

Analysis of Incident Characteristics of Selected Oil and Gas Operations in Niger Delta

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Abstract : This study investigated incidents trends from January 2018 to December 2020 in selected Oil Gas Companies in Niger Delta that are involved in different construction activities both in offshore and onshore locations, with over 7 million man-hours exposure within the period under review. Although, for the selected companies, there hadn't been any major property/asset damage, serious disabling injury or a fatal incident, however, there are several pointers to a serious incident, following the current trend. This study was guided by three research objectives and three research questions. The study was conducted using available data (Key performance indicators - KPIs) from the Safety Department of selected companies, recorded from January 2018 up to December 2020. KPIs set for a particular year were presented and reviewed. Incidents recorded for the period were trended and represented in pie-charts and graphs. The study made use of secondary data, the secondary data were derived via computer, printer, papers, hand file/jotters, memory storage devices, pens and mobile phone/email was used to contact different personnel that were utilized for the research. Findings from the study showed that the hand and finger are the body parts most vulnerable to recordable incidents (30); this was followed by the leg (18), the general body (6), the face (4) and the eye (2). The study recommended that employees should be trained on how to conduct effective risk assessment and job hazard analysis, to be able to discern hazards in the workplace that can pose a risk.

Key words: Incident Trend, Recordable Incident, Accident, amongst others.

I. INTRODUCTION

Background to the Study

The Niger Delta Oil and Gas Companies, the intent of establishing a strong HSE Management System for the construction and operation activities is to prevent losses due to incidents, minimize the risk of injuries to the employees at work, visitors, public, damage to plant and equipment and reduce risks that could have a negative impact on the environment. The overall aim of any organization striving to maintain a strong Health, Safety and Environment Management System (HSE MS) is to ensure good productivity by reducing unwanted cost of occupational injuries/illnesses that could result from medical treatments, lost time or delayed operation, compensation and litigation.

However, after a close look at the HSE key performance indicators over time, there are several unanswered questions that came to mind. Outstanding among these questions are: Why are recordable incidents still recorded, irrespective of all

efforts and commitments invested by management and the entire workforce? Could there be a way forward to know where efforts could be directed after a thorough incident trend analysis?

In the selected oil gas projects, key high-risk activities include, diving, welding and fabrication, excavation and trenching, drilling, concrete work, cable laying and termination, hydro test, heavy/complex lift and radiography. In the modern workplace, there are many different types of accident prevention programs ranging from simple to complex. "Widely used accident prevention techniques include failure minimization, fail-safe designs, isolation, lockouts, screening, personal protective equipment, redundancy, timed replacements and many others. These are individual components of a broader safety program. Such programs have evolved since late 1800s," (David, 2005)

The oil and gas companies recognize that high standards of Health, Safety & Environment (HSE) is an integral element of efficient management objectives and contributes to the operational efficiency and profitability of the company. For such standard to be achieved adequate resources are made available in order to ensure continual development in competence of employee, adequate supervision, monitoring and the provision of any necessary expert advice throughout the execution of the project.

A major area of consideration when assessing the effect of accidents on a given establish is the amount of lost time due to work related injuries. According to the National Safety Council, approximately 35,000,000 hours are lost in a typical year as a result of accidents. This time lost from disabling injuries does not include additional time lost for medical checkups after an injured employee returns to work

The intent of establishing a strong HSE management system for the C&M/P&U activities is to prevent losses due to incidents, minimize the risk of injuries to the employees at work, visitors, public, damage to plant and equipment and reduce risks that could have a negative impact on the environment. The overall aim of any organization striving to maintain a strong Health, Safety and Environment Management System (HSE MS) is to ensure good productivity by reducing unwanted cost of occupational injuries/illnesses that could result from medical treatments, lost time or delayed operation, compensation and litigation.

However, after a close look at the HSE key performance indicators over time, there are several unanswered questions that came to mind. Notable among these questions are; Why increase in recordable incidents in Niger Delta Project” irrespective of all efforts and commitments invested by management and the entire workforce? Could there be a way forward to know where efforts could be directed after a thorough incident trend analysis?

Statement of the Problem

Is it practicable to conduct a study that could clearly analyze and give clear indication why the incessant increase in recordable incidents in Niger Delta Project right from inception, using available incident statistics, safety documents, records and direct interview with the workforces?

Rationale for the Research

Since the beginning of the project, there had been a gradual increase in all types of incidents including near misses. From the theory of “Incident Triangle”, different studies have shown that when at risk behavior and unsafe conditions at the base of the triangle are not adequately identified and addressed, the tendency is almost certain for such a given system to be described as heading towards a major incident such as fatality. Although the figures obtained vary from study to study, but the principle remains outstanding. Heirich 1950 in his study has a ratio of 300:29:1 for no injury accident, minor injuries and major or lost time injury respectively. While Bird 1969, in his study has 600:30:10:1 for incident with no injury or damage, incident with damage, minor injuries and serious or disabling injury respectively.

Although, for the Niger Delta Project, there hadn’t been any major property/asset damage, serious disabling injury or a fatal incident, but there are several pointers to a serious incident, following the current trend. The worrying ever increasing incident trend such FAC, MTC, RWC etc are all clear indications that call for a thorough incident trend analysis, so as to ascertain where efforts should be directed to eliminate or reduce the current ugly trend observed, especially in late 2011 and throughout 2012.

The study will be used to advise management on where to invest materials and human resources and the impact of such investment will not only benefits the organization from financial point of view and reputation, it will also benefits employees successful completion of project without anyone getting hurt, Clients target completion without budget variations, lessons from the project incident analysis will help similar projects to know the area(s) where necessary actions will be required with regards to activities that are critically prone to incidents.

Aim and objectives of the Study

The purpose of this research is to critically analyze the selected projects in the Niger Delta recordable incidents

trends from January 2018 To December 2020. The following are the objectives of the study:

1. To determine the peculiar causes of the recordable incidents.
2. To determine the areas, activities and job types that are prone to incidents.
3. To determine the time and months where higher frequencies are recorded.

Research Questions

The following research questions will guide the study

1. What are the peculiar causes of the recordable incidents?
2. What are the body parts and activities that are prone to incidents?
3. At what time and months where higher frequencies of incidents are recorded?

II. CONCEPTUAL REVIEW

Occupational Risk

The term “occupational risk” refers to likelihood that an injury or illness will occur as a result of exposure to workplace hazards. The idea of occupational risk exists upon two axes: The first is the probability that a given injury or illness will occur, and the second is that injury or illness’ potential severity. Thus, two injuries that are equally likely but not equally severe would pose different levels of workplace risk.

In modern occupational health and safety contexts, when evaluating the level of risk within a given workplace, both actual instances of an injury occurring and “near misses” in which it almost occurred are used to evaluate the level of risk in a workplace.

The management of occupational risk is the central focus of modern occupational health and safety practices, regardless of whether those practices emerge from regulatory, scientific, or corporate contexts.

Approaches to risk management differ depending on the particular nature and interests of the organization being considered. Corporate occupational health and safety initiatives tend to prioritize safety risks that are also cost risks, while government regulatory occupational health and safety initiatives will prioritize the most urgent health and safety risks but refrain from passing regulations that might be overly costly to businesses.

Theoretical Framework

The theoretical framework for this study is based on the Domino Theory

Domino Theory

The Domino theory was the first sequential accident model developed by Heinrich in 1931. The model is based on the assumption that the occurrence of a preventable injury is the

natural culmination of a series of events or circumstances, which invariably occur in a fixed or logical order. Heinrich proposed that an accident is one of five factors in a sequence that results in an injury and an injury is invariably caused by an accident and the accident in turn is always the result of the factor that immediately precedes it. In accident prevention the bull's eye of the target is in the middle of the sequence an unsafe act of a person or a mechanical or physical hazard. Heinrich's five factors were social environment/ancestry; fault of the person; unsafe acts; mechanical and physical hazards; accident and injury.

Based on the domino model, accidents could be prevented by removing one of the factors and so interrupting the knockdown effect. Heinrich proposed that unsafe acts and mechanical hazards constituted the central factor in the accident sequence and that removal of this central factor made the preceding factors ineffective. He focused on the human factor, which he termed "Man Failure", as the cause of most accidents. Giving credence to this proposal, actual analysis of 75,000 insurance claims attributed some 88% of preventable accidents to unsafe acts of persons and 10% to unsafe mechanical or physical conditions, with the last 2% being acknowledged as being unpreventable giving rise to Heinrich's view of direct and proximate causes.

Extending the domino metaphor, an accident was considered to occur when one of the dominos or accident factors falls and has an ongoing knock-down effect ultimately resulting in an accident. The major contribution of this theory to this present study is to bring out the fact that accident is not the single result of a single cause or act. Hence, understanding occupational accident causation is intrinsic to their successful prevention.

III. REVIEW OF THE RELEVANT LITERATURE

In modern construction worksites, the average working conditions for employees have experienced significant improvement compared to what was obtainable in 1900s where several people were killed in mining accidents and in construction operations. The chance of worker being killed in an industrial accident is less than half of what it was 60 years ago, (Goetsch, 2005). According to the National Safety Council (NSC), the current death rate from work-related injuries is approximately 4 per 100,000 or less than the rate as at 50 years ago. It is believed that this figure could be significantly reduced through continuous improvement, but it takes a concerted effort of a particular group or team involved in a unit operation.

According to Heinrich's Domino Theory, five known aspects form the sequence of event leading to an accident, they are: ancestry and social environment, fault of person, unsafe act/mechanical or physical hazard, accident and injury. Heinrich's concluded that injuries are caused by the action of a preceding factor and removal of the central factor (unsafe act/hazardous condition) negates the action of the preceding factors, and in so doing prevent accidents and injuries,

(Goetsch, 2005). Lorient Consulting stated that accidents are primarily caused by people, equipment may be involved, but people handle the equipment, He argued that most accidents are the result of carelessness, inexperience and poor attitude. According to Gordon, (2008), the seven common causes of accidents are; taking shortcuts, being overconfidence, ignoring safety procedures, starting a job with incomplete instructions, poor housekeeping, mental distractions from work and failure to pre-plan your work. "The figures 1-10-30-600 relationships in the incident triangle ratio indicate clearly how silly it is to direct our major effort only at the relatively few events resulting in serious or disabling injury when there are so many significant opportunities that provide a much larger basis for more effective control of total accident losses" (The Accident Pyramid, 2008).

In 2003, ConocoPhillips Marine conducted a similar study demonstrating a large difference in the ratio of serious accidents and near misses. The study reveals that for every single fatality there are at least 300,000 at-risk behaviors, defined as activities that are not consistent with safety programs, training and components on machinery. Such behaviors could include overriding safety mechanism on machinery or avoiding safety procedures in the construction and production processes that employees considered to be slowing down the operations. The various studies conducted in the past are all clear indications that site specific situations could be different even though may have several aspects in common.

With effective training, at-risk behaviors, other identified failures common to a particular worksite/environment and near misses can be reduced or eliminated, but effective training requires more than just having key managers trained. It requires that effective systems are in place to address the performance issues facing the organization. According to Blanchard and Thacker, (2010), a system must be responsive to the needs and demands of its environment because the environment provides the input needed for the system to replenish itself. The training process will transform the various inputs into usable output for the organization, which will invariably improve the knowledge, skill and attitudes; job performance and many more.

It is believed that a thorough study of past incidents and their causes would proffer clear indications why the incessant increase in recordable incidents in Niger Delta Project right from inception, using available incident statistics, safety documents, records and direct interview with the workforces. This will enable the project to know areas, activities and job types that are prone to incidents. It will also show time and months where higher frequencies are recorded. The overall outcome will create awareness for discipline Managers, Supervisors, Foremen and all Employees and it will enable the adoption of necessary corrective actions/programs that are required by line Supervisors and Employees involved in Niger Delta Project. By so doing, the roles and responsibilities of employers and employees as clearly defined by OSHA, other

standard regulations and best practice will not be compromised.

IV. METHODOLOGY

Oil and Gas Companies Project Incident Trend Analysis was conducted using available data (Key performance indicators - KPIs) in the Safety Department, recorded from January 2010 up to September 2012. Data to be analyzed includes incidents such as First Aid Case (FAC), Medical Treatment Case (MTC), Restricted Work Case (RWC), Near Miss (NM), Equipment/Asset Damage (E/AD). Other proactive indicators like safety observations, routine audit/inspections, training, emergency drills, tool box talk, and management site walkthrough were analysis and compared with targets so as to ascertain if project safety plan was being complied with. Participants for this research included but not limited to the two key Safety Document Administrators in charge of all safety records, the roles of these participants were purely for providing the expected data from the pool of data in the records. The sample of the study comprised of Twenty-four supervisors directly involved in field activities from all sections; Civil, Mechanical, Electrical, Marine, Survey, Diving, Transport and Safety. They were selected based on their direct supervision of group of workforce, must have spent a minimum of six months on the Niger Delta project and must have direct or indirect involvement with incidents that happened in the project.

KPI set for a particular year was presented and reviewed. Incidents recorded for the period from 2018 to 2020 were trended and represented in pie-char. Furthermore, injury recorded were classified according to body part affected and the activity. The injury cases were also classified according to the time of the day they occur and by months. Classification was made according to the different company involved. Finally, the incidents will be evaluated and classified in line with their causes.

The study made use of secondary data, the secondary data were derived via computer, printer, papers, hand file/jotters, memory storage devices, pens and mobile phone/ email was used to contact different personnel that were be utilized for the research. Computer software like excel was used to analyze data. The validity of the measurement was assessed based on the fact that a genuine data source was used and reasonably presented in the expected manner.

Variables which were included in the analysis are: Near miss, high potential near miss, safety observation, property/asset damage, medical treatment cases, restricted work case, first aid case, heat stress, body parts, months, time of incidents and companies involved. Others are activities like cable pulling, carpentry, concreting/rebar, diving, excavation/trenching, paving transportation, welding/piping, housekeeping, installation/maintenance and lifting/rigging. The dependent variables for this study are: Near miss, high potential near miss, safety observation, property/asset damage, medical treatment cases, restricted work case, first aid case, heat stress

and body parts. The independent variables for this study are: months, time of incidents and companies involved. Others are activities like cable pulling, carpentry, concreting/rebar, diving, excavation/trenching, paving transportation, welding/piping, housekeeping, installation/maintenance and lifting/rigging. The decision-making criteria was based on the outcome of data analysis using excel software to determine the areas where the percentage tend to drift. All incident causes were factored into tables and generates graphs and pie-chart to show the percentage of the leading causes of the selected projects in Niger Delta incidents

V. RESULTS AND FINDINGS

Research Question 1: What are the peculiar causes of the recordable incidents?

Table 1: Distribution of the peculiar causes of the recordable incidents

Cause	2018	2019	2020	Total
Not following Instruction/ Procedure	1	11	13	25
Communication	1	0	1	2
Lack/ Poor Supervision	0	3	20	23
Maintenance/ Mech'l Failure	0	0	7	7
Unfavorable/ Bad Weather Condition	0	1	2	3
Total	2	15	43	60

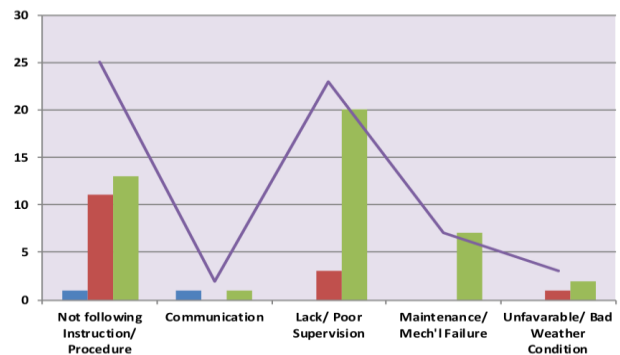


Figure 1: Distribution of the peculiar causes of the recordable incidents

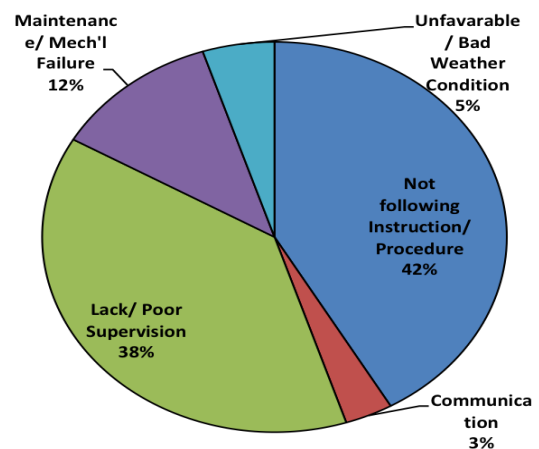


Figure 2: Distribution of the peculiar causes of the recordable incidents

Findings from the table and chart above shows that negligence to instruction and procedures were the major cause of recordable incidents in the work. This was followed by lack of poor supervision, maintenance and mechanical failure, unfavorable and bad weather condition, and inadequate or poor communication, respectively.

Research Question 2: What are the body parts and activities that are prone to incidents?

Table 2: Body parts that are prone to incidents

Body Parts	2018	2019	2020	Total
Body	1	0	5	6
Eye	0	0	2	2
Face	0	3	1	4
Hand/ Finger	1	9	20	30
Leg	0	3	15	18
Total	2	15	43	60

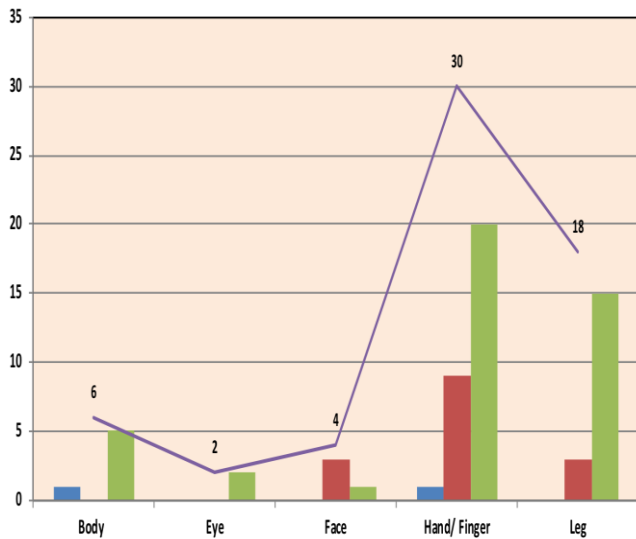


Figure 3: Body parts that are prone to incidents

Findings from the table and figure above shows the body parts that are prone to incidents. Findings showed that the hand and finger are the body parts most vulnerable to recordable incidents (30); this was followed by the leg (18), the general body (6), the face (4) and the eye (2).

Table 3: Activities that are prone to recordable incidents

Activity	Total
Cable Pulling	2
Carpentry	6
Concreting and Rebar	5
Diving	7
Excavation and Trenching	2
Painting	2

Transportation	2
Welding & Piping	4
Housekeeping	5
Installation and Maintenance	5
Lifting and Rigging	14
Others	6
Total	60

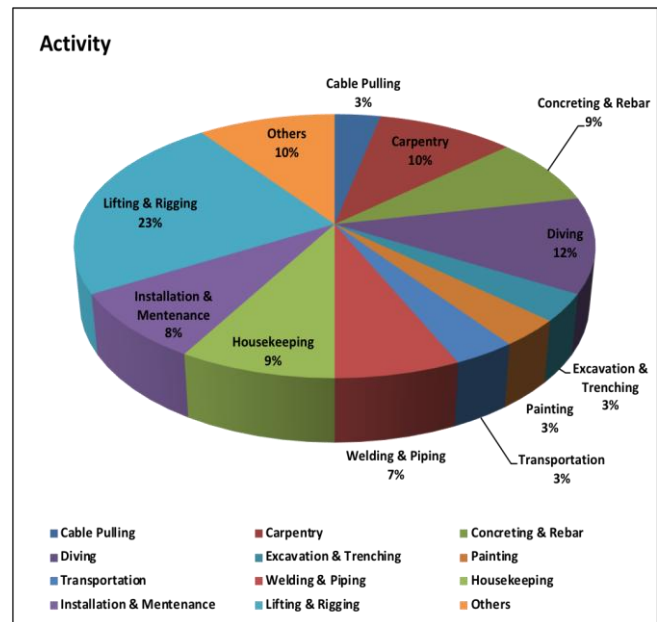


Figure 4: Activities that are prone to recordable incidents

Findings from the table and figure above shows that the activities that are prone to incidents. Findings showed that the lifting and rigging are the activity that causes the most recordable incidents (14); this was followed by the diving (7), whilst the activities that causes the least number of recordable incidents are cable pulling, painting and excavation/trenching (2).

Research Question 3: At what time and months where higher frequencies of incidents are recorded?

Table 4: Time and months of higher frequency of recordable incidents

Total Incidents	2018	2019	2020	Total
Jan	0	0	2	2
Feb	0	0	6	6
Mar	0	0	2	2
Apr	0	0	3	3
May	0	0	4	4
Jun	0	0	6	6
Jul	0	3	7	10
Aug	0	0	3	3
Sep	0	2	10	12

Oct	1	3	0	4
Nov	1	3	0	4
Dec	0	4	0	4
Total	2	15	43	60

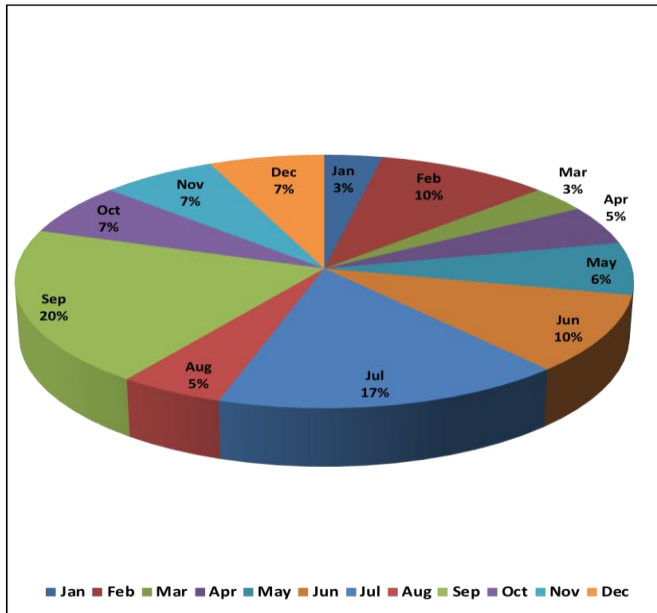


Figure 5: Time and months of higher frequency of recordable incidents

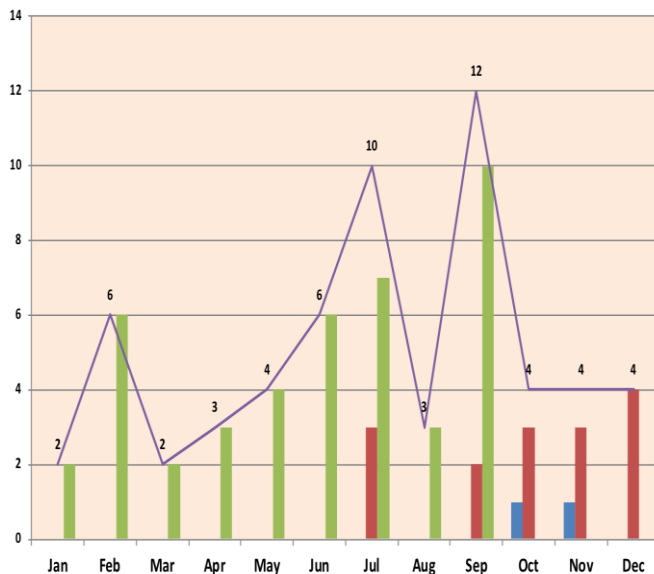


Figure 6: Time and months of higher frequency of recordable incidents

Findings from the table and charts above shows that the highest frequencies of recordable incidents occurred in September (12), July (10), February and June (6), whilst the lowest frequency occurred in August (3), and January and March (2)

VI. CONCLUSION

Findings showed that negligence to instruction and procedures were the major cause of recordable incidents in the work areas under review in the Niger Delta, followed by lack or poor supervision, maintenance and mechanical failure, unfavorable and bad weather condition, and inadequate or poor communication, respectively. Furthermore, the study discovered that the hand and finger are the body parts most vulnerable to recordable incidents, followed by the leg, the general body, the face and the eye. Lifting and rigging were the activity that caused the most recordable incidents, this was followed by the diving, whilst the activities that causes the least number of recordable incidents are cable pulling, painting and excavation/trenching (2). And the highest frequencies of recordable incidents occurred in September, July, February and June, whilst the lowest frequency occurred in August, and January and March.

VII. RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made;

1. Organizations should have an effective safety management system and safety management committee saddled with the responsibility of fulfilling the corporation’s safety functions.
2. Supervisors should be held accountable and penalized for their lack of adequate supervision whenever the surface or root cause of an incident can be traceable to them.
3. Employees should be trained on how to conduct a job hazard analysis, to be able to discern a hazard in the workplace that can pose a risk.
4. Employees who do not comply to safety rules and regulations should be punished.
5. Management should provide adequate work procedure, environment and schedule that will not endanger the life and health of employees.

Limitations of the Study

A likely limitation to the study is that, all incidents to be analyzed were previously investigated by different people that made up the investigation team. Contributing factors and main causes to the incidents to be extracted from the safety data base for this study could be subject to a decision of a shallow knowledge team. Also, several safety observation reports tracked from individual may as well be subjected to some degree of error that might not be easily verifiable, since some originators of some reports may not be available for a follow up should any question arises. The people to be interviewed, even though they will be told the objective of the study, there are likelihood we cannot completely erase the possibility of getting feedback that are either blown out of proportion or understatement

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