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Analysis of Hazard Identification, Risk and Control in the Drilling Area of Rig Using Job Safety Analysis (JSA) Method in PT PTM, in Indonesia

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Abstract

Oil and gas well drilling is a high risk activity. The biggest risks are fires, explosions and wild blowouts. The impact of potential hazards and high risks must be minimized through risk management, which includes hazard identification, risk assessment, and a risk hazard control hierarchy. The occupational safety and health management system creates the right system of rules and procedures (Standard Operating Procedure) that allow all hazards and risks in the workplace to be identified and their controls implemented on an ongoing basis. Potential hazards are based on their impact on workers such as infrastructure, equipment and materials, both provided by the company and other parties, including changes that are temporary and have an impact on operations, processes and work activities. The steps for hazard identification and risk assessment include: collect all information about the types of hazards that exist in the workplace; carry out routine inspections directly to find potential hazards and potential risks in the workplace; identify hazards to occupational safety and health unsafe acts and unsafe conditions, when a person comes into contact with chemical factors (solvents, adhesives, paints, poisons), physical factors (noise, lighting, vibration, work climate), biological hazards (infectious diseases), and ergonomics factors (repetitive movements, awkward postures, heavy lifting); and control hazards and risks in Drill Pipe (DP) reduction work using Kelly Swivel (KS) with Job Safety Analysis (JSA) method. The results of this study found potential biological, physical, electrical, psychosocial, chemical, mechanical and ergonomic hazards (a total of 13 with a total risk of 15). Additional hazards were also found during field work, namely movement hazards, gravity, environmental disturbance factors and hazards. Security threats (a total of 7 with a total of 11 risks) were considered, so that potential hazards and total risks can be found (hazard = 20 and potential risks = 26).

Keywords: Hazard, Risk Assessment, Control, Job Safety Analysis (JSA)

Introduction

The oil and gas industry is one of the industries with a very high level of hazard and risk of accidents. In the OSHA (Occupational Health and Safety Assessment Series) strategic management plan, the oil and gas industrial field is included in one of the industries with a high level of danger. Every hazard that can produce a Health and Safety Risk. This term is often used for events related to process safety, i.e. events that can produce consequences with the highest criteria according to Risk Assessment. Hazards such as noise, chemicals including products from the oil and gas sector itself, namely crude oil and gas which can cause fires, explosions, wild sprays, biological hazards from wild animals, also mechanical hazards from machines and heavy equipment. If the hazard is not properly prevented and controlled, it does not rule out the possibility of causing work accidents. One of the biggest risks in drilling activities is blow out. The results of a risk assessment in one of the oil and gas sectors in Indonesia show that all drilling operations have great potential hazards and risks because they involve heavy equipment, high-voltage electrical equipment, chemicals, and machines that have the potential to cause work accidents. The company has made efforts to achieve good

work safety performance, including through the provision of training, provision of equipment, design specifications of equipment and materials according to standards.

Table 1. Work accident data for upstream oil and gas activities in 2015-2019

Description	2015	2016	2017	2018	2019
Minor/Low	206	89	55	124	122
Medium	55	15	20	19	12
High	10	9	7	3	2
Fatality	2	4	4	3	3
Total	**273**	**117**	**86**	**149**	**139**

Source: Directorate General of Oil and Gas Ministry of Energy and Mineral Resources (2019)

So that the number of work accidents in PT. PTM can be minimized by carrying out Hazard Identification, Risk and control of hazards and risks in PT PTM field areas using the JSA (Job Safety Analysis) method. As a result, the level and potential of hazards in the workplace that must be faced by the workforce as well as to overcome them, hazard identification, risk assessment, control hierarchies such as Elimination, Substitution, Engineering Control, Administrative control, Personal Protective Equipment (PPE) is a must.

Research Purposes

Analyze hazard identification, risk assessment and control of hazards and risks in the work stages of Drill Pipe (DP) reduction into drilling work using Kelly Swivel (KS) with the Job Safety Analysis (JSA) method and it is expected to get hazards and other risks during the stages work in the field, so that obtaining other hazards will add to the identification of hazards and their potential risks, where in a literature review there are only 7 types of hazards

Literature Review

Job Safety Analysis (JSA)

Job Safety Analysis (JSA) is in the form of a procedural examination to determine whether the procedure being carried out is running as it should, and to examine aspects of the attitude of the people carrying out the work in question. The main point of job safety analysis is preventing accidents by anticipating and eliminating them as well as control the hazards. If the hazard has been identified, control measures can be taken in the form of physical changes or improvements to work procedures that can reduce work hazards. Job safety analysis (JSA) method can also control and identify existing hazards, determine controls that must be implemented and reduce the number of accidents.

Risk Management

The steps for hazard identification and risk assessment include: collect all information regarding the types of hazards that exist in the workplace, carry out routine inspections in person to find potential hazards and risks, identify hazards to Health and Safety unsafe acts and unsafe conditions, contact with chemicals dangerous, physical factors (noise, lighting, vibration, work climate), biological hazards (infectious diseases), and ergonomic factors (repetitive movements, awkward postures, heavy lifting), determine temporary control measures, and determine priority hazards that need to be controlled permanent. Temporary control measures to protect workers until a permanent hazard prevention and control program can be implemented.

Risk Management Process (Source: AS/NZS 4360, 2004): (1) Hazard Identification, (2) Risk Analysis and Risk Control. Hazard is a potential source of damage or a situation that has the potential to cause harm (Cross, 1998). Hazards are everywhere either in the workplace or

in the environment, but hazards will only have an effect if contact or exposure occurs (Tranter, 1999).

Hazards Identification

Types of hazards in the workplace can be classified, including:

a. Mechanical hazards – sourced from mechanical equipment or moving objects either manually or with a propulsion. This mechanical movement can cause injury or damage such as cuts, cuts, falls, pinches and slips.

b. Electrical hazards – namely the danger that comes from electrical energy which can result in various fire hazards, electric shocks and short circuits.

c. Chemical hazards – originating from materials produced during production, dissipated into the environment due to wrong working methods, damage or leakage from equipment or installations used in the work process.

d. Physical hazards – originating from physical factors, in a physical workplace which in this decision consists of working climate, noise, temperature, vibration, microwaves, ultraviolet rays and magnetic fields (Regulation of the Minister of the Ministry of Transmigration No.PER.13/MEN/X/2011).

e. Biological hazards – can come from microorganisms, especially those that can cause health problems, such as bacteria, fungi, viruses.

f. Ergonomics hazards – can cause physical disturbances to the body as a result of inappropriateness and wrong working methods that can cause disturbances in body position, low back pain.

g. Psychological hazards – stress in the form of work pressure, violence at work, and irregular working hours, can also come from inner conflict with the environment at work, both with colleagues and with facilities in the work environment

Risk Analysis and Risk Control

In dealing with a hazard, it is necessary to carry out a risk assessment so that workers can find out about the magnitude of the risk posed. Then after the risk or hazard has been identified, a risk assessment is carried out to find out how big the risk is. Risk assessment is very important because it can form an opinion or perception of a risk. Risk Assessment includes the risk analysis stage and includes the Risk evaluation stage.

Risk Analysis

Risk Monitoring carried out must include monitoring actions on Health, Safety Risk Control as follows:

a. Monitoring and measuring the health risks of industrial hygiene parameters from operating activities that can cause work-related illnesses. The health risk monitoring cycle includes:

b. Monitoring and measuring work safety parameters and causes of accidents (Unsafe Action, Unsafe Condition) from operating activities.

c. Environmental Risk Monitoring and measurement of environmental parameters from operational activities that can cause pollution.

d. Monitoring and measuring the level of vulnerability and threats to operations that can cause security disturbances.

After all risks can be identified, a risk analysis is carried out to determine the magnitude of a risk by considering the possibility of its occurrence and the magnitude of the consequences it may cause. The results of the risk analysis are evaluated and compared with predetermined criteria or applicable standards to determine whether the risk is acceptable or not.

Risk Control

According to Socrates (2013), risk control is a way to overcome the potential hazards contained in the work environment. Potential hazards are controlled by first determining a priority scale which can then assist in the selection of risk controls which is called the risk

control hierarchy. Risk control follows the Hierarchy of Control approach. The risk control hierarchy is a sequence in the prevention and control of risks that arise which consist of several levels sequentially, including:

a) Elimination: is an ideal step that can be taken and must be the first choice in controlling hazard risks. Eliminate work processes/equipment/materials that may pose a risk.
b) Substitution: as the replacement of hazardous materials with safer materials. replace high-risk work processes/equipment/materials with work processes/lower risk equipment/materials.
c) Engineering Control: is an effort to reduce the Level of Risk by changing the design of workplaces, machines, equipment or work processes to make them safer. Make modifications (changes in design) to materials/equipment/production facilities so that the level of risk is reduced, modify equipment, carry out combinations of activities, change procedures, and reduce the frequency of carrying out hazardous activities.
d) Administrative Controls: Administrative efforts are focused on the use of Standard Operating Procedures as a measure to reduce the level of risk, carry out risk control by making / installing warning signs, setting working hours, issuing work permits, outreach, maintenance programs.
e) Personal Protective Equipment (PPE): which serves to reduce the severity of the consequences of the hazard posed, carry out risk control by wearing personal protective equipment (PPE) that is adapted to the potential hazards that exist.

Methodology

Using a descriptive qualitative method approach to analyze with triangulation: interviews (checklist), observation, and documentation. Hazard analysis, Risk Assessment with the Job Safety Analysis (JSA) method.

The sampling technique is Purposive Sampling with a total of 15 informants (1 key informant), from various sections of the Assistant Manager/Superintendent, Rig Supervisor, Health Officer, Safety Officer, Security Officer, Fireman, Driller, Assistant Driller, Mechanic, Electrical Operator, HSE (Health Safety Environment) Assistant Manager, Environment Senior (HSE Department),

Results and Discussion

Identification of hazards, risks to ensure that operational risks in all processes of operational activities in the field are evaluated, controlled and monitored/monitored in order to minimize risks to health, safety, security, environment and quality discrepancies arising from operational activities apply in implementation of risk evaluation activities, risk control and operational risk monitoring within PT PTM and its partners.

Research results using the proactive Job Safety Analysis (JSA) method can be shown as follows.

A. Stages of Work in the Rig Well Service (RWS) Work Area Environment

There are types of hazards, potential risks and the control hierarchy are:

1. Type of Hazard:

1.1. Biological hazards: Exposed to the Covid-19 Virus; Potential risks: infected with the Covid-19 Virus.

Control:

a) Administrative Control: 1) Conduct ToolBox Meetings; 2) Do a Covid-19/antigen test; 3) Screening has done vaccines and checked blood pressure; 4) Medical team that has first aid kits; 5) Carry out Quarantine; 6) Clean the work area with disinfectant; 7) Efforts

to deal with Covid by means of 5 health protocol (1. Washing Hands; 2. Using a Mask; 3. Keeping Your Distance; 4. Staying Away from Crowds; 5. Reducing Mobility).

b) PPE (Personal Protective Equipment): Use general PPE, complete according to SOP (Standard Operating Procedure) when entering the work area (gloves, helmet, masks, vests, safety shoes, special PPE (Fullbody Harness).

1.2. Biological hazards: Animal attacks (cobra and tomcat bites into clothes: bitten by a snake: experiencing pain and pain in the part of the body that was bitten).

Control:

a) Administrative Control: 1) Conduct Tool Box Meetings; 2) Install a safety sign related to biological hazards; 3) First Aid Medical Team and Procurement of Anti-Snake Venom Serum.
b) PPE (Personal Protective Equipment): Use complete PPE (Personal Protective Equipment) according to SOP (Standard Operating Procedure) when entering the work area PPE (gloves, helmets, masks, vests, safety shoes).

1.3. Electrical hazards: Generator installation, entire installation in the rig area using electricity, electrical installation, exposed cables. Lightning strike Electrical hazard is a hazard associated with electrical equipment and lightning strikes that cause damage (towers, pump skids, generators, container offices, etc.), potential risk of loss of life, fire and explosion, damage to company assets, facilities and infrastructure that impact losses, especially on the continuity of the company's business (Business Continuity Plan).

Control:

a) Engineering Controls: 1) Lightning Protection Installation; 2) Rigs (towers, pump skids, gensets, container offices) must be equipped with a lightning rod using a standard (continuous length) grounding cable with an independent copper grounding system and measured a maximum resistance of 1ohm and a maximum grounding skid of 5 ohms (must be measured during inspection) ongoing & periodically every 14 days during the operation)
b) Administrative Control: 1) Before the work is carried out, you must have SIKA attached to the JSA; 2) Medical team that has a first aid kit; 3) Available SOP Work Over Well Service (WOWS); 4) Medical Team / Emergency Response Plan (ERP); 5) Availability of active fire protection such as fire extinguisher and hydrant.
c) PPE (Personal Protective Equipment): Use complete PPE (Personal Protective Equipment) according to SOP (Standard Operating Procedure) when entering the work area PPE (gloves, helmets, masks, vests, safety shoes).

1.4. Psychosocial hazards: Stress is a danger arising from physical, mental and emotional factors that cause mental or physical stress, such as ignorance of security and safety, negligence, limited knowledge/abilities, high levels of fatigue and so on. Often experiencing downtime, especially salary problems, disturbing at work because of the burden of thoughts, workload (over time), so that you experience work stress due to workload and uncomfortable environmental conditions.

a) Administrative Control: Avoid over time.
b) PPE (Personal Protective Equipment): Use complete PPE in accordance with SOP (Standard Operating Procedure) when entering the work area (gloves, helmets, masks, vests, safety shoes, Full Body Harness).

1.5. Chemical hazards: is exposure to chemical compounds originating from the chemicals used or from the characteristics of the products produced which can endanger safety in an acute nature. Chemicals can be in the form of solids, liquids or gases (for example: H2S gas, exposure to liquid HCl, KCl, CaCl, CO, oil, chemicals from H2O4, NaOH, and ammonia vapors); skin irritation.

a. Administrative control: 1) Install a Hazard Safety Sign; 2) Work Over Well Service SOP is available; 3) Availability of active Fire Protection such as Fire Extinguisher and Hydrant; 4) Medical team that has first aid kits; 5) Available MSDS (Material safety data sheet); 6) Housekeeping cleaning of residual oil using the 5R method (brief, neat, clean, care and difficult).
b) PPE (Personal Protective Equipment): Use PPE according to SOP when entering the work area (gloves, helmets, special masks or special respirators, vests, safety shoes) or special respirators, vests, safety shoes.

1.6. Mechanical hazards: All moving machine tools (pumps, rigs, heavy equipment cranes, backhoes, rotating, circulating, pressure, generators, Kelly swivels that can turn around. Potential Risks: Pinched, scratched, and cut.

a) Substitution: replacement of the hydromatic system if it is no longer suitable for use.
b) Engineering Controls: 1) For security, install a hydromatic system to regulate the ups and downs of the Kelly Swivel; 2) Use crown automatic for safety device.
c) Administrative Controls: 1) Before the work is carried out, you must have SIKA attached with JSA; 2) Work Over Well Service SOP is available; 3) The medical team has a first aid kit; 4) Availability of active Fire Protection such as Fire Extinguisher and Hydrant; 5) Has a Crew Certificate from mineral resource energy, Oil and Gas.
d) PPE (Personal Protective Equipment): Use complete PPE (personal protective equipment) according to SOP when entering the work area (gloves, helmets, masks, vests, safety shoes), Full Body Harness.

1.7. Ergonomic hazards: Health hazards arising from improper body position while working (e.g. lifting things in the wrong position), mechanics, bolt installation, confined space work conditions. Working position, especially in the mechanical part when positioning equipment, health hazards that arise due to a discrepancy between the design of the equipment and one's body shape. Risk: low back pain, Body aches, Low back pain.

a) Administrative Control: Working in accordance with the SOP at work is related to the correct work position and must be followed.
b) PPE (Personal Protective Equipment): Use complete PPE according to SOP when entering the work area (gloves, helmets, masks, vests, safety shoes).

B. Stages of Lowering the Drill Pipe (DP) into the Well using Kelly Swivel during the Drill Out Cement (DOC) Process at the Rig Well Service (RWS) and the Working Environment of the Drilling Area (Drilling)

Before the work is carried out, an inspection is carried out, checking the crane heavy equipment by using a checklist (checklist) on the elevation, lifting capacity, and maximum load that must be allowed.

1) The stage of lifting the Kelly Swivel by using a crane, then connecting it with the Drill Pipe on the string (to enter the Drill Pipe series)

1. Danger of Movement: Hit and run over by a worker's crane in the work area; Mechanical: pressure rotating tool, per/spring, fan belt; Vehicles, equipment moving, crane equipment moving movements; Potential risk: Causing the crane, drill pipe and Tower Rig to fall to workers in the work area, incidents of being hit and run over by cranes can occur

Control:

a) Administrative Controls: 1) Before the work is carried out, you must have SIKA attached to the JSA; 2) Work Over Well Service SOP is available; 3) Emergency Response Plan (ERP), Medical Team, Evacuation; 4) Availability of active Fire Protection such as APAR and Hydrant. Perform sterilization by installing a safety line area that will be passed by the crane.

b) PPE (Personal Protective Equipment): Use complete PPE according to SOP when entering the work area (gloves, helmets, masks, vests, safety shoes).

2) Lowering the Kelly Swivel and Drill Pipe assisted by a crane into the drilling well

1. Gravity hazard: Danger: The drill pipe that is lifted can fall from a height. Potential Hazards: The Drill Pipe (DP) that is lifted may fall from a height due to wind factors, other environmental disturbance factors, outdoor air temperature that does not comply with air quality standards. Potential risk: happen to workers who are currently working below around the work area.

Control

a) Administrative Control: 1) Before the work is carried out, it is mandatory to have SIKA which has been attached with JSA; 2) Availability of Work Over Well Service (WOWS) SOP; 3) The Emergency Response Plan (ERP) Team consists of a Medical, Evacuation, First Aid Team; 4) Active Fire Protection is available such as APAR and Hydrant; 5) Frontliner Crew Has valid Certificate of Inspection (COI) (cranes, forklifts) and other heavy equipment; 6) install Equipment Hazard Safety Sign, hovering/falling, restricted area; 7) Availability of Test / Inspection Documents, Inspection of Tubular Good maintenance (Drill Pipe, Kelly Swivel), pumps, rigs, heavy equipment such as cranes, backhoes).
b) PPE: use Complete PPE according to SOP when entering the area work (gloves, helmets, masks, vests, safety shoes).

2. Potential hazard: Strong wind conditions that could endanger heavy cranes, drill pipes and tower rigs (drilling). Potential risks: cause cranes, drill pipes and tower rigs to collapse.

Control:

a) Elimination: Pay attention to the direction of the wind, so you can avoid the danger of strong winds.
b) Engineering Controls: Measurement of working environment conditions, especially wind strength.
c) Administrative Control: 1) Before the work is carried out, it is mandatory to have SIKA which has been attached to the JSA; 2) Available SOP Work Over Well Service (WOWS); 3) The Emergency Response Plan (ERP) Team consists of the Medical Team, Evacuation; 4) Active Fire Protection is available such as APAR and Hydrant; 5) Frontliner must have a valid Certificate of Inspection (COI) (crane, forklift).
d) PPE (Personal Protective Equipment): Use complete PPE according to SOP when entering the work area (gloves, helmets, masks, vests, safety shoes).

The results of the discussion found: 7 types of hazards, namely: Biological, Physical, Electrical, Psychosocial, Chemical, Mechanical and Ergonomics, and additional hazards were also found at work stages and in the Rig Well Service (RWS) environmental area found: 3 types hazard namely Gravity Movement Hazards, Environmental Disturbance Factors and Hazards /Security Threat.

Conclusion

Based on the results of this study, it can be concluded that the number of Hazards and Risks from the stages of work: (A) Stages of work in the Rig Well Service (RWS) work area and (B) Stages of Lowering Drill Pipe (DP) into the well using Kelly Swivel during the Drill process Out Cement (DOC) in Rig Well Service (RWS) and Drilling Work Environment.

Hazard Identification

A. Identified hazards: (a) *Biological Hazards* (3 hazards: namely exposure to the Covid-19 virus, bitten by snakes and tomcats); (b) *Physical hazards* (2: namely, noise from a 95 dB generator that is >85 dB, and a fall from a height of more than 1.8 meters); (c) *Electrical hazard*

(1: is a lightning strike caused by installation equipment throughout the rig area using electrical installations (rig towers, generators, containers); (d) *Psychosocial hazards* (3: namely (work stress, workload and environmental conditions, high levels of fatigue, negligence, disregard for security and safety); (e) *Chemical hazard* (1: namely chemicals used in drilling operations, including: H2S Gas, HCl, KCl , CaCl, CO2, H2SO4, NaOh, Ammonia); (f) *Mechanical hazards* (3: namely hazards originating from all machine tools, rotating, pumps, Kelly swipe which can be reversed); (g) *Ergonomic hazards* (2: namely work positions that are not suitable when working, especially in the mechanical part, maintenance when positioning equipment).

B. In addition to the 7 types of hazards mentioned above, during the research there were also 4 additional hazards found in the drilling work and the work environment area, namely: (a) *Movement hazards* (2: namely mechanical (mechanical) pressure of rotating equipment, springs, fan belts, vehicles, moving equipment (tower rigs, drill pipes, cranes); (b) *Gravity hazard* (1: namely the danger of a Drill Pipe that could fall from a height); (c) *Danger of environmental disturbance factor* (1: namely heavy rain, lightning, strong winds (hurricane); (d) *Security Hazards/Threats* (3: Access Control Failure/Intruders (Entry and exit without permission, goods and vehicles entering/exiting the location), Air pollution (both from mobile and immovable sources), Ground water pollution).

Potential Risk Identification

A. For potential risks, risks can be found including: (a) *Biological hazard* (there are 3 risks: namely being infected with the covid virus, pain and soreness in the part bitten by a snake, blisters experiencing tomcat stung dermatitis), (b) *Physical hazard* (there are 5 risks: namely air temperature, hot weather from engine radiator steam, noise from generators 95 dB which is > 85 dB, Dust, and falling from a height of more than 1.8 meters), (c) *Electrical hazard* (there is 1 risk: namely because all installations in the drilling area use electricity so that lightning strikes cause fatalities, fire and explosion, damage company assets), (d) *Psychosocial hazard* (there is 1 risk , mental and emotional factors that cause mental and physical failure that interferes with work due to the burden of the mind), (e) *Chemical hazard* (there are 4 risks: namely chemicals in drilling operations, including: Gas H2S, HCl, KCl, CaCl, CO2, H2SO4, NaOH, Ammonia causes poisoning due to inhaling chemicals, irritation from these hazardous chemicals, shortness of breath and Fatality), (f) *Mechanical hazard* (there are 5 risks originating from all machine tools: cut, cut, fell, pinched and slipped), (g) *Ergonomics hazard* (there are 2 risks: namely back pain, low back pain, all limbs affected by ergonomic hazards experience pain).

B. In addition to the 7 types of hazards with a *total potential risk of 19 risks*, during the research it was found that there were *additional 4 types of hazards* with a total of *8 potential risks in drilling work and work environment areas* with a number of risks which can be shown as follows: (a) There are 2 *risks of movement*, namely mechanical, risk: causing the crane, drill pipe and Tower Rig to fall so that it can fall on workers in the work area, incidents of being hit and run over by cranes, pressure from rotating tools, springs, moving equipment (Tower Rig), Drill Pipes, Cranes); (b) *Gravity hazard* has 1 risk, which can befall workers working in the work area. Drill pipe hazards can fall from a height; (c) *Danger of environmental disturbance factors*, heavy rain, strong winds (hurricane) has 1 risk. Potential Risks: Causing Cranes, Drill Pipes and Rig Towers to collapse; (d) *Hazards/Security Threats*: there are 5 risks of environmental pollution that can disturb the surrounding community, the risk of terrorism, riots resulting from Access Control Failure (Entry and exit without permission, goods and vehicles incoming/outgoing location).

From the results of research on the stages of work in the drilling area at PT PTM, 13 and 7 potential hazards were found, so that a total of 20 potential hazards were found and 15 and

11 potential risks were found in the field, so that a total of 15 and 11 risks could be found. potential risks of 24 with control using controls are:

1. *Biological hazard*: Covid-19:

a) Administrative Control:

- Doing antigen tests, PCR, Doing Screening, already doing vaccines, Doing Quarantine, Cleaning work areas with disinfectants, Efforts to handle covid by means of 5M
- Bitten by a snake: Administrative Control Installing a Safety Sign. Procurement of Anti-Snake Venom Serum
- Tomcat stung: Administrative Control Conducting Tool Box Meetings, Installing Safety Signs, Spraying insect repellents in the work area

2. *Physical hazard*:

2.1 Noise from Genset 90 dB:

a) Engineering Controls: Conduct regular noise measurements with a soundlevel meter, perform maintenance on generator engines.

b) Administrative Control: Before the work is carried out, you must have SIKA attached to the JSA, Work Over Well Service SOPs are available, install a hazard safety sign, monitor the quality of the health of the work environment.

2.2. Fall from the height of the Rig platform

a) Administrative Control: before the work is carried out, you must have an SIKA attached with the JSA, Safety Sign Danger height e. Use PPE Full Body Harness.

3. *Electrical hazard*

3.1. Lightning strike causing fire and explosion of Rig (tower Rig (Drilling Rig),

a) Engineering Control: Installation of Lightning Protection b. Rigs (towers, pump skids, generators, container offices, etc.) must be equipped with a lightning rod using a standard (continuous length) grounding cable with an independent copper grounding system and a resistance measured of 1 Ohm and a maximum grounding skid of 5 Ohms.

b) Administrative Control: Before the work is carried out, you must have SIKA attached with JSA, Work Over Well Service SOP is available, Medical Team / Emergency Response Plan (ERP), Fire Protection Active is available such as Fire Extinguisher and Hydrant.

4. *Psychosocial hazard*

a) Administrative Control: Consultation with Psychologist, given training for refreshing.

5. *Chemical hazard*

a) Engineering Control: Installing 2 LEL (Lower Explosive Limit) Sensors, Installing 4 H2S Gas sensors on the Wellhead Rig Floor, Shale Shaker and Mud Tank.

b) Administrative control: Before the work is carried out, you must have SIKA attached with JSA, WorkOver Well Service (WOWS) SOPs are available, available MSDS chemical use books (Material safety data sheets), Explosion and fire hazard safety signs,

6. *Mechanical hazard*

The danger from the Kelly swivel that reverses downward when lifted up.

a) Substitution: replacement of the hydromatic system if it is no longer suitable for use.

b) Engineering Control: For security Install a Hydromatic System to regulate the rise and fall of the Kelly Swivel, Use an automatic Crown for a safety device.

c) Administrative control: before the work is carried out, you must have SIKA attached with JSA, work over well service (WOWS) SOP is available, frontliner crew has a certificate from Energy Mineral Resources.

7. *Ergonomics hazard*

a) Administrative Control: Work according to SOP in working related to the correct working position and procedures must be followed.

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