

Conference Paper

Risk Assessment of Work Accidents Among Loading and Unloading Workers at Terminal III (Ocean-going) of the Port of Tanjung Priok

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Abstract

Loading and unloading activities involved in removing and loading goods from ship to port or vice versa are associated with a high risk of work accidents. This loading and unloading activity includes several different processes, such as stevedoring, cargodoring, receiving, and delivery. The aim of this descriptive research study is to identify the risks and hazards associated with loading and unloading processes at Tanjung Priok Port Terminal III. Occupational accident and occupational health hazards data were collected using the HIRA method. Health and safety interventions play a critical role in finding and minimizing or eliminating existing risks, so that port workers can maximize their health and safety at work, and the company can profit maximally from its workers' excellent service.

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1. Introduction

In addition to human mobility, the mobility of goods is an important indicator of rapid national economic development. In Indonesia, the inter-island and inter-country distribution of most goods can only be accommodated more efficiently through marine transportation modes and routes, considering it is an archipelago country. Indonesia's port of Tanjung Priok in Jakarta has become a hub for national and international trade due to a number of advantages with regard to customs, the infrastructure, and other facilities. Based on the central statistics of the province of Jakarta data, during the period 2010-2014, the number of ships leaning on the port of Tanjung Priok fluctuate, in 2010 as many as 17,457 ships, increased to 18,914 ships in 2011, then in 2012 decreased to 18,832 vessels and in 2013 amounted to 18,283 ship, in 2014 again dropped to 16,747 ships. Of the 16,747 ships leaning on the port of Tanjung Priok, 12,574 ships

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are inter-island ships and 4,173 inter-country vessels. The 4,173 inter-country vessels are unloading 18,304,225 tons and loading 4,106,727 tons; with such loading density and adequate working shifts will increase the risk of accident occurrence.

The activities at the container port are not without risk. Based on data obtained from the Maritime Department of Hong Kong, the incidence of accidents related to cargo handling/loading and unloading containers in Hong Kong is quite high. In 2006, 302 cases of work accidents related to loading and unloading containers took place. In 2007, there were 240 cases of work accidents related to loading and unloading containers. The following years, 2008 to 2010, recorded 220 cases, 176 cases and 157 cases for each year, respectively.

Meanwhile, Hardianto [1] identified 46 potential hazards associated with manual loading and unloading activities at Cooling Terminal at Tanjung Perak Port of Surabaya—6 physical hazards, 1 chemical hazard, 3 biological hazards and 2 ergonomic hazards. The highest risk value of risk analysis is 15 that is the danger of falling and being hit.

Based on the preliminary survey conducted at Tanjung Priok port terminal III, it was found that the tools used in loading and unloading process such as QC (Quany Crane), RTG (Rubber Tired Gantry), HMC (Harbor Mobile Crane), CC (Container Gantry Crane) (Reach Stacker), RS (Reach Stacker), and FL (Fork Lift) in technical field workers and loading and unloading workers are faced with high, medium and low risk, such as while moving containers in loading and unloading process, workers are at risk of striking that can result in injury, physical disability and even death. Crane displays the dangers that engineering cannot eliminate, in this case the corresponding hazards can be reduced to the extent permitted by skill training, caution and good judgment [2].

In order to reduce the number of occupational accidents, everything must be in synergy. According to Suma'mur [3], safety and health work encompasses safety issues related to the machine, the aircraft, the work tools, the materials and the process of management, the type of work and environment, and the manner of doing the work. As loading and unloading workers face high and even fatal risks, health and safety interventions play a vital role in finding and minimizing or eliminating existing risks, so that workers can maximize their health and safety at work, and the company can profit maximally from their workers' excellent service. These factors make up the background for research conducted on the risk assessment of the loading and unloading process at Tanjung Priok Port Terminal III (ocean-going) in North Jakarta.

2. Methods

This research utilized a descriptive observational research design to identify and assess the risks and hazards associated with the loading and unloading process in order to support the risk management system implemented by Tanjung Priok Port Terminal III (ocean-going) in North Jakarta. Risk can be defined as the likelihood of that potential being realized. While a hazard is a potential danger, risk refers to the actual danger [4]. The risks can be identified via direct observation in the field of the overall loading and unloading activities undertaken by workers.

Stages of risk assessment conducted in this study are:

1. Decomposition of the type of work, type of activities in the order based on the process of loading and unloading process. The work sequence is done by grouping several activities.
2. Identification of potential hazards, potential hazards can be done by conducting direct observations at the port, observations made for all activities undertaken at the port.
3. Assessment of severity conducted risk assessment process with attention to important aspects of severity (Severity). Assessment of severity is divided into 4 categories: catastrophic, critical, marginal, and negligible. Severity is measured by the impact of an accident. Assessment of severity using the hazard severity classification table can be seen in Table 1.
4. Frequency assessment, at this stage the process of the frequency of the occurrence of accidents or the possibility of emergence of hazard by using hazard exposure classification table that can be seen in Table 2.
5. Calculating the amount of risk generated from a hazard source can be obtained by calculating the Risk Rating Number (RRN) value. Calculation of Risk Rating Number by using the formula:

$$\text{RISK RATING NUMBER} = \text{LO} \times \text{DPH}; \text{Description: LO} = \text{likelihood of occurrence or contact with hazard (Frequency)}$$

1. Hazard risk index, assessment of risk is given a certain value by combining the emergency level that can occur as well as from the frequency level of the occurrence of hazards and risks caused by using proposed criteria that can be seen in Table 3.

TABLE 1: Classification of severity.

Description	Category	Score	Mishap Definition
Catastrophic	I	4	Death or loss of system
Critical	II	3	Severe injuries that cause permanent disability Severe illness due to work Severe system breakdown
Marginal	III	2	Medium injury, requiring only medical treatment Mild illness due to work Partial system damage
Negligible	IV	1	Mild injuries, requiring only first aid Damage to a small part of the system

TABLE 2: Classification of frequency of exposure to hazards.

Description	Level	Score	Specific Individual Item
Frequent	A	5	Often occur, repeatedly in the system
Probable	B	4	Occurs several times in the system cycle
Occasional	C	3	Occurs sometimes in the system cycle
Remote	D	2	Never happened but it may happen in the system cycle
Improbable	E	1	Unlikely, never happen

TABLE 3: Index of hazard risk.

Index of hazard risk	Criteria
1A, 1B, 1C, 2A, 2B, 3A	Not acceptable
1D, 2C, 2D, 3B, 3C	Undesirable (requires management activity decisions)
1E, 2E, 3D, 3E, 4A, 4B	Can be accepted by review by management activity
4C, 4D, 4E	Acceptable without management review

2. Priority risk using a table of priority risk maps that can be seen in Table 4.

TABLE 4: Risk priority map.

RRN	Criteria
0.1 – 0.3	Lowest priority
0.4 – 4	Low priority/low risk
5 – 9	Medium priority/significant risk
10 <	Main priority/action is needed as soon as possible

3. Having known the level of risk generated, the HIRA table can be made.

The study was conducted from January to April 2017 at the port of Tanjung Priok Terminal III (Ocean Going), North Jakarta, which examined the risk assessment of loading and unloading (stevedoring, cargodoring and receiving/delivery).

3. Results

Tanjung Priok Port has four types of loading and unloading terminals that function as loading and unloading terminals based on ship type and destination. One of these is Terminal III (ocean-going), a terminal dedicated to serving cargo shipping containers abroad, and the focus of this research study.

Terminal III consists of two types of loading and unloading workers: implementing unloading, and loading and unloading workers. The loading and unloading implementers are divided into four working groups; each group has nine workers per work shift. The total number of implementing loading and unloading workers amounts to 36 people. The loading and unloading workers are employed by two loading and unloading companies (PBM). Each PBM has 30 workers, resulting in a total of 60 workers involved in the loading and unloading process, including stevedoring, cargodoring, and receiving and delivery.

The risk assessment for each loading and unloading process differs. Thus, the process of stevedoring work was found to be associated with seven dangerous activities, including climbing the ladder of the ship without a safety device that can result in slipping, loss of balance, and falling from a height; and running the crane during loading and unloading. In Terminal III, two types of cranes are used, the Quay Crane (QC) and the Harbor Mobile Crane (HMC), both of which have their respective advantages and disadvantages. Nevertheless, the noise and vibrations of both types of cranes can affect the operators' health, just as their use over a long period of time can cause fatigue. In addition, demanding work schedules can cause stress. It is important that workers are physically and mentally fit so that they are able to operate the cranes [2].

Another hazard is leaking spider crane oil and the ship's surrounding environment, which could potentially catch fire and pollute the environment, Although neither assets nor people have been harmed, a shoes lock fell when a container was lifted. Furthermore, when a shoes lock was sawed off a container, it fell and although the worker tried to dodge the blow, a small section next to his safety helmet was exposed, and the worker suffered a head wound. In another incident, spider rope broke, and the spider fell and hit the head of the container truck. Fortunately, the driver jumped out to avoid getting hurt. Nonetheless, such dangers should not be tolerated. Action

is needed as soon as possible to address these issues. Another dangerous activity is opening and/closing the container’s shoes lock. When unloading, the shoes lock must be opened and when loading, the container is supposed to be locked. The workers must open and close the shoes lock manually, often for the topmost containers, resulting in a number of common potential hazards, ranging from physical hazards to ergonomic hazards, situations in which no stair access is available, and climbing the containers without personal protective equipment.

One of the authors was told of an apprentice fitter in a large transport company who kept on having accidents until one day he had a fatal accident and of the guilt of his colleagues in not taking action before this happened [5]. Unfortunately, the majority of our people are accident prone [6]. The last dangerous activity is to move the container to a truck carrying several times recorded crashing workers at terminal III operation and some causing fatality.

TABLE 5: Hazard identification and risk assessment on stevedoring.

Type of Activity	Potential Hazard	Potential Risk	Severity		Frequency		Risk Rating Number	Index Hazard Risk	Risk Priority
			Category	Score	Level	Score			
Up the stairs of the ship	Slippery stairs, no safety tools	Slip, losing balance	III	2	B	4	8	3B	Medium priority/significant risk
Unlock the hold hatch	Hit	Heavy injury, disability, died	I	4	C	3	12	1C	Main priority/action is needed as soon as possible
Running the crane during loading and unloading	Noisy and Vibration	Hearing loss and other health problems	III	2	B	4	8	3B	Medium priority/significant risk
	Overcrowded work schedule	Stress and fatigue	III	2	B	4	8	3B	Medium priority/significant risk
	Spider crane oil is leaking inside the ship	Potential fires, pollute the environment	II	3	C	3	9	2C	Medium priority/significant risk
	The shoes lock of the container dropped while picking up the container	Injuries, swelling, tear wounds in the concussion head are mild to severe	II	3	C	3	9	2C	Medium priority/significant risk

Type of Activity	Potential Hazard	Potential Risk	Severity		Frequency		Risk Rating Number	Index Hazard Risk	Risk Priority
	Spider strap broken	Wounded by spiders, wounds, death	I	4	C	3	12	1C	Main priority/action is needed as soon as possible
Opening/closing the container lock shoes	Pinched	Sprains, blisters	IV	1	B	4	4	4B	Low priority/low risk
	Stricken, falling from a height	Heavy injuries, death	I	4	C	3	12	1C	Main priority/action is needed as soon as possible
	A frequent squatting position	Low back pain	III	2	C	3	6	3C	Medium priority/significant risk
Moving the container to the carrier truck	Crashing	Severe injury, permanent disability, death	I	4	B	4	16	1B	Main priority/action is needed as soon as possible

The container handling method in container yard terminal operation III is from the chassis truck, the container is removed by using RTG (Rubber Tired Gantry) to be placed according to the predetermined position. In the loading process, containers of the container yard are placed on the chassis truck to be brought to the dock. The cargodoring has six potential hazards, that is, the chassis truck does not run on track that can cause Accident, spill on the road can cause truck slipping and potential fire, direct exposure to the sun, piles of unsuitable or messy containers, noisy and vibration when running RTG (Rubber Tired Gantry). All potential hazards that exist in cargodoring activity have a Medium risk priority.

In the receiving/delivery, work process has a varied risk priority, and three potential hazards, as we often encounter many container trucks coming out into the harbor this is worsened by the condition of the busy road Tanjung Priok therefore to get in and out of the port is jammed surely often we encounter, this can create its own potential hazard, then positioned the end of gangway causing the workers hit, this happened several times especially at the time of the morning because at that moment the power of concentration decreased. Falling from the top of the truck can be caused by unsafe action from workers who are often joking, less serious, and assume the work they do is normal and does not need special worries.

TABLE 6: Hazard identification and risk assessment on cargodoring.

Type of activity	Potential Hazard	Potential Risk	Severity		Frequency		Risk Rating Number	Index Hazard Risk	Risk Priority
			Category	Score	Level	Score			
Transporting a container to the field/ Warehouse or otherwise	Truck does not go on track	Accidents, severe injuries	II	3	C	3	9	2C	Medium priority/significant risk
	Oil spills on the road	Truck tipping, potential fires	III	2	B	4	8	3B	Medium priority/significant risk
Checking data containers in containers yard	Direct exposure to the sun	Dehydration, concentration decreases, fatigue	IV	1	A	5	5	4A	Medium priority/significant risk
Constructing containers with RTG	Pile is not appropriate or messy	Containers fell	II	3	C	3	9	2C	Medium priority/significant risk
	Noisy, vibration	Hearing loss, stress and fatigue	III	2	C	3	6	3C	Medium priority/significant risk

TABLE 7: Hazard identification and risk assessment on receiving/delivery.

Type of activity	Potential Hazard	Potential Risk	Severity		Frequency		Risk Rating Number	Index Hazard Risk	Risk Priority
			Category	Score	Level	Score			
Sending goods to port or vice versa	Traffic jam	Fatigue and stress	IV	1	B	4	5	4B	Medium priority/significant risk
Position the end of the gangway on the Truck	Hit	Severe injury, death	I	4	C	3	12	1C	Main priority/action is needed as soon as possible
Checking the Container and truck out and enter the port	Falling off the top of the truck	Sprains, torn wounds, abrasions	IV	1	C	3	3	IVC	Low priority/low risk

4. Conclusion

On analyzing the research conducted on the assessment of occupational risk associated with loading and unloading activities in Tanjung Priok Port fields, the following conclusions were drawn: The hazards associated with loading and unloading activities in Tanjung Priok Port are dangerous for each work process.

In stevedoring, workers face the greatest dangers when opening and closing the container shoes lock and when spider crane straps break. The predominant type of danger is physical danger.

In cargodoring, the nature of the risk is the homogeneous medium. The highest risk in the stevedoring process is associated with opening and closing the container shoes lock and the spider crane straps breaking. The likelihood value is unlikely, and the consequence value is fatality. The risk value in the cargodoring process is a medium value.

The most dangerous component of receiving and delivery is when the worker is positioned at the end of the gangway on a truck. The likelihood value for this risk is possible. The evaluation results indicate that there is a high risk of danger associated with loading and unloading work at the port of Tanjung Priok, such as being hit or crushed or falling from a height.

5. Suggestion

In the stevedoring process, a special area for the decline of goods should be created in the port using a safety line. Moreover, a routine check of the crane machine is recommended before each use. Other improvements include placing a stop sign in front of the truck when the container will be placed on the truck chassis to minimize the risk of getting hit when closing the shoes lock.

In the cargodoring process, RTG tracks and truck tracks are needed. It is also recommended that routine checks be done on the RTG before each use. In addition, personal protective equipment should be used in the container yard.

Recommendations for the receiving and delivery process include: improving access to and exits from the port, prohibiting vehicles that having no interest in entering the harbor area, creating a safety culture, maintaining order in ports, and compliance with port regulations.

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