that organizations with a strong safety culture are more effective in preventing workplace accidents and injuries. Safety culture is a multidimensional concept. The factors as management responsibility, job satisfaction, individual responsibility, leadership style and communication, risk awareness, and risk taking.

Linda Haney and Maureen Anderson on their paper titled Behaviour Based Safety; A different way of looking at an old problem describes that Behaviour based safety is one approach to add to the existing knowledge and techniques for improving the health and safety of workers while maintaining a strong economy. The collaboration of occupational and environmental health and safety professionals in these efforts can enhance the health and safety of employees and benefit corporations.

3. Introduction about Company:

The company was established in 1923, and it comprises of seven companies with twenty-four plants dedicated to automobile component manufacturing. It symbolizes the successful integration of international quality with indigenous expertise. It employs over 5200 highly trained personnel and has an annual sales turnover (2017-2018) of about INR 4,520 crores. The company is head quartered in southern part of Tamilnadu.

Products Manufactured and it's Application with Process Flow:

The following are the various products manufactured in the organization.

- Brake Linings
- Disc Pads
- Composite Brake Blocks
- Clutch Facings

To manufacture the products various raw materials are used in combination to get required properties and efficiency. The process flow is given below.

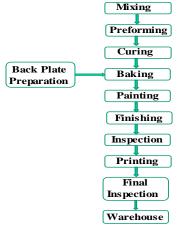


Figure 5: Process Flow

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PRODUCTS
APPLICATIONS
Brake Linings

Medium & Heavy Commercial Vehicle (M&HCV)

Light Commercial Vehicle (LCV)

Farm Tractors

Brake Lining & Disc Pads

Passengers Car Vehicle (PCV)

Utility Vehicle (UV)

Multipurpose vehicle (MPV)

Two-Wheeler (TW)

Composite Brake Blocks



Railways

Figure 6: Products Application

4. Problem Identification:

Profound study is carried out in the industry to identify the associated lagging indicators that plays a vital role in deteriorating safety culture. So, existing systems are reviewed by conducting field study and shortlisted with present status and proposed action are given below. To compare the final data with previous one, incident data are taken into account. For this, collected last 2 years data (2017 and 2018) as a benchmark. From the data we have break up into Reportable, Non-reportable and First-Aid. Total Reportable Accident in the period is 2number, Total Non-Reportable Accident in the period is 12 number and Total First aid case reported is 18 number. On detailed analysis of the incident, it reveals that maximum accidents are due to unsafe act of the employees.

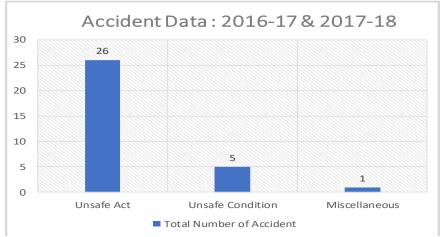


Figure 7: Accident Statistics

Hence, by using this data the lagging indicators which is also causes of further accidents is identified and listed below.

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S.	IDENTIFICATION OF	PRESENT	PROPOSED		
No	INDICATORS	STATUS	ACTION		
1	Incident Reporting System	Not Efficient	To be improved		
2	Unsafe Condition monitoring	Not Efficient	To be improved		
3	Work Permit System	Not Adequate	To be modified		
4	LOTO System	System in implementation stage	To be implemented		
5	Near Miss Reporting System	No System Found	To be implemented		
6	Safety Induction	Adhering	Sustain		
7	Training & Awareness	Not Adequate	To be modified		
8	Personal Protective Equipment	Non-Adherence	To be adhered		
9	Legal compliances	Adhering	Sustain		
10	Management certifications	Adhering	Sustain		
11	Equipment Safety	Not Efficient	To be improved		
12	Safety Checklists	Not Available	To be implemented		
13	Environment Monitoring	Adhering	Sustain		
14	Waste disposal management system	Adhering	Sustain		
15	Employee Health Monitoring	Adhering	Sustain		
16	Fun at work (Stress burning activity)	Adhering	Sustain		
17	Safety suggestions	Not Efficient	To be improved		
18	Mock Drill	Not Adequate and Not Efficient	To be improved		

Table 1: Indicators identified with present status and proposed action

All the above identified indicators that leads to negative safety culture is identified and profound study is to be carried out to enhance the safety culture of the organization. This project focuses on short listing the identified major lagging indicators that affect safety culture of the organization and appropriate counter actions are taken to improve the safety culture.

The major lagging indicators are,

- Incident reporting system
- Work permit system
- Near Miss, Unsafe condition & Unsafe act monitoring
- Awareness & Training

5. Implementation Methodology:

The following are the various methodology adopted to improve the safety culture of the organization. It includes step by step approach from identifying the problem to implanting and reviewing for its effectiveness.



Figure 8: Implementation methodology flow chart

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The above 5 sequential steps give the methodology for implementing the generative safety culture in this organization. They are as follows,

Step 1: Study about Current Safety Practices

Safety practices are reviewed with the help of existing documents and field-oriented observations. All the in and out, compatibility of the system and their effectiveness with respect to field implementation and follow-ups are observed and some of the lagging indicators are identified and shortlisted. Studies carried out through,

- Reviewing documents (Incident reporting system, Trainings, Previous audit documents, HIRA register and Legal compliance documents)
- Safety walkthrough for actual field observation
- Employee interviewing

Step 2: Identifying the Lagging Indicators

During problem identification stage, all the lagging indicators are identified by shortlisting as per the priority and defined as follows.

Incident Reporting System:

OSHA defines an incident as "an unplanned, undesired event that adversely affects completion of a task." Incidents range in severity from near misses to fatal accidents. To overcome the incidents, we need to focus on the possible causes and identify the root cause and provide pool proof control measures to avoid the same occurrence in future. To perform this, a proper incident reporting system is required. This system includes reporting of Near miss, First – Aid, Non - reportable accidents, Reportable accidents and Fire accidents.

Outcome on Analysis:

Industry is already following internal communication system as first line incident report and there is no detailed study of the incident is carried out and no proper pool proof control measures as per hierarchy is given. So, it is considered as a major lagging indicator to be addressed.

Work Permit System:

A permit to work system is a formal written system used to control certain types of work that are potentially hazardous. This is the entry level document which confirms the hazards involved in the activity and approval for the work is given after controlling the hazard.

Outcome on Analysis:

It reveals that there is no sufficient data are present in the existing work permit which may not address the hazards which may leads to incident. So, it is considered as a major lagging indicator to be addressed.

Near Miss, Unsafe Condition & Unsafe Act Reporting:

Unsafe Condition: A condition in the work place that is likely to cause property damage or injury or death. Unsafe Act: Any activity that deviates from a generally recognized safe way or specified method of doing a job and which increases the probabilities for an accident.

Near Miss:

An unplanned event that may not result in bodily injury or damage to product is called near miss or close call. Monitoring these 3 lagging indicators and providing appropriate counter measures will reduce the maximum incidents. Outcome on Analysis:

There is no regular inspection and audits carried out with reporting system is followed. So, it is considered as a major lagging indicator to be addressed.

Awareness and Training:

Awareness: Awareness is the ability to directly know and perceive, to feel, or to be cognizant of events. More broadly, it is the state of being conscious of something. Training: Training is the act of increasing the knowledge and skill of an employee for doing a particular job in a safe way. Both the awareness and training are a major part in safety management system to be followed for healthier and safer work environment.

Outcome on Analysis:

It is found that there is adequate and proper training and awareness given for all the level of employees. As per industry policy and legal norms training and awareness are mandatory programs to be conducted regularly. So, it is considered as a major lagging indicator to be addressed. For the above all shortlisted lagging indicators appropriate systems are followed to improve the overall safety performance of the organization which directly enhances the safety culture.

Step 3: Adhering the Lagging indicators by Appropriate Control Measures

All the identified lagging indicators are reviewed and suitable control measures are selected as per the system suitability.

S.No	Identification of Lagging Indicators	Present Status	Methodology Adopted
1	Incident Reporting System	Not Efficient	Safety Flash system implemented and Incident investigation system revised
2	Unsafe Condition, Act& Near miss Monitoring	Not Efficient	Safety Pause, Near miss & Unsafe condition monitoring system implemented
3	Work Permit System	Not Adequate	Multiple permit is replaced by single permit system
4	Training & Awareness	Not Adequate	Identifying training needs and implement with self - learning kiosk system.

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- Implementation of the control measures will be carried out as above discussed.
- All the methodology is implemented with proper supervision.
- Each methodology requires different method of approach.

The following are the various methodology applied to enhance the safety culture of the organization.

Incident Reporting System:

Before:

After occurrence of major incident HR team will investigate the accident along with maintenance team and share the report to corporate HR team. It is found that there is no adequate control measures and actual root cause is find out. So it is planned to revise the incident reporting system.

After:

There are 2 types of system designed to report the incidents. It includes Reportable, Non-reportable, First Aid & Fire Incident. In the 2 types,

- Safety Flash: It is a preliminary investigation report which should be sent to all responsible within 2 hours of the incident. It has only base line details without rot cause and counter measures.
- Incident Investigation Report: It is a detailed investigation report with brief why why analysis and root cause with appropriate control measures. The report should be shared within 24 hours of the incident. Also, the report consists of reviewing mechanism, in which the control measures are reviewed for its effectiveness and finally close the report.

After receiving the report, the counter measures are verified for its effectiveness and horizontally deploy the same to other manufacturing facility as a proactive measure to prevent incidents. The following shows the communication flow chart of safety flash and incident investigation report.

INCIDENT COMMUNICATION FLOW CHART

SAFETY FLASH Preliminary Incident Investigation Report After occurrence of any incident, information is to be passed to Plant HR & Security Office through Occupational Health Centre or through Module leaders If, it is First Aid case If, it is Reportable accident Communicate the incident to PH / FH / PHR / PED Communicate the incident to President / PH / CHR / through safety flash in mail by Module leaders Safety / FH / PED / Module leaders through safety flash by PHR **INCIDENT INVESTIGATION REPORT Detailed Incident analysis report** Cross functional team (FH / PED / PHR / Module Leaders) starts to analyze the Root cause for the accident with appropriate control measures and share it to PH / CHR / Safety in Incident Investigation Report format Incident Investigation report is to be validated based on the analysis by Safety / CHR and share it to MD / President by CHR If, it is Reportable accident Accident report is to be submitted to Inspector of Factories within 48 hours in the applicable format by respective plant HR Share the reports to other plants by CHR / Safety for horizontal deployment of control measures Communicate the incident details in Staff Meeting, Morning Meeting, Safety Committee Meeting, Business Review Meetings, Canteen Committee Meeting to create awareness for proactive actions

Note:

Safety Flash Report should reach to concerned person within 2 hours & Incident Investigation Report should reach within 24 hours.

Figure 9: Incident Communication Flow Chart

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Department of Mechanical Engineering, Knowledge Institute of Technology, Salem, Tamilnadu Unsafe Condition, Act& Near Miss Reporting:
Before:

There is no identification and reporting of unsafe act, unsafe condition and Near Miss. So, it leads to multiple incidents with deterioration of safety culture. To address this proper tool and communication system is designed.

The system is named as Safety Pause (Temporary stop in action to correct unsafe act) for identifying unsafe act. This is a card prepared by worker by observing the unsafe activity of fellow worker and he issue safety pause card to the fellow worker by mentioning the unsafe activity done and proper safe method of doing the work is explained in the format. Increase in number of safety pause holder receives penalty and issuer gets credits. As same as there is another system called hazard communication card in which unsafe condition and Near miss is reported in the form and kept in the hazard communication box. Each end of shift the supervisor collects the card and make a report of it. Immediate and high severity problem is addressed in a sequential manner followed by lowest one. This kind of activities improves the hazard communication in earlier stage that helps to prevent incidents.

Safety Pause						
Aim Enable team to proactively anticipate any risks to human, obserunsafe behaviour and change it						
Conduct by	All employees					
Duration	5-10 mins					
Approach Non-judgemental, positive, team building approach, focus everyone needs to know to maintain safety – "What safe a behaviour we need to be aware"						
Follow ups Observation identified, solutions introduced or being developed. To review in Safety Committee Meetings and Plant MBR						
Team Morale	Compliments for best observers					

The Safety Pause : Information Sheet						
What	"What was unsafety act / behaviour observed?"					
Why	"Why it was done?"					
Who	Name :	Department:				
When	Date	Time				
How (Safety Behaviour / act)	"How it will be corrected?"					
Observer	Name :	Department:				



Figure 10: Safety Pause System

Work Permit System: Before:

Earlier work permit system consists of 3 types of hazardous, Height work, Hot work & Confined space work. But it is not adequate to provide appropriate control to all kind of works. Also, existing work permit system doesn't address major hazards and there is no evidence for workers communication.

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Due to system non-compliance it is planned to revise the multiple work permit into a single permit to work system with proper worker communication. Maximum hazards and their control measures are addressed in the permit. It simplifies the operation and eliminate multiple paper work.

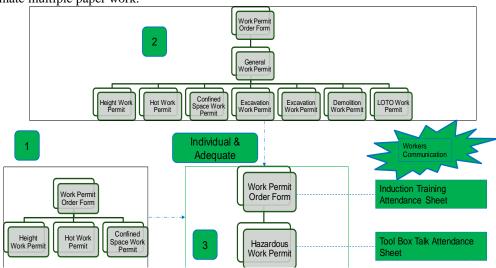


Figure 11: Work Permit Formation

Number 1 denotes that existing work permit system which is inadequate and number 2 shows multiple work permit system, but again it leads to multiple paper work. So number 3 work permit system is designed to address all types of hazardous work activity in a single sheet with proper risk control checks and worker communication sheet (Tool Box Talk and Induction Talk attendance sheet).

Location of plant : Chennai Hyderabad Pondicherry Trichy							
Work Start Authorization							
Name of the Company / Contract :			Work Location :				
Nature of Work :				Number of Workers :			
Work Duration Start Date :		_ <u>Tin</u>	ne :	End Date : Time : _			
Emergency Contact Name (Contractor) :	Mobile <u>No :</u>						
General Checks (Mandatory)	Yes	No	Na	Electrical Work Applicable Not Applicable		No	Na
Trained persons assigned to hazardous work				Electrical license holder available & informed			
Equipment's, Tools & Tackles are safe to use				Check that electricity is de-energized			
with adequate safety provisions & defect free				Insulated tools and equipment's are available			
Attended tool box talk (Attach attendance sheet)				Electrical protection PPE's are available			
Work area barricaded & signage displayed				Electrical insulation mats are available			
Is energy isolation required (If yes, apply LOTO)				Dismantling/Demolition Work ☐ Applicable ☐	Not A	pplicat	le de
Mention LOTO number :				Safety net/clothes are provided to restrict the	,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Check weather conditions suitable for work				flying/falling objects			
Proper access & egress provided				Check that nearby structure is protected			
Check adequate lighting in case of night work				Risk assessment in place if blasting allowed			
Height Work				Is safe work procedure is communicated			
Scaffolds are checked and safe to use				Excavation Work Applicable Not Applicable			
Ladders are checked and safe to use					=		_
Safe to use Tag in place for above equipments				Underground utilities checked & isolated			
Proper edge & fall protection system installed				Check nearby structures are protected			
Lifting tools & tackles are free from defects				Provide proper hard barricading and restrict			
Equipment's & Tools are secured against fall				nearby vehicle & unauthorized access			
Is Parallel activities are restricted				Shielding / Shoring is provided to avoid soil			
Overhead electrical lines isolated (if any)				collapse Confined Space Work Applicable Not Ap.	nlicable	,	
Hot Work ☐ Applicable ☐ Not Applicable				Check oxygen level is between 19.5% to 23.5%	pricabil	-	
Nearby flammable items protected				Intrinsically safer tools & equipment used			
Gas cylinder, torch, hose / Welding machine,				Check rescue devices availability & inform to			
holder is free from defects with earthing				ERT team			
Gas cylinder is placed in upright position at				Hazardous gas monitoring done & found safe			
trolley & secured against fall with no gas leak				(attach gas monitoring sheet)			
Is flashback arrestor installed on both ends of				Check for adequate ventilation lighting			
hoses and check availability of pressure gauge				Confined space attendant is to be present			
Check firefighting equipment availability				throughout the activity			l

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Personal Protective Equipments: ☐ Safety Helmet ☐ Safety Shoe ☐ Ear plug/muff ☐ Safety Goggles/Face Shield ☐ Nose Mask ☐ Safety Gloves ☐ Full Body Harness ☐ Apron / Coverall ☐ Reflective Jacket ☐ Self-Contained Breathing Apparatus (SCBA).

I have checked the above points and authorizing the activity to be carried out in the prescribed duration with proper risk controls. In case of any abnormalities or deviations identified / occurred permit is cancelled.

Authorization	Contract Supervisor	Monitoring Supervisor	PED Supervisor	Department Head / Plant Head	HR / Safety	
Name						
Signature						
Date & Time						

Work Stop Authorization Please tick the appropriate : Work Pending Work Completion Work Cancellation Work activity have inspected & found □Safe □Unsafe. Housekeeping carried out & wastages are stored in an authorized place. Monitoring Supervisor / DH / PH Date: Safety / HR Date: Name: Signature: Time:

Note: Display the permit in work area during work & return the permit in security office after completion / cancellation of work. This permit is valid only for 24 hours.

Figure 12: Revised Work Permit

Training and Awareness:

Before:

Earlier there are training program available which address only baseline safety trainings. There is no in depth or some mandatory training programs in the aspect of Environment, Health and Safety according to their category of work.

After:

Training assessment is conducted for all level of workers which includes, Permanent, Trainees, Contractor, Canteen employees, Security, Gardening workers are taken in to account and training needs are identified. As per the training requirement need specialized training calendar is prepared with applicable participants, duration and mode of trainers also given. Based on the training calendar, plant human resource team will allocate resources and conduct training as per schedule. This training calendar consists of legally applicable trainings too. The following are the various training program addressed in the training calendar. Induction training program, Refresher training, Firefighting training, Mock drill, Emergency preparedness, Legal amendments, Safe material handling procedures, LOTO system, Work permit system, Fork lift operation training, ETP/STP plant operating procedures, Dust handling safe practices, Air quality, Lux and Noise level monitoring training, Occupational health monitoring, Heat stress are some of the training programs planned for the calendar year 2019-2020. Out of 631 employees all are covered under induction training and on later stages all the remaining employees were trained. Some of the glimpses of induction and other training program are given below for reference. Apart from internal training program, employees are encouraged to attend external training program sponsored from organization to learn recent trends in the field of Environment Health and Safety.



Figure 13: Training & Awareness

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Apart from the manual training program, we have introduced 'Safety Kiosk'. It is a touch screen monitor with pre-programmed training module. It has various training module that can be used for different category of people (Drivers, Visitors, Suppliers, Intern / Project students etc...) This inbuilt module contains various topics addressed according to the user as mentioned above. Addition and deletion is possible with simple program modification. New trends and other training modules can be added as per demand. In addition to that internet can be used in that for employee emergency purpose. It is placed in the security office. Whoever enters in to the premises will undergo this training program and after successful completion he/she will get safety passport with 3-month validity. If he/she fails to get the safety passport then he will re-take the test until successful completion. The flow chart of training is given below.



Figure 14: Safety KIOSK & its module

The benefits of the kiosk is, Eliminate manual trainer, All persons entering into the premises will aware about safety practices, Multiple training can be attended until success and Enhanced learning experience through the visual aids.

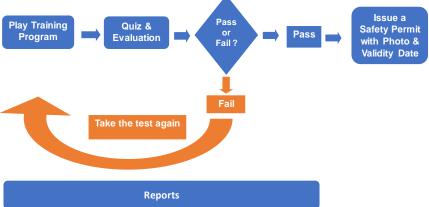


Figure 15: KIOSK Flow Chart

6. Conclusion & Way Forward:

Safety culture is consistently and independently associated with safety performance. In addition, employee perceptions and attitudes towards safety are consistently and independently associated with individual health and wellbeing. After implementing all the control measures, regular monitoring takes place for the last 5month (December 2018 to April 2019). It is observed that, there is no reportable accidents, no non-reportable accidents and first cases. Also, it is noticed that employee perception towards the Environment Health and Safety is improving and it is evidenced in reporting the near miss and actively participating in Safety pause system. It is regularly monitored to check the effective implementation and adherence level. When the perception of worker is positive then there is a change is happening in the real work environment. As way forward, the result is to measure with individual work behaviour and their changes has to be reviewed by qualitative and quantitative method by conducting employee opinion survey and reviewing first aid reports.

7. References:

- 1. Lourdes Ruiz Salvador, Duong Van Thinh, Occupational Safety and Health: An Overview, 11th IEEE International Symposium on Applied Computational Intelligence and Informatics, May 12-14, 2016, Timisoara, Romania
- 2. Linda Haney and Maureen Anderson, Behaviour Based Safety, A different way of looking at an old problem, AAOHN Journal1999j 47(9), 424-432
- 3. Frank J. van Dijk, Marija Bubas, & Paul B. Smits, Evaluation Studies on Education in Occupational Safety and Health: Inspiration for Developing Economies, Annals of Global Health, vol.81, no.4, 2015 OSH Education Review July to August 2015: 548 560
- 4. Hasan Basri Basagaa, Bayram Ali Temela, Muzaffer Atasoyb, Ibrahim Yildirimc, A study on the effectiveness of occupational health and safety trainings of construction workers in Turkey, Safety Science 110 (2018) 344–354
- 5. Pablo Marshall, Alejandro Hirmas, Marcos Singer, Heinrich's pyramid and occupational safety: A statistical validation methodology, Safety Science 101 (2018) 180–189

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Department of Mechanical Engineering, Knowledge Institute of Technology, Salem, Tamilnadu

- 6. Marjorie D. Weiss, Leveraging Best Practices to Promote Health, Safety, Sustainability, and Stewardship, Workplace Health & Safety, vol. 61, no. 8, 2013
- 7. Dianne Dyck and Tony Roithmayr, Great Safety Performance: An Improvement Process Using Leading Indicators, December 2004, vol.52, no.12
- 8. Sergey Sinelnikov, Joy Inouye and Sarah Kerper, S. Sinelnikovetal, using leading indicators to measure occupational health and safety Performance, Safety Science 72 (2015) 240–248
- 9. Jung-Keun Park, Ton T. Khai, Occupational Safety and Health Activities Conducted across Countries in Asia, 2015, Occupational Safety and Health Research Institute
- 10. Yangho Kim, Jungsun Park and Mijin Park, Creating a culture of prevention in occupational safety and health practice, Safety and Health at Work (2016), doi: 10.1016/j.shaw.2016.02.002
- 11. Deborah Fell-Carlson, Rewarding Safe Behavior: Strategies for Change, December 2004, vol. 52, no, 12
- 12. Xinxia Liu, Guoxian Huang, Huiqiang Huang, Shuyu Wang, Yani Xiao and Weiqing Chen, Safety climate, safety behavior, and worker injuries in the Chinese manufacturing industry, Safety Science 78 (2015) 173–178
- 13. Dr. Shiney Chib and Dr. Medha Kanetkar, Shiney Chib and Medha Kanetkar Safety Culture: The Buzzword to Ensure Occupational Safety and Health, Procedia Economics and Finance 11 (2014) 130 136
- 14. Siti Fardaniah Abdul Aziz and Fadzil Osman Does compulsory training improve occupational safety and health implementation? The case of Malaysian, Science direct 13 July 2018.