Abstract:

After each drilling operation the rig need to be moved to another location in order to drill and extract oil or gas from the new location, the purpose of this study is to perform a perfect and safe rig move operation at the onshore.

This study looks at how to transport the rig and all of its equipments one by one and to describe the progress of the operation day by day with the maximum of efficiency safely and smoothly.

The management of risk at the level of the rig is done with a process it is a responsibility of each member of the drilling camp no matter what position he occupies to preserve the health and safety of people, equipments and the environment of the rig .

After the application of JSA method on a rig of ENTP Company we could be able to determines all potential hazards and accident that may occur during the operation and gives recommended measure that can eliminate or reduce these hazards.

Key words: rig move, onshore, safety, ENTP, JSA, hazards.

Résumé:

Après chaque opération du forage la sonde a besoin d'être déplacé sur un autre emplacement pour forer et extraire le pétrole ou le gaz dans la nouvelle zone, le but de cette étude est d’exécuter une opération DTM parfaite et sûre.

Cette étude vise à expliquer comment se fait le transport de l’appareil de forage et tous ses équipements un par un et décrire le déroulement de ces opérations jour par jour avec le maximum d'efficacité sans risque.

La gestion de risque au niveau de la sonde se fait avec un processus ou chaque membre de l’équipe de forage est responsable, peu importe sa position ou son poste . Le but est de conserver la santé, la sécurité du personnel, des matériels et de l'environnement du chantier.

Après l'application de méthode JSA sur un appareil de l'ENTP pour analyser les risques, nous pourrions être capables de déterminer tous les dangers potentiels et accidents qui peuvent se produire pendant l'opération et de recommander des mesures de sécurité appropriées qui peuvent éliminer ou réduire ces risques.

Mot clés : appareil de forage, analyse de risques, sécurité, JSA, ENTP.

Acknowledgement :

In the Name of Allah, the Most Gracious and the Most Merciful, I give thanks to my creator, the able and powerful Almighty Allah for his help in seeing me through my master program. It would not have been an easy achievement if not for his love and mercy on me.

My personal thanks go to my dear family for constantly supporting, praying, blessing and encouraging me throughout my entire study and life.

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Many thanks and gratitude goes to my friend who works at the onshore for their great help.

Lastly, I am thankful to my friends at and my dignified institute IMSI specially our department for giving me the opportunity to carry out this research in a very conducive environment. Thank you.

Abbreviations list:

LNG: Liquid Natural Gas

GOSP: gas oil separation plant

FPSO: Floating, Production, Storage and Offloading

PDC: Polycrystalline Diamond Compact

ROP: Rate of Penetration

BOP: Blow Out Preventer

HP: Horse Power

JSA: Job Safety Analysis

ENTP: Entreprise National des Travaux aux Puits

IADC: International Association of Drilling Contractors

DTP: Direction des Travaux Pétroliers

DSP: Direction des Services Pétroliers

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GENERAL INTRODUCTION:

Hydrocarbon operations are generally hazardous in nature by virtue of intrinsic chemical properties of hydrocarbons or their temperature or pressure of operation or a combination of these. Fire, explosion, hazardous release or a combination of these are the hazards associated with hydrocarbon operations. These have resulted in the development of more comprehensive, systematic and sophisticated methods of Safety Engineering, such as, Hazard Analysis and Risk Assessment to improve upon the integrity, reliability and safety of hydrocarbon operations.

The primary emphasis in safety engineering is to reduce risk to human life and environment. The broad tools attempt to minimize the chances of accidents occurring. Yet, there always exists, no matter how remote, that small probability of a major accident occurring. If the accident involves

Hydrocarbons in sufficient large quantities, the consequences may be serious to the project, to surrounding area and the population therein.

Then, the Oil&Gas industry faces tremendous structural changes due to the growing energy demand of emerging countries and the increasingly geological complex reservoirs more difficult to access and exploit. This reality led to innovative technologies and new assessment methods to proper evaluate the drilling risk.

Algeria occupies a place of choice within the gas and oil-producing countries. In oil industry, the need for improvement is an obsession in all production facilities: exploration (drilling), exploitation, or also distribution.

Drilling as a final stage in the prospection of hydrocarbons contains a phase where several risks are found, according to the statistics of the accidents, which is the phase of (rig down, moving and rig up).

For that, in this modest work, we tried to work out in a more or less brief way, an analysis of the risks related to this phase on the level of the **National Company of well activities (ENTP)**, by using a risk assessment method. This analysis method is called Job Safety Analysis (JSA) which is a procedure that helps integrate accepted safety and health principles and practices into a particular task or job operation. It is used to observe a worker actually perform the job during all the rig move operation. The major advantages of this method include that it does not rely on individual memory and that the process prompts recognition of hazards.

Structure of the dissertation:

To illustrate this work, 4 chapters were primarily defined:

1st chapter: we begin with general concepts on drilling (history, onshore/offshore, exploration and drilling and rotary drilling).

2 nd chapter: contains the operation's definition, the rig move plan and its procedures.

3 rd chapter: devoted to the methodology of risk analysis.

4 th chapter: devoted to the application of this methodological step on the operation.

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Statement of the research problem

After the drilling operation, it exists a very significant phase which is the rig move, this phase is known by the highly risks level which was statistically proven . It is a very complex process involving numerous concurrent/simultaneous operations and activities with a variety of other contractors present. Because of this level of activity and the fact that different types of hazards from those encountered during drilling operations are present.

From this aspect, the aim of this paper was set to find sound answers to the following question:

What are the problems related to the operations: Rig up, Skid and Rig down?

Significant of the study

Rig move has always been a concern for most drilling companies for its importance in so many ways the significant of our study is to encourage safety awareness at every level in the company - from Manager to rigger. A strong safety culture contributes to the company's goal. That goal is to have all of the employees return home safely after a working day. So the main purpose of the study is to indicate how to prevent accidents and absence due to illness and strive to optimize working methods by improving safety which eventually reduces time and cost.

Study limitation

The present study was conducted in the national company of well activities (ENTP) where , we have collected the data concerning my main objective which is analysis of risks related to Rig move and for that we specifically chose Ain Aminas where we had the chance to visit 3 rigs (TP211,TP213,TP192).

Moreover, another limitation of the study is the time required to complete the study with the inclusion of analysis and findings which are all confined to 6 months including an internship period which was 4 weeks, a study like this required more efforts and timely delivery with results.

Introduction

Drilling is a very complicated domain, this chapter gives a preview on the oil drilling (its history, the types of wells, as well as the facilities, drilling process and rotary rigs).

I.1 History

Oil has been used for lighting purposes for many thousands of years. In areas where oil is found in shallow reservoirs, seeps of crude oil or gas may naturally develop, and some oil could simply be collected from seepage or tar ponds.

Historically, we know of the tales of eternal fires where oil and gas seeps would ignite and burn. One example from is the site where the famous oracle of Delphi was built around 1000 B.C. Written sources from 500 B.C. describe how the Chinese used natural gas to boil water.

But it was not until 1859 that Colonel Edwin Drake drilled the first successful oil well, with the sole purpose of finding oil. The Drake Well was located in the middle of quiet farm country in north-western Pennsylvania, and began the international search for an industrial use of petroleum. These wells were shallow by modern standards, often less than 50 meters deep, but produced large quantities of oil. The Phillips well on initially produced 4000 barrels a day in October 1861 and the Woodford well came in at 1500barrels a day in July, 1862.

The oil was collected in a wooden tank, in the foreground. There were many different sized barrels. At this time, barrel size had not been standardized, which made terms like "Oil is selling at $5 per barrel" very confusing (today a barrel is 159 liters). But even in those days, overproduction was something to be avoided. When the "Empire well" was completed in September 1861, it gave 3,000 barrels per day, flooding the market, and the price of oil plummeted to 10 cents a barrel.

Soon, oil had replaced most other fuels for motorized transport. The automobile industry developed at the end of the 19th century, and quickly adopted oil as fuel. Gasoline engines were essential for designing successful aircraft. Ships driven by oil could move up to twice as fast as their coal powered counterparts, a vital military advantage. Gas was burned off or left in the ground. Despite attempts at gas transportation as far back as 1821, it was not until after the World War II that welding techniques, pipe rolling, and metallurgical advances allowed for the construction of reliable long distance pipelines, resulting in a natural gas industry boom. At the same time the petrochemical industry with its new plastic materials quickly increased production. Even now gas production is gaining market share as LNG provides an economical way of transporting the gas from even the remotest sites.

With oil prices of 50 dollars a barrel or more, even more difficult to access sources have become economically viable. Such sources include tar sands in Venezuela and Canada as well as oil shale. Synthetic diesel (syndiesel) from natural gas and biological sources (biodiesel, ethanol) has also become commercially viable. These sources may eventually more than triple the potential reserves of hydrocarbon fuels. [1]

I.2 Types of Well

According to resulted from the geophysical analysis of the surveys and the geological data, several types of drilling are possible in the processes of prospection of hydrocarbons (see table below)

Table I.1: List various types of well in the prospection of hydrocarbons. [1]

Nomenclature	**well**	**remarks**
1. well of exploration	Well of recognition	Not yet found oil and gas.
	Well of discoveries	Oil and gas discovered.
	Dry wells	Small quantity of oil and gases found (for an economic exploitation).
2. wells of development		Oil and gas are produced in cases, the drilling of (development are dry).
3. wells with geo-pressure/ geothermic		Water under very high pressure (50MPa) and at high temperature (149°c) is present, and being able to contain hydrocarbons.
4. marginal wells		Quantity of hydrocarbon extracted is less than 10 barrels per day.
5. wells on several levels		Multiple formations productive are discovered several trains of drilling (one by formation) are introduced.
6. wells of injection		Pumping of (air, the water of gases or chemicals) in the productive layers and this for the maintenance of the pressure or the orientation of oil towards the wells of production.
7. service shafts		Salted water, (separated from oil and gas) is evacuated underground.

I.3 Onshore/Offshore:

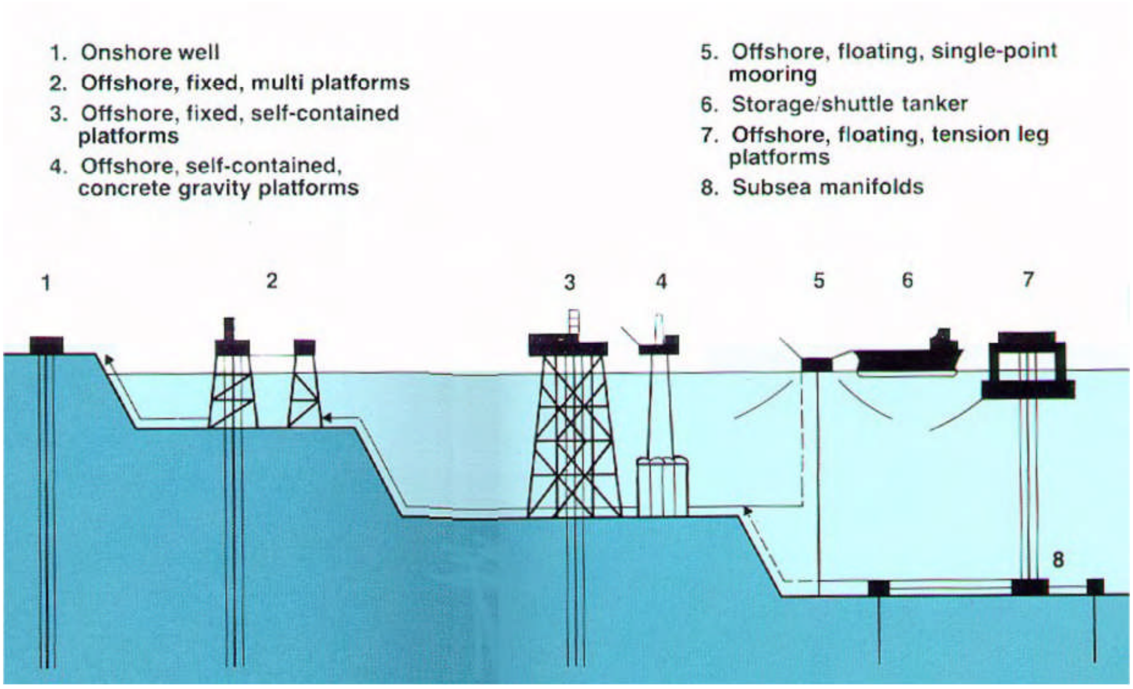

Figure I.1: oil and gas production facilities [2]

I.3.1Onshore

Onshore production is economically viable from a few dozen barrels of oil a day and upwards. Oil and gas is produced from several million wells world-wide. In particular, a gas gathering network can become very large, with production from thousands of wells, several hundred kilometers/miles apart, feeding through a gathering network into a processing plant.

However, there are many other ways of extracting oil from a non-free flowing well for the smallest reservoirs, oil is simply collected in a holding tank and picked up at regular intervals by tanker truck or railcar to be processed at a refinery.

But onshore wells in oil rich areas are also high capacity wells with thousands of barrels per day, connected to a 1,000,000 barrel or more a day gas oil separation plant (GOSP). Product is sent from the plant by pipeline or tankers. The production may come from many different license owners, therefore metering and logging of individual well-streams into the gathering network are important tasks.

Recently, very heavy crude, tar sands and oil shale have become economically extractable with higher prices and new technology. Heavy crude may need heating and diluents to be extracted. Tar sands have lost their volatile compounds and are strip mined or can be extracted with steam.

It must be further processed to separate bitumen from the sand. These unconventional reserves may contain more than double the hydrocarbons found in conventional reservoirs. [2]

I.3.2 Offshore

A whole range of different structures are used offshore, depending on size and water depth. In the last few years we have seen pure sea bottom installations with multiphase piping to shore and no offshore topside structure at all. Replacing outlying wellhead towers, deviation drilling is used to reach different parts of the reservoir from a few wellhead cluster locations. Some of the common offshore structures are: A shallow water complex- A gravity base- Compliant towers- Floating production- Floating Production, Storage and Offloading (FPSO) - Semi submersible platforms-Subsea production systems.[2]

I.4 Explorations and Drilling

When 3D seismic investigation has been completed, it is time to drill the well. Normally, dedicated drilling rigs either on mobile onshore units or offshore floating rigs are used. Larger production platforms may also have their own production drilling equipment.

The main components of the drilling rig are the derrick, floor, draw works, top drive and mud handling. The control and power can be hydraulic or electric.

Drillers and roughnecks working with rotary tables (bottom drives) are now replaced with top drive and semi-automated pipe handling on larger installations. The hydraulic or electric top drive hangs from the derrick crown and gives pressure and rotational torque to the drill string. The whole assembly is controlled by the draw works.

The drill string is assembled from pipe segments about 30 meters (100 feet) long normally with conical inside threads at one end and outside at the other.

As each 30 meter segment is drilled, the drive is disconnected and a new pipe segment inserted in the string. A cone bit is used to dig into the rock. Different cones are used for different types of rock and at different stages of the well. It exist roller cones with inserts, PDC (polycrystalline diamond compact) and diamond impregnated.

Figure I.2: drill string.

As the well is sunk into the ground, the weight of the drill string increases and might reach 500 metric tons or more for a 3000 meter deep well. The draw work and top drive must be precisely controlled so as not to overload and break the drill string or the cone. Typical values are 50kN force on the bit and a torque of 1-1.5 kNm at 40-80 RPM for an 8 inch cone. ROP (Rate of Penetration) is very dependent on depth and could be as much as 20 meters per hour for shallow sandstone and dolomite (chalk) and as low as 1m/hour on deep shale rock and granite.

Directional drilling is intentional deviation of a well bore from the vertical. It is often necessary to drill at an angle from the vertical to reach different parts of the formation. Controlled directional drilling makes it possible to reach subsurface areas laterally remote from the point where the bit enters the earth. It often involves the use of a drill motor driven by mud pressure mounted directly on the cone (mud motor, turbo drill, and dyna-drill), whip stocks - a steel casing that will bend between the drill pipe and cone, or other deflecting rods, also used for horizontal wells and multiple completions, where one well may split into several bores. A well which has sections of more than 80 degrees from the vertical is called a horizontal well.

Modern wells are drilled with large horizontal offsets to reach different parts of the structure and achieve higher production. The world record is more than 15 kilometers. Multiple completions allow production from several locations.

Wells can be of any depth from near the surface to a depth of more than 6000 meters. Oil and gas are typically formed at 3000-4000 meters depth, but part of the overlying rock can since have eroded away. The pressure and temperature generally increase with increasing depth, so that deep wells can have more than 200 C temperature and 90 MPa pressure (900 times atmospheric pressure), equivalent to the hydrostatic pressure set by the distance to the surface. The weight of the oil in the production string reduces wellhead pressure. Crude oil has a specific weight of 790 to 970 kg per cubic meter.

For a 3000 meter deep well with 30 MPa down hole pressure and normal crude oil at 850 kg/m^3, the wellhead static pressure will only be around 4.5 MPa. During production, the pressure will drop further due resistance to flow in the reservoir and well.

The mud enters though the drill pipe passes through the cone and rises in the uncompleted well. Mud serves several purposes:

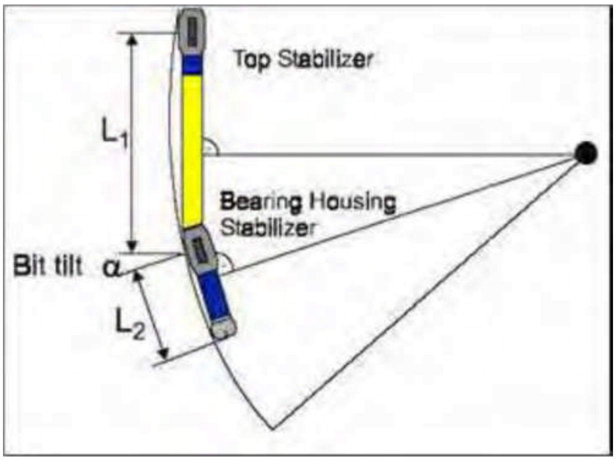

Figure I.3: directional wells

• It brings rock shales (fragments of rock) up to the surface

• It cleans and cools the cone

• It lubricates the drill pipe string and Cone

• Fibrous particles attach to the well surface to bind solids

• Mud weight should balance the down hole pressure to avoid leakage of gas and oil. Often, the well will drill though smaller pockets of hydrocarbons which may cause "a blow-out" if the mud weight cannot balance the pressure. The same might happen when drilling into the main reservoir.

To prevent an uncontrolled blow-out, a subsurface safety valve is often installed (BOP). This valve has enough closing force to seal off the well and cut the drill string in an uncontrollable blow-out situation. However, unless casing is already also in place, hydrocarbons may also leave though other cracks inside the well and rise to the surface through porous or cracked rock. In addition to fire and pollution hazards, dissolved gas in seawater rising under a floating structure significantly reduces buoyancy. The mud mix is a specialist brew designed to match the desired flow thickness, lubrication properties and specific gravity. Mud is a common name used for all kinds of fluids used in drilling completion and work over and can be oil based, water based or synthetic, and consists of powdered clays such as betonies, oil, water and various additives and chemicals such as caustic soda, barite (sulfurous mineral), lignite (brown coal), polymers and emulsifiers.

A special high density mud called Kill Fluid is used to shut down a well for work over, mud is circulated again. Coarse rock shales are separated in a shale shaker before it is passed though finer filters and recalibrated with new additives before returning to the mud holding tanks. [3]

I.5 Rotary Drilling

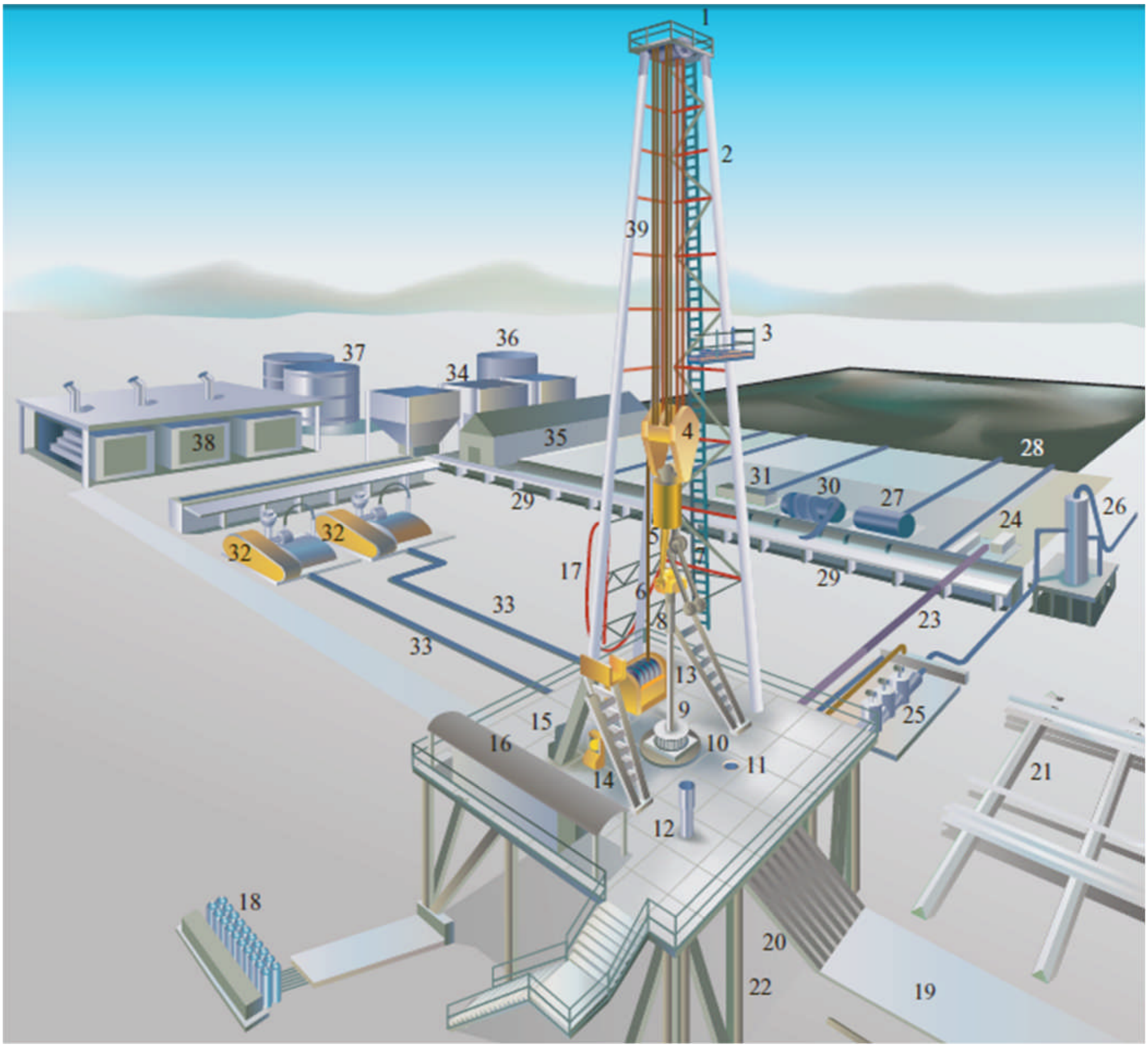

Figure I.4: Rotary drilling’s components

1 crown block	14 weight indicator	27 degasser
2 mast	15 driller's console	28 reserve pit
3 monkey board	16 doghouse	29 mud pits
4 traveling block	17 rotary hose	30 desander
5 hook	18 accumulator unit	31 desilter
6 swivel	19 catwalk	32 mud pumps
7 elevators	20 pipe ramp	33 mud discharge lines
8 Kelly	21 pipe rack	34 bulk mud components storage
9 Kelly bushing	22 substructure	35 mud house
10 master bushing	23 mud return line	36 water tank
11 mouse hole	24 shale shaker	37 fuel storage
12 rat hole	25 choke manifold	38 engines and generators
13 draw works	26 mud gas separator	39 drilling line

The functional components of a rotary drilling rig have been grouped under these activities/systems: [4]

- Power generation and transmission
- Hoisting the drill string
- Rotating the drill string
- Circulating fluid systems
- Materials handling during drilling operations.

I.5.1 Power Generation and Transmission

The primary power source is normally one or more internal combustion engines. On larger, modern rigs, the engines are frequently located at ground level, 100 or more feet from the derrick. This is to minimize the potential of fires caused by engines igniting gases that could escape from the well bore. On smaller rigs, the engines frequently are mounted immediately next to the derrick. The most common fuel used is diesel; but gasoline, natural gas, liquefied petroleum gas, and purchased electricity are also used. Typically, several hundred horsepower (HP) will be generated and used on a drilling rig, although a larger rig may produce more than 3,000 HP.

The transmission is mechanical or electric. A mechanical transmission, which is more common in older rigs, utilizes a "compound" of clutches, chains and sprockets, belts and pulleys, and a number of driving and driven shafts. An electric transmission is more common in newer equipment.

Most exposures to hazards associated with the power generation and transmission system occur during maintenance, fueling, and lubrication. Inadequate or nonexistent equipment guards and ineffectual (or the lack of) lockout procedures for maintenance operations during continuous drilling increase the risk of physical injury. Other hazards include high voltages, chemical injury to the eyes during fueling, fire, and explosion. The noise levels in power generation areas may be high, with the risk of hearing loss.

I.5.2 Hoisting the Drill String

The primary functions of the hoisting apparatus are to raise and lower the drill string components during tripping and drill stem lengthening operations and to support the drill string at the desired bit weight during drilling. The draw works is essentially a rotating spool, usually located on the drill deck, controlled by a clutch and brake system operated by the driller. The wire rope drill line runs from the draw works to the crown block at the top of the derrick, and then to the traveling block and hook, which is attached to the drill string during drilling operations. The drilling line diameter and reeving sequence of the blocks are determined by maximum drill string weight. The deadline anchor, usually located on the derrick substructure, serves as an adjustable terminal anchor point for the wire rope .Typically, the dead line anchor will be adjustable to allow for the continual addition of new wire rope to the hoisting system.

Employee exposure to hazards associated with hoisting should be slight unless structural defects exist or system overloading occurs. Routine inspection of elevated hoist mechanisms involves the risk of falls. Pinched fingers and injuries from wire rope splinters are other hazards.

I.5.3 Rotating the Drill String

In addition to rotating the drill string and bit, the rotary table provides for free vertical motion of the drill as the bit penetrates into the earth. Torque is transmitted from the rotary table to the drill by the kelly, which also conveys the drilling mud that is pumped into it through a swivel connector.

The kelly is a three-, four-, six-, or eight-sided 40-foot-long conduit (i.e., longer than the 30-foot drill pipe sections) that threads into the drill pipe and is connected to the hoist traveling block by the swivel. The swivel supports the buoyed weight of the drill string while allowing the kelly to rotate and the pressurized drilling fluid to enter the drill stem. The kelly is rotated by a suitably structured kelly bushing that transfers rotational force without impeding the continuous downward movement of the kelly. During operations such as tripping, the kelly bushing must be easily removable to permit the drill pipe to be withdrawn from the well. When the kelly is hoisted and stored in the rathole during a trip, the kelly bushing is removed as an integral part of the kelly assembly. To facilitate this maneuver, the kelly bushing sits inside a three-, four-, six-, or eight-sided master bushing that is a fixed portion of the rotary table. The rotary table (and other rotating parts) may turn at rates of up to 400 rpm; however, much slower speeds are usual, perhaps in the range of 25-100 rpm. The driller operates the rotary table clutch controls and hoist controls from the same station. The power source is either an electric motor or mechanical power that is connected to the rotary table by a compounded chain drive.

A typical drill string consists of 30-foot sections of drill pipe, male and female threaded, that weigh between 14 and 18 pounds/foot (500 pounds/joint). Several heavy, thick-•walled joints of pipe, called drill collars, are made up in the drill stem, just above the bit, so the bit will penetrate into the formation being drilled. A single drill collar can weigh between 2,500 and 4,000 pounds (or more) depending on its diameter.

It should be noted that employee exposure to rotating parts during drilling makes this operation one with a high potential for severe injuries, although the frequency of occurrence is low. The rotary table and kelly bushing are in nearly continuous motion and are not usually provided with any guarding mechanism. Contact with either is likely to cause slips, falls, and bruising accidents; also, there is a risk of being caught between stationary and rotating parts.

I.5.4 Circulating Fluid Systems

Drilling fluid, or "mud," is typically a mixture of water and bentonite (absorbent, gel-forming clay) and sometimes oil or other components. It has four primary functions: cooling, lubricating, and cleaning the bit; removing the cuttings; providing hydrostatic pressure to prevent entry of formation fluids into the well bore; and reducing the risk of hazardous blowouts.

Mud pumps force the mud up a standpipe and through the flexible kelly hose to the swivel, where it enters the drill string via the kelly and eventually emerges at the bit in the well bore. Continuous pressure (up to 3,000 psi) forces the mud up the well annulus and out the mud return pipe, where it is first screened of larger cuttings at a shale shaker and then processed through a series of desanders and desilters prior to recycling. Cuttings carried by the drilling fluid are taken for analysis to determine the composition of the stratum being drilled.

Hazards associated with working on or around components of circulating fluid systems are various. Mixing of the mud exposes workers to airborne respirable dust and chemical splashes. Tanks in which mud is mechanically stirred are hazardous when unguarded, or when effective lockout procedures are not followed during maintenance operations. Walking surfaces nearby may be slippery, especially in wet or icy weather. Pressure surges causing line rupture are an occasional hazard.

I.5.5 Materials Handling During Drilling Operations

On a drill rig, most of the materials handling equipment is unique to the oil field. This equipment is used in the working routines of raising and lowering the drill string, adding new sections of drill pipe, and tripping. This equipment and its operation are described in operational sequence in this chapter.

To extend the length of the drill string, a joint (30-foot section) is hoisted from horizontal pipe storage racks (located at ground level) to the drill deck. The joint is lowered into a hole in the drill deck (known as a mouse hole), where it is stored until it is added to the string. This hoisting operation can be performed with a fiber rope, hands-on friction pulley (known as a cathead) that protrudes from each side of the draw works. Most modern drilling rigs have steel cable air hoists to perform the hoisting of the drill pipe. When the kelly is at the level of the kelly bushing, the rotary table and mud circulating pumps are stopped. The driller raises the drill stem until the bottom of the kelly pipe joint connection is about 2 feet above the level of the rotary table. A set of "slips" is wedged into the space between the master bushing and the drill stem to maintain the drill pipe's position. Large pair of counterweight-suspended wrenches, called tongs, is used to "break out" the torqued kelly pipe joint connection. Once the tongs are clamped above and below the connection, mechanical force is applied to the handle of the breakout tong by a tong pull line originating from a mechanical cathead located on the draw works. When the connection has been loosened, the joints are "spun out." Some rigs use an air-operated kelly spinner to spin out the kelly from the drill pipe, whereas others spin out the drill pipe with the rotary table after the tool joint has been "broken" with the pipe tongs. When making up a connection, some rigs use a pipe spinner to spin the joint up; then it is tightened with the pipe tongs. Many rigs use the traditional spinning chain to make up a joint of pipe; then it is tightened with the pipe tongs.

Once disengaged, the lower end of the kelly, suspended by the hoist, is pushed/pulled by the floor hands until it is centered over the pipe joint that was temporarily stored in the mouse hole. The kelly is "stabbed" into the pipe joint, spun up, and tong tightened. The driller next engages the draw works and raises the kelly and pipe joint assembly, which in turn is stabbed into the drill stem that is held by the slips. This connection is then spun up and tong tightened. The slips are removed, the mud pumps and rotary table are reactivated, and the drilling operation proceeds.

Tripping is a procedure used when well bore inspections and bit changes are necessary. The entire drill string must be removed from the hole and later returned if the drilling is to proceed. During a "round trip" (cycle of removal and replacement), the kelly is disconnected and stored in the rat hole, a hole in the rig floor into which the kelly and swivel are placed during hoisting operations. Elevators, a set of clamps affixed to the bails on the swivel below the traveling block, are attached to the bell portion (tool joint) of the drill pipe and used to raise the drill string from the hole. Pipe tongs and frequently the rotary table are used to disconnect the stands (usually 90 feet of drill pipe) as one unit. The initial breaking of the pipe joint is properly performed by the automatic cathead tensioning the breakout tong. To ensure well control, drilling mud is usually added to the well bore to replace the fluid volume displaced by the drill stem and to maintain hydrostatic pressure when the drill stem is removed. The derrick man, usually using a fall-arresting derrick climber, climbs the derrick and works from the monkey board, which is usually located 90 feet above the rig floor. His task is to coordinate the placement of the triple joints between the fingers of the "finger board" for temporary storage during the trip and to disconnect the drill pipe from the elevators.

Once the bit has been removed from the hole, it is inspected for wear and replaced as necessary. "Logging" devices may be lower into the hole on a stranded wire electric cable by a cathead power takeoff system or an independent electric winch. If the well drilling operation is to continue, the above sequence is reversed, completing the round trip.

Workers directly involved in these operations are close to moving equipment components, while performing tasks that require substantial exertion and good coordination between individuals. Transferring drill pipe from the rack to the drilling platform may result in the stockpile rolling or in the mishandling of suspended loads, with the risk of crushing injury. Handling of the tongs requires well-coordinated efforts and proper body limb placement. Mistakes in the hands-on spinning chain operations can lead to entanglement that may result in crushing, amputation, and death. Machinery is activated by an operator who depends on visual and/or audible cues; a mistake can lead to premature activation while workers are still in contact with moving parts. Mechanical failure from overloading systems can occur. Lifting and moving heavy items on wet surfaces may lead to slips, falls, and overexertion. Eyes are at risk from material falling off the drill pipe. Potential hazards in these operations can be increased if the drilling crew has not worked together very long; teamwork is necessary to carry out the operations quickly and safely.

I.6 Special Hazards

In certain areas and depths, if proper precautions and control methods are not employed, two conditions may be encountered that have the potential to cause major disasters: blowouts and the escape *of* hydrogen sulfide. [5]

I.6.1 Blow Outs

A blowout is an uncontrolled escape of gas, oil, or formation fluids that may lead to fire, explosion, drilling rig destruction, injury, or death.

Blowouts may occur when the formation fluid pressure exceeds the hydrostatic pressure of the circulating fluid in the well annulus such as the totally unexpected encountering of unpredictable pressures and/or when mechanical controlling methods; e.g., blowout preventers (BOP's) or other pressure-control techniques, fail through misuse, misapplication, or malfunction. During a drilling operation, the mud serves as the first control method. If there is a pit level increase (or any of several other indications), then the formation pressure exceeds the hydrostatic pressure of the mud. This is called a kick. If a kick occurs, the driller should take steps to close in the well with the BOP's. After the BOP's are closed, the mud weight is increased so that it can exert a pressure equal to, or slightly higher than, the pressure of the formation.

Most wells are drilled in oil fields with predictable formation pressures. BOP's selected to be compatible with these pressures are installed as soon as the surface casing is in place. BOP's function by sealing off the well bore. A series of hydraulic (and some manual) rams activated from ground level (not on the derrick) seal and contain the formation pressures.

If the kick is not noticed in time or the techniques used to control the formation pressures are not adequate, then a blowout occurs. Since blowouts and subsequent fires involve the loss of equipment and time (as well as employee exposure to extremely hazardous conditions), the industry usually takes great care to prevent their occurrences. [5]

I.6.2 Hydrogen Sulfide

Hydrogen sulfide is a highly toxic, colorless gas. It is a very insidious industrial hazard for two reasons: unreliability of odor as a warning, and sudden onset of incapacitation. Hydrogen sulfide has been identified by NIOSH as a leading cause of sudden workplace death. At concentrations up to 30 parts per million (ppm), it has an odor of rotten eggs. However, at more deadly concentrations (100 ppm), hydrogen sulfide rapidly fatigues the olfactory nerves .A person may momentarily smell the gas but think little of it when the odor is no longer detectable. If exposure is sufficiently intense, unconsciousness and respiratory failure may occur without warning symptoms. The gas is 1.2 times denser than air, and at high concentrations will tend to accumulate in low spots. Mixed with air in concentrations of 4.3-45.5%hydrogen sulfide is explosive .It may also burn with the production of toxic sulfur dioxide.

During oil and gas well drilling operations, H_2S is first released to the atmosphere at the shale shaker area and later at the circulation fluid treatment areas. It may also be released during tripping procedures in the immediate area around the drilling operation. Typically, however, only nominal amounts of H_2S are released during normal drilling operations.

The effect of hydrogen sulfide on metals, known variously as metal fatigue, hydrogen embrittlement, and sulfide stress cracking, can cause failure of the drill string during a well control situation. Such failure can result in the release of hazardous concentrations of H_2S in the drilling area. Careful selection of resistant metals and chemical treatment of drilling fluids can effectively guard against such failure.

With the exception of exploratory or "wildcat" wells, drilling operations take place in oil fields where the hydrogen sulfide locations and formation pressures likely to be encountered are known. With the demand for hydrocarbons increasing, formations historically deemed too dangerous to produce are now being developed. In some instances, there is frequent to nearly continuous employee exposure to hydrogen sulfide at concentrations from 10 ppm (OSHA 8-hour permissible exposure limit (PEL)) to life-threatening levels requiring the wearing of self-contained breathing apparatus. Innovative technologies, alarm systems, and respiratory protective equipment and programs are being employed without uniform Federal regulation. [6]

Conclusion:

After drilling operation the drilling rig and all of its equipments will be moved to another location in order to start drilling over again this operation is called rig move which is the object of the next chapter.

Introduction

After the last operation of drilling, it exists very significant phase that contains several risks which is the rig move: rig down, move or skid and rig up .

This chapter contains general information on rig move, the course of the activity step by step and the means of lifting concerning this phase are represented in this chapter.

II.1 Definition of the Rig Move

The Rig move is the operation which consists in ensuring the transfer of this apparatus, from a site to another thus it is an operation which is carried out before and after the drilling, what leads us to say that it is an autonomous operation of the rig's activity. There are three primary steps to a rig move (ONSHORE):

Rig down: The Company Man releases the rig from the well and rigging down sequences can commence. Take apart equipment for storage and portability. Equipment typically must be disconnected from power sources, decoupled from pressurized systems, disassembled and moved off the rig floor or off location.

Move or skid*:* Transporting the rig to the target location or well.

Rig up*:* To make ready for use. Equipment must typically be moved onto the rig floor, assembled and connected to power sources or pressurized piping systems.

*Depending on the type of rig, the layout may vary. However all equipment must be set in place according to the associated rig layout (see appendix 4). The order of setting the equipment in place may also vary.

Generally the operation of rig move includes the transfer of the apparatus itself and the related camp of life. However, in certain situations, this operation can be reduced to transfer only the rig. [7]

II.2 Definitions

Central Camp: A fixed drilling camp to house and support-all essential personnel for both Drilling Rigs and the Rig crew members.

Critical Loads: Rig loads that are required to be in place allowing the Rig to be powered up to raise the mast.

Field Location Moves: A rig move from a location in one field to a location in a different field**.** Example: Hassi messaoud to Ain aminas.

Infield Location Moves: A rig move between locations in the same field. Example: HMDN to HMDS.

Leap Frog: A Substructure, Mast, Draw works, and Doghouse that will be rigged up in position on the next location, prior to the release of a given rig from its present location.

Non-Critical Loads: Rig loads that are not required to power up the rig

Leap Frog Crew: A typical 24 hr crew consists of seventeen personnel: (1) Tool pusher, (1) Night Tool pusher (1) Assistant Driller, (10) Roustabouts, (2) Certified Crane Operator assigned to rig-down, move and rig-up the LEAP FROG, (1) Mechanic and (1) Electrician.

Rig Move Plan: A modified form of a traditional network diagram in which rig equipment to be moved from location to location (Rig move) is identified as lifts and loads, both of which are arranged in a logical sequence on a form so that the least amount of time to move the equipment can be identified based on the available resources.

Lifts: A single piece of equipment or pieces of equipment that are bound together which alone or combined can be lifted as a single unit by a winch truck, forklift and/or crane. Examples: mud tank, choke manifold, a master skid with 3 shakers (although the shakers are 3 individual pieces, they are bound together by the master skid which can be lifted as a single lift)

Load: Loads comprise any combination of lifts which when combined together by a physical means for the purpose of moving, do so simultaneously. Ex: any *lifts* combined together into a single truck, train, ship, and/or airplane are considered a load.

Criticality: A way of assigning priority to equipment during a rig move by grouping them into the following categories:

C. Critical: A Critical piece of equipment is one that must be moved during its specified time as other pieces of equipment rely on the critical piece to be in place for their assembly.

M. <u>Pre-Move</u>: A pre-move piece of equipment is one that can and should be moved prior to finishing the current well as it is not considered required for the completion of the current well.

N. <u>Non-Essential</u>: A Non-Essential piece of equipment is one that can be moved at any time during a rig move. Usually those non-essential pieces of equipment that can be rearranged in a rig move plan in order to expedite the rig move process.

Network Diagram: A Project Management tool is to place events or tasks in chronological order so that the longest and shortest time can be established. By rearranging tasks and/or events, a new and shorter timeline can be achieved.

II.3 Creating a Rig Move Plan

II.3.1 Determining Equipment "Lifts"

1. In order to establish a *rig move plan*, a complete list of rig *lifts and loads* must be established. It must be pointed out that the requirements on this section are best determined with a computer and an electronic copy of the form used in Microsoft Excel as multiple sorting of equipment on the form will have to be carried out.

2. The Rig Load Analysis Worksheet must include all *lifts* making sure that you include the estimated weights and dimensions for each *lift*. This information will be required to determine transportation of the *lifts*.

1. At this point, the following columns on the worksheet must be completed:

A. Lift

B. Lift Description

C. Estimated weight

D. Length, Width, and Height (LWH). [8]

II.3.2 Determining Criticality

1. Once the *lifts* have been determined, assessment of the criticality of the lift must be now determined. Criticality is grouped into one of the following categories:

C -Critical lift

M -Pre-Move lift

N -Non-essential lift

2. Mark each *lift* as per the above legend in the "CMN" column. Logic and experience will have to be used to group *lifts* into the categories. In addition, make sure to comply with any contractual requirements when determining criticality of *loads*.

3. Sort the data by criticality (column c) in ascending order in the Excel form. If Excel is not being used, you will have to rewrite the form in criticality order.

4. The *lifts* should now be sorted in order of criticality. [8]

II.3.3 Determining Single "Loads"

1. Now that lift criticality has been established and sorted, *load* determination must be established through combination of *lifts*. *Loads* will be determined and limited to transportation means in which rig moves will be achieved. For example, if rig moves will take place using trucks with 40-ton flatbeds which are 40'-0" long, then *lifts* will have to be combined in a manner in which to comply with the length and weight requirements of the truck beds. In essence, the following requirements must be adhered to when combining *lifts* into *loads*:

A. Maximum weight allowance of the vehicle (truck bed, train car, etc.)
B. Maximum dimensions of the vehicle (truck bed, train car, etc.)

2. Combine *lifts* into *loads* in order to increase efficiency, combine as many *lifts* into a *load* as possible not exceeding the limits. In order to express this information in the form, put a *load* number into any *lifts*, which will be combined into a *load* but making sure they are both part of the same criticality. For example: If lift #21 "M/G Separator" (criticality C) and lift #13 "Choke Manifold" (criticality C) are to be combined into a *load*, then mark the load number on both items (such as load #1, etc).

3. Once the *loads* have been determined, resort the information so that it is sorted by load number (column b) in ascending order in the Excel form. You have now determined the number of *loads* and combination of *lifts* into any single *loads*. In addition, you have established which *loads* can be moved prior to the actual rig move, which *loads* are critical to be moved during the rig move, and which *loads* can be moved as needed during the rig move.

4. Print the completed form in order to continue with the process. [8]

II.3.4 Establishing a Rig Move "Network Diagram"

1-A Network diagram is a process derived from Project Management. A Network diagram is a method in which tasks are listed in linear form, and then re-arranged in order to combine tasks, which can take place at the same time (simultaneously). In the case of planning Rig Moves, any combination of *loads* which can take place simultaneously have to be determined based on logistical equipment available so that a final rig move plan can be derived. As listed in the example below (Fig II.1), *loads* 1-10 make up our pre-move loads (criticality M) and our objective is to move these as soon as possible given we have (2) trucks, (2) forklifts (1 at each location), and (2) cranes (one at each location) for the rig move. Note: Pretend these *loads* were previously determined

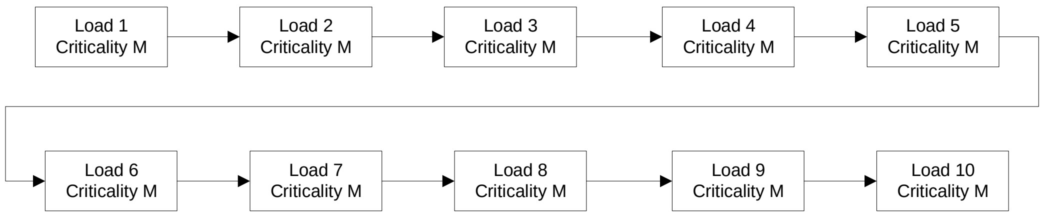

Figure II.1: network

1. Once the tasks (*loads* in this case) are aligned in linear format (fig II.1), they now have to be rearranged so as to maximize the move efficiency and minimize the move time. Ex: Fig. II.2 displays the linear diagram from above changed into two simultaneous and concurrent diagrams to take into account the two trucks available for the rig move. Thus in fig II.2 loads 1 and 2 are loaded, moved, unloaded, and set at the same time. The trucks return to the old location, they now take loads 3 and 4 simultaneously and so on. In essence, this plan now reduces the time required to make the move in fig II.1 by 50%.

Note: Sometimes it is easier to write the *loads* on sticky notes and lining them up in a linear format, then rearranging them to determine the network. It is a simple yet effective way of rearranging *loads*.

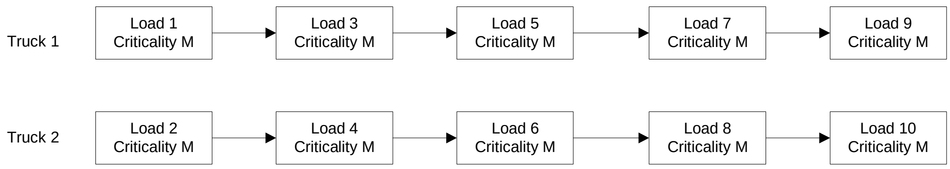

Figure II.2: network diagram 2

2. Complete a network diagram as shown in figureII.2 taking into account all available resources (trucks, train cars, etc) for the specific rig move.

3. Place the logistical resources on the left row and the loads on the columns in the order in which they must be carried just as determined through the network diagram above. Use as many forms as required until all rig loads are accounted for; however, all criticalities must be completed in separate groups of forms. The form should look like Table II.1 [8].

Table II.1: rig load analysis time plan 1

RIG LOAD ANALYSIS TIME PLAN

RIG: 192 PAGE: 1 TOTAL PAGES: 1 CRITICALITY (C,M,N): C

	LOAD PLAN TIME (HOURS)										
RESOURCE	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	TOTAL TIME
Flatbed truck 1	1		4		6		7		9		
Lowboy truck 2	2		3		5		8				
Flatbed truck 3	10		11		12						

II.3.5 Applying Time

1. Time has not played a factor until this point for a purpose. First we had to establish the tasks (loads that had to be moved), as well as the resources available to make the move (trucks, train cars, etc.). Once the tasks and the resources have been established, time in which to make the moves can be established.

2. Record the estimated time to load each of the loads as well as the transit time required to the next location, unload time, and return time of the resource to take on another load.

3. Add all times for each resource in each row and record the total time in the Total Time column. The forms should be similar to Table II.2.
4. Repeat this step for all pages of all criticalities. Once complete, determine the longest total time required by indicating the largest number in each of the criticalities. This is how long it will take you (in hours) to complete the Pre-Move Loads (M), Critical loads (C), as well as the Non-Essential loads (N).
5. If rig moves will only take place during daylight hours and/or daylight shift, divide the number of daily work hours into the total hours. This determines the number of days it will take to perform a rig move.

Table II.2: rig load analysis time plan 2

RIG LOAD ANALYSIS TIME PLAN

RIG: 192 PAGE: 1 TOTAL PAGES: 1 CRITICALITY (C,M,N): C

	LOAD PLAN TIME (HOURS)										
RESOURCE	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	TOTAL TIME
Flatbed truck 1	1 1	2	4 1.25	2	6 1	2	7 1.75	2	9 2	2	17
Lowboy truck 2	2 1.5	2.5	3 1.5	2.5	5 1.5	2.5	8 2	2.5			16.5
Flatbed truck 3	10 2	2	11 2	2	12 2	2					12

II.3.6. Improving Rig Move Times

1. If the Pre-move loads, Critical loads, and/or Non-Essential loads are not within the desired/required, perhaps adjustments need to be made in order to improve move times. These improvements can take place in one or more of the following fashions:

A. Better distribution of loads with existing resources
B. Need for additional resources (trucks, train cars, etc)
C. Extended work hour

2. Better distribution of loads with the existing resources is accomplished by studying better distribution of loads within the existing network. For example, in Table II.2 the time it will require to make a move is 17 hrs as it is the longest total time. However, if load number 7 is given to resource number 3 (Flatbed truck 3), then 4 hours can be reduced from resource 1 (Flatbed truck 1) and added to resource 3. Thus, Flatbed truck 1 will take 13 hours to complete its tasks and Flatbed truck 3 will take 16 hours to complete. This simple change has made the

longest total time resource 2 (16.5 hrs) and not resource 1 (which is now 16 hours). This simple change in resource has reduced the critical move by ½ hour (3 %). This is called "resource leveling".

3. If better distribution of loads does not reduce the total time sufficiently, then additional resources may have to be considered. Given the example in Table II.2, we now add two additional resources (one additional Flatbed and one additional Lowboy truck), and then apply resource leveling. The rig move can be reduced by 5.75 hours (35 %) as shown in Table II.3.

4. If load distribution has been optimized, and obtaining additional resources is not financially sound and/or possible, then a review of work hours may have to be made in order to determine if additional work hours (night) can be carried out. Extreme caution must be used in part of the Area Manager and/or Field Superintendent when considering night-time rig moves as there is an increased risk factor. Consideration must be made to the experience level and training of all local personnel prior to relying on this method to improve rig moves. [8]

Table II.3: rig load analysis time plan 3

RIG LOAD ANALYSIS TIME PLAN

RIG: 54 PAGE: 1 TOTAL PAGES: 1 CRITICALITY (C,M,N): C

	LOAD PLAN TIME (HOURS)										
RESOURCE	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	LOAD NO./ LOAD TIME	TRANSIT/ UNLOAD TIME	TOTAL TIME
Flatbed truck 1	1 1	2	12 2	2	4 1.25	2					10.25
Lowboy truck 2	2 1.5	2.5	8 2	2.5							8.5
Flatbed truck 3	10 2	2	11 2	2							8
Lowboy truck 4	5 1.5	2.5	3 1.5	2.5							8
Flatbed truck 5	9 2	2	7 1.75	2	6 1	2					10.75

II.3.7.Approving Rig Move Plans

1. Once all rig move plans have been completed and optimized, as well as all time improvements assessed for risk and financial burden, a final plan must be approved by the Area Manager on a Rig Move Plan Cover Sheet.

2. A final Rig Move Plan consists of all three completed forms. [8]

II.4 Assumptions

1. Rig moves will generally be made over rough oil field roads consisting of rocky clay and may include steep grades.

2. Transport equipment utilized will consist of the following:

- (5-14) Winch tractors with hi-boy trailers
- (3)winch trucks equipped with oil field decks, and live rolls (Bed Trucks)
- (3)Low-boy trailers equipped with live rolls
- (4) 50 ton cranes
- (1) 70 ton cranes
- (2) Caterpillar Front End loaders
- (2) D-9 Caterpillar Dozers

3. Equipment Placement:

a. Current Location (2) Cranes, (1) Front End Loader, and (2) Bed Trucks
b. New Location (2) Cranes (1) Front End Loader, and (1) Bed Truck

4. Drill site location will be approved 3 to 5 days prior to rig release.

5. Pre-move loads indicated in the schedule of number loads will be moved to the new location prior to rig release on the current well.

6. Rig move operations will generally be conducted on a 24 hours per day basis given adequate portable lighting on both locations. [9]

II.5 Procedures

This is a typical sample of a rig move operation day by day: [10]

II.5.1 Pre-Move

1. Three to five days prior to the rig-move, once the new location has been visited by the Rig Manager, he will travel the route to inspect roads and crossings. In particular he will look for potential problem areas in terms of safety. He will also look for potential time consuming bottlenecks/restrictions. He will complete an inspection of the location and the cellar. At this time all construction should be completed, the location should be level, and should be ready to accept the rig.

2. The trucking contractor will accompany the Rig Manager to inspect the route and insure that the roads, crossings, and location are suitable to allow for a safe and timely rig-move and rig-up.

3. Approximately two to three days prior to release of the rig, six to eight of the non-essential loads can be moved (if deemed economical by the operator). If this is not the case, the non-essential loads will be moved following the rig camp move.

II.5.2 Day Number One

1. Upon release of the rig a pre-operational briefing and safety meeting will be attended by all personnel involved in the operation. The Rig Manager will chair the meeting and outline the plans, activities, and objectives for the day. He will designate crew tasks and responsibilities under the leadership of their immediate supervisors. He will refer to the overall rig-move plan, to the load numbers and will identify the sequence of events etc. A safety meeting will follow on topics relevant to the nature of activities planned for that day and will focus on the potential safety hazards and/or risks involved.

2. Rigging-down of equipment occupies the first 12 hours following the rig release. The rig crews rig-down the mud tanks, mud pumps. The flow line is removed along with the stairs to the mud tanks. The water lines are all disconnected, and the water tanks rigged-out. Once this equipment has been made ready to load out, the shaker tank and the suction tanks are hauled to the new site and spotted in position. The front end of the rig is then cleaned out, with the removal of the tubulars, pipe racks, cat walks, and the choke lines.

3. While one crew has been rigging-out the above equipment, the other crew is rigging-down the carrier and mast and preparing them to be moved (as per the attached rig-down and rig-up procedures).

4. The crew breakdown for the first day is as follows:

a) The night crew breaks tour, in order to return in the morning of Day Two.
b) The day crew arrives at 07:00 and works to 15:00 hours.
c) The afternoon crew arrives at 10:00 and works to 18:00 hours.

5. Status at the end of day number 1:

Rigged-down: 50%

Rigged-up: 10%

Loads moved: 2

Load numbers: 8 & 9

Total loads moved: 2

II. 5.3 Day Number Two

1. Pre-operational briefing and safety meeting with all personnel, with the delegation of crew and supervisor responsibilities.

2. Crew breakdown for Day Two:

a) Daylight and afternoon crews arrive at 07:00 hours and work to 15:00 hours.
b) Night crew arrives at 10:00 hours and works to 18:00 hours.

3. The crew that is designated to rigging-down continues to do so as per the attached rig-down procedure. On Day One the rig-down procedure should have been completed up to item #15 (just prior to moving the carrier off the mud boat).

4. The crew that is designated to load out the equipment will move seven loads (loads 1 to 7 inclusive).

5. The crew that is designated to spot loads on the new location will spot the two mud pumps, the sub and the mud boat. They will rig-up the mud tanks, connect the pumps, the sub, and the mud boat.

6. The mast will be laid down following the lay down procedure only after the pre-lowering inspection has been completed and signed-off by the Rig Manager. Once this has been done and the mast has been laid over, the hydraulic and electrical systems will be rigged-down.

7. At the end of Day Two the rig-down procedure will be 100% completed. The rig-up procedure should have progressed as far as item # 13, i.e. the sub and mud boat should be spotted and pinned and ready to accept the mast.

8. <u>Status at the end of day number 2:</u>

Rigged-down: 100%

Rigged-up: 50%

Loads moved: 7

Load numbers: 1 - 7

Total loads moved: 9

II.5.4 Day Number Three

1. Pre-operational briefing and safety meeting with all personnel.

2. Crew breakdown will be the same as Day Two.

3. The crew designated to rig-up the mast and the carrier will follow the rig-up procedure and continue on from item #13. The mast will be moved in and pinned to the sub. It will then be telescoped out as per the procedure. The mast will only be raised after the pre-raising inspection is completed and signed by the Rig Manager.

4. The crew designated to spot loads and rig-up the support equipment will spot the utility manifold, the accumulator building, the generator building and the fuel tank immediately after

the mast is pinned. This is necessary so that the hydraulic system can be utilized to telescope-out and raise the mast. Once the above support equipment is spotted and running, this crew can continue to spot the water tank and any additional equipment that is on the location.

5. The crew that is designated to load out will handle nine loads on Day Three. These will be loads # 10 to 18 inclusive on the attached load list.

6. At the end of Day Three the rig-up procedure should be completed up to, and including, item # 81.

7. <u>Status at the end of day number 3:</u>

Rigged up:	70%
Rig moved:	75%
Loads moved:	9
Load numbers:	10 – 18
Total loads moved:	18

II.5.5 Day Number Four

1. Pre-operational briefing and safety meeting with all personnel.

2. Crew breakdown will be the same as Day Three.

3. The crew designated to rig-up the carrier will continue with the rig-up procedure. The carrier should be prepared to reverse on to the mud boat.

4. The crew designated to spot loads and rig-up the support equipment will spot both of the water tanks, the mechanic's shop, the crew change shack and pipe tubs. They will also rig-up the water and air lines and the electrical cables.

5. The crew designated to load out equipment from the old location will load out 10 loads. These loads will be loads numbered 19 - 21 and 29 - 35 inclusive.

6. At the end of Day Four the rig-up procedure for the major components should be 100% completed. On Day Five the rig-up crew will concentrate on the handling equipment etc.

7. <u>Status at the end of day number 4:</u>

Rigged up: 85%

Rig moved: 90%

Loads moved: 10

Load numbers: 19 - 21, 29-35

Total loads moved: 28

II.5.6 Day Number Five

1. Pre-operational briefing and safety meeting with all personnel.

2. Crew breakdown:

a) Daylight crew will arrive at 07:00 hours and work to 15:00 hours;
b) Night crew will arrive at 07:00 hours and work to 15:00 hours;
c) Afternoon crew will arrive at 15:00 hours and work to 23:00 hours;
d) The night crew will come back and work from 23:00 hours to 07:00 hours.

3. The rig-up crew will rig-up the rig floor and mix spud mud. When this is complete they will pick up the bottom hole assembly and proceed to drill the rat hole and the mouse hole.

4. The second crew will rig-out the camp, move it to the new location and rig it up. This will comprise loads # 22 - 28 inclusive, plus #36 (8 loads total).

5. After the rat hole and mouse hole have been drilled, the pre-spud inspection will be performed by the Rig Manager in conjunction with the Operator's Representative. Once the inspection has been completed and the Operator's Representative accepts the rig, the well can be spudded as per the Operator's instructions and drilled in accordance with the Operator's Drilling Program.

6. Status at the end of day number 5:

Rigged up: 100%

Rig moved: 100%

Loads moved: 8

Load numbers: 22 - 28, 36

Total loads moved: 36

II.6 Load List of the Rig

Table II. 4: loads list [11]

DAY	LOAD No.	DESCRIPTION
1	8	Shaker Tank
1	9	Suction Tank
2	1	Carrier
2	2	Derrick
2	3	Sub Section
2	4	Sub Section
2	5	Mud Boat
2	6	Mud Pump #1
2	7	Mud Pump #2
3	10	Koomey Building
3	11	Generator House
3	12	Fuel Tank
3	13	Water Tank
3	14	Tool house/Mechanic Shop
3	15	Top Dog House
3	16	Cat Walks & V-Door
3	17	Suitcases & Steps
3	18	Crew Change House

4	19	Junk Box
4	20	Pipe Box
4	21	Pipe Box
4	29	Water Tank #2
4	30	Storage Container
4	31	Storage Container
4	32	Pipe Box
4	33	Pipe Box
4	34	Pipe Racks
4	35	Additional DP & DC
5	22	Company Man Office
5	23	Rig Superintendent Office
5	24	Rig Manager Office
5	25	8-Man Sleeper
5	26	8-Man Sleeper
5	27	Conference Room
5	28	Kitchen/Diner
5	36	Miscellaneous

II.7 Criticality of the Loads

II.7.1 Critical Loads

1. Shaker Tank
2. Mud Pump
3. Mud Pump
4. Suction Tank

II.7.2 Non-Critical Loads

23. Trip Tank / Choke Manifold
24. Mixing Skid
25. Cat Walk (Pipe handler)
26. BOP Skid

5. Pre-mix Tank
6. Accumulator Building (grass hopper)
7. SCR Building
8. Generator #1
9. Generator #2
10. Generator #3
11. Mechanical Shop
12. Fuel Tank
13. Top Drive Support Building
14. Rig Managers Office
15. Company Mans Office / Quarters
16. Geologist Office / Quarters
17. Mud Mans Office / Quarters
18. Mechanic / Electricians Quarters
19. Medic's Quarters and Clinic
20. Rig Managers Quarters
21. Water Tank
22. Generator / Mud Lab

27. Rig Water Tank
28. Rig Water Tank
29. Rig Water Tank
30. Rig Water Tank
31. Rig Water Tank
32. Top Drive
33. Sub Rack / Fishing Tools
34. Junk box
35. Welders Skid
36. Ware House
37. Tea House
38. Crane
39. Fork lift

II.7.3 Pre-Move Loads

40. Pipe Tub with Racks
41. Pipe Tub with Racks
42. Pipe Tub with Racks
43. Pipe Tub with Racks
44. Pipe Tub with Racks
45. Drill Collar Rack

46. Drill Collar Rack
47. Drill Collar Rack

This load list does not include Oil Company Loads such as Casing, Mud Products etc. Some of the “non-critical loads” will most likely become “pre-move loads” as time progresses and the rig moves become more efficient. [11]

Conclusion

Rig moving is a very complex process involving numerous concurrent/simultaneous operations and activities with a variety of other contractors present. Because of this level of activity and the fact that different types of hazards from those encountered during drilling operations are present, an analyze of hazards and a risk assessment are essential to carry out a safe and efficient rig moving operation which is the object of the next chapter

Introduction

As part of managing the health and safety of business the company must control the risks in its workplace. To do this it needs to think about what might cause harm to people and decide whether it is taking reasonable steps to prevent it. This is known as risk assessment and it is something that is required by law to carry out.

A risk assessment is not about creating huge amounts of paperwork, but rather about identifying sensible measures to control the risks in your workplace and in this chapter we'll talk about a useful method known as Job Safety Analysis JSA

III.1 Presentation of the Company

The national company of well activities known by the sign ENTP comes from the restructuring of Sonatrach . Its main job is drilling , but because of its location and its presence in the south Algeria has led the company to develop combined transport operations, oil service and hospitality to fulfill its main mission management drilling rigs for exploration and development of hydrocarbon fields and waterways, as well as maintenance (Work- over) producing wells, oil, gas and water. [12]

The company is located in the Sahara in Algeria, Hassi Messaoud exactly.

III.1.1 History of ENTP Company

The Algerian drilling is a product of Sonatrach since 1968.

KESKASSA1 was the first well to be drilled. The operational structure called Directorate oil services (DSP) has had a fleet of four drilling paired.

July 1972: (DSP) takes the name of Directorate oil activities (DTP).

First in August 1981: the restructuring of Sonatrach in the early 80s, emerged the heiress ENTP of DTP drilling and work-over created by Decree No. 81-171, ENTP became operational January 1, 1983.

In June 1989 ENTP was formed in economic public company, stock company (EPE-SPA).

In 1993 became a member of IADC (International Association of drilling contractors)

On March 30, 1998: ENTP is part of the hydrocarbon group services (GSH). Sonatrach services Holding is the majority shareholder with 51% holding of its capital. Among this group are NAFTOGAZ, NPHS, ENAGEO, and ENGB. On April 4, 2003: ENTP got brilliantly ISO 9001-2000 certification for all its activities.

Capital: 2400000000DA. Currently held by:

- Holding services (51%).
- The investment management company of energy TRAVEN works (49%).

III.1.2 ENTP's Market

ENTP is the first drilling contractor in Algeria (50% market share).Its main clients are:

- Sonatrach
- Foreign operators associated with Sonatrach
- The provinces of southern Algeria for hydraulic drilling

The ENTP has a drilling fleet of 38 drilling rig, including two acquisitions in 2003 and two in 2005. Our park will be strengthened by the acquisition of two other rigs planned for 2006.Its devices are equipped with modern facilities such as:

- SCR
- Top Drive
- Wireless Net Work Communication

The table below represents the ENTP's different type of rigs

Table III.1: type of rigs of ENTP.

Type	Power	Number
National Oil Well	1 250 HP	2
Oil Well 2000 E	2 000 HP	1
Oil Well 840 E	1 400 HP	11
National 80 UE	1 000 HP	1
National 110 UE	1 500 HP	4
National 1320 UE	2 000 HP	3
Cabot 1200	1 200 HP	8
Cabot 750	750 HP	4
Cabot 500	500 HP	2

III.1.4 Organizational chart of ENTP

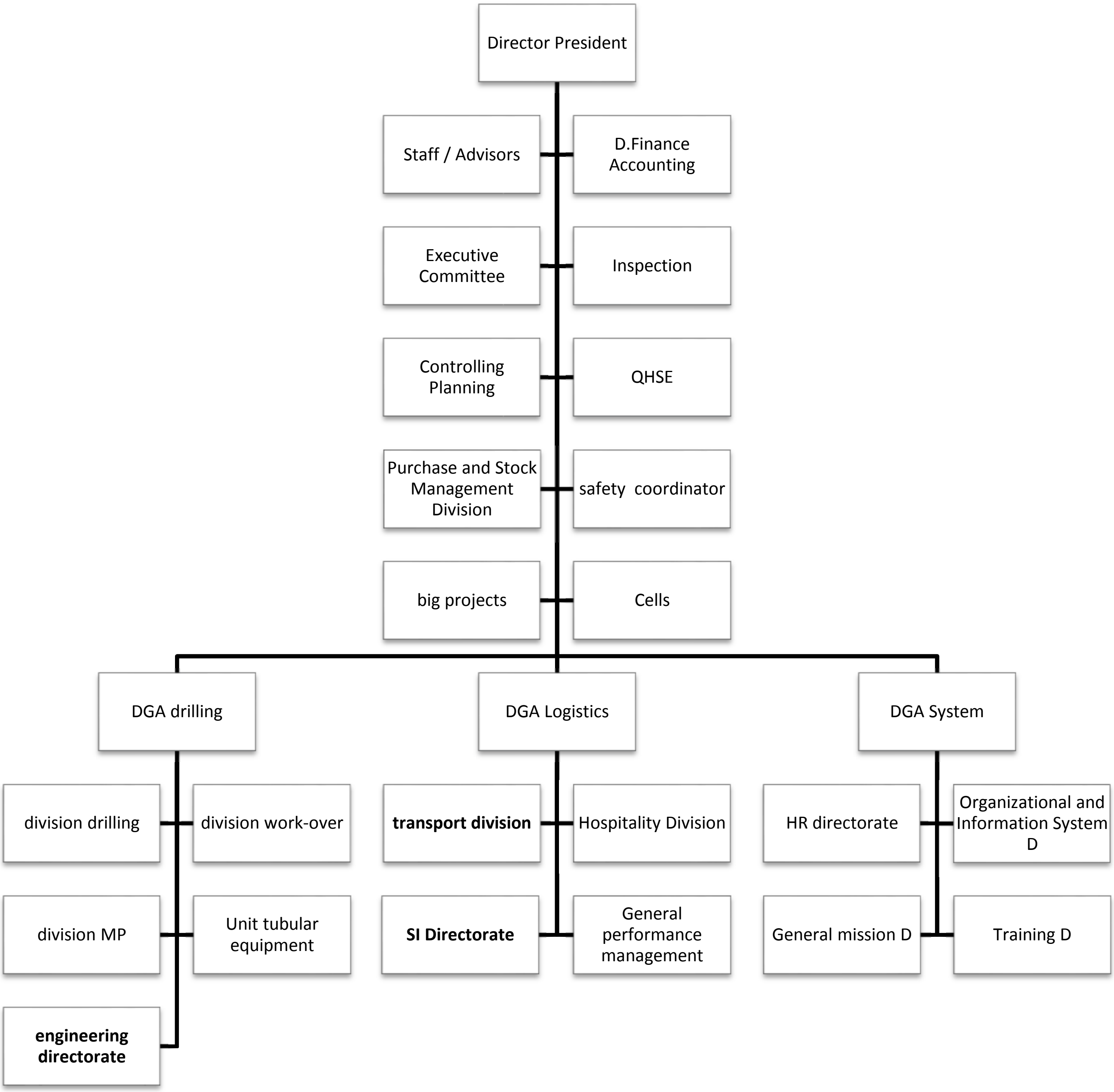

Figure III.1: organizational chart.

III.1.5 Description of Drilling Site

A. Human resources:

• Administration (ADG).

• Support (maintenance, HSE).

• Drilling (drillers, surveyors, floor man).

Drill Crew Positions:

Table III.2: drill crew. [13]

Drilling Personnel :	Staff Support
• 04 floor man	• 01mecanic (surface).
• 03 roughnecks.	• 01chief mechanic.
• 01 derrick-man.	• 01 electrician.
• 01 Assistant driller.	• 01 chief electrician (surface)
• 01 driller.	• 01 tool pusher (surface).
• 01 Rig Manager.	• 01 engineer HSE (surface).
	• 01 engineer (surface).
	• 01 floor man (surface).

III.2 Job Safety Analysis

III.2.1 Definition of JSA:

A job safety analysis (JSA) is a procedure which helps integrate accepted safety and health principles and practices into a particular task or job operation. In a JSA, each basic step of the job is to identify potential hazards and to recommend the safest way to do the job. Other terms used to describe this procedure are job hazard analysis (JHA) and job hazard breakdown (JHB).

Some individuals prefer to expand the analysis into all aspects of the job, not just safety. This approach is known as total job analysis. Methodology is based on the idea that safety is an integral part of every job and not a separate entity. In this document, only health and safety aspects will be considered.

The terms "job" and "task" are commonly used interchangeably to mean a specific work assignment, such as "operating a grinder," "using a pressurized water extinguisher," or "changing a flat tire." JSAs are not suitable for jobs defined too broadly, for example, "overhauling an engine"; or too narrowly, for example, "positioning car jack." [14]

III.2.2 The benefits of doing a Job Safety Analysis

One of the methods used in this example is to observe a worker actually perform the job. The major advantages of this method include that it does not rely on individual memory and that the process prompts recognition of hazards. For infrequently performed or new jobs, observation may not be practical.

One approach is to have a group of experienced workers and supervisors complete the analysis through discussion, this approach necessities a brain storming. An advantage of this method is that more people are involved in a wider base of experience and promoting a more ready acceptance of the resulting work procedure. Members of the joint occupational safety and health committee must participate in this discussion.

Initial benefits from developing a JSA will become clear in the preparation stage. The analysis process may identify previously undetected hazards and increase the job knowledge of those participating. Safety and health awareness is raised, communication between workers and supervisors is improved, and acceptance of safe work procedures is promoted.

A JSA, or better still, a written work procedure based on it, can form the basis for regular contact between supervisors and workers. It can serve as a teaching aid for initial job training and as a briefing guide for infrequent jobs. It may be used as a standard for health and safety inspections or observations. In particular, a JSA will assist in completing comprehensive accident investigations. [14]

III.2.3 The Four Basic Steps

Four basic stages in conducting a JSA are:

- selecting the job to be analyzed
- breaking the job down into a sequence of steps
- identifying potential hazards
- determining preventive measures to overcome these hazards. [15]

III.2.4 The Important to Know When Selecting the Job

Ideally, all jobs should be subjected to a JSA. In some cases there are practical constraints posed by the amount of time and effort required to do a JSA. Another consideration is that each JSA will require revision whenever equipment, raw materials, processes, or the environment change. For these reasons, it is usually necessary to identify which jobs are to be analyzed. Even if analysis of all jobs is planned, this step ensures that the most critical jobs are examined first.

Factors to be considered in setting a priority for analysis of jobs include:

- Accident frequency and severity: jobs where accidents occur frequently or where they occur infrequently but result in disabling injuries, we can base on the feedback experiences.

- Potential for severe injuries or illnesses: the consequences of an accident, hazardous condition, or exposure to harmful substance are potentially severe.
- Newly established jobs: due to lack of experience in these jobs, hazards may not be evident or anticipated.
- Modified jobs: new hazards may be associated with changes in job procedures.
- Infrequently performed jobs: workers may be at greater risk when undertaking non-routine jobs and a JSA provides a means of reviewing hazards. [15]

III.2.5 Breaking the Job Into Basic Steps

After a job has been chosen for analysis, the next stage is to break the job into steps. A job step is defined as a segment of the operation necessary to advance the work. See examples below.

Care must be taken not to make the steps too general. Missing specific steps and their associated hazards will not help. On the other hand, if they are too detailed, there will be too many steps. A rule of thumb is that most jobs can be described in less than ten steps. If more steps are required, you might want to divide the job into two segments, each with its separate JSA, or combine steps where appropriate. As an example, the job of changing a flat tire will be used in this document.

An important point to remember is to keep the steps in their correct sequence. Any step which is out of order may miss serious potential hazards or introduce hazards which do not actually exist.

Each step is recorded in sequence. Make notes about what is done rather than how it is done. Each item is started with an action verb.

This part of the analysis is usually prepared by knowing or watching a worker do the job. The observer is normally the immediate supervisor. For a more thorough analysis often happens by having another person, preferably a member of the joint occupational health and safety committee, participate in the observation. Key points are less likely to be missed in this way.

The job observer should have experienced and be capable in all parts of the job. To strengthen full co-operation and participation, the reason for the exercise must be clearly explained. The JSA is neither a time and motion study in disguise, nor an attempt to uncover individual unsafe acts. The job, not the individual, is being studied in an effort to make it safer by identifying hazards and making modifications to eliminate or reduce them. The worker's experience contributes in making job and safety improvements.

The job should be observed during normal times and situations. For example, if a job is routinely done only at night, the JSA review should also be done at night. Similarly, only regular tools and equipment should be used. The only difference from normal operations is the fact that the worker is being observed.

When completed, the breakdown of steps should be discussed by all the participants (always including the worker) to make that all basic steps have been noted and are in the correct order. [15]

III.2.6 Identifying Potential Hazards

Once the basic steps have been recorded, potential hazards must be identified at each step. Based on observations of the job, knowledge of accident and injury causes, and personal experience, list the things that could go wrong at each step.

A second observation of the job being performed may be needed. Since the basic steps have already been recorded, more attention can now be focused on each potential hazard. At this stage, no attempt is made to solve any problems which may have been detected.

To help identify potential hazards, the job analyst may use questions such as these (this is not a complete list):

- Can any body part get caught in or between objects?
- Do tools, machines, or equipment present any hazards?
- Can the worker make harmful contact with moving objects?
- Can the worker slip, trip, or fall?
- Can the worker suffer strain from lifting, pushing, or pulling?
- Is the worker exposed to extreme heat or cold?
- Is excessive noise or vibration a problem?
- Is there a danger from falling objects?
- Is lighting a problem?
- Can weather conditions affect safety?

- Is harmful radiation a possibility?
- Can contact be made with hot, toxic, or caustic substances?
- Are there dusts, fumes, mists, or vapors in the air?

Potential hazards are listed in the middle column of the worksheet, numbered to match the corresponding job step. For example:

Table III.3: example of a JSA

Sequence of Events	Potential Accidents or Hazards	Preventive Measures
Park vehicle	a) Vehicle too close to passing traff b) Vehicle on uneven, soft ground c) Vehicle may roll.	
Remove spare and tool kit	a) Strain from lifting spare.	
Pry off hub cap and loosen lug bo	a) Hub cap may pop off and hit you b) Lug wrench may slip	
And so on.....	a)...	

Again, all participants should jointly review this part of the analysis. [14]

III.2.7 Determining Preventive Measures:

The final stage in a JSA is to determine ways to eliminate or control the hazards identified. The generally accepted measures, in order of preference, are: [16]

1. Eliminate the hazard

This is the most effective measure. These techniques should be used to eliminate the hazards:

- Choose a different process
- Modify an existing process
- Substitute with less hazardous substance
- Improve environment (ventilation)
- Modify or change equipment or tools

2. Contain the hazard

If the hazard cannot be eliminated, contact might be prevented by using enclosures, machine guards, worker booths or similar devices.

3. Revise work procedures

Consideration might be given to modifying steps which are hazardous, changing the sequence of steps, or adding additional steps (such as locking out energy sources).

4. Reduce the exposure

These measures are the least effective and should only be used if no other solutions are possible. One way of minimizing exposure is to reduce the number of times the hazard is encountered. An example would be modifying machinery so that less maintenance is necessary. The use of appropriate personal protective equipment may be required. To reduce the severity of an accident, emergency facilities, such as eyewash stations, may need to be provided.

In listing the preventive measures, do not use general statements such as "be careful" or "use caution". Specific statements which describe both what action is to be taken and how it is to be performed are preferable. The recommended measures are listed in the right hand column of the worksheet, numbered to match the hazard in question. For example:

Table III.4: example of a JSA [14]

Sequence of Events	Potential Accidents or Hazards	Preventive Measures
Park vehicle	a) Vehicle too close to passing traffic b) Vehicle on uneven, soft ground c) Vehicle may roll.	a) Drive to area well clear of traffic. Turn on emergency flashers b)Choose a firm, level parking area c) Apply the parking brake; leave transmission in PARK; place blocks in front and back of the wheel diagonally opposite to the flat

Remove spare and tool kit	a) Strain from lifting spare.	a) Turn spare into upright position in the wheel wel your legs and standing as close as possible, lift spare out of truck and roll to flat tire.
Pry off hub cap and loosen lug bolts (nuts).	a) Hub cap may pop off and hit you b) Lug wrench may slip	a) Pry off hub cap using steady pressure b) Use proper lug wrench; apply steady pressure slowly.
And so on.....	a) ...	a) ...

III.2.8 Making the Information Available to Everyone Else

JSA is a useful technique for identifying hazards so that workers can take measures to eliminate or control hazards. Once the analysis is completed, the results must be communicated to all workers who are, or will be, performing that job. The side-by-side format used in JSA worksheets is not an ideal one for instructional purposes. Better results can be achieved by using a narrative-style communication format. For example, the work procedure based on the partial JSA developed as an example in this document might start out like this: [16]

1. Park vehicle.

a) Drive vehicle off the road to an area well clear of traffic, even if it requires rolling on a flat tire. Turn on the emergency flashers to alert passing drivers so that they will not hit you.

b) Choose a firm and level area for parking. You can jack up the vehicle to prevent rolling.

c) Apply the parking brake, leave the transmission in PARK, place blocks in front and back of the wheel diagonally opposite the flat. These actions will also help prevent the vehicle from rolling.

2. Remove spare and tool kit.

a) To avoid back strain, turn the spare up into an upright position in its well. Stand as close to the trunk as possible and slide the spare close to your body. Lift out and roll to flat tire.

3. Pry off hub cap, loosen lug bolts (nuts).

a) Pry off hub cap slowly with steady pressure to prevent it from popping off and striking you.

b) Using the proper lug wrench, apply steady pressure slowly to loosen the lug bolts (nuts) so that the wrench will not slip, get lost or and hurt your knuckles.

4. And so on.

TableIII.5: sample of JSA work sheet.

Job Safety Analysis Worksheet		
Job:		
Analysis By:	Reviewed By:	Approved By:
Date:	Date:	Date:
Sequence of Steps	**Potential Accidents or Hazards**	**Preventative Measures**

Sample forms for Tasks and Job Inventory

Table III.6: sample form for tasks and job inventory

Tasks with Potential Exposure to Hazardous Materials or Physical Agents		
Analysis By:	Reviewed By:	Approved By:
Date:	Date:	Date:
Tasks	**Name of Material or Physical Agent**	**Location**

Table III.7: Job inventory of hazardous chemical

Job Inventory of Hazardous Chemicals		
Analysis By:	Reviewed By:	Approved By:
Date:	Date:	Date:
Name of Chemical	**Route of Entry and Physical State**	**Controls**

Conclusion

In this chapter we provided the presentation of the company and how to conduct a job safety analysis on our operation (JSA), its application will b illustrated in the next chapter.

Introduction

Rig moving is a very complex process involving numerous concurrent/simultaneous operations and activities with a variety of other contractors present. Because of this level of activity and the fact that different types of hazards are present**,** an analysis of hazards is required which demand a perfect knowledge of the system being analyzed by collecting information on its technical, functional and environmental aspect.

Based on this information we will be able to conduct our risk assessment using JSA methods on these operations:

- Rig down top drive
- Lowering mast
- Rig down generators
- Forklift safety
- Rigging down skids, pins, mud house and the dog house
- Rig down top drive
- Lowering mast
- Rig down generators
- Forklift safety
- Rigging down skids, pins, mud house and the dog house

IV.1 Application

Table IV.1: the JSA of rig down top drive. [13]

Work Activity (Job) Description : **RIG DOWN TOP DRIVE** *Work Team Leader:*		
WORK SEQUENCE (JOB STEPS)	**HAZARDS OR POTENTIAL ACCIDENTS**	**RECOMMENDATIONS TO ELIMINATE OR REDUCE HAZARDS**
Conduct pre-job safety meeting with all affected personnel	Miscommunication, missing personnel	Ensure all affected personnel understand their responsibilities and job tasks.
1. test and tryout all top drive hydraulic, electric lines	Electric shock, moving parts	Follow safety procedures by function testing
2. Remove Kelly hose and electrical cables links, elevators, and misc	Falling, struck by hoses or hammer	100% tie of tools and personnel use man lift -stay out from under men working overhead
3. Install bottom roller to track	Pinch point between roller frame and track -struck by roller	Watch hand/body placement- use tag lines and rated rigging
4. Remove upper and lower turn buckles ratchet cable hanger away from mast leave room for blocks to pass freely	Falling and dropped pins or tools	100% tie off use man lift don't get under men working
5. Set top drive on lower pins, disconnect from blocks	Falling and dropped pins or tools	Use man basket
6. Rig up bridle assembly to blocks by lowering the blocks to floor pulling the top drive with air hoist.	Damage equipment, smashed hand and fingers	Watch hand placement use correct tools, communication lubricate sliders on carrier. Ensure adequate length of drilling line is on drum.
7. Install carrier to track and raise up to latch carrier into track	Striking equipment, falling out of derrick, smashed hands/other body parts	Go up through derrick slowly with blocks, use inspector to ensure that rigging is on correctly
8. Derrick man go up to spear and verify latch release spear and remove safety cables After release lower track to connect fork lift to roller assembly	Falling, drop track, drop equip.	100% tie off, radio's for the derrick man and driller to Communicate, stay out from man working in the derrick
9. Use fork lift to pull track assembly over the front of rig v-door area lower to approximately 5 feet above rig mast	Rigging failure, struck by swinging track, track hung up in derrick	Spot for driller look up, use good rigging practices, stay clear and be alert to the unexpected watch for lines in mast that could hang up

Discussion:

The table above represents the JSA of rigging down the Top drive where it is composed of three columns which contain: job steps, potential hazards and recommendation to eliminate or reduce hazards.

While doing this task several hazards exist such as: electric shock, moving parts, pinch and falling.

To prevent these hazards safety procedures must be followed, all tools should be tied, use tag line to prevent unauthorized persons from getting into dangerous zones, watch body and hand placement and use the correct tools for each task.

This operation is considered a critical one of medium risk. The lowering of the top drive should be accomplished during day light hours whenever possible. When it is necessary to accomplish this task during the hours of darkness, the operation should only proceed when maximum illumination of the operating area is provided by the rig move light towers and the lighting within the mast.

Proper communication between the Driller, Personnel working in the mast, Rig Manager and Trailer Tractor Driver are very important. Hands-free radios will be used to achieve this purpose.

The operation is to be supervised by the Rig Manager or by a more senior level person.

Table IV.2: the JSA of lowering the mast. [13]

Work Activity (Job) Description : **LOWERING MAST** *Work Team Leader:*		
WORK SEQUENCE (JOB STEPS)	**HAZARDS OR POTENTIAL ACCIDENTS**	**RECOMMENDATIONS TO ELIMINATE OR REDUCE HAZARDS**
1. Driller and Tool pusher look over and double check the bridal assembly, sheaves, and lines.	Dropping the derrick.	The tool pusher and the driller need to double check for proper rigging.
2. Make sure that all cables, electrical lines, and hoses are ready for the derrick to be lowered.	Equipment damage. Being struck by a cable or line after it has broken under stress.	Make sure that everything is ready for the derrick to lay-over
3. Drive the derrick retainer pins from the A-legs.	-Driving out the wrong pins and loosing the derrick. -Falling -Dropping the pin and striking someone.	The tool pusher and the driller are on the floor and responsible for making sure the proper pins are removed. -Use the hierarchy of fall protection. -Observe the buffer zone. Use a pin catcher.
4. Align the fast line with the A-leg sheave.	The fast line riding on the pin instead of the sheave damaging the drill line and pin. Dropping the derrick.	Make sure the sheave and fast line are in alignment.
5. Attach the break-over line to the forklift.	Burs and wickers on the break-over cable.	Wear work gloves and do not let the cable slide through your hands.
6. Driller let down on the blocks while the forklift steadily pulls on the break-over line.	Letting the blocks down too fast and the derrick breaking over too hard against the bridal lines. Breaking the bridal line. Dropping derrick.	Have competent flagger flagging the driller and forklift operator.
7. Once the derrick is broke-over, untie the break-over line from the forklift.	Burs and wickers on the break-over cable.	Wear work gloves and do not let the cable slide through your hands.
8. Slowly lower the derrick while the forklift operator retrieves the derrick stands.	Dropping the derrick. Tilting the derrick stand back onto the forklift.	Lower derrick slowly, using clutch, hydraulic, dynamitic, etc. Do not tilt the forks back when carrying the stand.
9. As the derrick gets close to the ground, position the derrick stand under the stand blocks.	Cables getting hung up. Contacting the derrick and damaging it.	Use a flagger. Do not lower the derrick too low before the stand is in place.
10. Driller lowers the derrick onto the derrick stand.	Damaging the derrick by setting down too hard on the derrick stand.	Lower the derrick slowly.

Discussion:

The table above represents the JSA of lowering the mast where it is composed of three columns which contain: job steps, potential hazards and recommendation to eliminate or reduce hazards.

The first column gives instruction for the mast to be lowered step by step in the safest way

The second column is for the potential hazards and accidents that may occur during the job such as: dropping the derrick, falling dropping and sticking someone or equipment damages.

The third one is for recommendations to eliminate or reduce hazards: The tool pusher and the driller need to double check for proper rigging, and they are responsible for applying the procedures planned before, all workers should wear their right PPE at the job.

Preparing the Mast to be lowered is not a deviation from normal procedure. Lowering the Mast is a critical task of medium risk during a rig move and should be accomplished during daylight hours whenever possible. An Inspection of the Mast must be carried out using the checklist, prior to lowering. When the Mast is to be lowered during hours of darkness it should only be accomplished with adequate lighting (all light towers positioned to give maximum illumination of the operation, and mast lighting to be operational throughout the procedure). Check lists are to be completed only under a Rig Managers supervision or more senior level person.

The Rig up Crew may also perform this operation.

TableIV.3: the JSA of rig down the generators. [13]

Work Activity (Job) Description : **RIG DOWN GENERATORS** *Work Team Leader:*		
WORK SEQUENCE (JOB STEPS)	**HAZARDS OR POTENTIAL ACCIDENTS**	**RECOMMENDATIONS TO ELIMINATE OR REDUCE HAZARDS**
1. Kick out all electrical circuits.	Electric shock. Burning up electrical equipment.	Make sure all circuits are kicked out.
2. Idle the generator motors down and allow them to cool down.	Engine damage.	Be sure to allow the motors ample time to cool down.
3. Kill generator motors.	Burns. Cumulative hearing damage.	Be aware of hot surfaces. Wear hearing protection.
4. Lock-out/tag-out the starter switches for the generator motors.	Someone engaging a starter while work is being performed.	Competent supervision –use signals for prohibition of touching the starters
5. Disconnect the air lines to the starters and throttle.	Struck by air hose. Air injection under skin.	Make sure all pressure is relieved before disconnection.
6. Disconnect the diesel lines.	Environmental spill. Eye and skin irritation due to exposure to diesel.	Prevent spills. Wear PPE. Make sure there is no pressure in the line.
7.Disconnect the generator leads from the SCR.	Smashed fingers. Burs and wickers at cable ends. Electrical shock.	Use proper tools for the job. Wear work gloves. Make sure the generators are not running and locked-out/tagged-out.
8. Roll electrical leads up and tie them off on the generator skid.	Overexertion.	Use teamwork. Roll cables on the ground.
9. Pull ground rods.	Overexertion. Cuts or abrasions.	Use proper tools for the job. Wear work gloves.
10. Tie everything off that could fall off during the rig move.	Loosing equipment or parts during rig move.	Tie everything off that could fall off during the rig move.

Discussion:

The tables above represents the JSA of rigging down the generator which is an operation with high level of risk and critical damages the table it is composed of three columns which contain: job steps, potential hazards and recommendation to eliminate or reduce hazards.

The first column gives instruction step by step for the generator to be rigged down safely starting with all electrical circuit to kicked out then idle the generator motor down and allow them to cool down, the starter switches should be locked out/tagged out after that the air line the diesel line can be disconnected and tie everything that could fall during the rig move.

The second column is for the potential hazards and accidents that may occur during the job such as: Electric shock, burning up electrical equipment, damage of the engine, Burns, overexertion and Loosing equipment or parts during rig move.

The third one is for recommendations to eliminate or reduce hazards: there must be a competent supervision during all the time of the operation, briefing hse must be done before every shift change so the employee will be aware of the hazards exist and the safety procedures to take to prevent them, employees have to wear their PPE at the job.

Table IV.4: the JSA of the use of forklift. [13]

Work Activity (Job) Description : **FORKLIFT SAFETY** *Work Team Leader:*		
WORK SEQUENCE (JOB STEPS)	**HAZARDS OR POTENTIAL ACCIDENTS**	**RECOMMENDATIONS TO ELIMINATE OR REDUCE HAZARDS**
1. Hold a pre-job safety meeting with all personal involved.	Miscommunication, equipment/property damage or injury due to lack of training.	Establish lines of communication. Only personal authorized and trained may operate forklift. Use spotter if needed or required.
2. Inspect forklift, check fluid levels, air pressure and reverse alarm. Check seat belt.	Unnoticed damage to forklift.	Follow the company's guidelines on inspection and use approved check off list. Wear seat belt before operating forklift.
3. Know the lifting capabilities of forklift.	Dropping load causing damage or injury.	Do not exceed lifting capabilities of forklift.
4. Have swamper wear an orange vest.	Swamper runs over by forklift.	Look in all directions before moving forklift, swamper stay in operator's line of sight.
5. Center forklift under load.	Unbalanced load falling, causing equipment damage or injury to personal.	Make sure you are centered under every load.
6. Pick up and haul load. Be aware of uneven ground.	Unstable load, dropping load, load shifting due to excessive speed, running over someone or something. Tipping forklift	Inspect load to insure stability. Keep load as low as possible. Drive slowly and be aware of what's happening around you. Drive straight up and down uneven ground. Do not drive on the sides of hills.
7. Set down load.	Lowering load to fast causing it to become unstable.	Set load down slow and smooth. Do not set load down while forklift is moving.
8. Park forklift.	Trip hazards, forklift shifting position.	Always park forklift with forks on the ground, parking brake set and engine shut off before exciting forklift. Allow no passengers and always wear your seatbelt.

Discussion:

The table above represents the JSA of using of the forklift which is an operation with medium level of risk, the table it is composed of three columns which contain: job steps, potential hazards and recommendation to eliminate or reduce hazards.

The first column gives instruction step by step for the safe use of the forklift: the forklift must be inspected before every use, know the lifting capabilities of it, center the forklift under the load and be aware of uneven ground

The second column is for the potential hazards and accidents that may occur during the use of the forklift such as: damages of the equipment and the materials, unbalanced load falling or running over someone or something due to excessive speed.

The third one is for recommendations to eliminate or reduce hazards: Only trained personnel will be allowed to operate the forklift.

When loading/unloading: the operator of the forklift will ensure that no one is within 6m radius of the forklift or the truck.

When a forklift is left unattended, the load will be fully lowered, controls will be neutralized, power shall be shut off, and brakes set.

The forklift shall not be driven forward when carrying a load as high or wide as to obstruct the view of the driver.

The forklift shall travel with loads lowered as close to the driving surface as feasible.

The forklift shall be parked with the forks on the ground, and secured when weather conditions deteriorate and the vehicle cannot operate safely.

Table IV.5: the JSA of Rigging down skids, pins, mud house and the dog house. [13]

Work Activity (Job) Description : **Rigging down skids, pins, mud house and the dog house** *Work Team Leaders:*		
WORK SEQUENCE (JOB STEPS)	**HAZARDS OR POTENTIAL ACCIDENTS**	**RECOMMENDATIONS TO ELIMINATE OR REDUCE HAZARDS**
1. Hold pre-job safety meeting with everyone involved in the operations.	Break down in communications. People not alerted to specific hazards.	Discuss job, hazards policies, and expectations with everyone involved in the job tasks.
2. Move out all houses and skids in the back yard with tandem truck and stage them at the edge of location.	Load falling and causing crush injuries and equipment damage.	Observe a safe buffer zone around "live" loads.
3. Haul-out trucks load, tie down, and move each house and skid to the new location.	Falling of loads – crush of materials or employee	Ensure that each component of the load is secured properly.
4. Move out the pumps with tandem truck and stage them at the edge of location.	Load falling and causing crush injuries and equipment damage.	Observe a safe buffer zone around "live" loads.
5. Haul-out trucks load, tie down, and move the pumps to the new location.	Loosing equipment between locations. Equipment damage.	Ensure that each component of the load is secured properly.
6. Cranes lower the mud house.	Falling. Dropping the load. Crush injury.	Utilize the hierarchy of fall protection. Use proper rigging. Use tag line to control load.
7. Move out the mud house with the tandem truck and stage it at the edge of location.	Pinch points – miscommunication between the personnel	Observe a safe buffer zone around "live" loads.
8. Haul-out truck loads, ties down, and moves the mud house to the new location.	Slipping of the loads – injuries –poor weather conditions	Ensure that each component of the load is secured properly.
9. Move out the pits with the tandem truck and stage them at the edge of location.	Load falling and causing crush injuries and equipment damage.	Observe a safe buffer zone around "live" loads.
10. Haul-out trucks load, tie down, and move the pits to the new location.	Loosing equipment between locations. Equipment damage.	Driver to secure the loads with chains

11. Cranes set the top dog house on the ground.	Falling. Dropping the load. Crush injury.	Utilize the hierarchy of fall protection. Use proper rigging. Use tag line to control load.
12. Move the top dog house with the tandem truck and stage it at the edge of location.	Load falling and causing crush injuries and equipment damage.	Observe a safe buffer zone around "live" loads.
13. Haul-out trucks load, tie down, and move the top dog house to the new location.	Loosing equipment between locations. Equipment damage.	Ensure that each component of the load is secured properly.
14. Cranes set the derrick on the ground.	Falling. Dropping the load. Crush injury.	Utilize the hierarchy of fall protection. Use proper rigging. Use tag line to control load.
15. Crane removes each section of the derrick as it is disassembled and loads the components on haul-out trucks.	Tripping crane -Dropping the load. Crush injury.	Utilize the hierarchy of fall protection. Use proper rigging. Use tag line to control load.
16. Haul-out trucks tie down and move the derrick components to the new location.	Loosing equipment between locations. Equipment damage.	Secure the loads with chains – teamwork
17. Cranes and forklift remove the center steels and load them on haul-out trucks.	Uneven load causes overloading of the crane and the forklift – falling of equipment	Utilize the hierarchy of fall protection. Use proper rigging. Use tag line to control load.
18. Haul-out trucks tie down the center steels and move them to the new location.	Loosing equipment between locations. Equipment damage.	Ensure that each component of the load is secured properly.
19. Cranes and tandem truck disassemble the sub-base.	Load falling and causing crush injuries and equipment damage.	Observe a safe buffer zone around "live" loads.
20. Haul-out trucks load, tie down, and move the sub-base to the new location.	Loosing equipment between locations. Equipment damage.	Ensure that each component of the load is secured properly.

Discussion:

The tables above represents the JSA of rigging down the generator which is an operation with high level of risk and critical damages the table it is composed of three columns which contain: job steps, potential hazards and recommendation to eliminate or reduce hazards.

The first column gives instruction step by step of the operation starting with moving out all houses and skids in the back yard then haul-out trucks load, tie down, and move each house and skid to the new location

After that pumps will be moved out to the new location .Cranes then can lower the mud house Move it then we move to the pits, dog house and the derrick's components all of them will be moved in this order to the new location.

The second column is for the potential hazards and accidents that may occur during the job such as: Loosing equipment between locations, dropping the load, crush injury and load falls causing crush injuries and equipment damage.

The third one is for recommendations to eliminate or reduce hazards: -Discuss job, hazards policies, and expectations with everyone involved in the job tasks.

-Observe a safe buffer zone around "live" loads.

-Ensure that each component of the load is secured properly and use the chains .

-Utilize the hierarchy of fall protection. Use proper rigging. Use tag line to control load.

Identification of all existing hazards en-route prior to commencing the rig move with proper procedures put in place to safely manage any hazards found, clear communication must be present during all the operation using radio.

Work Activity (Job) Description : **Loading and Transportation of over dimensions loads**

Work Team Leaders:

WORK SEQUENCE (JOB STEPS)	HAZARDS OR POTENTIAL ACCIDENTS	RECOMMENDATIONS TO ELIMINATE OR REDUCE HAZARDS
Appropriate lifting and placing	• Toppling of the crane • Breakage of slings	• Select suitable crane for the rated load. • Place the crane in a stable ground. • Inspect the crane and slings prior to use. • Ensure the color coded sling of rated capacity. • Use appropriate slinging technique, so the sling holds the calculated working load.
Securing the load	• Fall of person from trailer/bunk • Roll off of the load from trailer. • Hit injury/incidents	• Secure the small components and the other components as per the guidance rendered by the supervisor to avoid toppling of the load while transporting. • Ensure to work from a stable platform. • Ensure the pipe components are not protruding away from the trailer. • Make sure that the head protection board is placed appropriately. • In case of the drill pipes, ensure to the place the pipes within the bins and secure the bins, so that the pipes may not jump off. • Secure the individual components in case where there are a number of components are placed in a single trailer.
Unloading the over dimensions load	• Toppling of the crane • Breakage of slings	• Select suitable crane for the rated load. • Place the crane in a stable ground. • Inspect the crane and slings prior to use. • Ensure the color coded sling of rated capacity. • Use appropriate slinging technique, so the sling holds the calculated working load.

Table IV.6: the JSA of Loading and Transportation of over dimensions loads. [13]

Discussion:

The table above represents the JSA of loading and transportation of rig components, the table is composed of three columns:

The first column gives instruction step by step for a safe loading and transportation of the rig components: all loads must be lifted and placed in appropriate way, loads must be tied and secured and loads which are over dimensions (height, weight and length) should be treated more carefully.

The second column is for the potential hazards and accidents that may occur during this operation such as: Toppling of the crane, fall of person from Trailer/Bunk ,roll off of the load from trailer and hit injury/incidents

The third one is for recommendations to eliminate or reduce hazards:

-Select suitable crane for the rated load

-Place the crane in a stable ground

-Use appropriate slinging technique, so the sling holds the calculated working load

-Secure the small components and the other components as per the guidance rendered by the supervisor to avoid toppling of the load while transporting

The loads should generally be moved during day light hours as they are often the overweight and oversized components of the rig. All oversized loads shall be piloted, using two vehicles equipped with two way communication radios, one at the front and the other at the rear. In addition to the restricted speed limits imposed, a further reduction in speed may become necessary due to poor visibility and/or dust cloud.

Table IV.7 : the JSA of raising the mast.

Work Activity (Job) Description : **Rising the mast** *Work Team Leader:*		
WORK SEQUENCE (JOB STEPS)	**HAZARDS OR POTENTIAL ACCIDENTS**	**RECOMMENDATIONS TO ELIMINATE OR REDUCE HAZARDS**
Hold a pre-job safety meeting with all personal involved with task.	Miscommunication, Improper procedures, Missing information	Make sure all personnel are aware of their tasks. Use Rig Specific Procedures. Establish buffer zone to keep personnel clear of falling objects.
1. Inspect bridle line. Ensure lines are strung in sheaves properly.	mast falling, personnel falling from the mast.	100% Tie off procedures should be observed. Insure that all safety keepers are in place and know how many cycles are on bridle line.
2. Check for any loose objects or tools left in the mast.	Tools or loose objects falling from the mast during raising operation.	Remove any loose objects or tools. Make sure all equipment in the mast is secure.
3. Inspect rest of mast using API inspection sheet.	Structural damage.	Ensure that the mast is thoroughly inspected before raising.
4. Check drilling line anchor in drum and deadline anchor for tightness.	Pulling drill line out of drum. Line slipping on deadline anchor.	Ensure that all clamps are tight on anchors and make sure that there is a safety clamp on deadline anchor.
5. Tie fork truck onto derrick inspector approved line for snubbing in the mast or tie air taggers onto forklift to snub in mast	Line not approved for the use of snubbing in derrick.	Make sure that lines are rated for task at hand.
6. Check to make sure draw works are secured to substructure.	Draw works moving on substructure.	Double check that all tie down systems are tight and in place. After all inspections are done a re-walk around should be done to insure that nothing is missed.
7. Slowly raise the mast off of crown stand.	Erratic raising of the mast.	Ensure that draw works is in low gear and come off crown stand slow and steady.
8. Keep raising the mast slow and steadily to upright position.	The mast slamming into A-Legs. The mast falling.	Forklift is to slowly ease the mast into A-Legs. Make sure that all hands are kept out from under the mast while raising and Ensure that no lines become entangled in the mast or on pipe racks while raising the mast.
9. Pin the mast to A-Leg section.		A separate JSA for pinning A-Legs to the mast section should be used for best practices and procedures.

Discussion:

The table above represents the JSA raising the mast. The table is composed of three columns:

The first column gives instruction step by step raise the mast: first Inspect bridle line and check for any loose objects or tools left in derrick then Pin derrick to A-Leg section and slowly raise derrick off of crown stand after that Tie fork truck onto derrick inspector approved line for snubbing in the mast or tie air taggers onto forklift to snub in mast and Slowly raise the mast off of crown stand finally Pin the mast to A-Leg section

The second column is for the potential hazards and accidents that may occur during this operation such as: Structural damage, Tools or loose objects falling from the mast during raising operation, mast falling or the mast slamming into A-Legs

The third one is for recommendations to eliminate or reduce hazards:

-Make sure all personnel are aware of their tasks

-Ensure that the mast is thoroughly inspected before rising.

-Make sure all equipment in the mast is secure.

-Ensure that draw works is in low gear and come off crown stand slow and steady.

-Make sure that all hands are kept out from under the mast while raising and insure that no lines become entangled in the mast or on pipe racks while raising the mast.

Raising the mast is a critical task of medium risk, and should be accomplished during daylight hours whenever possible. In the event it becomes necessary to raise the mast during the hours of darkness it will only be permitted after a very thorough inspection by the senior level of supervision on site, which will be at a Rig Manager or higher level. Sufficient levels of lighting must be available to perform this operation (all light towers positioned to give maximum illumination of the operation, and mast lighting to be operational throughout the procedure).

The mast will be raised (day or night) only under the supervision of a Rig Manager or person of a more senior level.

Tab IV.8: the JSA of Rig up Generator package. [13]

Work Activity (Job) Description : **Rig Up Generator Package** *Work Team Leader:*		
WORK SEQUENCE (JOB STEPS)	**HAZARDS OR POTENTIAL ACCIDENTS**	**RECOMMENDATIONS TO ELIMINATE OR REDUCE HAZARDS**
1. Set generator in proper place per rig move plan.	Backing into equipment, dropping equipment, breaking slings, pinch points to hands, fingers, and toes, getting caught in between loads.	Use spotters to assist placement, inspect all rigging before use. Use tag lines. Stay away from loads.
2. Ground generator skids.	Struck by hammer. Could create trip hazards, cuts to hands.	Use proper tools to drive ground rods and put caps on all ground rods. Install rods out of traffic areas.
3. Rig up electrical lines to proper receptacles.	Wrenches slipping, struck by electrical connections and/or lines, trip hazards, falls. Back or muscle strain.	Use proper fall protection and ensure ladders are in good working condition. Use proper tools for the job. Require help when moving lines and cables.
4 Hook air lines and fuel lines to generator.	Wrenches slipping, struck by lines, trip hazards, falls. Back or muscle strain. Contact with fluids.	Use proper tool for the job. Use of proper PPE to include rubber gloves. Require help when moving lines and hoses.

Discussion:

The table above represents the JSA of rigging up the generator package, the table is composed of three columns:

The first column gives instruction step by step for a safe rigging up the generator package: first the generator should be set in proper place per rig move plan then Ground generator skids after it electrical lines can be rigged up to proper receptacles finally we Hook air lines and fuel lines to generator.

The second column is for the potential hazards and accidents that may occur during this operation such as: dropping equipment, pinch points, struck by electrical connections and/or lines, trip hazards, falls. Back or muscle strain.

The third one is for recommendations to eliminate or reduce hazards:

-Use spotters to assist placement

-inspect all rigging before use.

- Use tag lines

-Use proper tools to drive ground rods and put caps on all ground rods

-Use of proper PPE including rubber gloves.

The operation must be done during the daylight hours and it has high priority so it has to be done as far as possible this operation should be done under the supervision of the rig manager

Tab IV.9: the JSA of Pick Up Top Drive. [13]

Work Activity (Job) Description : **Pick Up Top Drive** *Work Team Leader:*		
WORK SEQUENCE (JOB STEPS)	**HAZARDS OR POTENTIAL ACCIDENTS**	**RECOMMENDATIONS TO ELIMINATE OR REDUCE HAZARDS**
1. Gather all tools and equipment. Discuss procedures with all parties involved prior to beginning task.	Personnel not involved in pre-job planning, not understanding procedures. Uniformed workers	Only personnel involved in pre-job planning allowed working on task.
2. Spot truck and trailer. Rig up Air hoist to top of runner/track. Rig up winch truck to bottom of runner/track.	Rigging failure. Pinch points between rigging and track. Slips, Trips and Falls. Struck by track or rigging equipment and trucks.	Inspect and document lifting equipment. Use only lifting equipment rated to handle the job, and in good condition. Watch foot placement. Watch hand and finger placement when rigging. Use a spotter when backing trucks.
3. Raise top section of track to rig floor and lay flat. Rig up track to the blocks.	Rigging failure. Pinch points between rigging, track, and floor. Pinch points when pinning bucket to blocks. Struck by track by lifting to fast.	Stay clear of track path of travel. Constant visual contact between spotter, air hoist operator, and winch truck operator. Known hand signals before starting lift. Watch hand placement when setting track and pinning bucket.
4. Raise track up mast using the blocks, while winch trucks keep track centered.	Track caught under girds. Track becoming out of balance and tipping or falling.	Stay out from under overhead loads. Use spotters. Maintain effective communication. Raise track slowly.
5. As the last piece of track is being lifted off trailer, hold back by using winch truck.	Winch Failure. Line failure	Stay clear of lines and track. Use effective communication .
6. Attach track cables to hydraulic rams. Rams should be at rig floor level.	Fall from V-Door, Pinch point between eyes, cables, and track.	Be cautious of trapped energy in cables. Use tools available instead of hands.
7. Raise track to rig floor using winch truck until Top Drive is hanging over the rotary table. Slack off winch and remove from track. Lower winch line to ground.	Hit by winch line. Struck by track.	Stay clear of lines and track. Use ropes to help lower winch line. Use teamwork to free winch line.

8. Remove lifting assembly from track by pulling safety pin and shifting lever on latch assembly. Confirm with driller. Make sure derrick man has moved service loop support arm away from track before lowering the blocks.	Falling. Pinch points on Top Drive lifting assembly. Damage to swing arm.	100% Tie-off. Watch hand and finger placement when removing lifting assembly. Watch body position and foot placement. Use effective radio communication.
9. Rig up hydraulic lines to service loop. -Energize track until rigid-Lower Top Drive lifting assembly to Top Drive -Remove assembly from track -Remove lower roller assembly. -Lower blocks to floor using the air hoist/ lay down line to guide blocks away from Top Drive.-Remove lifting assembly from blocks and hoist blocks to top of Top Drive. Pin blocks to Top Drive.	Falls, Pinch points between track sections and between lifting assembly and track. Caught between track joints. Being struck while removing pins. Pinch points between lifting assembly and blocks.	-100% Tie-off. Watch hand and finger placement when removing lifting assembly. -Use pin catchers. -Derrick man moved clear of track joints before energizing. 100% Tie-off. ---Come down slowly and in control with blocks.
10. Raise blocks above Top Drive and connect block to the Top Drive Links. When hooked up, pick up off shipping pins and remove both top and bottom pins.	Falls from man lift. Moving Top Drive with shipping pins left in. Pinch points between bucket and links. Dropped tools and parts.	Trained man lift operators. 100%Tie-off. Verify all shipping pins are removed. Keep all body parts out of pinch points or crush points. Stay out from under overhead loads.
11. Rig up service loop, Kelly hose, Links, Elevators, Turnbuckles Upper and Lower)	Electrical shock, Falling, Pinch points, Dropped tools and parts	Ensure Top Drive feeder breaker is off. Use man lift. Trained man lift operators. Tie-off tools. Stay out from under overhead loads.

Discussion:

The table above represents the JSA of picking up the Top drive where it is composed of three columns which contain: job steps, potential hazards and recommendation to eliminate or reduce hazards.

The first column is for instruction about how to pick up the Top drive step by step : starting by gather all tools and equipment and spotting truck and trailer until the blocks are hoisted to the top drive and pinned

The second column is gives all potential hazards and accidents exist at the operation such as : rigging failure, pinch points ,trips and falls. Struck by track or rigging equipment, hit by winch line, electrical shock and dropped tools and parts.

The third column is to eliminate or reduce these hazards by:

- Inspect and document lifting equipment.
- Use only lifting equipment rated to handle the job
- Stay out from under overhead loads
- Stay clear of track path of travel. Constant visual contact between spotter, air hoist operator, and winch truck operator
- Use effective communication.
- Be cautious of trapped energy in cables.
- Use tools available instead of hands.
- Watch hand and finger placement when removing lifting assembly
- Ensure Top Drive feeder breaker is off
- Keep all body parts out of pinch points or crush points

This operation is considered a critical one of medium risk. The installation of the top drive into the mast should be accomplished during day light hours whenever possible.

Proper communication between the Driller, Personnel working in the mast, Rig Manager and Trailer Tractor Driver are very important. Hands-free radios will be used to achieve this task.

The operation will be supervised by a Rig Manager or by a person of a more senior level.

Conclusion:

The application of the JSA method allowed us to discover all changes that can affect the transportation of the rig from the current location to the target location, and prevent any scene of hazards that may harm the employee or the equipment of the rig.

The advantage of this method is that it allow us to discuss any activity before it takes place with all employees involved to do the tasks safely

GENERAL CONCLUSION

Conclusions

Rig move is a very significant phase after drilling, it involves many operations and activities with a variety of other contractors present. Because of this level of activity, and the fact that different types of hazards, from those encountered during drilling operations, are present we conducted this study.

The global objective of our study after one convenient practical month within the ENTP company (national company of well activities), based on an analysis of risks bound to the rig move operation) is to do a safe rig move with maximum of efficiency and minimum of accidents saving employees, materials, equipments and environment involved in this operation

The choice of the ENTP for our study, allowed us to discover the operation at the real field and to learn a new tool of risk assessment which is JSA, so we applied this method at the rig move operation leading us to discover the operation step by step, identifying all potential hazards related to the operation and the safety measures to eliminate or reduce them

The JSA method has the advantage that it can be diffused to all workers involved at the operation so it ensures they all get the safety procedures from regular contact between supervisors and workers. It can serve as a teaching aid for initial job training and as a briefing guide for infrequent jobs. It may be used as a standard for health and safety inspections or observations.

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[12] Document of ENTP company DHR(Department of Human resources)

[13] Document of ENTP Company DQHSE (Department of Quality Health Safety and Environment)

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[15] US Dept of Labor (2002) Job Hazard Analysis. OSHA 3071

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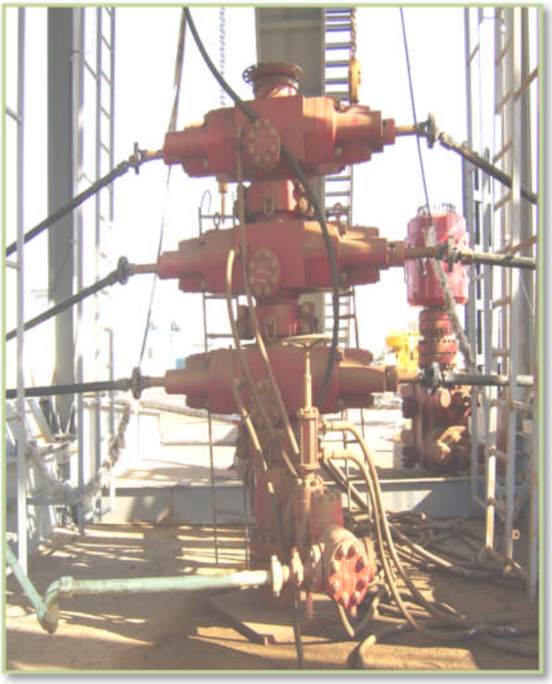
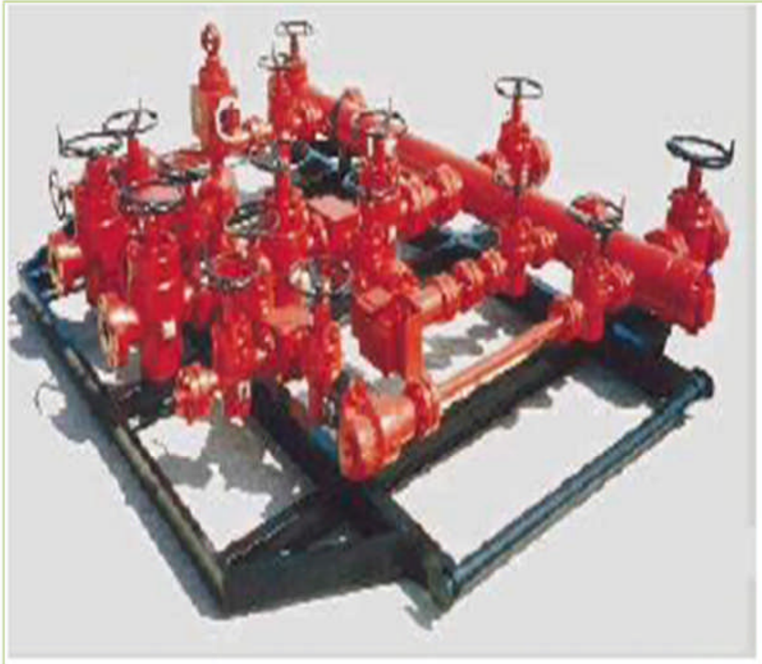


Blow Out Preventor stack (BOP)

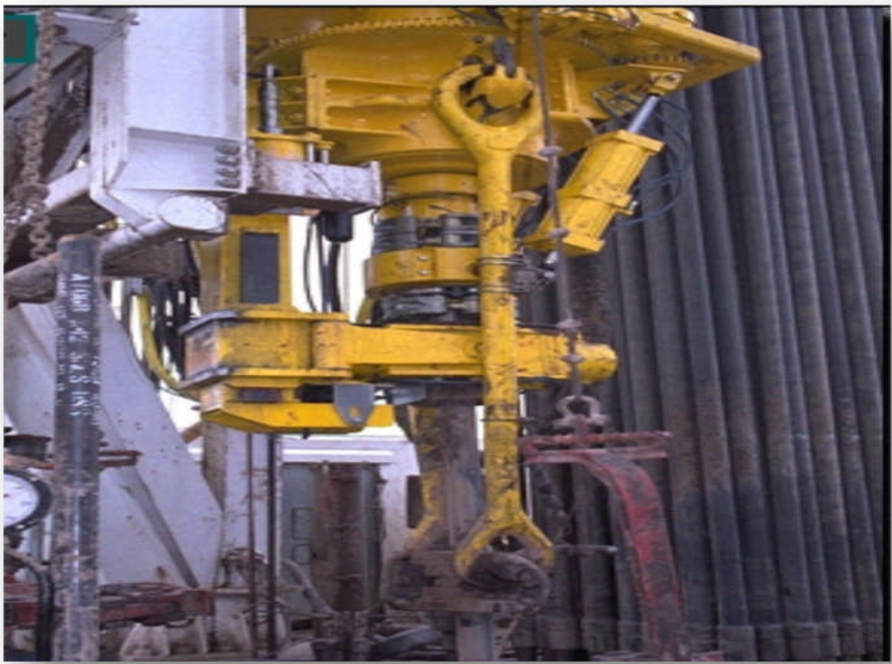


Manifold

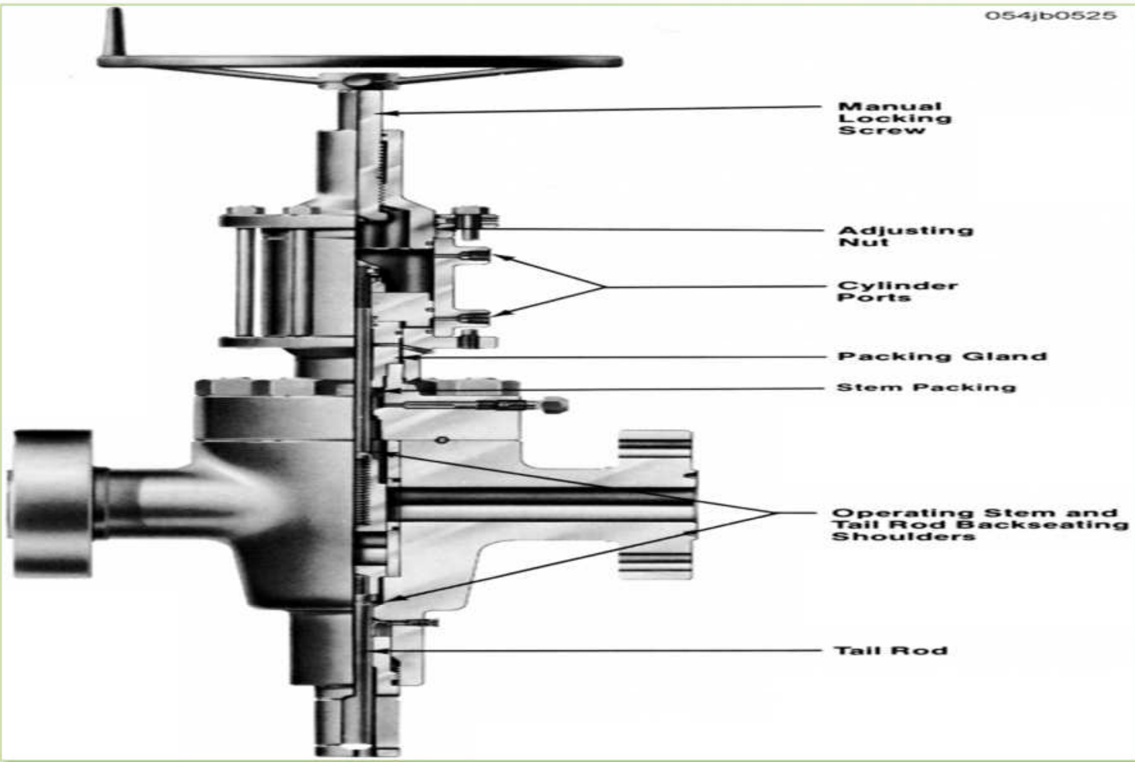
Accumulator (KOMMEY)

Safety equipment

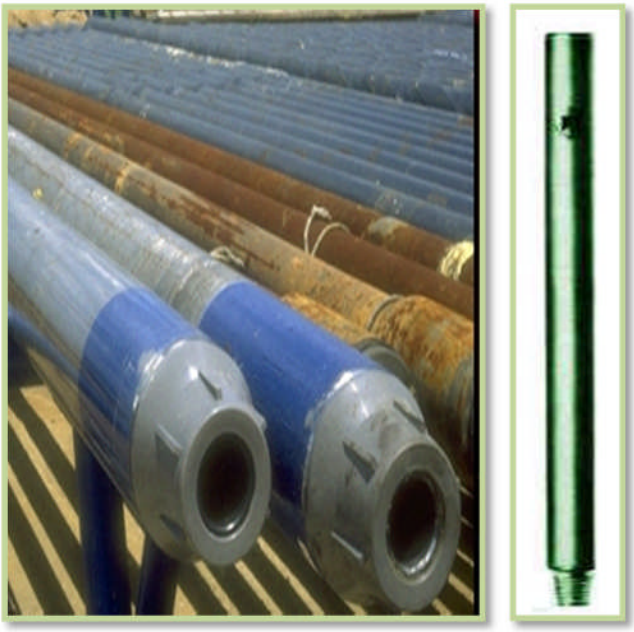
Appendix 1 : Equipements of the Rig



The Top Drive



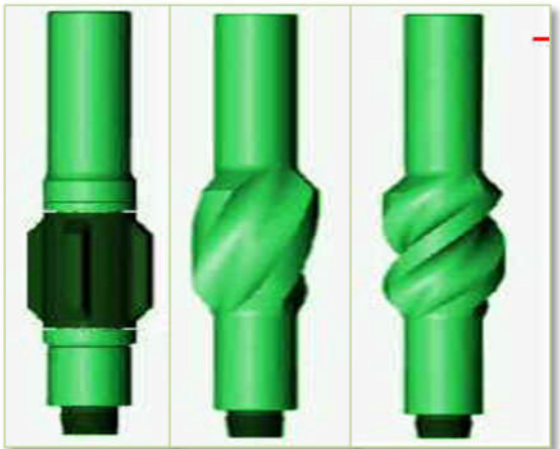
Commended valve used from distance at the manifold of BOP



Drill collar

Drilling pipes

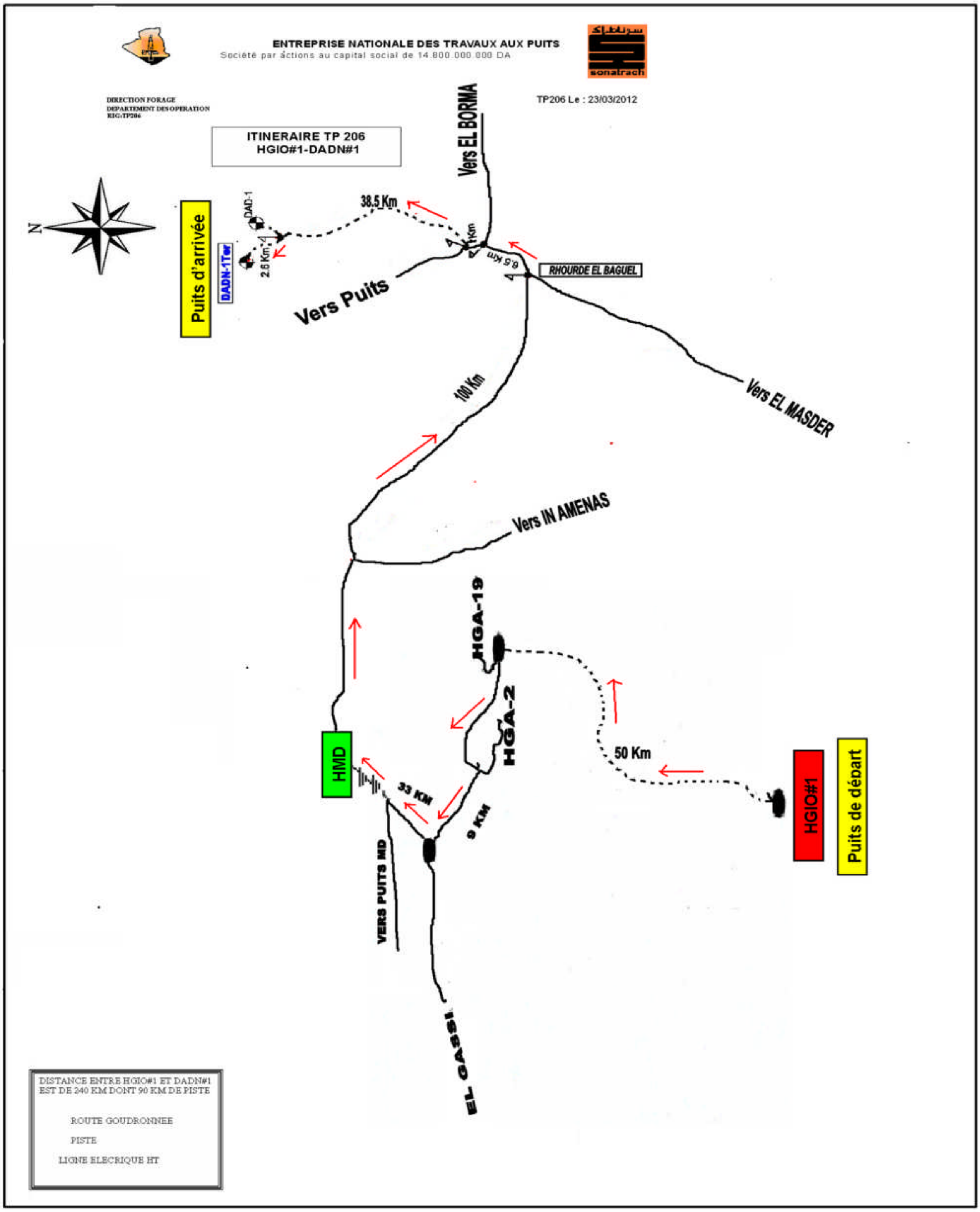
Pin and Box



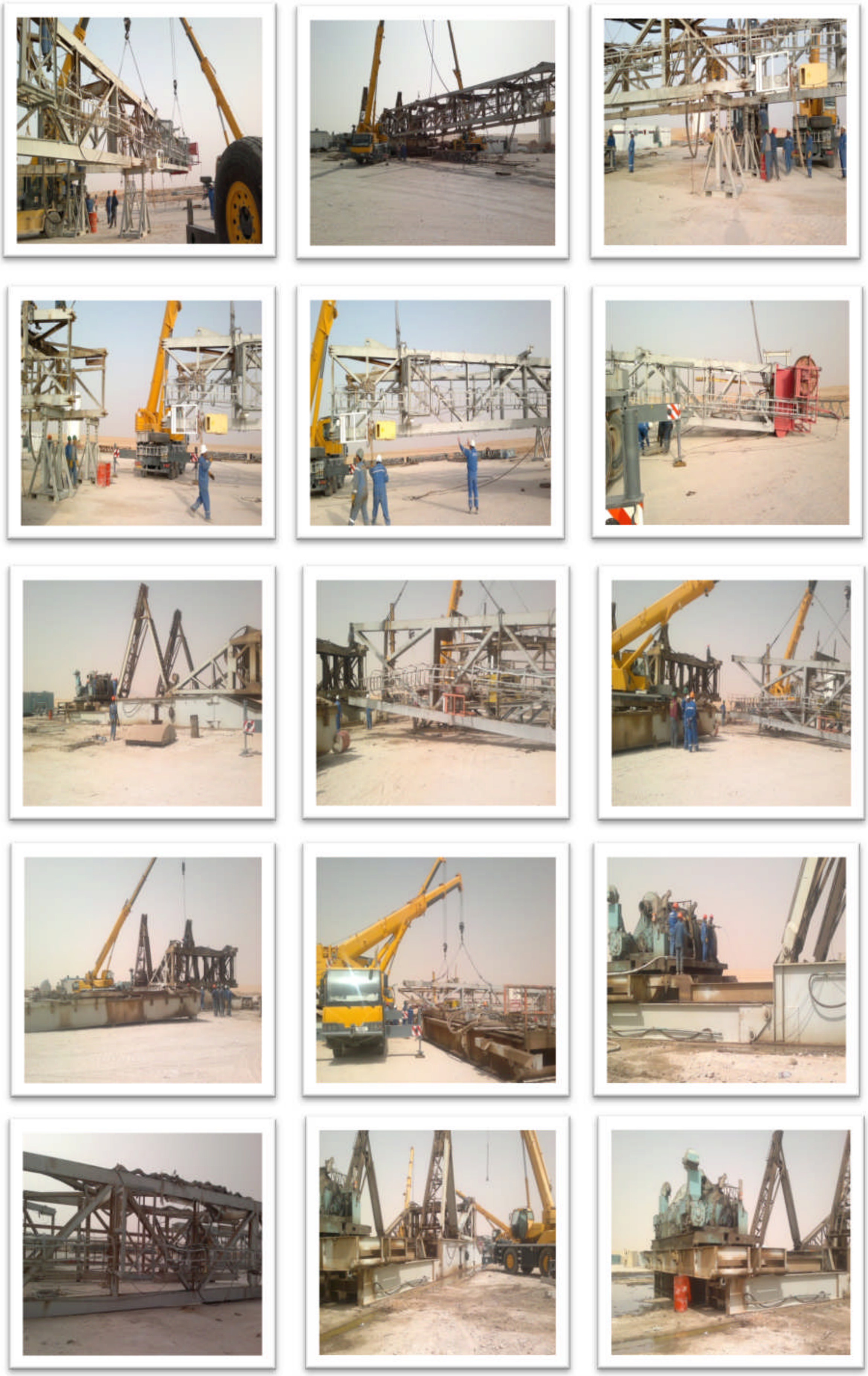
The Stabiliser

Equipment of drilling

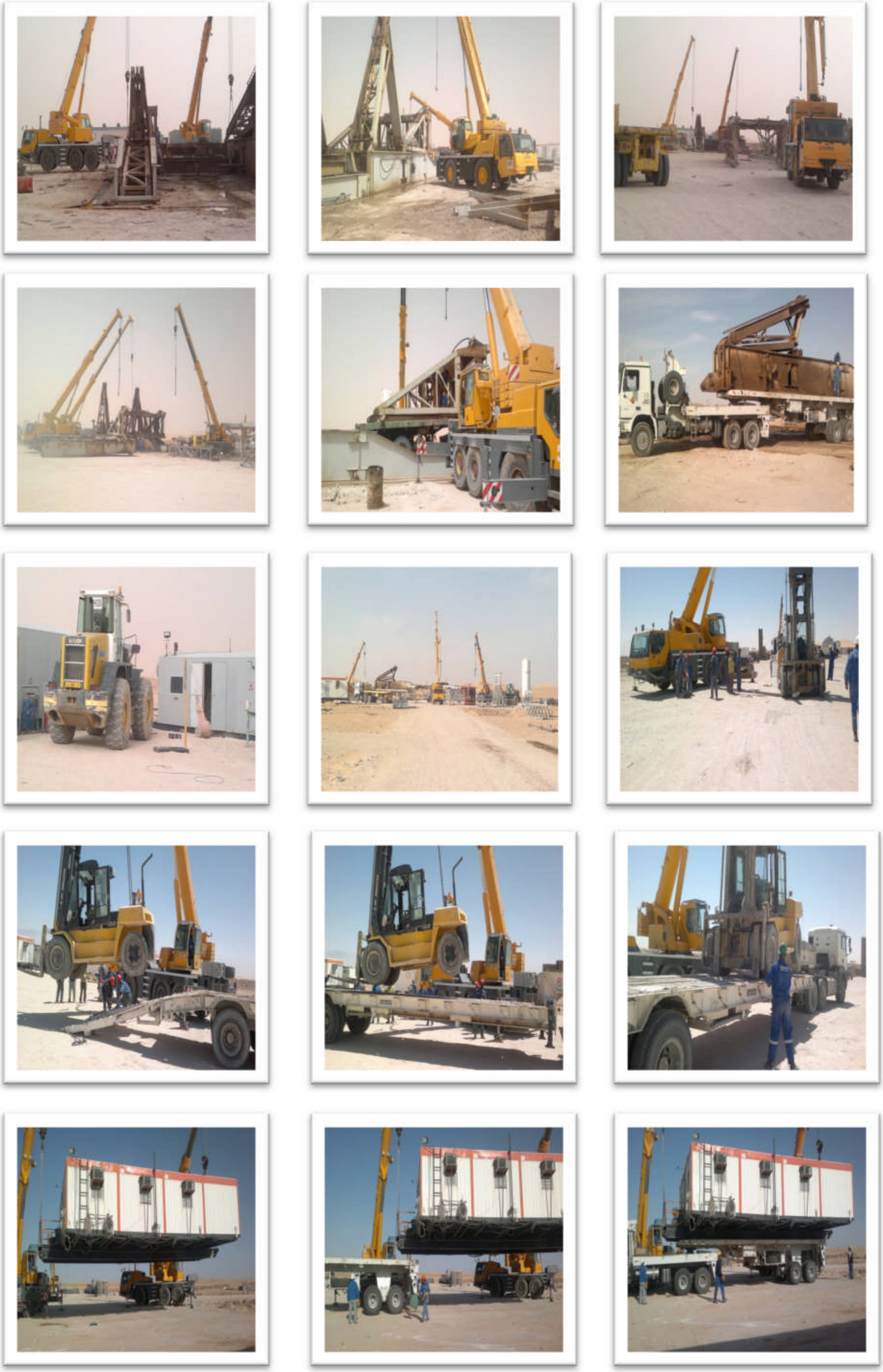
Appendix 1 : Equipements of the Rig



Appendix 2: A map of ENTP Company describes the track a rig move

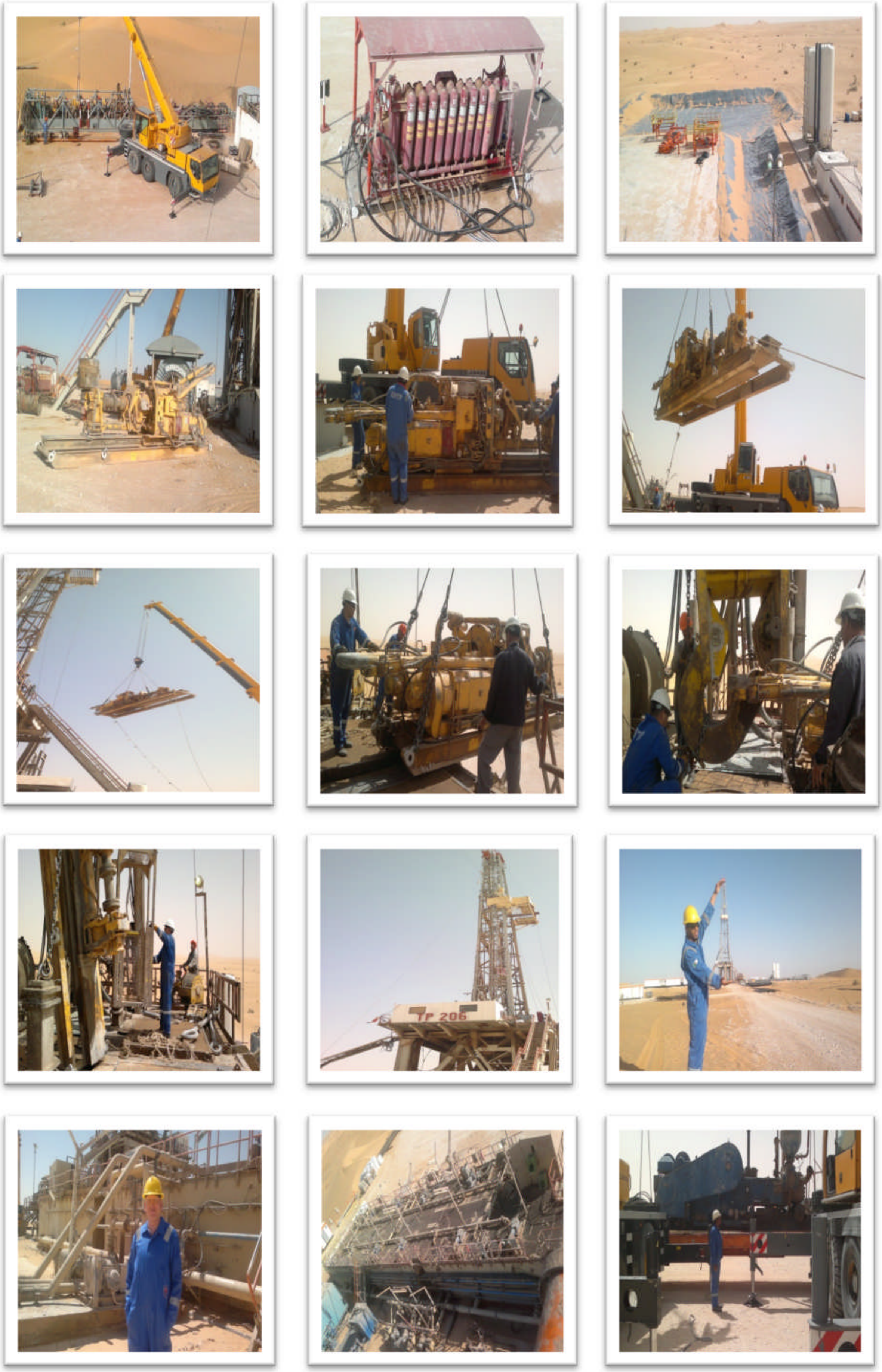


Appendix 3D: Pictures while rigging down

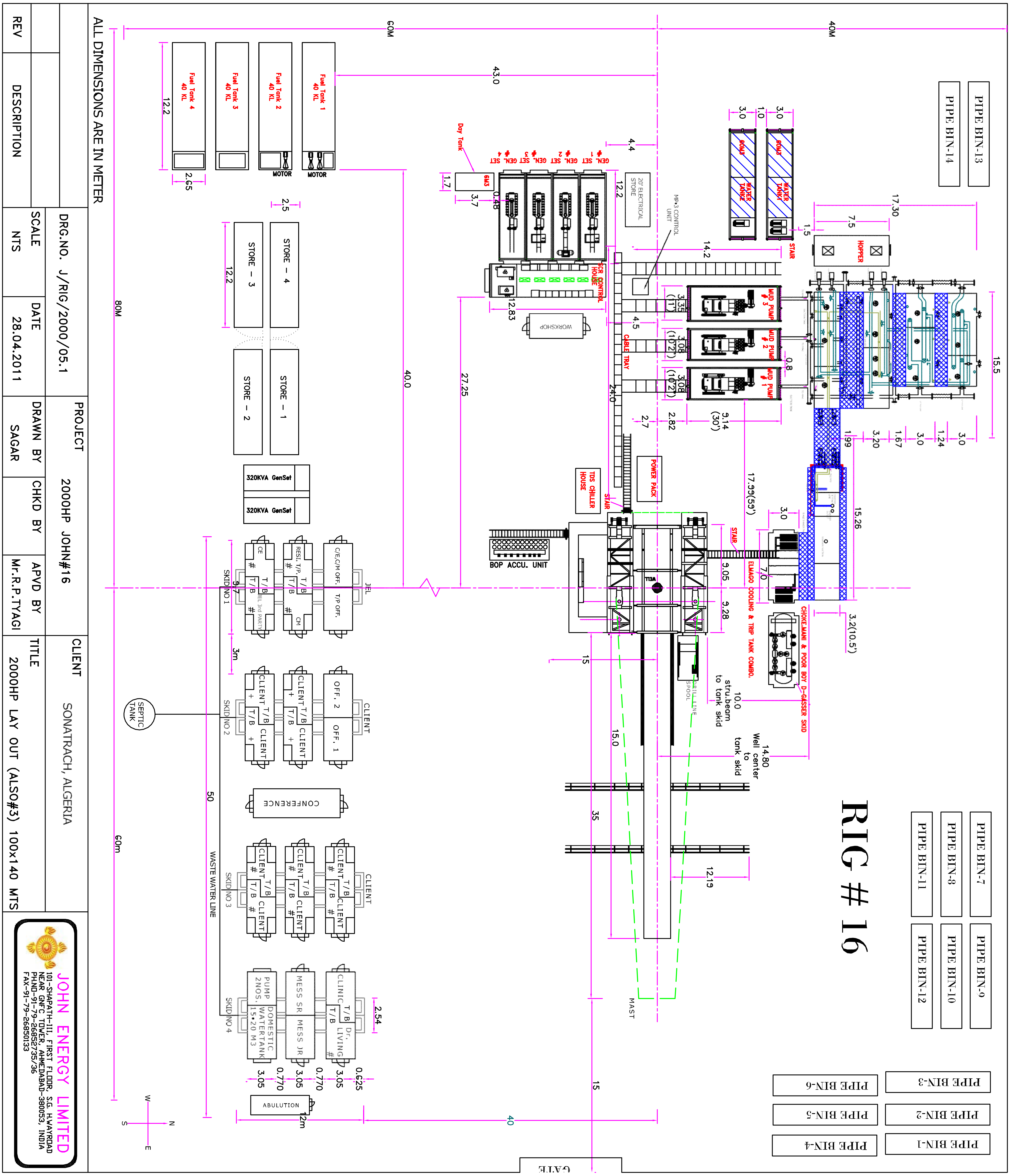


Appendix 3D: Pictures while rigging down

Appendixes 3S: Pictures while Skid



Appendix 4: Pictures while rigging up



Appendix 4: Rig layout