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Job Hazard Analysis for Critical Lifting Using Crane in Oil and Gas Industry

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Abstract: The lifting activity separated to two categories which were general lifting and critical lifting in some of oil and gas industry. A critical lifting was a rigging activity that required a comprehensive plan to minimize the risk of crane failure or catastrophic loss in the oil and gas industry. Over the past several years, the number of accidents happened in the company was slightly increased from year to year due to various type of operation in there. One of the activities that quite making the number increased was lifting activity. The method used has been shown effectively in result making. Past incident records were used as a reference to differentiate data that has been recorded from year to another year and has been summarize too. The creation of a Job Hazard Analysis (JHA) was the main method used to reduce the risk of accidents happened based on past incident records. This method is further strengthened by the observation on site method. The Job Hazard Analysis form was used to determine how to complete a task step by step, as well as any risks connected to the task and any controls to reduce those risks. As a result, the number of incidents happened during critical lifting activity shows a decrease from year to year. This might be because of several method that has been used to reduce this incident and the implementation of Job Hazard Analysis was the most effective way to used. It was because the Job Hazard Analysis process focuses on four interconnecting relationships which was the worker, task, tools and environment. For the conclusion, the research can be used as a reference to help with problem-solving strategies and the analysis that have been made can support community of safety and health in the oil and gas industry to promote safety and health at the workplace. Finally, this study offers hope for enhancing a positive safety culture at work.

Keywords: Oil and Gas, Critical Lifting, Job Hazard Analysis

1. Introduction

In oil and gas industry, there are various type of activity that can cause the number of accidents happened increase. One of the activities involved was lifting activity. Lifting activity or operation are essential in any construction, shipbuilding, ship repair or manufacturing process. This activity has created a challenge not only to oil and gas industry but other industry too. Due to high number of accidents happened when proceeding this activity based on past incident record, Job Hazard Analysis (JHA) need to be created in minimizing the risk of accidents happened. JHA tool is used to identify how to perform a task step by step, as well as any hazards associated with the task and controls to mitigate the hazards.

1.1 Problem statement and objectives

Over the past several years, the number of accidents happened in the company was slightly increased from year to year due to various type of operation in there. One of the activities that quite making the number increased was lifting activity. Accidents also happened due to lack of knowledge in differentiate between general and critical lifting by the workers. Besides, this activity can be considered as one of the most activities that is being held in sites. There are many hazards and near miss accidents record in this lifting activity or operation for example falling of load, hitting & crushing of a load to existing facilities, toppling of crane, high wind speed, poor communication and poor visibility and damage to underground utilities of earth.

The objectives of this study are:

1. To identify critical lifting process in oil and gas industry.
2. To determine potential hazards that occur during critical lifting activity.
3. To propose control measure during critical lifting activity to minimize risk of accident.

1.2 Expected outcome

This research is a contribution to the application of proposing risk assessment in minimizing the risk and hazard in critical lifting activity where there were several cases or accident happened before this using other methods. Therefore, this research provides insight to which method of assessment are most effective to minimize the risk and hazard occurred in the work area.

2. Materials and Methods

Planning for early stage such as observation on site has been carried out and followed by records incident from past several years for data analysis.

2.1 Materials

Past study, journals and research was gathered to get better understanding of this study specifically in oil and gas industry. It is all related to the issues with crane, safety practice, safety system, etc.

2.2 Methods

For the purpose of this investigation, a quantitative methodology has been put into place as one of the components. This will be accomplished through the conduct of a risk assessment using Job Hazard Analysis (JHA) in critical lifting activities, observation and records based on past accidents. The results of the methods that were put into action will be factored into the compilation and examination of the data that is gathered. The first method is collecting data from past record then analyze the data collection that has been collected. After that, an observation on work area will be conduct. The next step is implementation of JHA based on data collected, observation taken and discussion with industrial supervisor to get the better result. The research flowchart is as below:

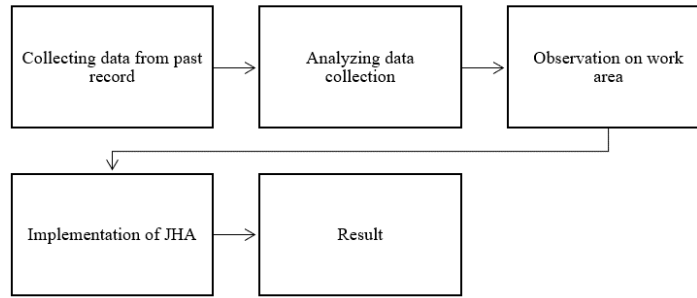


Figure 1: Research flowchart

3. Results and Discussion

The result will provide an explanation of the various techniques that were applied in the process of data collection and analysis that were pertinent to the research. The purpose of this study on research methods is to make the study more methodical and to ensure that the subsequent stages of this study will be more organised. The methodological study that is currently being carried out has the purpose of determining the strategies or processes that were utilised in the study to acquire responses to each question that was included in the study's objectives.

It also presents these findings in-depth and discusses on critical lifting process, data collection from past incident record and potential hazards of this activity. Each piece of information collected was subjected to an analysis known as a Job Hazard Analysis (JHA). By using data incident record, the effectiveness of preventive measures in JHA risk assessment in identifying hazards and controls to mitigate the hazards can be determined.

3.1 Results

Critical lifting activity can be determined as high possibility of hazard can be occurred. Therefore, a safety precaution needs to take before this activity happened. These are the potential hazards that can occur during critical lifting:

Topple, collapse and collision	Limited visibility	Loads hit live pipeline
Crane and lifting gear failures	Falling object	Sharp edges & pinch point
Crush/Struck by load	Fatigue	Bad weather

Figure 2: Potential hazard of critical lifting

A job hazard analysis (JHA) is a tool that breaks down every job or process into individual tasks to identify the associated hazards. With those hazards picked out, a method of hierarchy controls can be used to deal with it. The hierarchy of controls starts with elimination and works down to substitution, engineering controls, administrative controls, and finally, PPE. First goal is to eliminate the hazard. If eradicating it isn't possible, then replace the hazard, isolate the hazard, divert people away from it, and provide people with PPE if they must interact with it. The JHA process focuses on four interconnecting relationships: the worker, task, tools, and environment. JHAs are a vital part of the safety landscape

because it allows to be proactive and systematic in job and process design. When build safety into the systems rather than using it as a blanket, it's had more tools at organization disposal to prevent incidents and limit hazards. The JHA process focuses on four interconnecting relationships: the worker, task, tools, and environment. Below shown JHA that has been create by researcher.

Table 1: Job Hazard Analysis briefing form

Step No.	Description of Step/ Task	Potential Hazards & Consequences	Who or What might be harmed (PEAR)	Initial Risk Rating	Control and/or Recovery Measures	Final Risk Rating	Action/Responsible Person (s)		
1.0	Critical Lifting using Crane Critical Lift - Crossing live, Tandem lift, Load >20T, Night lifting, Blind Spot, Over 75% load capacity, lift of special load and Others	1.1	Topple, collapse and collision	People / Asset	VH	1.1.1	Every critical liftings need approved lifting plan from the company	M	Receiving Authority / Supervisor / Workleader
					VH	1.1.2	All involved personnel should be brief prior lifting activity and wear orange vest	M	Receiving Authority / Supervisor / Workleader
					VH	1.1.3	Crane operator needs to have a valid driving license (JPJ & DOSH)	M	Receiving Authority / Supervisor / Workleader
					VH	1.1.4	Authorized signalman to be at site at all time during lifting activity	M	Receiving Authority / Supervisor / Workleader
					VH	1.1.5	Outrigger to be fully deployed and rest on sole plate/wooden block	M	Receiving Authority / Supervisor / Workleader
					VH	1.1.6	Use proper size of sole plate/wooden block	M	Receiving Authority / Supervisor / Workleader
					VH	1.1.7	Do not lift more than 75% of crane load capacity	M	Receiving Authority / Supervisor / Workleader
					VH	1.1.8	Authorized rigger and safety supervisor shall fully monitor critical lifting activity at site	M	Receiving Authority / Supervisor / Workleader
					VH	1.1.9	Any deviation from approved lifting plan shall be re-verified by lifting supervisor	M	Receiving Authority / Supervisor / Workleader
					VH	1.1.10	Ensure crane being inspected by the company	M	Receiving Authority / Supervisor / Workleader
	1.2	Limited visibility (Blind spot/Night lifting)	People / Asset	H	1.2.1	To have adequate lightings for night lifting	M	Receiving Authority / Supervisor / Workleader	
				H	1.2.2	To establish proper communication tools eg. Walkie talkie	M	Receiving Authority / Supervisor / Workleader	
				H	1.2.3	To use 2 signalman if there is restriction of vision on the 1st signalman	M	Receiving Authority / Supervisor / Workleader	
				H	1.2.4	To get approval with company area owner	M	Receiving Authority / Supervisor / Workleader	
				H	1.2.5	To use non explosive lighting / inspected lighting equipment.	M	Receiving Authority / Supervisor / Workleader	
	1.3	Load hits live pipeline or live equipment	Asset	Asset	VH	1.3.1	Install 2 taglines on each side of the suspended load during lifting & 2 persons to control the tagline.	M	Receiving Authority / Supervisor / Workleader
					VH	1.3.2	Only competent rigger and signalman (with orange vest) are allowed to perform rigging and lifting activities and ensure proper rigging method	M	Receiving Authority / Supervisor / Workleader
					VH	1.3.3	Crane operator must only follow the instructions of competent signalman	M	Receiving Authority / Supervisor / Workleader
					VH	1.3.4	Communication between the crane operator and signalman shall be clear using walkie talkie / hand signal.	M	Receiving Authority / Supervisor / Workleader
					VH	1.3.5	Crane operator must be competent and have experience working in the company area.	M	Receiving Authority / Supervisor / Workleader
					VH	1.3.6	Operated at specified load & radius as per stated in approved lifting plan & lifting certificated	M	Receiving Authority / Supervisor / Workleader
	1.4	Crane and lifting gears failures	People / Asset	People / Asset	H	1.4.1	All lifting gears/equipment's must have test certificate and marking with inspection tagging. Daily inspection by RA/WL	M	Receiving Authority / Supervisor / Workleader
					H	1.4.2	To replace defect lifting gear with a new and remove the defect item from site	M	Receiving Authority / Supervisor / Workleader
					H	1.4.3	Check chains, shackles, hooks and rings for cracks, corrosion and wear and tear	M	Receiving Authority / Supervisor / Workleader
					H	1.4.4	Lifting gears/equipment inspected and tagged with inspection tagging	M	Receiving Authority / Supervisor / Workleader
					H	1.4.5	Do not exceed the safe working load limit (SWL) when lifting	M	Receiving Authority / Supervisor / Workleader
H					1.4.6	Ensure webbing sling is padded if in contact with sharp edges of the load to ensure sling not damaged	M	Receiving Authority / Supervisor / Workleader	

	1.5	Falling object due to wrong rigging method	People / Asset	H	1.5.1	To use a double choke hitch around the load to prevent load slippage when lifting rounded material	M	Receiving Authority / Supervisor / Workleader	
			People / Asset	H	1.5.2	To use spreader bar with proper padding to prevent excessive side pressure on the load (if applicable)	M	Receiving Authority / Supervisor / Workleader	
			People / Asset	H	1.5.3	To use taglines to prevent load rotation	M	Receiving Authority / Supervisor / Workleader	
			People / Asset	H	1.5.4	For loose material, use approved bucket etc	M	Receiving Authority / Supervisor / Workleader	
			People / Asset	H	1.5.5	Barricade area within lifting radius and display signage (white red tape)	M	Receiving Authority / Supervisor / Workleader	
			People / Asset	H	1.5.6	Prevent workers from working / passing by under the suspended load	M	Receiving Authority / Supervisor / Workleader	
			People / Asset	H	1.5.7	To refer load chart before doing lifting	M	Receiving Authority / Supervisor / Workleader	
			People / Asset	H	1.5.8	To prevent/control authorized person from passing barricade area	M	Receiving Authority / Supervisor / Workleader	
			People / Asset	H	1.5.9	Authorized/competent rigger to properly monitor the correct rigging method	M	Receiving Authority / Supervisor / Workleader	
				1.6	Sharp edges and pinch point	People	M	1.6.1	Cover sharp edges with a cotton rags (if required)
People	M	1.6.2				Wear glove (semi leather glove) as per PTW requirements	L	Receiving Authority / Supervisor / Workleader	
	1.7	Crush/Struck by load	People / Asset	M	1.7.1	Lift load slowly	L	Receiving Authority / Supervisor / Workleader	
			People / Asset	M	1.7.2	To use taglines to prevent load rotation	L	Receiving Authority / Supervisor / Workleader	
			People / Asset	M	1.7.3	Load must not left unattended	L	Receiving Authority / Supervisor / Workleader	
			People / Asset	M	1.7.4	Do not stay or bypass under the suspended load	L	Receiving Authority / Supervisor / Workleader	
			People / Asset	M	1.7.5	Barricade and signage at the lifting area (white red tape)	L	Receiving Authority / Supervisor / Workleader	
			People / Asset	M	1.7.6	Competent crane operator	L	Receiving Authority / Supervisor / Workleader	
	1.8	Fatigue	People	M	1.8.1	Work rotation for workers	L	Receiving Authority / Supervisor / Workleader	
			People	M	1.8.2	To follow as per fatigue schedule	L	Receiving Authority / Supervisor / Workleader	
	1.9	Bad Weather	People / Asset	M	1.9.1	Stop work during the heavy rain, strong winds and thunderstorms	M	Receiving Authority / Supervisor / Workleader	
			People / Asset	M	1.9.2	Crane operator shall lower down the boom before leaving	M	Receiving Authority / Supervisor / Workleader	
2.0	Housekeeping	2.1	Slip, trip and fall	People	M	2.1.1	Work area shall be free from loose / un-used material	L	Supervisor / Work Leader
				People		2.1.2	Tools and material shall be kept in the proper container		Supervisor / Work Leader
		2.2	Back pain/ergonomic problem due to manual handling	People	M	2.2.1	Use correct/proper tools & proper manual lifting method	L	Supervisor / Work Leader
				People		2.2.2	Wear proper PPE as per PTW		Supervisor / Work Leader
				People		2.2.3	Correct body posture & do not over stretch body		Supervisor / Work Leader
				People		2.2.4	Working in buddy system		Supervisor / Work Leader
		2.3	Waste Disposal (Domestic & Scheduled waste)	Environment	L	2.3.1	To segregate domestic and scheduled waste	L	Supervisor / Work Leader
				Environment		2.3.2	To properly allocate the scheduled waste in drum and labelling		Supervisor / Work Leader
				Environment		2.3.3	To seal the drum once the scheduled waste full		Supervisor / Work Leader
				Environment		2.3.4	Send the full schedule waste drum to the scheduled waste storage		Supervisor / Work Leader
Environment	2.3.5			Remove domestic waste by daily basis		Supervisor / Work Leader			
Environment	2.3.6			Ensure the liquid/sludge like waste are not dripping from the drums/pallets to avoid spillage during transferring of drums.		Supervisor / Work Leader			
Environment	2.3.7			Ensure the maximum level of waste in drums do not exceed 80% to avoid spillage during transferring of drums.		Supervisor / Work Leader			
Environment	2.3.8			Scheduled waste drum/container must be put on concrete or on proper lining (e.g canvas, hdpe lining) with proper bunding to avoid spillage.		Supervisor / Work Leader			

4. Conclusion

This chapter concludes the results and findings from this study. Discussion on each objective of this study were elaborated based on the results and analysis of the data. The limitation of the study also

stated in this chapter. Conclusion and the aim on the whole project were then stated followed by recommendations to improve the study in the future.

As per objective 1 which is identify critical lifting process can be solve by differentiate between general and critical lifting. Critical lifting has it characteristic as shown in result and discussion. For the result that has been collected from past year incident record, it shows that workers are slowly to understand the meaning of critical lifting. For conclusion, all workers need to be brief for better knowledge on identifying the term of critical lifting.

The potential hazard on critical lifting can be observe during the activity happened. This can be done by observation from researcher on work area that has been chosen. As stated in result, the potential hazard has been determined and all this hazard can be prevented.

For the last objective which is the control measure used to minimize the risk, it can be seen that the researcher have chosen Job Hazard Analysis method as a main control measure. Besides, JHA can be revised time by time which means the responsible person who created this method can amend or improve on the control measure that has been used. Job hazard analysis is proven to be the best method in this case study.

A similar study could be conducted with higher number of evidence during incident to achieve a better explanation to worker on dangerous of this critical lifting activity. Besides, this report can serve as a guide or reference for figuring out how to reduce the severity of the problems. Aside from that, the analysis has the potential to improve the community's overall health and safety in the oil and gas industry.

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