Role of Near-misses and Behavioral Patterns in Preventing Work Place Injuries (Oil & Gas -Upstream)

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Abstract- Business activities of Upstream Oil & Gas Industry are exposed to different kinds of hazards and risks. Along with other fundamental Health, Safety and Environmental Management system in place, human behaviors are ultimately the key factors in preventing accidents. Systematically adopting lifesaving rules and its implementation through behavioral changes brings significant reduction of work place injuries. Management focus on encouraging sustainable behavioral safety culture and deeply investigating the root causes of the incidents including near misses may help to achieve a culture of "accident free work place in Oil & Gas".

This paper describes the role of near-misses and Behavioral interventions in prevention of accidents in upstream work environment. A total of 250 near-misses that have occurred in an upstream Oil & Gas facility were analyzed and about 10000 behavioral Observations were also studied. The outcome of the study indicates that serious work place injuries are having correlation with near-misses and behavioral interventions. Serious injuries are resulting due to over sighting of near-misses and failure to correct the repeat at risk behaviors.

Index Terms- Accidents, Behavioral Safety, interventions, Oil & Gas (Upstream), lifesaving rules, work place safety.

I. Introduction

Oil and Gas Industry is vulnerable for low probability and high impact incidents. However good the Health, Safety, Environmental management systems in place, the human behaviors at work place are ruling the prevention of accidents. Root causes of major accidents attributed as personnel not following the fundamental procedures, poor work place supervision, inadequate training and competence. Further strong reasons are failure to identify hazards and risk assessment.

II. Near-misses and Safety Observations

Near-misses are defined as the incidents have just occurred with a potential to cause serious injury or damage but did not result in.

An event which under slightly different circumstances could have resulted in an injury/damage/loss. Generally such events are unplanned and the consequences are avoided by circumstances. Examples:

Tripped or slipped while walking down the stairs, but held on to some form of support thus avoiding the risk of injury

While lifting a bundle of cable trays using crane, few trays slipped and fell from a height. The rigging crew who were just left the spot have escaped without injury where the trays fell on ground.

Near-misses play a vital role in accident prevention. In the hierarchy of accident occurring pyramid, near-misses takes the bottom of the place. However, they are the significant contributors for a serious accident to occur if they are not analyzed and prevented recurrence of the same.

As per Heinrich's law for every accident that causes a major injury, there are 29 accidents that cause minor injuries and 300 accidents that cause no injuries. These includes Near-misses.

- Therefore if we capture more and more Near-miss events and follow-up with corrective actions, the potential for major injuries / fatalities will get minimized.
- Near misses are smaller in scale, relatively simpler to analyze and easier to resolve. Thus, capturing near misses not only provides an inexpensive means of learning, but also has some equally beneficial spin-offs.
- Near misses provides immense opportunity for "employee participation," a basic requirement for any successful HSE Program.
- Near-miss system creates an open culture whereby everyone shares and contributes in a responsible manner. Near-Miss reporting has been shown to increase employee relationships and encourage teamwork in creating a safer work environment.

Many Organizations do have reporting of near-misses, analysis of near-misses and publish lessons learnt from the same to prevent reoccurrence. However, many research studies indicate that near-miss reports are still not optimally used for learning. One potential barrier is that the definition of a near miss is unclear.

At risk behaviors and unsafe conditions are another set of contributors for accident. However these are fundamentally associated with human behaviors at work place. They are greater in number than the near-misses. Over a period of time, Behavioral changes and self-realization of the personnel at work place, timely interventions, only reduces the incidents. These are the core values of safety culture.

Unsafe practices such as unsafe conditions, unsafe acts are basic causes of accidents. The International Association of Oil & Gas Producers (IOGP), has been collecting safety incident data from its member companies globally since 1985. The data

collected are entered into the IOGP safety database, which is the largest database of safety performance in the exploration and production (E&P) industry. The annual reports provide trend analysis, benchmarking and the identification of areas and activities on which efforts should be focused to bring about the greatest improvements in performance.

The IOGP incident reporting system covers worldwide E&P operations, both onshore and offshore, and includes incidents involving both member companies and their contractor employees.

Total man-hours worked in Oil & Gas industry is increasing year on year. There is a 16% increase in total man-hours worked including employees and contractors during the year 2014. Therefore the rate of exposure to work place hazards is a greater challenge. However, introduction of life saving rules associated with behavioral aspects by IOGP and its practice by member Organizations have resulted in reducing serious accidents.

The IOGP lifesaving rules focus on modifying behaviors at workplace and created a sense of zero tolerance towards at risk behaviors. Adopting these rules found to be great effect on reducing fatal accidents rates. During the year 2014, there was about 51% reduction in fatal accident rate. It is further reported that 78% of fatal accidents would have been averted by following lifesaving rules. These rules are significantly supported by behavioral changes and timely interventions.

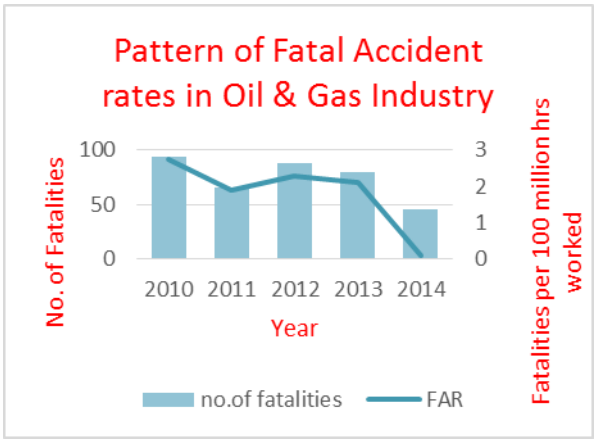

Figure 1. Pattern of fatal accident rates as per IOGP

The pattern of Unsafe acts, unsafe conditions and near-misses contributing for incidents are represented as:

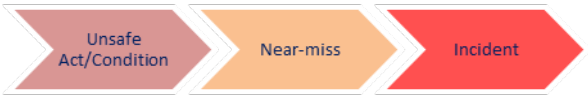

Figure 2, Concept representation of unsafe act /unsafe condition, near-misses and incidents

While analyzing the lost time cases of one of the E&P company, it is observed that fall of objects from a rig floor, fall of personnel from height during rig operation, fall of personnel into cellar pits, fall of personnel due to collapse of false flooring were the causes. Relatively reporting of related near-misses, unsafe conditions and unsafe acts were low or adequate controls were not established to prevent recurrence of the incidents. However, when the Organization intensified their intervention programs and continuous education on recognizing the hazards before starting the every job, creating safe work environment have significantly increased number of near-misses and Unsafe conditions and Unsafe acts reporting.

III. Methods and Materials

Collection of near-miss data of an Upstream Oil & Gas installation, interaction with field personnel in understanding their interpretation of near-misses and safety observations, work place safety inspections, lessons learnt from various incidents were the methods adopted in this study.

A comprehensive literature survey was conducted on accident Patterns, Near-miss reporting, behavioral observations and intervention programs in Oil & Gas industry.

A survey with specific questions relevant to the study was conducted.

Why-Why process and Bow-tie analysis methods were applied as to analyses the near- misses. For each top event to result, the barriers in place, and how the barriers failed were studied. Root causes were derived from the said methods.

The number of behavioral observations at work site were collected through well designed safety observation cards. These cards were objectively designed to obtain the information on elements including personal factors, job factors, unsafe acts, unsafe conditions, Personal protective equipment and tool and equipment. Trends were plotted and identified the weak barrier in the system.

The samples for the study were collected from Cairn India, an Oil & Gas Exploration and Production company located at Barmer district of Rajasthan, India.

Cairn India is the largest independent Oil and Gas exploration and production company in India with a market capitalization of US $ 7 billion and the largest private sector producer of crude oil in India. Cairn India operates 27% of India's domestic crude oil production. The Mangala field in Barmer, Rajasthan, discovered in January 2004, is the largest onshore oil discovery in India in more than two decades. Mangala, Bhagyam and Aishwariya fields-major discoveries in Rajasthan block have gross ultimate Oil recovery of over 1 billion barrels. Cairn India was rated as the fastest-growing energy company in the world, as per the 2012 and 2013 Platts Top 250 Global Energy Company rankings.

Cairn aspires to a zero-harm environment for personnel at work. It has engaged 20000 work force in peak time of constructing well-pads, Mangala processing terminal and other associated facilities. These work force comprises unskilled, semiskilled and highly technical from various states of India and also rest of the world. The harsh climatic conditions were one of the work place Health and safety challenges. With continuous efforts, Cairn has established a strong Health, Safety and Environmental management systems engaging the workforce. As a result, it has bagged several recognitions from national and International level. It has focused to create safe work environment and recognized to bring awareness on significance of near-misses, its reporting, analyzing and corrective actions. It has encouraged the employees and contractors to report near-

misses through periodic training programs, tool-box talks, supervisor responsibility, contractor engagement process and mass communication methods, the personnel who reported significant near-misses were recognized at highest level which motivated individual to be proactive always.

Over a period of Three years, the safety observation system has percolated to grass root level at all assets and the number of observation cards increased from 12000 during 2012-13 to 70000 during the year 2014-15. It has greatly contributed in achieving HSE excellence in a sustainable manner.

The samples of observations and near-misses collected from the data published by Cairn for the years2012-2015.

VI Result and Discussion

About 250 near-misses occurred during the year 2012-2015 at Cairn India were studied and the pattern is represented as

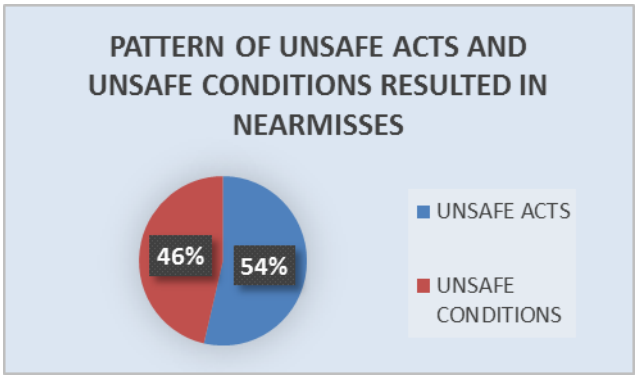

Figure 3 Pattern of Unsafe Acts and Unsafe Conditions Resulted near-misses

54% of near-misses have been contributed by unsafe acts and are directly associated with behavioral aspects.

The examples of near-misses in the study found to be:

- During routine plant round, an engineer hit against a 1/8" tubing on the platform and got tripped. He balanced himself holding the handrail. The tubing was of moisture analyzer and falling in the walkway causing a potential trip hazard.

The majority of near-misses are due to fall of objects at rig floor, fall of personnel from height, collapse of false ceiling, zero tolerance behaviors, not adhering to safety procedures.

It also attributed that proper analysis of near-misses and strengthening the barriers have reduced its further escalation. However, serious injuries have resulted when near-misses are over sighted and missed to incorporate the barriers in place.

Understanding the mechanism, reporting the near-misses itself is the challenge at work site. This is due to lack of safety awareness and motivation. Often personnel misinterpreted the at risk behaviors as near-misses.

Specific near-misses awareness campaigns, motivation and recognition methods found to be encouraging the increase in near-miss reporting trends.

It appears that the activities those commonly being executed on day to day basis and the observers made maximum number of observation on those activities, are having less number of incident or no incident.

At the same time the common activities those being executed on day to day basis but having less Safety observation, are having more number of incident.

Therefore the theory of behavioral modulation can be proved right through this data. More monitoring and interference by first line management on a particular activity can help to reduce the chance of incident greatly in that area.

Unsafe acts, unsafe conditions and Near-misses are the core components in the accident occurring patterns.

Behavioral interventions are significant in bringing awareness among work men in preventing accidents.

About 10000 Safety Observations were analyzed and the key findings are:

95% of Observations reflecting safe work practices demonstration by the workforce. These observations program made an opportunity for all level of personnel to involve in building safety culture.

The remaining 5% Observations are attributed to personnel not following the procedures, inadequate work supervision, and competency of work force, work pressure and poor safety awareness.

About 250 samples (safety observations) are considered for analysis and the trends are represented as

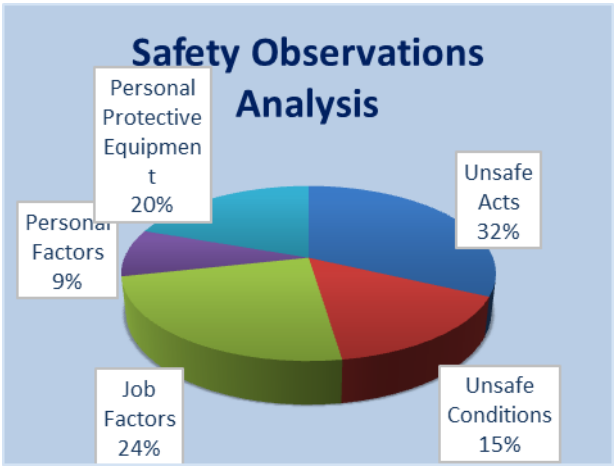

Figure 4 Safety Observation Analysis.

Unsafe acts (32%) found to be the major contributor followed by Job factors (24%) and noncompliance to personal protective equipment (20%). Unsafe acts including are procedures not followed and failure to make work place safe. The Job factors includes inadequate leadership / supervision, poor housekeeping issues. Therefore all these factors may be corrected with employee engagement process, timely interventions and positive feedbacks.

The barrier in the process found to be

- Inadequate visibility of Top Leadership on the ground
- Lack of ownership from Front line Supervisors
- Contractor performance monitoring and control
- Poor competency levels of Contractor supervisors
- Delayed response in closing unsafe conditions/acts

Typical Safety Observations in the study found to be:

- Stopper for the Pipe rack were not in practice. This repeat observation resulted in a lost time injury involving roll over of pipes and a contractor workmen was trapped in between the pipes. It is significant that overlooking the safety observations lead to near-misses and further repetition of same incidents lead to serious accidents.
- Personnel found not using three point contact while ascending or descending the ladders or stair cases.
- Poor control on grating management i.e. either gratings are missing at platforms or not properly fixed have created a high risk incidents.
- Poor housekeeping includes, slippery floors, tools on floor, access / egress
- However, a significant improvement on housekeeping at work place was observed through safety observations reports.
- Noncompliance to use of personal protective equipment.

In another case study published in IOGP, after reviewing work-related fatalities that occurred between 2000 and 2008, Shell found that a failure to comply with a limited number of safety rules was a significant factor in the majority of cases. In response, Shell launched a programme to reinforce what employees and contractors must know and do to help prevent serious injury or fatality. Compliance is mandatory for all Shell employees and contractors while on business or Shell sites. The 12 Shell Life-Saving Rules were launched in 2009 across the company.

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Siva Prasad Penkey has several papers on work place safety improvements presented during national and International Conferences. He has carried out work place research on "Participation approach improves work place Health and Safety". Presented a paper in American Industrial Hygiene Conference and Expo, May 21-26, 2005, Anheim, California, USA. He was also active member as Head, Occupational Health and Safety of ASSE Chapter Kuwait. He carried out more than 50 accident investigations. He mentored more than 20 University students for their project works.

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