

**Original Research Paper****The risk analysis of workers at height at construction companies in Kepulauan Riau****Meidia Wahyuni, Herniwanti\*, Ahmad Satria Efendi, Endang Purnawati Rahayu, Asril**

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**Abstract**

Construction work cannot be separated from working at heights that have a high risk of danger and accidents. The purpose of this study was to analyze the risk of work at height at a construction company in Kepulauan Riau. The method used descriptive qualitative with sampling using the snowball technique. The results of hazard identification using the HIRARC method were obtained from 2 activities with 22 potential hazards with a very high risk level of 13, priority 1 of 6 and substantial of 3. The control hierarchy that had been carried out by the company was engineering control, administrative and use of Personal Protective Equipment.

**Keywords:** construction company; risk analysis; risk assessment; risk control; working at height**1. Introduction**

Workplace accidents at height work had occurred in several areas, such as in Batam (16/3/21) there was an accident at PT ASL Shipyard which killed 1 worker due to the worker's own negligence. Working at heights has a large potential for danger. Work accidents that occur in this work have become the biggest contributor to fatality accidents in the construction industry (Gemely, 2018). The high number of work accidents is still a topic of discussion in a company to find solutions to existing problems. Work accidents generally occur in the construction industry (Mardlotillah, 2020). Progress in the construction industry is currently making an important contribution to the development and economic growth in Indonesia. It can be seen that the progress of the construction industry has not shown a balance between the progress of the development program and the increased awareness of the importance of Occupational Health and Safety (OHS) Management. (Liy, Ibrahim, Affandi, Rosli, & Nawi, 2016; Safitri & Widowati, 2017).

Several ways can be done to reduce the risk of work accidents at work at heights. Analysis of risk is the first step that can be done by identifying hazards clearly and knowing the dangers that will be faced when doing a job (Ira, Mulyani, & Nuh, 2016; Mulyani, 2016). It is also necessary to carry out a risk assessment afterwards as a selection stage to determine the level of risk in terms of the likelihood of occurrence and the severity of the incident (Ramli, 2014). After that, it can be ascertained that control efforts are in accordance with the existing risks by taking into account the hierarchy of risk control such as elimination, substitution, engineering control, administration and the last step is the use of PPE. The method that can be used is the HIRAC method. By using the HIRAC method, risk control efforts can be carried out and the possibility of work accidents is getting smaller and mitigation can be done properly (Akbar, Indarjo, & Wahyuningsih, 2015; Rawis, Tjakra, & Arsjad, 2016).

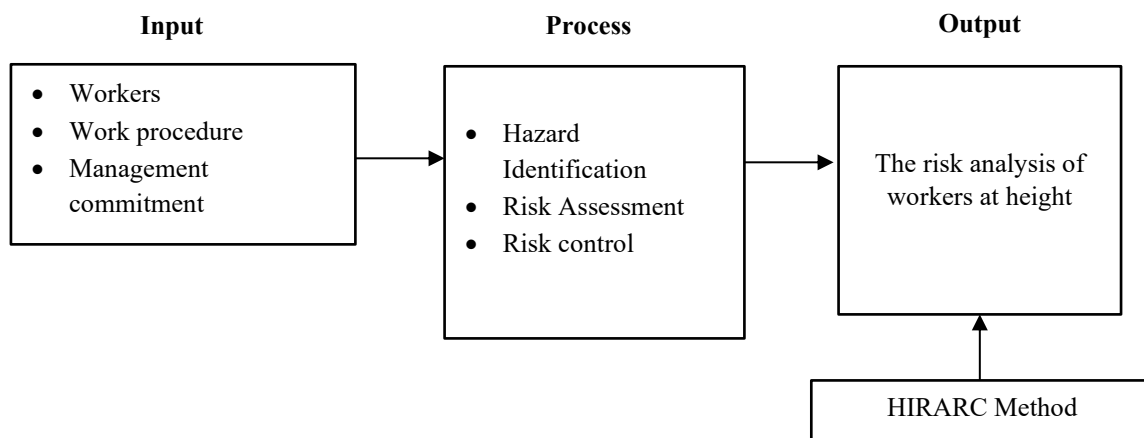
The Construction Company is a domestic private company located in Kampung Melayu Gunung Kijang, Bintan Regency, Kepulauan Riau. The company provides a complete range of services for oil and gas projects from engineering, procurement, construction, installation and commissioning of

pipelines and modules especially for oil and gas projects. Work at heights has dominated the company's work area in the construction of jackets and topsides of up to 40 meters. This construction company has experienced an increase in accident cases that occurred in 2020 to 2021 which were only recorded until June. The total number of accidents that occurred in 2020 was 14 cases to 17 cases until June 2021. This data is supported after seeing firsthand the situation in the field, there is one worker who does not attach the safety latch hook to the hand drill. This data is sufficient evidence that occupational safety and health problems in Indonesia are still often neglected (Sangaji, J, Jayanti, 2018; Zainal, Monica, & Noeryanto, 2019) .

The purpose of this study was to analyze the risk of work at height at a construction company in the Kepulauan Riau. Specifically to identify workers, work procedures, management commitment, job hazards, as well as assessment and control of work risks at heights at Construction Companies in the Kepulauan Riau. Because work in the construction industry sector has a high risk of accidents.

## 2. Method Research

The research method used in this research is descriptive qualitative using in-depth interviews with individuals to obtain a complete description. Data were obtained from informants through an in-depth interview process using interview guidelines, field observations and document searches. The selection of informants used a non-probability sampling approach with a snowball sampling technique. The informants in this study were *Safety Engineer, Sr. Safety Coordinator and Safety Admin* as key informants, workers at height as key informants, Safety Officers and Safety Inspectors as supporting informants.



**Figure 1. Research flow**

The study was conducted from August to September 2021. In this study, the variables to be studied were labor, work procedures, management commitment, hazard identification, risk assessment and risk control. To maintain the truth of the information collected in this study, the researchers triangulated to analyze the data that had been obtained previously.

**Table 1.** Definitions of terms for research paths.

Variable	Definition of Terms	Measuring instrument	Data Measurement Method
Labor	People who are trained and have the ability to produce goods or services	Interview guide and checklist sheet <i>Source: Modification</i> (Peraturan Menteri Ketenagakerjaan Republik Indonesia Nomor 9, 2016)	In-depth interview, observation and document review
Work procedures	Structured procedures for using work tools properly and performing work correctly in order to work safely at heights	Interview guide and checklist sheet <i>Source: Modification</i> (Regulation of the Minister of Manpower of the Republic of Indonesia Number 9 of 2016 concerning Occupational Safety and Health in Work at Height, 2016)	In-depth interview, observation and document review
Management Commitment	The obligation of a management to protect workers from the dangers of working at heights	Interview guide and checklist sheet <i>Source: (Liy et al, 2016)</i>	In-depth interview, observation and document review
Hazard Identification	Efforts are made to find and find out the factors that will cause accidents and occupational diseases	Interview guide and checklist sheet <i>Source: Modification</i> (Akbar et al., 2015)	In-depth interview, observation and document review
Risk Assessment	Stages of selection to determine the level of risk	<i>Risk matrix</i> semi-quantitative technique <i>Source: (Ramli, 2010)</i>	In-depth interview and document review
Risk control	Ways to reduce or control a risk that occurs	Interview guide and risk matrix <i>Source: (Ramli, 2010)</i>	In-depth interview, observation and document review

### 3. Results and Discussion

*Work at Height Regulation 2005* argues that working at height is working anywhere including above or below ground level that has access or a way out while working except having stairs in a fixed workplace (Health and Safety Executive, 2014). Various methods of working at heights such as the use of scaffolding, ladders, gondolas and access systems using ropes make this work having a high potential hazard. For this reason, the board or management responsible for this type of work needs to review the use of methods that specifically pay attention to aspects of effectiveness and risks that are financial and non-financial. (Decree of the Director General of Labor Inspection No. KEP. 45/DJPPK/IX/2008 concerning Guidelines for Occupational Health and Safety at Height Using Rope Access, 2008). Risk is a combination of several hazardous conditions or impacts with the severity obtained from the injury caused by the situation and the impact itself (OHSAS180001:2007, n.d.; Rout, B. K., & Sikdar, 2017).

**Table 2.** Observation of job requirements at height

Observed components	Information
Worker competency certificate	There is
Safety Induction	Implemented
Work permit implementation	Implemented
Medical examination	Implemented

Source: Primary data from research

Table 2 shows that the workers were given induction first and carried out the work permit procedure (permit to work). Before starting work activities at height, the workers were subjected to a health check in the form of checking blood pressure and oxygen saturation. The following was the narration of the informants obtained from the interviews.

"we have to have such a thing as a permit to work, especially for working at heights (Informant 1).

"of course they have done safety induction and have done and received training to work at height" (Informant 3).

"People who are going to work are checked for tension by the medical team and if they are already worthy of the tension, they are healthy and then they can work at heights. (Informant 6).

The company has requirements for workers who will work at heights, including safety induction. Then after that permit to work which furthermore, when starting working at height, a health check will be carried out such as measuring blood pressure and oxygen saturation. In addition, as workers who will work at heights, they must also have qualifications as evidenced by the existence of an Operating Permit (SIO) and use complete Personal Protective Equipment (PPE) such as a body harness which is a mandatory Personal Protective Equipment (PPE) for working at heights (Atmaja, Suardi, Natalia, & Mirani, 2018). After all the requirements are met and declared fit for work by the authorities, the work at height can be carried out by the workers (Ramdan & Handoko, 2016).

Work procedures as one of the requirements for working at height must be owned by the Employer or Management. This procedure is written which includes:

- a. Methods and ways to protect yourself from falling
- b. Equipment handling method
- c. Methods and way of carrying out supervision on a job
- d. Protect the work area
- e. Emergency vigilance and response

Implementing proper work procedures is an important part of doing work at heights. With the existence of work procedures made by the Employer or Management so that it can be understood properly by the workers or people involved in the work before the work begins (RI, 2016).

**Table 3.** Observation of work procedures

Observed components	Information
availability of work procedures	There is
Implementation of understanding work procedures	There is

Source: Primary data from research

Table 3 shows that the company already has procedures for working at heights. The procedure is contained in the permit to work where it is explained before starting work at height. In addition, training is also carried out in order to provide understanding to workers regarding procedures for working at heights. After providing training related to the type of work to be carried out, it is continued with an evaluation process to find out the extent to which workers understand about working procedures, especially at work at heights (Mardison & Sariah, 2017; Persada, 2015). Evaluation is carried out by asking questions related to the work to be done, from this evaluation process results will be obtained stating that the worker is eligible to work at height by going through the following stages. Once in the field, supervision will be carried out by the supervisor and Sr. safety officer in order to supervise workers so that they can work in accordance with existing procedures (Martawi & Koesyanto, 2017; Sirait & Paskarini, 2016).

The failure to understand and implement work requirements and procedures is a failure of the management's commitment to a company which ends up in workers' loss. This can be seen directly from the impact of management's failure to provide PPE such as safety boots, safety belts and safety helmets which can result in falling accidents. PPE is an important safety equipment that must be provided by management to workers whenever working on a construction site. Apart from PPE, lack of education such as safety training and orientation can also increase the risk of falls for workers at height due to poor worker (Fairyo & Wahyuningsih, 2018; Liy et al., 2016).

Although there are still obstacles in the implementation of the company's management commitments, these obstacles can be overcome. The importance of suggestions or thoughts from various parties by forming a cooperation in order to make improvements in the implementation of management commitments that are even better. One of the efforts that can be done is to conduct a risk analysis on work at height starting with the implementation of hazard identification. The hazard identification process in the Company is carried out by supervisors and safety officers. The methods used in this hazard identification are Job Risk Assessment (JRA) and HIRADC (Alfiansah & Kurniawan, 2020).

The steps that can be taken in analyzing risks in work at heights are by identifying hazards which are providing overall and detailed information about risk discovery which also includes the impact of the risks found from mild risks to severe risks (ILO, 2013). Furthermore, a risk assessment is carried out which is a selection stage to determine the level of risk seen from the possibility of occurrence and severity (Ekasari, 2017).

To reduce the likelihood and severity of this, it is necessary to carry out risk control. There is some hierarchy of control that needs to be done on this type of work at height which is useful for obtaining relevant and appropriate countermeasures. This activity is commonly referred to as Risk Analysis. The method that can be used is the HIRAC method. By using the HIRAC method, risk control efforts can be carried out and the possibility of work accidents is getting smaller and mitigation can be done properly (Abryandoko, 2018; Akbar et al., 2015).

**Table 4. Risk analysis observation**

<b>Observed components</b>	<b>Information</b>
Implementation of hazard identification	Implemented
Implementation of risk assessment	Implemented
Implementation of risk control	Implemented

Source: primary data from research

Based on Table 4, the Company has carried out hazard identification at work at heights. Hazard identification really needs to be done in every area of the production process. Because within a company

has different potential hazards in each production process. This is done so that workers know the dangers that will be faced when doing a job and can know what they should do when the danger will come (Rinawati, 2018). Hazard identification is the provision of overall and detailed information about risk findings which also includes the impact of the risks found from mild to severe risks. The steps that can be taken when identifying hazards according to Afifuddin (2019) as follows:

- a. Form of activity or working area conditions
- b. Potential hazard
- c. Impact of danger
- d. The degree of impact of the hazard
- e. Chance rate
- f. Handling

The results of the hazard identification are as many as 22 potential hazards at work at heights at this Construction Company. Based on an in-depth interview with one of the informants that there was an incident in the form of a nearmiss or First Aid Case (FAC) that occurred in the Company. In addition, during the observation, there was one worker who did not attach the safety latch hook to the hand drill. The results of this in-depth interview and observation reinforced by the process of searching related documents were in accordance with the narration of the informants.

After knowing the potential hazards at work at heights, it is necessary to carry out a risk assessment to determine the level of risk in terms of the likelihood of occurrence and severity. The technique in carrying out the risk assessment that the researcher used was a semi-quantitative technique which was considered more concrete because it was expressed in numerical form and this technique was very dependent on the accuracy and completeness of the information (Moniaga & Rompis, 2019). The stages of semi-quantitative analysis were as follows:

- a. Carried out hazard identification using a hazard analysis sheet
- b. Conducted risk assessment based on risk score
- c. Determined the level of risk

Table 3 shows that the company had carried out a risk assessment in determining the amount of exposure to a risk/hazard that might occur. Researchers conducted a risk assessment referring to the Australian Standard/New Zealand Standard model by analyzing the probability level. This probability level analysis was carried out to determine the possibility of an accident caused by work activities (C. Yuliani, 2016; F. P. Yuliani & Umar, 2019; U. Yuliani, 2017). After that, it was continued by analyzing the consequence risk assessment to assess how big the consequences would be if the accident occurred. And the last one was by conducting an exposure risk assessment analysis to assess how much exposure caused by an accident. According to the results of the risk assessment that had been carried out, the level of risk was obtained with the following classifications: very high 13 potential hazard, priority 1 6 potential hazard and substantial 3 potential hazard (Rosdiana & Anggraeni, 2017; Rosdianawati & Gusdini, 2020). The main and the most fatal risk when working at height is falling. For this reason, employers must ensure safety measures where there is a risk of falling (D. I. Prabawati & Mifbakhuddin, 2019; Z. Prabawati, 2018). To reduce the impact of hazards that will occur, it is necessary to carry out risk control efforts. Efforts in risk control are a step to control emerging risks so that they can be eliminated or minimized to a tolerable limit (Wijaya, A. Panjaitan, T, W, S. Palit, H, 2015; Wulandari & Widajati, 2017) in his research explains that risk assessment is a step used to provide an overview of the level of risk of a work activity. For this reason, control efforts are required to be guided by a hierarchical control approach, namely elimination, substitution, engineering, administration and Personal Protective Equipment (PPE). This control hierarchy is intended to be a reference in carrying out the steps to prevent and control risks that will later arise (Ihsan, Hamidi and Putri, 2020).

As for the 5 hazard control efforts, 3 of them have been carried out by the Company. This effort is engineering control by installing barricades at certain work locations to limit the scope of work that is

considered dangerous if passed by other workers (Ismiyati & Sanggawuri, 2020)(Ismiyati & Sanggawuri, 2020). Furthermore, administrative efforts are carried out by carrying out work procedures according to the type of work carried out and the last is the use of personal protective equipment as the last step in the risk control hierarchy so as not to cause health problems related to ergonomics in working at heights (Fitriani et al, 2022).

Procedures for working at heights are needed in order to provide information related to safe working procedures at work at heights. In addition, to provide further understanding by conducting training to increase the knowledge of workers and as a process of reminding them of working procedures at work at heights so that workers know and understand. Furthermore, supervision is carried out to monitor the implementation of work procedures when work at heights is in progress or in hospitals to clean tall buildings (Jehan Al Habib Murvi, Endang Purnawati Rahayu, Aldiga Rienarti Abidin, Herniwanti, 2022; Marzuki, Afandi, & Endang, 2021).

By providing facilities in the form of Personal Protective Equipment (PPE), workers can carry out their work activities safely (Ardhana & Mahendra, 2021; Mahendra & Kurniawan, 2017). Not only used but Personal Protective Equipment (PPE) must also be treated and inspected to determine the suitability of the tool when it will be used on work at heights (Hernandi & Tamtana, 2020). In addition, providing understanding to workers such as training is very helpful in adding information and knowledge to workers related to work at heights, including in palm oil mill companies (Aishakina, Dewi, & Purnawati Rahayu, 2021),

The implementation of hazard identification is very necessary to find out which hazards have the potential to cause an accident or disease caused by the work itself (Messah, Bella, & Lolo, 2015). In addition, in the process of identifying the hazards found, they can be re-analyzed so that any efforts can be made to minimize these hazards. There needs to be an understanding regarding the identification of this hazard to workers (Handari & Qolbi, 2021; Rethyna, 2018). For this reason, workers can participate in this hazard identification process. Because workers also know the potential hazards in their work place and process, even if it's in the office or in the hospital (Mega Ratu, Endang Purnawati Rahayu, Masribut, Herniwanti, 2021; Sovia Arisandhi, Santoso, M. Kamali Zaman, Herniwanti, 2022).

The risk assessment is intended to find out how much potential danger will occur at work at height (Askhary, 2017). Therefore, in carrying out a risk assessment, it can be done by discussing between workers and safety who conduct a risk assessment. high to avoid risk (Wahyuni et al., 2021)

The efforts of risk control that can be made by carrying out a hierarchy of hazard control starting from the hazard elimination stage, if the hazard is impossible to eliminate then proceed with the substitution stage. Then proceed with engineering control, namely the provision of boundaries for certain work areas. Furthermore, administrations such as doing work rotations to reduce risk exposure and the last is Personal Protective Equipment (PPE)(Kartika, Purnawati Rahayu, Zaman, Studi Magister Kesehatan Masyarakat, & Hang Tuah Pekanbaru, 2022).

#### **4. Conclusion**

The conclusion of this research is that the construction company has carried out a risk analysis on work at heights. Although in the implementation of the components there are still obstacles. There was an increase in near miss and first aid cases (FCA) from 2020 to 2021 and there were workers who did not attach the safety latch hook to the hand drill during observation. It was obtained from the results of the risk analysis that there were 22 potential hazards from 2 work activities at heights with the following risk levels: very high with 13 potential hazards, priority 1 with 6 potential hazards and substantial 3 potential hazards. The control hierarchy has been carried out by the company from 5 hazard control efforts, 3 of which have been implemented. The effort is engineering control by installing barricades at certain work locations to limit the scope of work that is considered dangerous if passed by other



workers. Furthermore, administrative efforts are carried out by carrying out work procedures according to the type of work carried out and the last is the use of Personal Protective Equipment (PPE) as the last step in the risk control hierarchy.

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