International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 4, Issue 7, July-2018

DEVELOPMENT & EVALUATION OF SMART HSE [HEALTH SAFETY & ENVIRONMENT] ASSURANCE PROGRAM IN A CONSTRUCTION PROJECT

Senthil Kumar Loganthan[1], Nihal Anwar Siddiqui[2]

[1]Post-Graduate, [2] Professor and Head,
Department of Health, Safety, Fire and Environment, College of Engineering Studies,
University of Petroleum and Energy Studies, Dehradun, India.

ABSTRACT

The main objectives of this study are to provide assurance to the management through effective implementation of HSE (Health Safety & Environment) expectations and monitoring of HSE performance on continuous basis, to provide assurance to the management that all respective proactive HSE KPIs (Key Performance Indicators) are accomplished as expected, to provide assistance in understanding of scope of the verifiable parameters and determining required evidence/ facts to be provided against each KPI, to pinpoint the gap in the existing HSE Management system, to prepare a roadmap to overcome the gaps and overall and above to enhance the HSE culture within the company. In nutshell, the purpose of this study is to develop a comprehensive safety program named as "SMART HSE Assurance Program" for a construction worksite in line with the local and international standards and to implement the same in a construction project to manage the Health, Safety and Environment of the People, Equipment, Environment and the reputation of the company. The Program was developed by considering all the essential elements of health, safety and environment. As a part of the program a Program guideline was developed to provide a base for the preparation & implementation of SMART HSE Assurance Plan. The plan was implemented in the project for the past one year in a construction worksite. The success of any safety program is measured by the Key Performance Indicators. Likewise to find out the effectiveness of the safety program all the required necessary key performance indicators were computed and assured that the implemented safety program performs effectively and few gaps were identified during the study of the indicators which will be addressed and the program will be revised accordingly for future projects.

INTRODUCTION

SMART HSE Assurance Program is developed and implemented as part of Companies HSE Policy & Strategic HSE Objectives. The main objective of this Program is to provide assurance to management through consistent implementation of proactive HSE measures in all Projects & Construction activities to prevent incidents/injury/ill health, Environment and . Systematic and periodic verification shall be completed to ensure that all the HSE & Crisis Management aspects are implemented effectively throughout the life cycle of the Project & Construction activities throughout the organization.

Basic idea of the program: PDCA model

P for Plan

This stage is about setting the direction for effective health and safety management system, usually by producing a policy that sets a clear direction for the business.

It should help to ensure communication of health and safety duties and benefits throughout the organization. Policies should be designed to meet legal requirements, prevent health and safety problems, and enable you to respond quickly where difficulties arise or new risks are introduced.

When setting the policy:

- think about where you are now? and where you need to be?
- set out the company's aims and objectives for health and safety, who will be responsible for what?, how you will achieve your aims?, and how you will measure your success?
- decide how you will measure performance?
- consider fire and other emergencies and compile a clear plan of how you would deal in the event of such situations arising?
- plan for changes and identify any specific legal requirements that apply to you

From this start point you should be able to identify an action plan of how to implement the policy.

D for Do

In essence this is about implementing the plan that you have put into place during the previous stage. In doing this you should aim to involve your workers and communicate and ensure that adequate resources are allocated to the plan, including competent advice where needed.

The stages you should go through, broadly speaking are to:

- put in place the preventive and protective measures needed (as identified in the planning stage)
- provide the right tools and equipment to do the job and keep them maintained
- train and instruct staff, to ensure everyone is competent to carry out their work
- provide adequate supervision to make sure that arrangements are followed

C for Check

Unless you check what is going on you will not know how effectively your health and safety plans are being implemented. Monitoring and reporting are important parts of health and safety arrangements. When monitoring performance do not just rely on reactive indicators such as accident reports. Whilst lessons can be learned it is better to monitor proactively as well as you may stop incidents happening in the first place.

Proactive measures include:

- Make sure that your plans have been implemented by observing working practices.
- Assess how well the risks are being controlled and if you are achieving your aims through informal inspections or formal audits.
- Encouraging feedback from staff, both good and bad.
- Health surveillance.

Reactive measures include:

- Investigating the causes of accidents, incidents or near misses.
- Monitoring sickness absence.
- Dissemination of lessons learned.

A for Act

It is important that organizations review their health and safety performance as it tells you whether your system is effective in managing risk and protecting people.

Reviews should include:

- Learning from accidents and incidents, ill health data, errors and relevant experience, including from other organizations.
- Revisiting plans, policy documents and risk assessments to see if they need updating.

Action plans should include:

- Close out actions from audit and inspection reports.
- Have names and dates placed next to actions so they do not "fall between the cracks"; it is easy for everyone to assume someone else is doing something.
- Finally, the "act" stage then feeds back into the planning process. It may lead to revisions to your policy or procedures if you find a better or more effective way of doing something. It may even help you to streamline your policy if you realize that you have superfluous procedures.

Once your company has gone through one cycle of Plan-Do-Check-Act it should then become a more fluid process and benefit to your other management procedures. Doing it safely is usually the most efficient way!

SMART HSE ASSURANCE PROGRAM

To consider a program as a SMART one the program has to fit in all elements of these categories Specific, Measurable, Attainable, Relevant & Time bound. The HSE Assurance program explained here fits these entire categories.

SPECIFIC	The program is designed very specific to the project and it can be altered specific to the Company/industry.
MEASURABLE	The scoring mechanism in program makes the program measurable.
ATTAINABLE	Implementing the program with required resources makes the program to fulfill the objective of the program.
RELEVANT	The program designed in such a way that it is so completely relevant in managing HSE.
TIME BOUND	The application of this program in the project makes the program time bound with respect to the project duration.

Table 2.1: SMART Definition

SCORING MECHANISM:

In order to determine tangible outcome in accomplishment of expectations under SMART HSE Assurance Program, fixed scores have been assigned to each expectation, summing to a total of 10 points equal to 100%. During implementation verification; HSE Assurance Committee assessor will evaluate evidences and will accordingly provide scores.

ELEMENTS OF THE SMART HSE ASSURANCE PLAN:

1. Leadership and commitment at worksite.

   i. Senior Management visibility at worksite.

   ii. Construction Worksite Supervision and Safe System of work, Permit to Work.

   iii. Organization's resource and competency

2.1 Project HSE Organization & Key Personnel

2.2 HSE Inductions & Trainings

2.3 Lifting Operations & Equipment/ Plants & Machinery

2.4 Personal Protection Equipment & Respiratory Protection Equipment

3. Risk evaluation and management

3.1 Risk Assessment / Job Safety analysis

4. Planning

4.1 Transportation Safety Plan

4.2 Welfare management Plan

4.3 Environment Management Plan

4.4 Emergency Management Plan

5. Implementation

5.1 Occupational Health & Medical requirements

5.2 Project HSE Studies/ Recommendations

5.3 Excavation/Confined Space Entry/Scaffoldings & Work at Height Safety

5.4 Grinding/Welding/cutting/ Working on live equipments

6. Monitoring

6.1 HSE Inspection

7. Accident / Incident Reporting and investigation

7.1 Reporting, Analysis and investigation of Hazards (Unsafe Act/ Unsafe Conditions), Near-misses and Incidents.

8. HSE Audit

9. HSE Incentive Scheme

10. Sub-contractors' Management

GUIDELINE TO IMPLEMENT - PLAN

1. Leadership and commitment at worksite.

1.1 Senior Management visit to site		**6%**
Responsibility	Project Manager	Frequency: Weekly
Expectation	Demonstrate Commitment and engagement through participation in key HSE programs.	
Activity	Conduct site visits dedicated to HSE issues as per defined targets with respective Contract Administrator.	
Evidence	1. Site Inspection report 2. HSE Meeting MOM 3. Action Tracker to ensure the close-out of major findings	

1.2 Construction Worksite Supervision and Safe System of work, Permit to Work.		**5%**
Responsibility	Project Manager / Site Manager	Frequency: Daily
Expectation	Ensure availability of sufficient number of HSE professional as per contract and establishment of a clear reporting protocol and roles and responsibilities to ensure proper HSE Monitoring on sites and enforcement of compliance with requirements.	
Activity	Construction Supervisors to perform daily site visits to revalidate the controls/precautions identified in the utilized safe system of works like PTW, TRA/JSA.	
Evidence	Signed hard copies of the PTW, TRA/JSA.	

2. Organization's resource and competency

2.1 Project HSE Organization & Key Personnel		**6%**
Responsibility	Project Manager / Site Manager	Frequency: Daily
Expectation	Availability of sufficient number of HSE professional as per requirement and establishment of a clear reporting protocol and roles and responsibilities to ensure proper HSE Monitoring on sites and enforcement of compliance with requirements.	
Activity	1. Develop Projects HSE Organization and reporting protocol. *2.* Develop Responsibility Matrix for the projects and communicate.	
Evidence	Approved Project HSE Organization Chart & Responsibility Matrix	

1.1 HSE Inductions & Trainings		**4%**
Responsibility	Project Manager / Site Manager	Frequency: Daily
Expectation	Ensure that all the essential HSE information is communicated to all the new entrants/visitors/employees to the construction work sites.	
Activity	Conduct HSE Induction to all respective employees (new) and Sub - Contractors and maintain records.	
Evidence	Attendance sheets.	

2.2 Lifting Operations & Equipment/ Plants & Machinery		**5%**
Responsibility	Project Manager / Site Manager	Frequency: Daily
Expectation	Ensure contractor is in compliance with HSE Requirement with respect to the use of lifting equipment / plant & machinery.	
Activity	Maintain an auditable inventory of lifting equipments / tools / tackles.	
Evidence	1. Register of equipment / tools / tackles 2. Certification of the lifting equipment / tools / tackles	

2.3 Personal Protection Equipment & Respiratory Protection Equipment		**5%**
Responsibility	Project Manager / Site Manager	Frequency: Daily
Expectation	Ensure that all the essential risk control measures are implemented effectively.	
Activity	1. Maintain sufficient stock of all the mandatory PPEs as per the requirement 2. Conduct calibration of H2S Monitors and gauges of EEBAs 3. Conduct periodic testing and inspection of all life saving equipments (EEBA, SCBA, H2S Monitor)	
Evidence	1. Inventory of PPEs 2. Distribution list for the employees & spot checks 3. Calibration certificates 4. Testing and inspection reports.	

3. Risk evaluation and management

3.1 Risk Assessment and job safety analysis		**5%**
Responsibility	Site Manager/HSE Engineer	Frequency: Daily
Expectation	Ensure all activity is covered by risk assessment prior to carry out any activity at site.	
Activity	Conduct task risk assessment (TRA), Job Safety analysis (JSA) specific to the task/location.	
Evidence	Approved TRA/JSA	

4. Planning

4.1 Transportation Safety Plan		**4%**
Responsibility	Site Manager / Transport In-charge	Frequency: Once / Initially
Expectation	To ensure that all the fleet engaged in the project activities are adhering to the approved transportation safety plan.	
Activity	1. Develop Project Transport Safety Plan 2. Implement the project Transport safety plan	
Evidence	Approved project Transport safety plan	

4.2 Welfare Management Plan			**4%**
Responsibility	Project Manager/ Site Manager	Frequency	Monthly
Expectation	Ensure that contractor's welfare management plan is implemented effectively.		
Activity	1. Establish Welfare committee. 2. Conduct monthly meetings of the welfare committee.		
Evidence	1. Approved welfare committee. 2. Attendance sheet and minutes of meeting.		

4.3 Environmental Management Plan			**4%**
Responsibility	Project Manager / Site Manager	Frequency	Once / Initially
Expectation	Ensure all type of waste generated at project sites are collected, stored, transported and disposed in line with the local laws and regulations.		
Activity	Comply with waste management procedure / Plan in line with the local laws and regulations.		
Evidence	Waste disposal record, STP report and the lab test report		

4.4 Emergency Management Plan			**4%**
Responsibility	Site Manager/HSE Engineer	Frequency	Once / Initially
Expectation	Ensure that emergency preparedness plan is established and site is sufficiently capable to deal with any emergency situation if it arises including medical emergency.		
Activity	1. Develop emergency response plan. 2. Implement the emergency procedure.		
Evidence	Approved emergency response plan including medical emergency.		

5. Implementation

5.1 Occupational Health & Medical requirements			**4%**
Responsibility	Site Manager/HSE Engineer	Frequency	Once / Initially
Expectation	To ensure healthy workforce and verify compliance.		
Activity	1. Conduct Pre-employment medical examination of all the new employees prior to joining the sites. 2. Conduct periodic medical examination of existing employees as per requirements.		
Evidence	Medical fitness status report of all the employees including pre-employment and periodic medical examinations.		

5.2 Project HSE Studies/ Recommendations		**4%**
Responsibility	Project Manager / Site Manager	Frequency: Once / Initially
Expectation	Ensure that HSE impact of new or substantially altered projects is identified through systematic process, and mitigation requirements are established and implemented, to demonstrate that residual HSE risks during normal operations are tolerable and ALARP.	
Activity	Implement HSE Studies recommendation.	
Evidence	Approved HSE Study recommendations close out report.	

5.3 Excavation/Confined Space Entry/Scaffoldings & Work at Height Safety		**4%**
Responsibility	Site Manager/HSE Engineer	Frequency: Daily
Expectation	Ensure that all the critical activities are performed by competent staff and as per the safe system of work.	
Activity	Deployment of competent personnel for various critical activities.	
Evidence	Valid certificates & HSE Training passport and/or training cards.	

5.4 Grinding/Welding/cutting/ Working on live equipments		**4%**
Responsibility	Site Manager/HSE Engineer	Frequency: As required
Expectation	Ensure that all the critical activities are performed by competent staff and as per the safe system of work.	
Activity	Deployment of competent personnel for various critical activities.	
Evidence	Valid certificates & HSE Training passport and/or training cards.	

6. Monitoring

6.1 HSE Inspection		**5%**
Responsibility	Project Manager / Site Manage	Frequency: Weekly
Expectation	Ensure that all are effectively implemented across the assets during various phases of the project.	
Activity	1. Develop annual HSE inspection schedules. 2. Conduct inspections as per plan.	
Evidence	1. HSE Inspection schedule. 2. Action tracking register.	

7. Accident / Incident Reporting and investigation

7.1 Reporting, Analysis and investigation of Hazards (Unsafe Act/ Unsafe Conditions), Near-misses and Incidents.		**8%**
Responsibility	Project Manager / Site Manage	Frequency: Weekly
Expectation	1. Prevent an incident/injury, unsafe act or unsafe conditions by ensuring Safe Work. 2. Practices proactive reporting of hazards/near-miss and follow up.	
Activity	1. Report unsafe act and/or unsafe condition and/or near misses as per target. 2. List of targeted employees to be updated periodically.	
Evidence	1. HSE Observation registers. 2. Action tracking register.	

8. **HSE Audit**		**6%**
Responsibility	Project Manager / Site Manage	Frequency: Quarterly
Expectation	Ensure that all are effectively implemented across the assets during various phases of the project.	
Activity	1. Develop annual HSE audits schedules. 2. Conduct audits as per plan.	
Evidence	1. HSE Audit schedule. 2. Action tracking register.	

9. **HSE Incentive Scheme**		**6%**
Responsibility	Project Manager / Site Manage	Frequency: Monthly
Expectation	To ensure contactor employees are actively participating in HSE activities to a safe work environment at the project sites.	
Activity	1. Implement HSE incentive scheme 2. Reward & recognize the best performing employees	
Evidence	1. Signed distribution list of HSE Incentives 2. Evidence of reward and recognition programs.	

10. **Sub-contractors' Management**		**7%**
Responsibility	Project Manager / Site Manage	Frequency: Quarterly
Expectation	1. Ensure that all the sub contractors' are pre-qualified. 2. Ensure that all the sub-contractors fully understand the expectations of the HSE Assurance Program.	
Activity	1. Provide prequalification for all the sub-contractors. 2. Conduct awareness session for all the respective sub-contractors.	
Evidence	1. List of approved prequalified subcontractors. 2. Attendance sheets of the awareness session.	

Table: 2.2 - Guideline for SMART HSE Plan

PREREQUISITES TO IMPLEMENT THE PLAN

A. HSE ASSURANCE COMMITTEE

Responsibilities:

HSEA Committee Head

1. To ensure the HSE Assurance plan action is effectively implemented in line with the approved plan.
2. To ensure the allocation necessary resource required to implemented and carry out the plan.
3. To review the assessor report and approve recommend action to overcome the identified gaps.

HSEA Committee Chairman

1. To organize and implement the HSE Assurance plan action as planned by delegation and providing all kind of resources necessary to carry out the actions.
2. Time to time to check the implementation by carrying out informal inspections and surprise walk through.
3. Coordinate the review meetings and audits.

HSEA Advisor

1. To advise the committee chairman about the status of the implementation of the plan.
2. To advise the chairman and arranging necessary thing to complete the action point required to close-out the pending actions.
3. To advise shortage of resource etc to the committee chairman and get the things completed in time.

HSEA Assessor

1. To carry out quarterly HSE Assurance audit as per the schedule and to identify the positive observation and gaps or area of improvement.
2. To carry out field visit along with the members and carry out extensive site verification to identify the area of improvement.
3. To report the HSEA Committee head about the overall status of the project at any point of time and to ensure that the action is being taken to overcome the gaps identified.

Member

1. To support the advisor and the assessor to perform their duties.
2. To give suggestions that can be helpful for improvement of site performance.

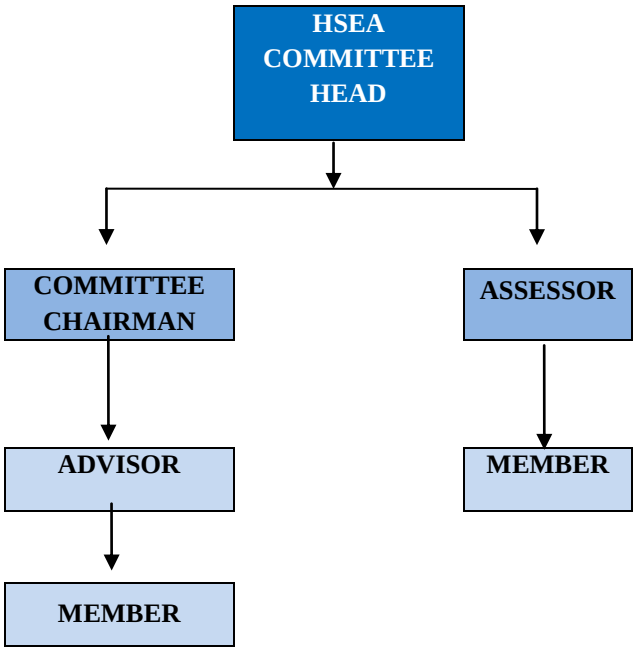


Figure:2.3 - HSEA Committee Structure

B. HSE ASSURANCE TRAINING

1. Appropriate training to be provided to all the committee members about the objective of the committee,
2. Individual roles & responsibilities to be communicated during the training session.
3. Sub-Contractor shall be a part of the committee.

C. MANPOWER RESOURCES

The manpower resources required to carry out the program effectively to be made available to make the program successful.

Figure: 2.4 STAGES OF THE SMART HSEA PROGRAM

EVALUATION OF HSEA PROGRAM

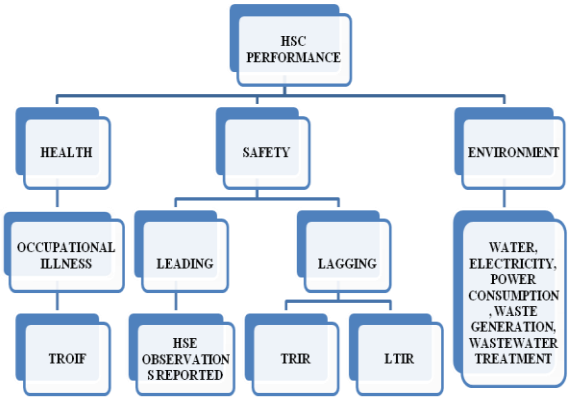


Figure: 4.1 - HSE Performance criteria

TROIF	Total reported occupational illness frequency	TROIF = (Number of reportable occupational illness x 200000) / Number of man-hours
HSE Observations reported	Number of HSE Observations (Unsafe Act & Conditions) reported	
TRIR	Total Recordable Incident Rate	TRIR = (Total number of recordable injuries x 200000) / Number of man-hours
LTIR	Lost Time Incident Rate	LTIR = (Number of LTI x 200000) / Number of man-hours

Table 4.1: HSE Performance criteria

Figure: 4.2 - TROIF:

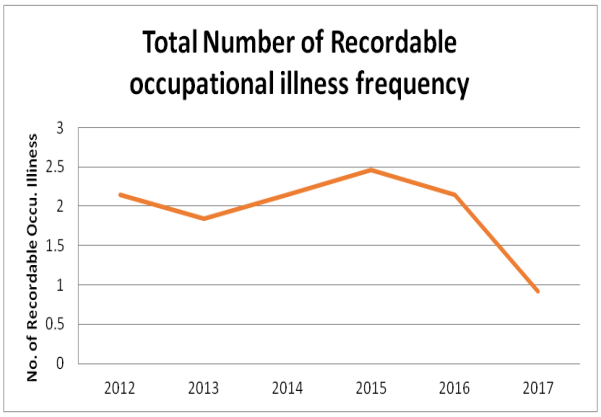


Figure: 4.3 - MAN-HOUR PER OBSERVATION

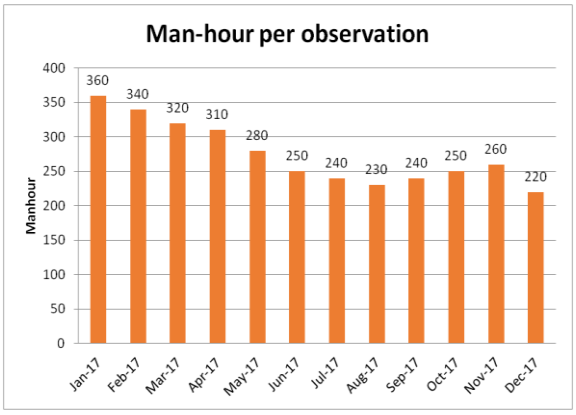
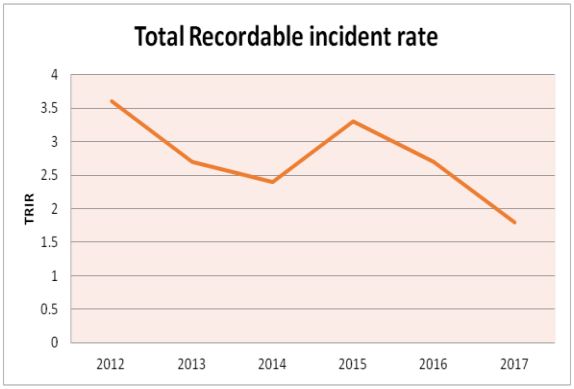


Figure: 4.4 – TRIR



LTIR:

No LTI has been reported for the past five years and hence the LTIR is not taken into the consideration for this evaluation.

ENVIRONMENTAL PERFORMANCE INDICATOR:

There were no major considerable changes in the water, electricity and paper consumption and hence this environmental performance indicator is considered same throughout the period of study except the few initiatives taken in the last year to clean the work location, accommodation camps, and desert cleaning campaigns for each quarter.

OTHER LEADING INDICATOR AND LAGGING INDICATORS:

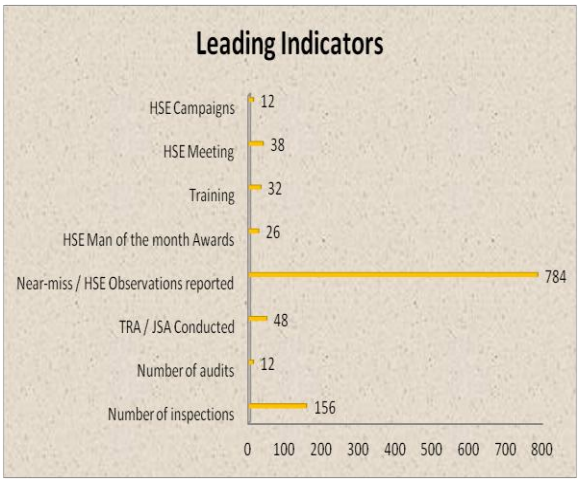


Figure:4.5 – Leading Indicators

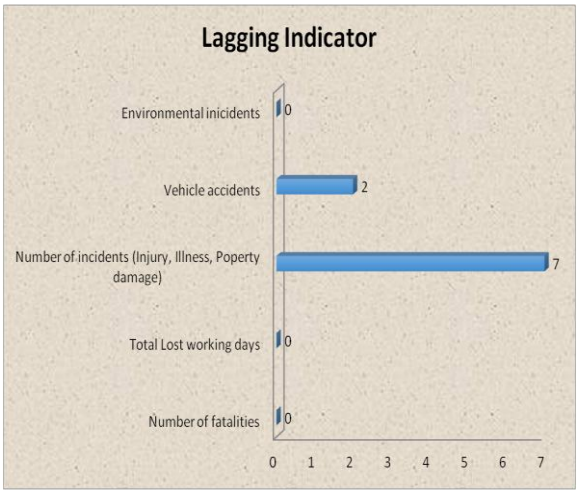


Figure:4.6 – Lagging Indicators

ACCIDENT TRIANGLE:

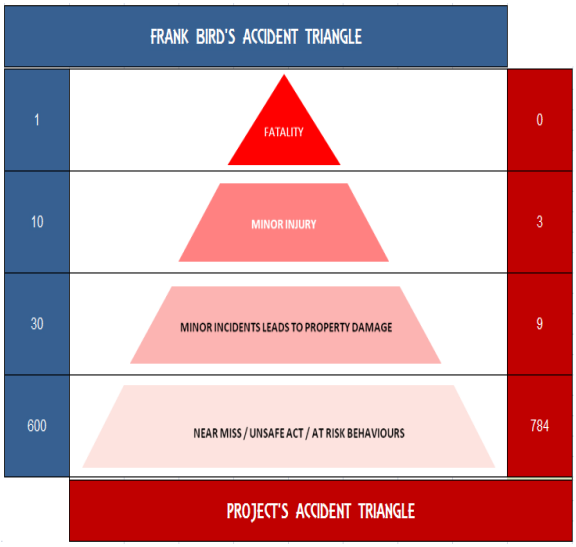


Figure:4.7 Frank Bird's Accident Triangle

FRANK BIRD'S ACCIDENT TRIANGLE

Bird analyzed 1,753,498 accidents reported by 297 cooperating companies. The study revealed the above ratios in the accidents reported: For every reported major injury (resulting in fatality, disability, lost time or medical treatment), there were 9.8 reported minor injuries (requiring only first aid). For the 95 companies that further analyzed major injuries in their reporting, the ratio was one lost time injury per 15 medical treatment injuries. The final analysis indicated that 30.2 property damage accidents were reported for each major injury.

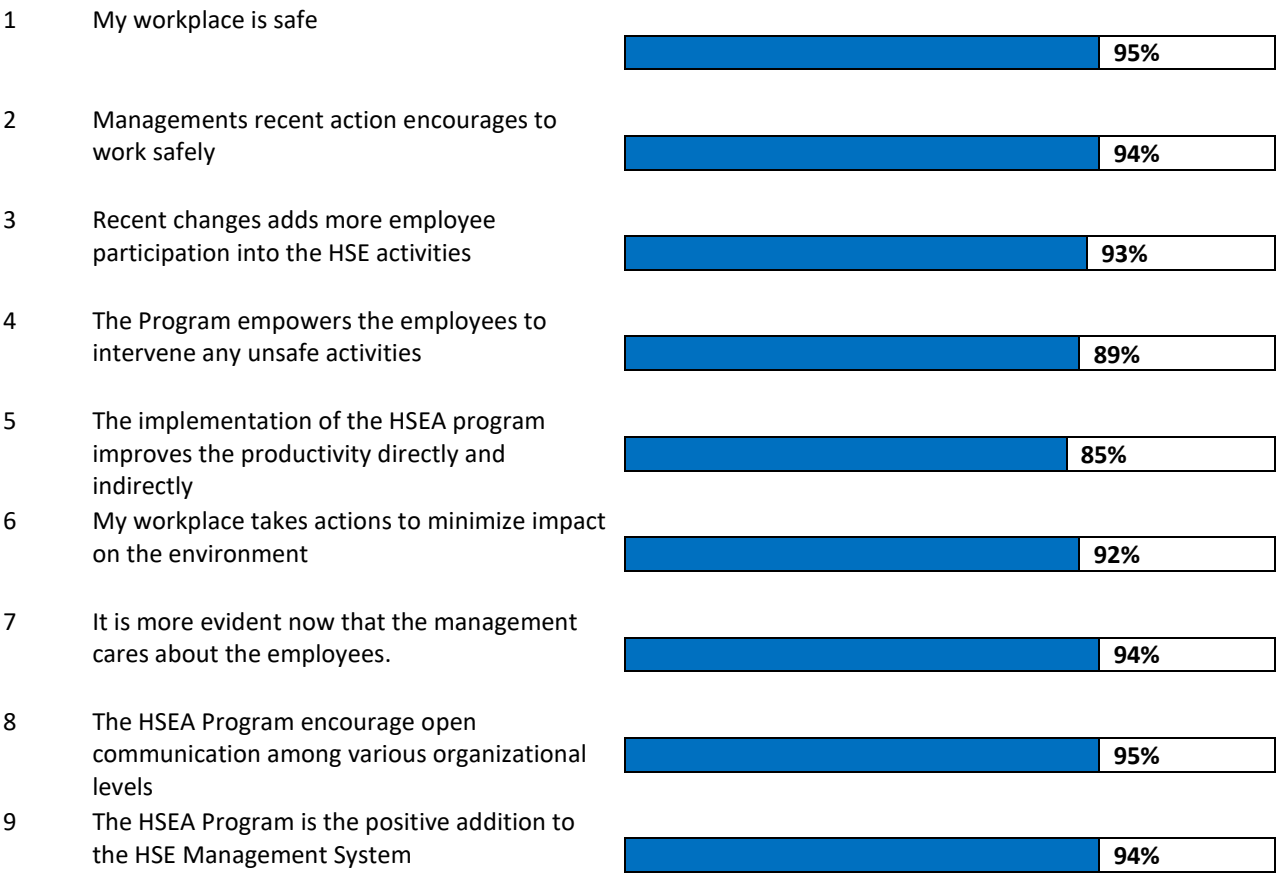
PROJECT'S ACCIDENT TRIANGLE

It is worth emphasizing that the ratio study was of a certain large group of organizations at a given point in time. It does not necessarily follow that the ratio will be identical for any particular occupational group or organization. That is not its intent. The significant point is that major injuries are rare events and that many opportunities are afforded by the more frequent, less serious events to take actions to prevent the major losses from occurring. The Project accident triangle represents that the minor incidents, HSE Observations reported are properly handled and appropriate actions were taken which has prevented major incidents from happening.

EMPLOYEE PERCEPTION SURVEY

Employee's perception survey was carried out among the employees at different categories to evaluate the HSEA program. The survey was carried out amount 100 employees and the report was summarized.

EMPLOYEE PERCEPTION SURVEY RESULTS SUMMARY:



INTERPRETATION OF SUMMARY:

1. Most of the employees for all level of management believe that the HSEA program is a positive addition to the existing HSE Management System.

2. Management believes that the HSEA Program improves the safe productivity.

3. Most of the employees are encouraged to make positive contribution to the HSEA Program.

RESULTS AND DISCUSSION

A Successful safety program is vital for all businesses, particularly for a construction industry it is very important to implement, practice a safety program to achieve a good safety performance. A safety program shall have all essential elements to serve its purpose, in that regard the SMART HSE Assurance program proposed and implemented in the project has all essential key elements for the program success.

The data from the Figure 4.2 shows that after the implementation of the SMART HSE Assurance program in the projects it was evident that the key performance indicator – TROIF has considerably declined after the implementation of the HSEA Program. The important reason for this is the proactive approach followed in the program. i.e. the on the job trainings, HSE campaigns, and other awareness enhancement element included in the HSEA Program.

The data from the Figure 4.3 reveals that the reporting of near-miss, HSE Observations (Unsafe act & Condition) was increased sharply after the HSEA Implementation. The key targeted approach to report the Near-miss /HSE Observations (Unsafe Act/Condition) and the HSE Award program linked to the reporting of Near-miss /HSE Observations (Unsafe Act/Condition).

The data from the Figure 4.4 is revealing that the TRIR has fallen steeply during the implementation period of HSEA Program which was one of the ultimate objectives of the program. The holistic approach of the program enables to achieve the maximum level of safety at worksite which resulted in reduction of incidents.

All other leading indicator shown in the Figure 4.5 & Figure 5.6 indicates the pro-active statistics i.e. the actions performed as per the HSEA Program and the lagging indicator indicates the reactive statistics.

The program has an area for improvement. The program lacks environmental performance KPI's which is identified during the project work. The gap will be analyzed further and environmental performance KPI's related to the construction projects will be included in the program.

REFERENCES

BRITISH STANDARD, (BS) 8800: Guide to Occupational health and safety management systems. Copyright by the British Standards institution. 1996.

CCPS, Process Safety Leading and Lagging Metrics, 2007.

Cooper, M.D., 2000. Towards a model of safety culture. Safety Science 36, 111â136.

Cox, S., Flin, R., 1998. Safety culture: philosopherâs stone or man of straw? Work & Stress 12 (3), 189â201.

Cox, S.J., Cheyne, A.J.T., 2000. Assessing safety culture in offshore environments. Safety Science 34, 111â129.

Denzin, N.K., Lincoln, Y.S., 2000. Handbook of Qualitative Research. Sage Publications, Thousand Oaks.

European Agency for Safety and Health at Work, 2008. <http://osha.europa.eu/>.

European Journal of Work and Organizational Psychology 17 (1), 133â 152.

Flin, R., Mearns, K., OâConnor, P., Bryden, R., 2000. Measuring safety climate: identifying the common features. Safety Science 34, 177â192.

Geertz, C., 1973. The Interpretation of Cultures. Basic Books, New York.

Glaser, B., Strauss, A.L., 1967. The Discovery of Grounded Theory: Strategies for Qualitative Research. Aldine, New York.

Guldenmund, F.W., 2000. The nature of safety culture: a review of theory and research. Safety Science 34, 215â257.

Guldenmund, F.W., 2007. The use of questionnaires in safety culture research â an evaluation. Safety Science 45, 723â743.

HÃ¸ivik, D., Brandsdal, E., Moen, B.E., 2007. Associations between self-reported working conditions and registered health and safety results. Journal of Occupational and Environmental Medicine 49 (2).

HÃ¸ivik, D., Brandsdal, E., Moen, B.E., 2008. Nearest management is important for health and safety. A longitudinal study of perceived working conditions 1001 in offshore and onshore petroleum industry. Maritime Medicine Journal 8 (1).

Hale, A.R., Hovden, J., 1998. Management and culture: the third age of safety. In: Feyer, A.M., Williamson, A. (Eds.), Occupational Injury. Risk Prevention and Intervention. Taylor and Francis, London.

Haukelid, K., 2008. Theories of (safety) culture revisited â an anthropological approach. Safety Science 26, 413â426.

Hovden, J., Lie, T., Karlsen, J.E., Alteren, B., 2008. The safety representative under pressure. A study of occupational health and safety management in the Norwegian oil and gas industry. Safety Science 46, 493â509.

HSE, Developing Process Safety Indicators, HSG254, 2006.

http://www.ehstoday.com/safety- leadership/optimizing-safety-through-leading-indicators

INSAG, 1988. Basic Safety Principles for Nuclear Plants. International Nuclear Safety

International Journal of Occupational Hygiene, 2008-5435/14/63-45-53, IJOH 8: 45-53, 2016

Kvale, S., 1996. Interviews. An Introduction to Qualitative Research Writing. Sage Publications, Thousand Oaks.

Malterud, K., 2001. Qualitative research: standards, challenges and guidelines. Lancet 358 (9280), 483â488.

Martin, J., 1992. Culture in Organisations: Three Perspectives. Oxford University Press, New York.

Mearns, K., Hope, L., 2005. Health and well-being in the offshore environment: The management of personal health. Research report 305. Health and Safety Executive, UK.<http://www.hse.gov.uk/research/rrpdf/r r305.pdf>.

Mearns, K.J., Flin, R., 1999. Assessing the state of organizational safety-culture or climate? Current Psychology 18, 5â17.

Mearns, K.J., Flin, R., Gordon, R., Fleming, M., 1998. Measuring safety climate on offshore installations. Work Stress 12, 238â254.

Mearns, K.J., Flin, R., Gordon, R., Fleming, M., 2003. Human and organizational factors in offshore safety. Work Stress 15, 144â160.

OECD, Guidance on Developing Safety Performance Indicators, 2008.

OSHA Safety and Health Program Management Guidelines, November 2015 Draft

Patton, M.Q., 1990. Qualitative Evaluation and Research Methods. Sage Publications, Thousand Oaks.

Reason, J., 1997. Managing the Risk of Organizational Accidents. Ashgate Publishing, Hants, Aldershot.

Richter, A., Koch, C., 2004. Integration, differentiation and ambiguity in safety cultures. Safety Science 42, 703â722.

Safety culture: an integrative review. International Journal of Aviation Psychology 14 (2), 117â134.

Tharaldsen, J.E., Olsen, E., Rundmo, T., 2008. A longitudinal study of safety climate on the Norwegian continental shelf. Safety Science 46, 427â439.

Wiegmann, D.A., Zhang, H., von Thaden, T.L., Sharma, G.J., Gibbons, A.M., 1997.

www.hse.gov.uk