Review Paper

PERSONAL INJURY ANALYSIS OF LAND DRILLING RIGS WITH EMPHASIS ON HAND / FINGER INJURIES & STUDY ON HOW EFFECTIVE IMPLEMENTATION OF BEST PRACTICES CAN PREVENT HAND / FINGER INJURIES

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ABSTRACT

The operations in the oil and gas sector are considered as the most risky activities compared to other sectors in the industry. Other than the fire and explosion risks, the other significant risks are injuries to hands/ fingers which these oil & gas industry workers face on a regular basis in their operations. In spite of intensified worker awareness and improved training efforts by employers in the oil and gas industries, the number of hand/ finger injuries consistently increase in the oil and gas industry. The various incident statistics in oil & gas industry shows that, hand/ finger injuries make up around 40 to 50 percent of recordable personal injury incidents in the oil and gas industry.

The hand is the most valuable tool of human beings, almost everything in our life can not been done without hands. The main source of injury to the hands include caught between objects, struck by, chemicals, vibration, heat, cuts, bruises, breaks, burns, punctures, amputations, cold and infectious or biological agents. The hands and fingers have more nerve endings per square centimeter that any part of the human body and more pain receptors than any part of our bodies.

The main intension of this study is to do an analysis of the personal injuries in the land drilling rigs based on the IADC statistics for the land drilling rigs in the Middle East with emphasis to the hand/ finger injuries which helps to identify the area to be focused to improve. The study also shows how the effective implementation of best practices in drilling rigs will help to prevent the hand/ finger injuries & thus improves the overall HSE performance of the Drilling Contractor.

INTRODUCTION

According to the International Association of Drilling Contractors (IADC) 2015 & 2016 statistics, hand and finger injuries comprised around 48 percent of all recordable incidents on land drilling rigs. The occupation wise personal injury analysis of land drilling rigs shows that floor man & roust-about are mostly affected categories compared to other designations.

Considering all the above statistics, the oil & gas industry companies are concentrating more and more on hand and finger injury prevention strategies. However, petroleum industry has bring vast hazards which may lead to hand and finger injury. It is obviously to know from OSHA and IADC data that finger injury is the most frequently occurred accident in our field. Therefore by sharing & implementing the best practices and latest techniques are really necessary and to be implemented to reduce the number of hand/ finger injuries and thus overall improving the safety performance of oil & gas industry.

OBJECTIVE OF THE STUDY

The overall objective of this study is:

- ☞ Analyzing the personal injury incidents in drilling operations as per IADC statistics with emphasizing on the hand/ finger injuries and significance in preventing the same.
- ☞ Personal injury analysis of Land Drilling Rigs as per the statistics from International Association of Drilling Contractors (IADC) for 2015 & 2016 based on occupation, body part & type of incident for the Lost Time Injuries & Recordable injuries
- ☞ Hand/ Finger injury prevention using the hierarchy of hazard control technique with various examples.
- ☞ Study on how the best practices on hand/ finger injury prevention helps to reduce the rate of personal injuries in Land Drilling Rigs.

PERSONAL INJURY ANALYSIS OF LAND DRILLING RIGS FOR 2015 & 2016 AS PER IADC ISP PROGRAM

The personal injury analysis is done as per the International Association of Drilling Contractors (IADC) incident statistics for 2015 & 2016. The IADC Incident Statistics Program (ISP) has tracked safety and accident information for the drilling industry.

- ☞ To record data reflecting accident experience which can be compared to other industries.
- ☞ To identify causes and trends of drilling industry injuries.
- ☞ To provide a means of recognizing rig crews for outstanding safety performance.

Personal injury analysis of Land Drilling Rigs as per the statistics from International Association of Drilling Contractors (IADC) for 2015 & 2016 based on occupation, body part & type of incident for the Lost Time Injuries & Recordable injuries and focused on the percentage of hand finger injuries.

SUMMARY OF PERSONAL INJURY ANALYSIS AS PER IADC INCIDENT STATISTICS

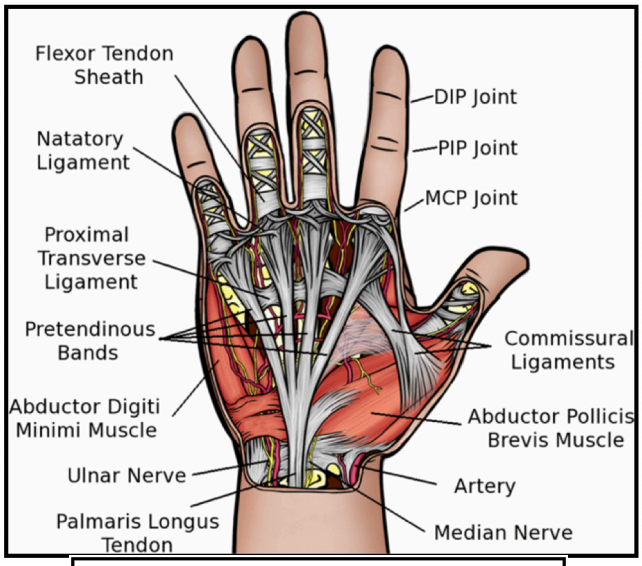
Personal Injury Analysis	Focused Area	2015		2016	
		LTIs (%)	Recordable Injuries (%)	LTIs (%)	Recordable Injuries (%)
Body Part	Hand/ Finger	46	48	23	48
Occupation	Floor man	31	32	19	25
	Roust about	24	19	23	31
	Driller/ Derrick man	13	12	19	11
	Total	***68***	***62***	***61***	***67***
Type of Incident	Caught Between/ In	38	32	26	35
	Struck By	24	24	26	27
	Total	***62***	***56***	***52***	***62***

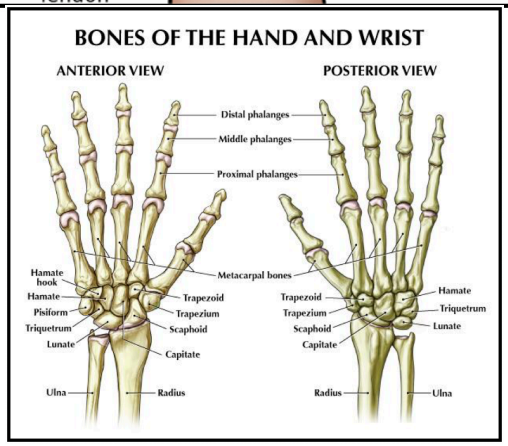
The personal injury analysis based on body part, occupation & type of incident as per IADC statistics shows that the areas to be focused are hand/ finger injury prevention which is around 48% of recordable injuries for 2015 and 2016. Also to improve HSE performance the other focused area as per occupation wise analysis are floor man, routs about & driller/ derrick man and as per type of incident analysis are caught between/ in & struck by, which is around an average of 65% & 59% respectively.

SUMMARY OF PERSONAL INJURY ANALYSIS AS PER IADC INCIDENT STATISTICS

A hand injury is literally the most common type of injury in the workplace. Hand injuries are even more prominent in drilling industry. We use our hand constantly and a disabling hand injury can have a dramatic effect on our quality of life. A hand injury can impact not only the ability to perform our job, but daily routines as well. A hand injury can occur in a second, but the social, financial and emotional effects can last a lifetime.

The human body is an engineering marvel. Our hands consist of 27 bones, ligaments, muscles, tendons, nerves, blood vessels, skin and nails. Fingers contain some of the densest areas of nerve endings in the body, and are the richest source of tactile feedback. They also have the greatest positioning capability of the body; thus, the sense of touch is intimately associated with hands. See the pictures below for the details.





Working in unison, they provide strength and dexterity which enables us to perform routine tasks and accomplish precision movements. Because of their tremendous versatility, hands are exposed and susceptible to many types of injuries. Hand injuries are difficult to repair because of the complexity of the hand and after a hand injury; the hand may not function as it did before the injury due to loss of: motion; dexterity; grip & ability to complete the simplest of tasks.

Protecting your fingers and hands is important for your work and quality of life. Work-related hand injuries are one of the leading reasons workers end up in the emergency room and miss work. Damage to the nerves in your fingers and hands, loss of a finger, a skin burn or allergic reaction, can negatively impact the quality of your work, your productivity – or worse – end your career and seriously detract from your quality of life. The cost of these types of injuries and illnesses to the industry is estimated as huge amount each year.

OSHA Standard reads, 29CFR 1910.138(a) (b), Employers shall select and require employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances, sever cuts or lacerations; severe abrasions; punctures' chemical burns; thermal burns; and harmful extremes. Employers shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the tasks to be performed, conditions present, duration of use, and the hazards and potential hazards identified.

The hand injury prevention begins with a recognition and respect for the hazards. Because we use our hands so

frequently, we can start to take them for granted and not truly respect the potential risk we place them in. It is important to maintain your concentration and focus at all time when working around moving equipment and machinery. Injuries occur because your hands were in the wrong place at the wrong time; don't allow that to happen.

COMMON CAUSES OF HAND / FINGURE INJURIES

As per the incident analysis in drilling industry the common causes of hand injuries are:

- ☞ Bypassing safety procedures
- ☞ Lack of awareness/ training
- ☞ Inadequate/ improper PPE
- ☞ Inadequate assessment of risk
- ☞ In a cutting corners / rushing. Mistaken priorities -safety versus objectives.
- ☞ Inattention or lack of focus
- ☞ Using the incorrect tool for the job

The analysis of hand and finger injuries happens shows the most common reasons as follows.

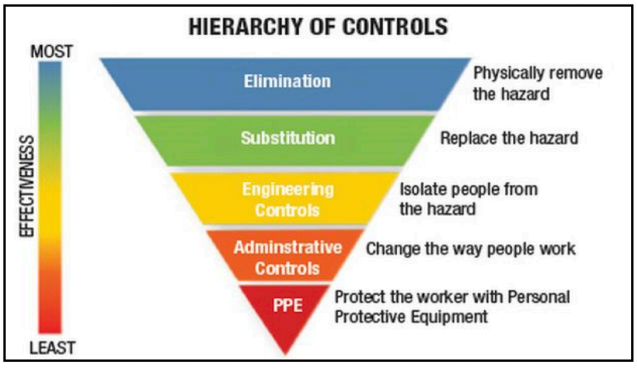
- ☞ Being caught between tools and equipment.
- ☞ Hitting objects after exerting force or momentum during manual lifting or moving of heavy objects (pipe, drums, tools, etc).
- ☞ Trauma after reaching inside, around, or underneath equipment and losing sight of the hand.

Even when people seem to know of the existence of these dangers, hand and finger injuries still happen. Pinch points can occur anywhere a part of the body can get caught between two objects. This hazard is everywhere in the workplace. But pinches in the workplace can be a lot more serious. There is no comparing the power of a slammed screen door with the force of industrial machinery. A pinch point injury on the job can be seriously disabling and can cause amputation, or even death. Any place where equipment is transmitting energy, there is a pinch point.

Often pinch-point injuries are the result of workers, who are not properly trained, don't realize the dangers of machinery, or take shortcuts to get the work done more quickly, but end up injuring themselves instead. Never perform a task without proper training, by taking shortcuts, or bypassing procedures; the consequences could be serious.

HAND / FINGURE INJURY PREVENTION USING HIERARCHY OF HAZARD CONTROL IN DRILLING OPERATIONS

Hierarchy of hazard control is a system used in industry to minimize or eliminate exposure to hazards. It is a widely accepted system promoted by numerous safety organizations. This concept is taught to managers in industry, to be promoted as standard practice in the workplace. Various illustrations are used to depict this system, most commonly a triangle. See the info graphic by NIOSH below.



Control methods at the top of graphic are potentially more effective and protective than those at the bottom. Following this hierarchy normally leads to the implementation of inherently safer systems, where the risk of illness or injury has been substantially

reduced. Employers should begin at the top of the pyramid and work their way down when trying to reduce hazards.

The top level of the hierarchy is **elimination**, which is when a hazard is completely taken out of the workplace. For example, implementing hand free lifting operations in drilling operations.





Substitution can often take the danger of a hazard out of the equation completely, too.

A common example is to provide hand free tools for various activities where potential hand/ finger injury is there.

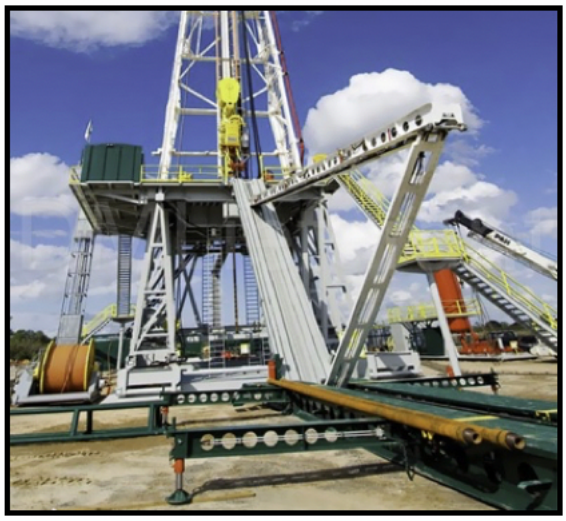




Elimination and substitution, while most effective at reducing hazards, also tend to be the most difficult to implement in an existing process. If the process is still at the design or development stage, elimination and substitution of hazards may be inexpensive and simple to implement. For an existing process, major changes in equipment and procedures may be required to eliminate or substitute for a hazard

Engineering controls, which are the third level of the hierarchy, are a common way to reduce the risk of a hazard. Engineering controls are based on the principle of designing the hazard out of the job (elimination), and when that cannot be achieved, enclosing the hazard, substituting it with safer alternatives, or modifying the equipment or working arrangements. Machine guards that prevent a worker from reaching into a machine while it's moving are an example of a frequently used engineering control. An automated

catwalk eliminates workers' risk of moving pipe between the catwalk and the rig floor.





Engineering controls are favored over administrative and personal protective equipment (PPE) for controlling existing worker exposures in the workplace because they are designed to remove the hazard at the source, before it comes in contact with the worker. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The initial cost of engineering controls can be higher than the cost of administrative controls or PPE, but over the longer term, operating costs are frequently lower, and in some instances, can provide a cost savings in other areas of the process.

The fourth level of the hierarchy is **administrative controls**, which deal specifically with the people working in hazardous areas. Administrative controls generally relate to workplace rules and safety procedures.

♣ Work procedures and job safety analyses

♣ Training employees to recognize the hand/ finger injury hazards

♣ Job rotation of personnel in jobs

♣ Developing policies to prevent hand/ finger injuries

♣ Housekeeping at the work place

♣ Hand/ Finger injury prevention campaigns

Part of an effective plan is ensuring that all policies, safety conversation procedures, and training programs have been updated to specifically place an emphasis on hand safety. These policies help promote a positive safety culture in which employees are encouraged to be more aware of workplace hazards and how to protect themselves. To further emphasize this point, employees are asked to simulate how a hand

Finally, at the bottom of the hierarchy is **PPE**, which is often used in conjunction with other control measures listed above. In many cases, a hazard cannot be eliminated or adequately controlled with elimination, substitution, engineering controls and administrative controls, and in those cases it is appropriate to provide employees with PPE and instructions in how and when to use it. If we take the example above about switching from a hazardous cleaning chemical to a less dangerous one, it's possible the new chemicals could still irritate the skin. In this case, employees can still wear gloves to protect themselves. Combined, these strategies would reduce the hazard enough for employees to work safely and avoid accidents.

Employees often start a task without putting on their gloves because they fail to recognize that gloves make a

marked difference in hand safety. A study has demonstrated that at least 60% of hand injuries are caused by not wearing gloves or by wearing the wrong gloves for the task. During incident investigations, employees sometimes stated that they could not properly perform a particular job with the glove options they had available. Most frequently, employees complained that the gloves did not provide the dexterity they needed to do the task. The resulting reluctance to wear gloves greatly increases the potential for hand injury. Glove clips are also provided to allow employees to carry more than one pair with them in case the type of work changes.

STUDY ON VARIOUS INITIATIVES BY TWO DRILLING CONTRACTOR (A&B) IN HAND / FINGURE INJURIES PREVENTION

As an Operator based on increased trend of hand/ finger injuries in Drilling Operations which comes around 40 to 45% of total personal injuries, the following initiatives took to reduce the hand/ finger injuries & thus to improve the overall HSE performance.

☞ Incident analysis done for the hand/ finger injuries to identify the root causes and the areas to be focused for improvement.

☞ Safety alerts prepared with the recommendations & sent to all Drilling Contractors based on the incident analysis.

☞ Conducted an exclusive workshop for all the Drilling Contractors to share the best practices followed in their operations to prevent the hand/ finger injuries and included a presentation from a subject matter expert in the hand protection field.

☞ Hand/ finger injury analysis done for the three years based on occupation, category of incident, working area, equipment & activity wise to give a clear picture to Contractor to which area to be focused.

☞ HSE awareness session conducted in each rig directly by the Operator HSE during the periodic Rig inspection.

☞ Recommended to revise the Drilling Contract to ensure that more stringent clauses for hand/ finger protection is included.

Hand/ Finger Injury Prevention Program by Drilling Contractor A&B

Drilling Contractor A & B implemented various initiatives in their drilling rigs for the hand/ finger injury prevention by effectively implementing the cost effective hand/finger injury prevention programs with the available resources & without any major cost implication and thus to improve the overall HSE performance. Some of the initiatives are mentioned below.

1. Pinch Point Hazard Identification

A team with key personnel from Operator & Contractor was formed and they first identified the pinch point hazards in the drilling rigs. After based on this identification, the Contractor prepared the list of equipment & areas to be focused during this program.

Some of the key identified equipment and areas by the Contractor are as below list based past incidents in their rigs and also based on the various lessons learnt from other incidents.

- Lifting operations mainly using slings
- Hammering activities using chisels
- Gratings in the rig floor and the mud tank area
- Substructure area where tool height is adjusted
- Casing tongs and manual tongs
- Spider elevator, Bit breakers & Split bushings
- While lowering the loads using crane
- Door frames in camps & offices
- Pipe rack area during rolling pipes
- While arranging pipes in stand

Some of the pictures of the focused areas are given below.







2. Preparation of Pinch Point Register

Based on the pinch point hazard identification and the equipment/ area of pinch points based on the survey carried out at the rig, the pinch point register is prepared with photo graph of pinch point and updated as and when required at the rig site.

3. Employee Training & Awareness Campaign

The aim of this training & campaign is to help identifying problem, areas, equipment and also give the employee the realization of the amount of hand and finger injuries we are having. The onsite training given to all categories of employees at rig site on the pinch point register mainly for the new employees to rig. The training helps the employees to understand it's their responsibility to identify the hazards not only to protect them but his coworkers also. Hands and Fingers Safety Board was distributed and posted on all Rigs to increase the awareness. Increasing crew awareness through training, T.V fixed in rig dining room which continuously showing HSE awareness videos. Safety Observation program is aimed at preventing incidents and injuries and is designed to help participants working in hazardous operations (such as drilling) look at safety in a new way. Through this program workers can help themselves and their co-workers work safely.

4. Implementation of Pinch Point Marking at Work Place

Based on pinch point hazard identification of equipment/ area these are highlighted in yellow and black color for easy identification by the crew & to take necessary precautions to prevent the hand/ finger injuries. Also based on some previous incident hand/ finger injuries some modifications done to prevent the recurrences. Some the examples of pinch point marking at drilling are given below like manual tongs, gratings, casing tongs, split bushing, bit breaker, spider elevator etc.

The tool height adjuster modified to avoid the hand/ finger injury after one serious finger injury incident at rig site while doing the adjustment and hand

rails provided over genie lift basket to protect hand/ finger while operating.



5. Provide Proper Tools for Hand/ Finger Injury Prevention

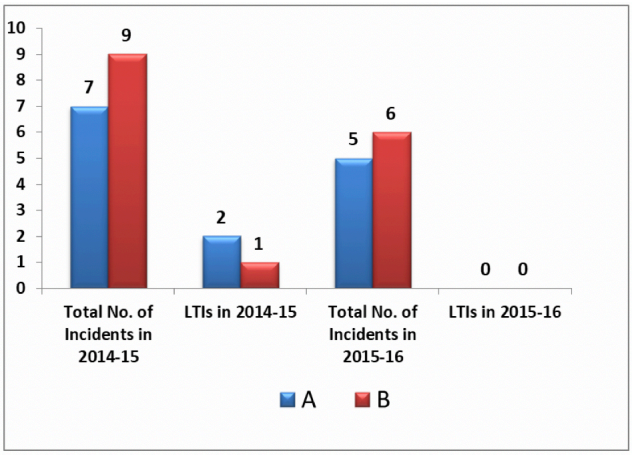
To prevent/ minimize the hands and fingers injuries at drilling rigs, the rig crew provided all the proper tools to ensure the employees fingers are away from pinch points while hammering and rolling casing or handling tubular. These tools eliminate/ & substitute the hand/ finger injury hazard while performing the task. Some of the tools used at the drilling rigs are shown below like push stick, finger saver tools etc.

6. Selection & Implementation of Correct PPE

The contractor procedure revised incorporating that only impact gloves are allowed for the drilling rigs. The main purpose of this revised procedure is to prevent/ minimize hands/ fingers injuries and to reduce the severity of consequence if any impact in case of incident occurs.

Evaluation of HSE Performance for Contractor A & B before & after Implementing the Hand/ Finger Injury Prevention Program at Drilling Rigs: Evaluated for 2014-15 & 2015-16

The Contractor A&B HSE performance evaluation done for 2014-15 & 2015-16 based on the hand/ finger injuries reported and also based severity of injury. This is evaluated to see the difference in hand/ finger injuries reported before and after the implementation of hand/ finger injury prevention program by Contractor A&B in their drilling rigs. The evaluation done for the total number of hand/ finger injuries reported & number of LTIs for the years 2014-15 & 2015-16. All incidents below are for mentioned are only for hand/ finger injuries only.



Summary & Conclusion of the Study

The personal injury analysis based on the available International Association of Drilling Contractors (IADC) incident statistics for 2015 & 2016 shows that the hand/ finger injuries are contributing 48% of total recordable personal injuries in drilling rigs. Also hand/ finger injuries contribute 46% & 23% of Lost Time Incidents (LTI) for 2015 & 2016 respectively.

The occupation wise analysis for 2015 & 2016 shows that floor man, roust about & derrick man contribute 62% & 67% of total recordable personal injuries and 68% & 61% of LTIs shows that mostly affected three categories are floor man, roust about & derrick man those who are exposed to hand/ finger injuries also.

The analysis based on type of incident shows that caught between/ in and struck by incidents contribute 56% & 62% of total recordable injuries at drilling rigs for 2015 & 2016 respectively and same contributes 62% of LTIs for 2015 &

2016.

The above analysis based on IADC incident statistics show the necessity of the hand/ finger injury prevention to improve the overall HSE performance at drilling rigs and the occupation wise & type of incident analysis helps to identify the areas to be focused while designing the effective implementation of the cost effective hand/ finger injury programs for the drilling rigs. The cost effectiveness of any safety program in drilling rigs is very important during this period where the oil price is in a lower level compared to few years before.

The HSE performance evaluation of Contractor A&B based on the hand/ finger injuries reported in 2014-15 & 2015-16 shows that after effective implementation of hand/ finger injury prevention program which consist various initiatives & following the industry best practices which helped to reduce 30% & 33% of hand/ finger injuries compared to previous year for Contractor A & B respectively and the most important thing No LTIs (100% reduction) related to hand/ finger injuries reported from both Contractors for the year 2015-16 whereas 03 LTIs reported from Contractor A&B in the year 2014-15 .

Therefore this study shows that the effective implementation of various hand/ finger injury programs without any major cost implication (cost effective hand/ finger injury prevention program) helps to reduce the personal injuries in drilling rigs to a great extent and thus improves the overall HSE performance in Drilling Operations.

References

1. OSHA Standard, 29CFR 1910.138(a)(b) and OSHA 3170-02R 2007

2. IADC Incident Statistics Program (ISP) 2015: Summary of Occupational Incidents – Middle East Land Total

3. IADC Incident Statistics Program (ISP) 2016: Summary of Occupational Incidents – Middle East Land Total

4. IADC Health, Safety and Environmental Case Guidelines for Land Drilling Units

5. Hierarchy of Hazard Control info graphic by NIOSH