MAKING THE DECISION TO CHANGE

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ABSTRACT

More often than not, the most difficult part of any change is “Making the Decision to Change.” Corporate change is cultural in nature, as it must be done on a level-by-level basis to become effective. It must be inclusive of all and any change must be universally embraced and implemented to be effective. Corporate change speaks to and helps define the personalities of the corporation and ultimately its leadership.

This paper blends the technical aspects of defining the needs, visualizing the system, designing, building, and marketing a "clean sheet, automated, and robotic well service system" with the research-development-bottom line anatomy of corporate America. Clearly, the mission is to build the safest, most efficient, and the most accurate system to service oil and gas wells. The associated risks and rewards, as well as the "Why do it" and "How to do it" from both the service company and the oil and gas operator perspectives are discussed in this paper.

GENERAL DISCUSSION:

A good starting point for a paper on “change” might be to take an inventory of where our industry is today. A caveat: Exact numbers are difficult to obtain, as companies tend to keep certain information under their cuffs. One might argue the absolute values of the numbers below but he or she cannot argue the magnitude or impact of what is assumed and presented. Having said that, where are we today?

- There are approximately 3,200 well service rigs running in the U. S.
- One fourth of the rigs are on completions or recompletions and three fourths of the fleet are performing maintenance activities.
- Well servicing rigs generate approximately 2 billion dollars in revenue per year.
- Accounting for weather, weekends, and holidays, the average rig works 250 days/year.
- The average well service rig works 200 hours/per month or 2,400 hours per year.
- The average field hand works 50-60 hours per week.
- There are four and one half field employees associated with each rig. Collectively, they work 750,000 man-hours per week or 36-38 million man-hours per year.
- The average attrition rate for well service field hands is 60%.
- The average depth of an oil well in the U. S. is 4,500 feet.
- There are approximately 400,000 oil wells in the U. S. under artificial lift systems. The Permian Basin has just under 150,000 wells.
- The average well failure rate is .50.
- Several large and small oil companies now operate their own rigs because of past dissatisfaction with their service providers.
- It is difficult for a well servicing company to attract and retain qualified employees due in part to self-limiting pay scales and working environment.
- It is difficult to measure and track work product quality in well servicing.
- It is difficult to get a hurt man out of the derrick.
- The safety record of the well servicing industry has improved over the years, but still remains at unacceptable levels. There is ample room for improvement.
- Hurting folks and/or accidental deaths is not an option we choose to live with.

If the industry is willing to accept the above, then there is clearly no reason for change and no benefit to read further. On the other hand, if improvements are needed and are possible, then the course for change is set in motion.

What are the real meanings of the data and numbers?

The Well Servicing Magazine publishes safety statistics each year and the trend chart below is one that catches most eyes.

Clearly and most assuredly, the industry is on the right trend as the OSHA Total Recordable Incident Rates and (TRIR) and Lost Time Accidents (LTA) are dropping each year. The trend on this chart is a true testament to

emphasis service companies are placing on job safety. There is, however, more information and one must understand where the numbers come from to determine the "current state" of our industry.

TRIR and LTAs are reportedly based on 200,000 man-hours worked. The 200,000 number comes from 100 workers working 40 hours per week for 50 weeks per year and therefore becomes the normalizing base for reporting purposes. According to the AESC, this chart is based on 61,072,689 man-hours worked in 2008.

THE MATH

For LTA: [.67] X [61,072,689] / [200,000] means our industry had 205 lost time injuries in 2008.
For TRIR: [2.57] X [61,072,689] / [200,000] means 787 workers required medical attention in 2008.
Rig accidental deaths are not tracked and reported by the AESC and are very difficult to track, but each year our industry experiences such tragedies. There is an SPE paper (121056) on the subject if one is inclined to need more data. Suffice it to say: **No accidental deaths are acceptable.**
AESC also reports other useful data as follows in charts 2-6.

It is a safe wager that the majority of companies believe that even though the numbers have improved over the years, they are not yet acceptable. The goal should and must be zero but the service rig, however, remains a dangerous environment for workers and continuous improvement will become more difficult. Obviously, removing the workers from harm's way wherever and whenever possible will reduce accidents and fatalities.
Dollars: Safety aside, the major catalyst for change remains: ***economics***. Statistically, the data on the service industry provides a wealth of opportunities for improvements in the numbers. A few examples:
If 80% of the 400,000 wells in the U. S. are on beam pumps and the wells have with an average depth of 4,500 feet, then

- [400,000] X [4,500] X [80%] / [25'] or 57,600,000 sucker rods in use.

A failure rate of .50 means approximately 160,000 beam-pumping wells will be pulled and run each year. Since virtually all well interventions, (pump changes, tubing leaks, parted rods) require the rods to be pulled and if there are 250 workdays per year, the math becomes:

- [160,000 wells] X [4,500'] / [25] / 250 days or 116,000 rods are pulled and run each day.
- If a rig is racking triples, [116,000] / [3] X [2] or 77,000 connections are made or broken out per day

Note: Californians running 30-foot rods and standing doubles, multiple trip fishing jobs, and new well completions are not included in the math above. The questions become:

- Is there any industry in America today that performs routine tasks 77,000 times a day without automation?
- Next, who can make a more precise connection, the human or machine?

Well Servicing Employee Attrition Cost: The larger service companies report a 60% attrition rate at the rig level and that number is higher in boom times. Most of these workers do not leave the industry but rather switch employers to take advantage of a pay increase or to remain in a particular area when the servicing contract is given to another service provider. The fact remains, it costs money to train, orient, certify, and integrate the new employee into the new workforce. The math:

- [3,200 rigs] X [4.5 employees/rig] X [60% attrition] = 8,600 employees switch employers per year.

If the average cost to test, train, and orient a new hire is $1,000, then attrition costs the industry $8,600,000 per year.
Labor Cost: If an automated robotic well servicing system can run with a two man crew, what might the savings be in direct labor cost? Assume the average rig employee makes $20/hour and the associated cost is an additional 30%. If the conventional rig uses four men, the direct hourly labor cost is:

- [4] X [$20] X [1.3] = $104/hour

Assume the rig will need an operator with a higher skill level (example coiled tubing or treater type technician) so the new operator gets a 50% raise bringing his rate to $30/hour. The second man gets a 25% raise and his new rate is $25/hour.

- [$30] + [$25] = [$55/hr.] X [1.3] = $72/hour or a $32/hour savings.

If 25% of the rig fleet used this type of rig and the work hours per rig remain constant, then:

- [3,200 rigs] X [25%] X [2,400 hrs/year] X [$32/hr] = $61,500,000 per year savings in costs.

Safety Savings: This is a no brainer. If a rig has fewer workers working on it and those workers have a reduced exposure to hazards, both the number and cost of accidents or mishaps will be reduced. Ironically, the same logic

applies to driving to and from the location accidents, which account for 28% of the total rig fatalities. If a vehicle accident occurs and there are only two workers in the truck compared to four, the accident rate will be halved.

What is in this for the oil and gas well operator? Approximately 1/3 of well failures are rod failures of some type. About 1/4 of the rod failures are connection related, meaning the coupling or pin failed. Of course, this number is higher in high lift applications and it is certainly geographically dependent. If the average cost of a well failure is $6,000, then:

- [160,000 failed wells] X [1/3 due to rods] X [1/4 are connection failures] or about 13,000 wells fail each year due to connection issues. [That is 8% of the total failures/year]
- [$6,000] X [13,000] or the rod connection is an $80,000,000 per year problem.

After studying thousands of hours of rig data and working with crews, one can make a convincing argument that:

- Rig crews do not follow API 11 BR
- They do not understand and/or appreciate the complexity of a rod connection.
- They do not properly clean, dry, and lubricate each connection.
- Wells fail because of improper make up…Loose under a load…

Additional proof lies in that fact that no one has ever stood up and made the following statement: "I guarantee my rig crews make up every rod connection to precise manufacturer's specifications."

Oversight and Supervision Cost: Normally, some form of supervision is required at a wellsite to ensure safety procedures are followed, company policies are being followed, and quality workmanship is being performed. It is an accountability thing and when humans are involved, it is a necessary expense. If 160,000 wells fail each year and each failure results in a consultant or company man overseeing the repair work, what is that cost? For simplicity in the math, suppose the cost is $1,000/failure. If that is the case, wellsite supervision costs the industry $160,000,000 per year. Question: If the robotic system replaces the human and literally, every movement and action is captured and documented, how much money could be saved in supervision costs? Maybe half……or as little as a third?

All the above being said, the fact remains: ***Sustained efficient and economic production determines the financial fate of every producer. Conducting the well service business in a safe and efficient manner pays dividends to all parties.***

Why has it not been done before? If automating the process makes sense for the wellbeing of the workforce and it makes economic sense, why has it not been done? To understand that, it might be a good time to review some laws of nature and people. The laws listed below are a play on words mixing science with human nature:

- Newton's First Law: "A body at rest will remain at rest until acted on by an outside force." In this case, no one or any company is going to move or change until some force makes them move. It is called the comfort zone and folks like to stay in it.
- Newton's second Law: "F = MA." Force is equal to the Mass times the Acceleration. In this case, the larger the mass (M being the number of employees) the greater the force it is going to take to make the change. Said differently: Larger companies are more difficult to change or alter their way of conducting business.
- Newton's Third Law: "For every action, there is an opposite and equal reaction." Making the need case and then selling the idea is the action. Buying the need and idea is the reaction that starts the change process.
- Murphy's first law: "Anything that can go wrong will go wrong and always at the most inopportune time."
- Murphy's fifth law: "Left to themselves, things tend to go from bad to worse."
- Law of First Learned-Always Learned: This is a common among those in educational fields and what it means is: If you learn it right the first time, you will continue doing it right. When learned wrong the first time, one will continue doing it wrong even when re-trained and told how to do it right. There is that "Comfort Zone" again.
- First Law of the Jungle: The service company's income is the oil operator's costs.
- Second Law of the Jungle: Failure rate is often inversely proportional to the cost of the repair.
- Third Law of the Jungle: Talking safety sounds good but has costs limiting characteristics.
- Fred's Law. Every dog gets a bone.
- Fred's second law: Not Failure. Low Aim is a Crime.

- Fred's third law: If a robot or a machine fails, call a technician, not a doctor and robots don't talk to attorneys.
- Fred's forth law: Choosing a service company based on costs/hour is foolish and counterproductive.

The Best Idea in the World has No Value Until It is Developed and Implemented: "I wish" or "I want" is simply not good enough to effect change. If one wants to institute change, he/she must:

- Recognize or indentify the needs.
- Dream or envision the solutions.
- Develop a plan, which includes both the technology and the business aspects.
- Convince others to buy the plan.
- Fund it, build it, and implement it.
- Do not be afraid of failure.
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Note that all six bullet points above have people elements and one must understand the drivers of people who can either implement or retard the changes. The best way to cover that topic is to review the various generic job descriptions, skill sets, and attitudes of corporate America.

- **Board of Directors:** the BOD's job is quite simple. They are to maximize the investor's dollars, hire a great CEO, provide fiduciary oversight, search for investment opportunities, and set policies. Generally speaking, the board needs to be long-term planners and thinkers, but they are herded by the stockholders and therefore, are somewhat restricted.
- **Chief Executive Officer:** The CEO's job is also simple. He/she is to carry out the policies of the board, maximize profits, seek investment opportunities, and provide a healthy work environment for the employees in the workplace to plant and grow beans. The CEO must balance long term and short-term thinking. Sits on the right hand of the president of the board and is very close to the CFO. The CEO likes line item entries.
- **Chief Financial officer**: A simple job: Count beans and knows exactly where the beans come from and where they go. Routinely gives bean reports to the CEO and BOD and sends out multipage spread sheets to all levels of management. Can run a ten key at the speed of light and has the biggest-badest printer in the company. Speaks in "line item terms" and EBIDA codes, which only the CEO and BOD understand. Most assuredly can calculate the ROI on any investment.
- **Middle Management:** Most likely the most difficult level in which to work. To be successful in this position requires a daily balancing act. They are to maximize profits, which means produce more with less and hold costs down. They coordinate services and people in accordance with policy. They must provide a safe and attractive workplace for all the real bean growers. They send "net" beans to the CFO and constantly ask for more growth beans. They become highly skilled at dog and pony shows as well as the art of compromising. They will buy or push for a new idea only if it makes their job successful and it makes sense, but there must be an open slot in the CFO's line item spreadsheet. This job can often become reactionary in nature.
- **The worker:** They plant and harvest beans as directed by middle management. They are the source of best ideas for improvement to either grow more beans or reduce the number of beans it takes to operate the bean farm. They are the trench workers who know his/her business from the ground up and left unattended to, they will find another farm to grow beans. They do not care too much about line items and budgets and would prefer fair pay for working in a safe clean environment with a chance to grow in the job.
- **The stockholders:** A very strange group with almost indefinable expectations. Most stockholders want long term growth opportunities, but measure performance based on quarterly results. They often speak with forked tongues as they hold the BODs, CFOs, and CEOs accountable to produce short-term gains, but insist they invest in long-term growth, which impedes short-term gains they so desire. An oxymoron? A very confused group to work with and understand, but in fact, the stockholders own the company.

The bottom line of this word play on our capitalistic society players is that the change must be embraced at all levels if it is to be accepted and successful. The innovator must sell his/her idea to all the above. One more point: Over the past few decades, as the markets moved from a long term investment strategy to short term-quarterly reporting and thinking, publicly held companies responded by cutting research and development budgets. This phenomenon might explain why the majority of job creations, as well as patent applications, come from small businesses.

The Law of First Learned, Always Learned: One might ask how product quality in well servicing contributes to well failure rates? Several years ago**,** during a safety school, ten experienced rig operators were asked questions as follows:

- How much pressure do you use to make up tubing? The answers were all in psi and no operator used the word "torque." Only one operator changed pressures depending on the make and model of the tongs. Only one operator knew that a closed face Foster required a different pressure setting from an open faced Oil Country. Four operators argued that the low gear or high gear option did not matter because it was all about pressure and not gears? Only one operator could explain the torque-pressure relation chart for tongs.
- Do you clean every rod connection and lubricate it? Only 2 operators said yes to this one. Several said it depended on if the company man was there or they had another job pending.
- Do you card the rods? Four out of the ten said yes. Six said they knew their tongs and use the pressure gage only.
- Do you know if you have Mark IV or Mark V tongs on your rig? No one could tell which ones they had on their rigs and furthermore, none knew that the Mark IVs require 50% more pressure to achieve the same final torque.

Every operator said they had learned their skill in the field and they often used the term "that is the way I learned it" when responding to the questions. Clearly, if you can take the human element out of the makeup process and turn it over to a computer driven machine, precision can be obtained, which will be followed by a lower well failure rates which will be followed by lower lifting costs. The "once learned, always learned law" is equally applicable to safety issues as bad habits and behavioral issues are passed down over the years just as good ones are. Morris Massey in his book "*What you are is where you were when*" says that often only a life-changing event will alter one's behavior or thinking. Training and re-training may not be the key to step advancement in the well servicing industry.

Every Dog Gets Bone: To successfully implement change, there must be something in this new concept for both the well servicing industry and the oil producing industry. **I**f you have two dogs in a pen and toss only one bone over the fence, a fight is likely to ensue. Likewise, if one company's income is another company's cost, naturally there is going to be some disagreement. The industry, although currently designed this way, does not have to be. Everyone who has ever been around a service rig knows today's rigs are built to repair and complete wells. Today rigs are not designed to help lower failure rates or lifting costs and in fact, have no inherent systems aimed at toward goal. Rigs pull and run stuff.

The What If Game: What if a totally new rig and well servicing system were designed to:

- Focus on safety,
- Offer precision workmanship and a higher quality work product,
- Offer total accountability,
- And be proper designed and equipped to lower failure rates?

Might that become the glue that bonds the service company and the well operator?
Hopefully, the stage for change is now set for re-thinking the whole business model of well servicing. There are clear safety and financial drivers for change, the rules are laid out, and the players are named and in position. So the question is: How and who is going to buy into this concept? In Freiburg's book *Nuts*, which is the story of Herb Kelleher and Southwest Airlines, the author lays out the reward hierarchy for a successful company. He says the stockholders are first, followed by the employees, followed by the customers. Clearly, if any element is missing or if any element does not receive a benefit, the company will fail. Applying his lessons, the "buy in" to change must be across the spectrum of the industry, from the bottom up to the top down.

The Brain Game: It will take a major paradigm shift to significantly improve the safety performance and to move the service rig industry from being a commodity to a niche driven market. Designing and building the hardware and technology might be the easy part. Getting the field to alter thinking and work habits will most likely be the most difficult part. It will take time.

A computer animation of the envisioned system will follow this paper.

CHART 1 – TRIR FREQUENCIES

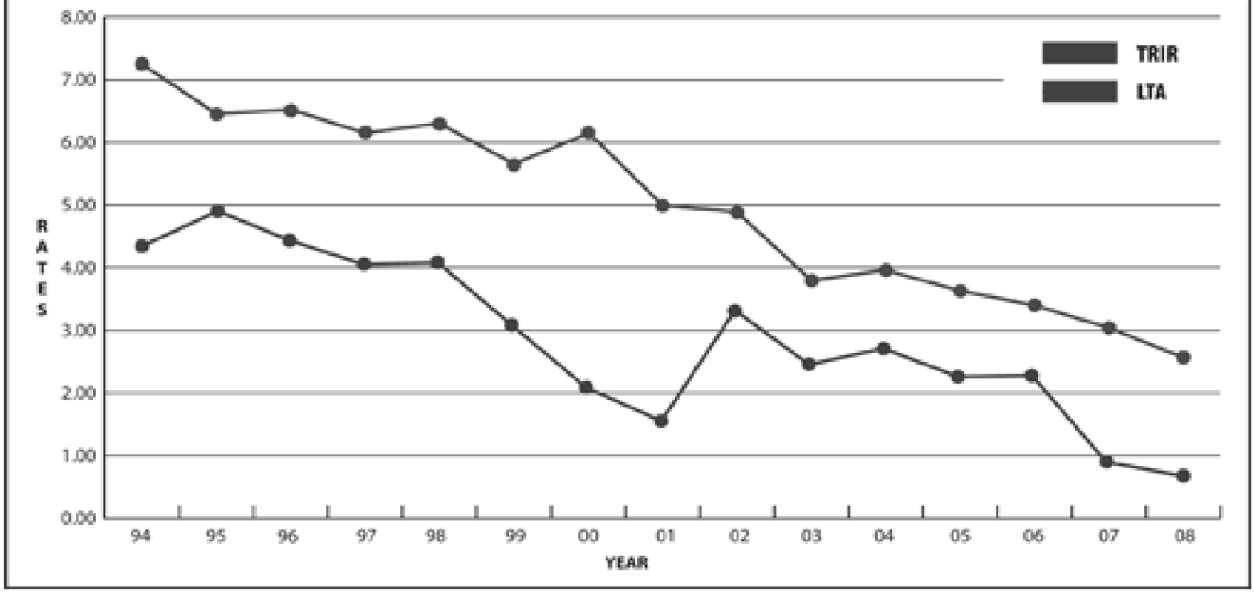


CHART 2 – JOB TITLE OF INJURED PERSONNEL

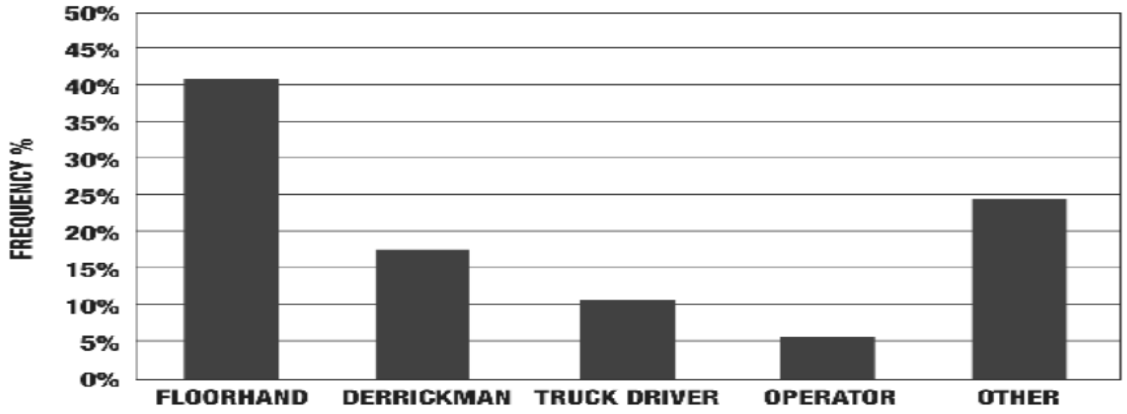


CHART 3 – TYPE OF INCIDENT

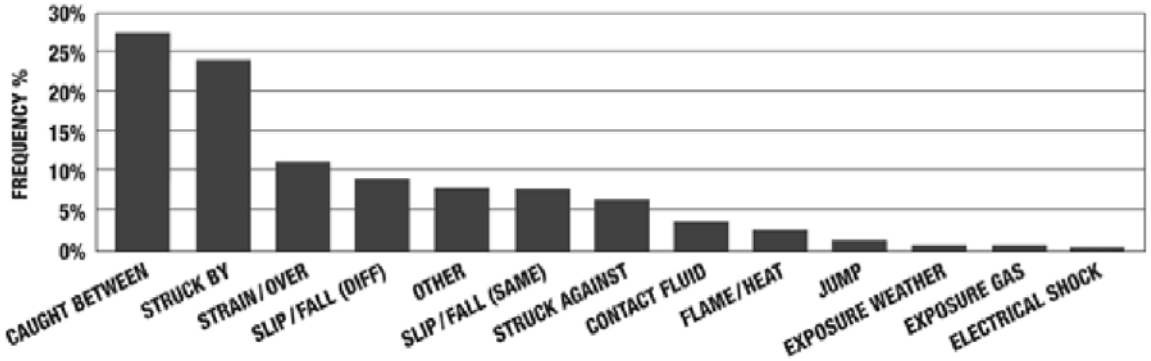


CHART 4 – EQUIPMENT INVOLVED WHEN INJURED

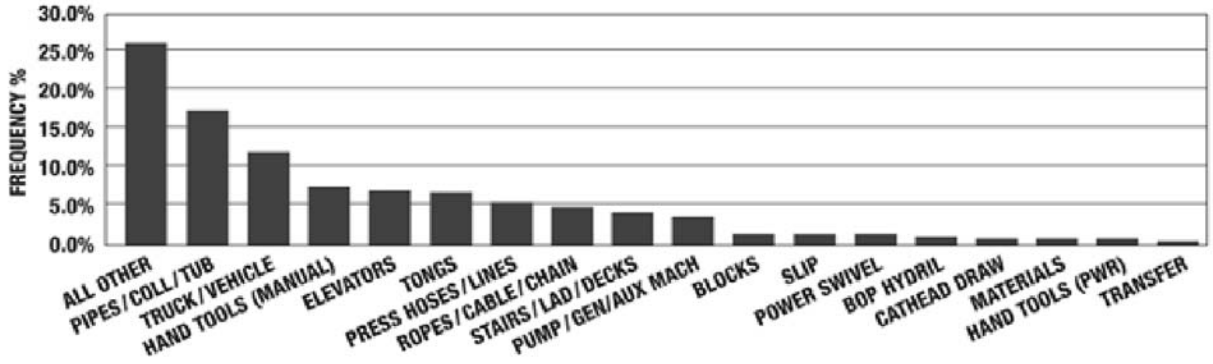


CHART 5 – ACTIVITY INVOLVED WHEN INJURED

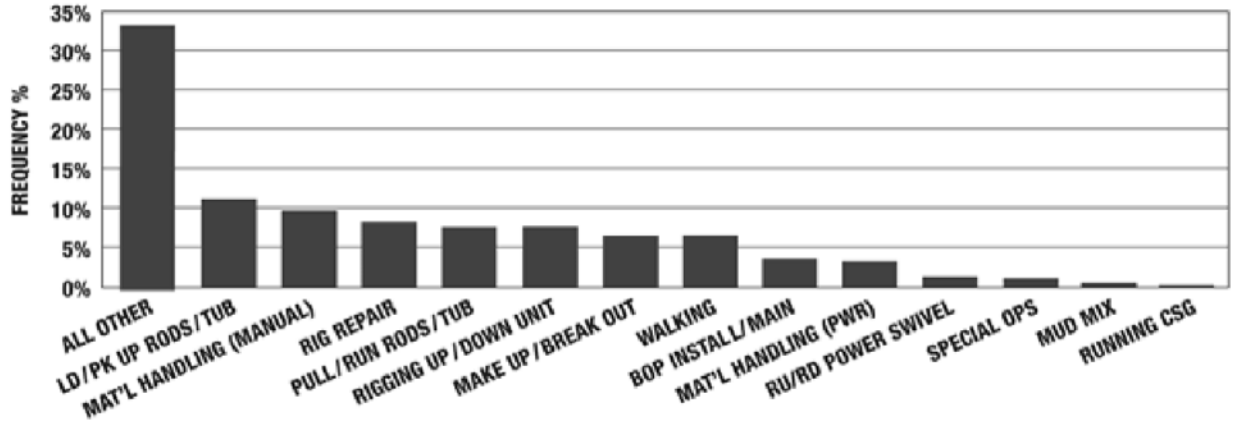
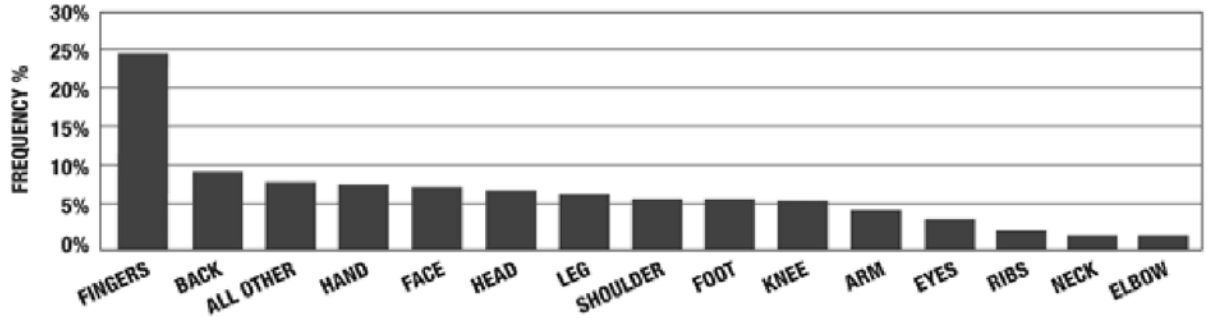


CHART 6 – PART OF BODY INJURED



This room is equipped with the new Edison light bulb.
They will not harm your health.
Do not try to light with a match.

A sign found in a New York Hotel Room in 1899