



Dampak Kelelahan Kerja Terhadap Risiko Incident Pada Crew Kapal PT Dian Ciptamas Agung Cabang Berau Kalimantan Timur

The Impact of Work Fatigue on Incident Risk in the Ship Crew of PT Dian Ciptamas Agung

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Abstract: Occupational fatigue is a significant factor that increases the risk of accidents in the shipping industry, especially for crew members working under high stress and strenuous operational conditions. Several incidents, such as crew members falling into the water and fingers being pinched in barge bolder, demonstrate the link between fatigue and occupational risk. This study aims to identify the causes of fatigue in ship crew, its impact on work safety, and prevention efforts in the ship's operational environment. The research method used is descriptive qualitative method to determine the impact of fatigue on the risk of incidents on ship crews. This research uses data collection techniques with observation, documentation, interviews with safety officers, crew, and ship captains and literature studies. Data analysis is carried out through several stages, such as data collection, data reduction, data presentation, and conclusion drawing or verification. For validity, researchers use triangulation of sources and triangulation of techniques so that the data is declared valid. The results of the study indicate that work fatigue in the crew of PT Dian Ciptamas Agung is influenced by irregular working hours, lack of adequate rest time, and high workload pressure. These conditions contribute to the increasing risk of incidents on board. To overcome this, systematic steps are needed by the company such as rearranging work schedules and rest times, providing safety training for crew, and monitoring work duration. Evaluation and strengthening of fatigue management policies are key to efforts to minimize the risk of incidents on an ongoing basis.

Keywords: *fatigue management, occupational accidents, occupational fatigue*

Abstrak: Kelelahan kerja merupakan faktor signifikan yang meningkatkan risiko kecelakaan di industri pelayaran, terutama bagi awak kapal yang bekerja di bawah tekanan tinggi dan kondisi operasional yang berat. Beberapa insiden, seperti awak kapal yang jatuh ke dalam air dan jari terjepit di bolder tongkang, menunjukkan hubungan antara kelelahan dan risiko pekerjaan. Penelitian ini bertujuan untuk mengidentifikasi penyebab kelelahan pada awak kapal, dampaknya terhadap keselamatan kerja, dan upaya pencegahannya di lingkungan operasional kapal. Metode penelitian yang digunakan adalah metode deskriptif kualitatif untuk mengetahui dampak kelelahan terhadap risiko terjadinya insiden pada awak kapal. Penelitian ini menggunakan teknik pengumpulan data dengan observasi, dokumentasi, wawancara dengan safety officer, kru, dan nakhoda kapal serta studi literatur. Analisis data dilakukan melalui beberapa tahapan, seperti pengumpulan data, reduksi data, penyajian

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data, dan penarikan kesimpulan atau verifikasi. Untuk keabsahan, peneliti menggunakan triangulasi sumber dan triangulasi teknik sehingga data dinyatakan valid. Hasil penelitian menunjukkan bahwa kelelahan kerja pada awak kapal PT Dian Ciptamas Agung dipengaruhi oleh jam kerja yang tidak teratur, waktu istirahat yang kurang, dan tekanan beban kerja yang tinggi. Kondisi tersebut berkontribusi terhadap meningkatnya risiko terjadinya insiden di atas kapal. Untuk mengatasi hal tersebut, diperlukan langkah-langkah sistematis yang dilakukan oleh perusahaan seperti mengatur ulang jadwal kerja dan waktu istirahat, memberikan pelatihan keselamatan kerja kepada awak kapal, serta melakukan monitoring durasi kerja. Evaluasi dan penguatan kebijakan manajemen kelelahan menjadi kunci dalam upaya meminimalisir risiko insiden secara berkesinambungan.

Kata kunci: *manajemen kelelahan, kecelakaan kerja, kelelahan kerja*

INTRODUCTION

The shipping industry is one of the sectors with a high level of occupational safety risk. Ship crews often face strenuous working conditions, such as long and erratic working hours, pressure of operational targets, and a challenging work environment both physically and mentally. One significant factor contributing to safety risks is fatigue. This condition can reduce concentration, alertness, and increase the risk of incidents on board (Indriani et al., 2025). Work fatigue is a condition that arises from excessive individual activity until the individual is no longer able to complete it. Work fatigue can cause a decrease in performance which has the potential to increase errors in work and potentially cause work accidents (Ariani, 2019). Work fatigue is a complex phenomenon that is influenced by internal factors such as nutrition, age, health and psychological conditions, as well as external factors such as workload, duration of service, working hours, and work environment conditions (Sri et al., 2025). Work fatigue arises from the accumulation of excessive physical and mental activity without adequate rest time. In the shipping industry, high workloads such as barge berthing, loading and unloading activities, and alternating watch schedules without adequate breaks have the potential to be the main trigger of fatigue. Symptoms include drowsiness, decreased concentration, and slow work reactions. This fatigue not only impacts the individual, but also the safety of the entire team.

PT Dian Ciptamas Agung, Berau Branch, East Kalimantan Province is a shipping company that owns and operates a fleet of tugboats and barges for coal transhipment operations. In its operations, the company cooperates with PT Berau Coal and is responsible for loading and unloading coal from the jetty to the mother vessel in the middle of the sea (transhipment). Although the company has a Standard Operating Procedure (SOP), there are still discrepancies in its application in the field that have the potential to increase the risk of work accidents. Based on observations and interviews, the crew experienced fatigue due to high workload and lack of rest time. In addition, there is still inconsistent use of PPE and uneven understanding of work safety.

Some of the identified incidents, such as the crew falling into the water upstream of the Suaran jetty and the crew's left hand being pinched by a barge bolder, suggest a link between fatigue and an increased risk of incidents. Incident itself is defined as an event or situation that occurs without an element of intent and has the possibility or causes injury to workers, which could have been prevented (Adriansyah et al., 2021). This finding is supported by various previous studies. Tjendera (2018) found that work fatigue has a significant relationship with work accidents, where workers who experience fatigue have almost three times the risk of having an accident. Another study by Muhammad (2021) showed that fatigue management that has not been optimized, especially in terms of rest and implementation of SOPs, contributes to the high potential for human error. Preventive efforts such as safety talks and fatigue training have proven to be able to reduce fatigue levels. Furthermore, Muhamad (2023) also confirmed that fatigue contributes directly to

an increase in incidents, and that the systematic implementation of fatigue management can significantly reduce the risk.

Based on this exposure, this study aims to identify the factors that cause fatigue in the crew of PT Dian Ciptamas Agung Berau branch in East Kalimantan, to find out the impact caused by fatigue, and to find out the efforts made to minimize fatigue. Thus, this research is expected to provide a clear picture of the impact of fatigue on the risk of incidents on the crew of PT Dian Ciptamas Agung Berau Branch, East Kalimantan.

METHODS

A. Theoretical Study

The following are some of the theories used in this research:

1. Work Fatigue

Work fatigue is a physiological and psychological condition that arises due to excessive activity that exceeds an individual's capacity to recover energy, resulting in decreased performance and increased risk of work accidents (Ariani, 2019). This fatigue is complex because it involves internal factors such as age, nutritional status, physical and mental health, as well as external factors such as long working hours, high workloads, and an uncondusive work environment (Sri et al., 2025). In the context of working on board a ship, fatigue is a significant challenge due to the erratic work rhythm, long work shifts, and minimal rest time. Fatigue can be acute, which occurs in a short time and recovers with rest, or chronic, which lasts for a long time and has the potential to interfere with concentration, alertness, and work safety.

In general, work fatigue can be classified into several types, namely muscle fatigue caused by excessive physical activity, general fatigue due to accumulation of high workload, acute fatigue due to lack of sleep or heavy work, and chronic fatigue that persists even after rest (Sitohang et al., 2019). The causes of work fatigue in ship crews vary widely, ranging from individual factors such as age, nutritional status, and psychological conditions, to environmental factors such as irregular working hours, high temperatures and noise, and additional workloads outside of the main task (Chofsoh & Sahri, 2022). The impacts include not only physical fatigue, but also psychosocial and mental health such as stress, sleep disorders, and even depression. Therefore, measuring fatigue is important to detect physical, psychological, and behavioral symptoms of work that can interfere with operational safety and effectiveness on ships.

2. Incident Risk

A work incident is an unexpected event that can cause injury, illness, damage, or operational disruption, although it does not always result in direct losses (Adriansyah et al., 2021). Incidents are important indicators in the work safety system because they indicate gaps or weaknesses in the ongoing risk management system. In the world of work, incidents are classified into two main categories: work accidents and non-accident incidents. A work accident is an event with serious impacts such as serious injury or death caused by unsafe acts, damaged equipment, or hazardous environmental conditions. Meanwhile, non-accident incidents include minor, moderate, to near-miss incidents that still need to be recorded as material for evaluating the safety system and future prevention. This classification is important to encourage proportional and preventive incident handling, especially in the world of work with high risk levels such as the maritime and port sectors.

The causes of work incidents are generally divided into direct and indirect factors. Direct factors include human error, inadequate equipment conditions, and unsafe work environments, while indirect factors are rooted in suboptimal work systems, such as lack of training, lack of supervision, and fatigue or work

stress (Fakhriansyah et al., 2022). To reduce the number of incidents, a prevention strategy is needed through a systematic approach in occupational safety and health (OHS) management. These efforts include risk assessments, implementation of hazard control hierarchies (elimination to use of PPE), preparation of standard operating procedures (SOPs), and comprehensive occupational safety training. The implementation of a comprehensive safety culture in the workplace is also key to reducing the potential for incidents, while creating a safer, healthier, and more productive work environment.

3. Crew

Ship crew are professional workers who work on board ships based on a Sea Work Agreement (PKL), and have valid sailor certification as regulated in Law of the Republic of Indonesia Number 17 of 2008 concerning Shipping. Ship crew are an important part of shipping operations because they are responsible for maintaining safety, security, and protection of the maritime environment. To become a ship's crew member (ABK), a person must meet certain requirements such as a minimum age of 18 years, be physically and mentally healthy, and have a sailor's certificate and sailor's book authorized by the port authority (KSOP). In the ship's organizational structure, the ship's crew is divided into two main departments, namely the deck department which handles navigation and shipping operations, and the engine department which manages the ship's mechanical and electrical systems. Each position in the two departments has specific and complementary responsibilities for the smooth running of sea travel.

As maritime workers, crew members have rights and obligations protected by national and international maritime law. These rights include wages according to the work agreement, access to adequate food and accommodation on board, health insurance and leave, and compensation in the event of a work accident or unilateral termination of employment. On the other hand, ABK also has an obligation to obey the orders of the company and the captain, work according to the work agreement, and maintain discipline and professionalism during the voyage. The implementation of crew duties refers to official documents such as PKL, certificate books, muster lists, and standing orders from the captain. With a good understanding of these roles, rights, and obligations, ship crews are expected to be able to carry out operational functions optimally and support the creation of safe and efficient voyages.

B. Research Methods

This research uses a descriptive qualitative approach with the aim of obtaining an in-depth description of the impact of fatigue on the risk of incidents on ship crews. This approach was chosen because it is able to explain the problem contextually through a deep understanding of the experiences and perspectives of the research subjects. Through direct interaction in the field, researchers can explore data widely and deeply. The research was conducted in the ship work environment owned by PT Dian Ciptamas Agung Berau Branch, which is located at Jalan Gatot Subroto, Rinding, Tanjung Redeb District, Berau Regency, East Kalimantan Province, with the implementation time from July 31, 2023 to June 10, 2024.

The data sources used consisted of primary data and secondary data. Primary data was obtained directly from informants through interviews and observations, with the main informants including the ship's crew (ABK), skipper, and HSE Officer. Meanwhile, secondary data was obtained from company documents such as work accident reports, work shift data, attendance, and K3 policies, which were used to complement and strengthen primary data. Data collection techniques in this study include observation, interviews, documentation, and literature study. Observations were made directly by observing the work activities of the crew during working hours and indirectly through analyzing video recordings, reports, and documentation related

to working conditions and potential incidents. Interviews were conducted in a semi-structured manner using an open-ended question guide, so that researchers could explore informants' answers more deeply. Interviews were conducted with the HSE Officer, skipper, and crew to gain a more comprehensive understanding of the phenomenon of fatigue and its risks. Documentation was used to collect secondary data in the form of official company documents that support primary data and help strengthen the validity of the research results (Yusra et al., 2021). In addition, a literature study was conducted to explore the theories and findings of previous research relevant to occupational fatigue and occupational safety.

Qualitative data analysis in this study uses the Miles and Huberman model which includes four main stages, namely data collection, data reduction, data presentation, and conclusion drawing or verification. Data collection was carried out by systematically recording the results of observations, interviews, and documentation. Furthermore, data reduction was carried out by selecting, simplifying, and grouping information based on themes such as factors that cause fatigue, symptoms of fatigue, and types of incidents that occur (Agama et al., 2022). The reduced data was then presented systematically in the form of descriptive narratives, tables, or charts to facilitate analysis. In the last stage, researchers draw conclusions based on the patterns and relationships of the data found, then verify them by comparing data from various sources, triangulating, and confirming the findings with informants to ensure the accuracy and validity of the research results.

To ensure data validity, this research uses triangulation techniques consisting of source triangulation and technique triangulation. Source triangulation is done by comparing data from the same various informants using uniform collection methods, while technique triangulation involves the use of various data collection methods such as observation, interview, and documentation to obtain a description of the phenomenon from various points of view. This approach is in accordance with the principle of validity in qualitative research to ensure that the data obtained is valid and can be accounted for (Husnullail et al., 2024).

RESULT AND DISCUSSION

A. Result

PT Dian Ciptamas Agung is a company engaged in the transportation and logistics sector with specialization in the operation of a fleet of tugboats, barges, floating cranes, as well as ship agency services in Indonesia. Established in 2015, the company currently manages 14 units of tugboats and barges operating in various regions in Indonesia, with a primary focus on providing efficient and quality services to buyers, producers, as well as the national coal industry. In addition, PT Dian Ciptamas Agung also provides services in the field of ship agency, loading and unloading, tugboat and barge rental, as well as the provision of floating cranes to support customer operational needs. The company has structured work procedures and strongly emphasizes loyalty in serving partners, supported by more than 100 employees who are competent and knowledgeable in their fields. The company's head office is located in Jakarta, with several branch offices spread across Bunati, South Kalimantan; Berau, East Kalimantan; and Kendari, Southeast Sulawesi, including an important branch in Berau which is one of the company's main operational locations. PT Dian Ciptamas Agung also implements strict work safety standards and operational procedures to ensure crew safety and the smooth process of loading and unloading and transporting coal. The company actively innovates by using the latest technology in fleet monitoring and logistics management to improve efficiency and minimize the risk of work accidents. Commitment to sustainability and social responsibility is also part of the company's vision, with various training and human resource development programs as well as concern for the environment around its operational areas. All these aspects make PT

Dian Ciptamas Agung one of the main players in the marine transportation and logistics industry that is trusted in Indonesia.

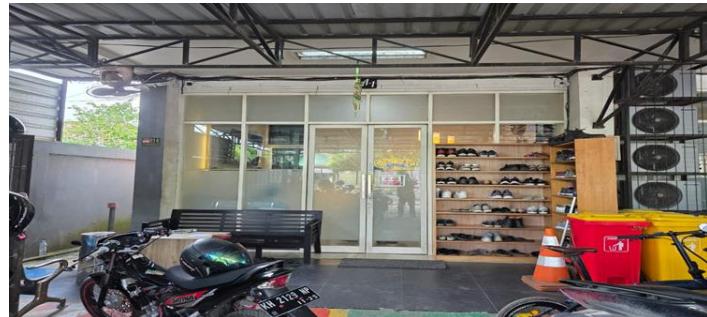


Figure 1. PT DCA Berau Corporate Office
Source: Personal Documentation Year 2024

Based on the results of observations and incident reporting at PT Dian Ciptamas Agung Berau Branch during 2023, two cases of work accidents were found that highlight the importance of implementing work safety and managing risk factors in the ship's operational environment. The first incident involved the crew of the TB. KSA 97 who had an accident when he lost his balance and fell into the water on the inner side of the Suaran jetty on the evening of February 19, 2023. This incident occurred during the process of transferring the mooring line from bolder number 3 to bolder number 2 on the barge BG ISA 302, where the condition of the stretched barge position caused the crew to spontaneously hold the rope and lose balance. Severe fatigue and decreased concentration of the crew while performing duties during the night watch are suspected to be the main causes of the accident. The second incident, which occurred on August 2, 2023, involved the crew of TB. PANCARAN 812 who suffered an injured left hand finger caught between a rope and the bolder of the barge BG PST 812. These two incidents confirm that even though the company has implemented strict safety procedures, the risk of accidents can still arise due to demanding working conditions and human factors such as fatigue. Therefore, these findings provide an important illustration for PT Dian Ciptamas Agung to continuously improve its safety, training, and risk management programs to protect the crew's welfare and maintain the company's smooth operations on an ongoing basis.



Figure 2. Crew Examination by Paramedics
Source: Personal Documentation 2023

Based on the results of interviews with the ship's crew, the cause of the first incident was the narrow working area conditions and the presence of coal spills on the outside of the barge's sideboard, which increased the risk of accidents. In addition, the crew also experienced fatigue due to the heavy workload, which reduced their alertness when carrying out their duties. Meanwhile, in the second incident, observations showed that the accident occurred on August 2, 2023 at 00.57 WITA when the crew of the TB Pancaran 812 ship was carrying out the cast off process or releasing the mooring from CTS Bulk Sumatra. At that time, the crew suffered injuries to the middle and index fingers of the left hand because they were caught between the

eye rope and the barge's bolter, which occurred when opening the eye rope of the bolter on verbal instructions from CTS Bulk Sumatra. From the results of interviews related to the second incident, it was found that the crew did not use Personal Protective Equipment (PPE) in accordance with the Standard Operating Procedure (SOP). In addition, the crew involved also had SID Card results that did not meet the passing grade, which indicated a lack of understanding of work safety procedures. These findings indicate that factors of work environment conditions and aspects of compliance with safety protocols are crucial matters that need serious attention to reduce the risk of accidents at PT Dian Ciptamas Agung, Berau Branch.



Figure 3. Crew's Left Hand Fingers Trapped in Barge Bolder

Source: Company Documentation 2023

B. Discussion

Based on the results of the study conducted through observation, documentation, and interviews with the crew of PT Dian Ciptamas Agung, several factors were found to cause work fatigue in the crew which greatly affect operational performance and safety. The main factors causing fatigue are irregular working hours and lack of adequate rest time, where the crew often have to work beyond the normal working hours, especially during the loading and unloading process or when repairing damaged ship equipment. In addition, an uncomfortable working environment such as hot temperatures, high engine noise, and ship vibrations also contribute to increasing levels of fatigue. Psychosocial factors also play a role, with pressure from the company related to the heavy operational load and a sense of boredom due to not having received leave, which further reduces the physical and mental condition of the crew. In addition, the crew's habit of using mobile phones excessively during rest time, especially at night after work hours, to access social media, play games, or watch videos, causes sleep disturbances and reduces the quality of rest, thus impacting fatigue the next day which has the potential to reduce concentration and increase the risk of work accidents.

The study also found that the barge docking process is often carried out during break times or at night. This is due to the tight operational schedule and the target load that must be achieved, so the docking process must still be carried out even outside normal working hours. The docking process requires the involvement of more than one crew member because this activity requires teamwork to ensure the smooth and safe maneuvering of the ship. Each crew member involved must actively carry out tasks such as tying mooring lines, monitoring the ship's position, and communicating with the mother ship or jetty. This condition has an impact on significantly reducing the crew's rest time, especially if this activity occurs repeatedly in one working week.



Figure 4. Barge Docking Process Activities
Source: Company Documentation 2024

In addition, maintenance and cleaning of machine equipment are often carried out during breaks or at night. This happens because of the density of operational activities, especially when the ship is actively carrying out operations such as pulling barges to the loading and unloading dock (jetty) or the middle of the sea (transhipment). These conditions require the engine crew to carry out routine maintenance and handle unexpected damage outside of regular working hours. Urgent damage, such as oil leaks, disruptions to the engine cooling system, or decreased engine performance cannot be postponed until the end of operational time, so repairs must be carried out immediately even though it is the ship's crew's break time.



Figure 5. Maintenance and Cleaning of Anchor Machine Equipment
Source: Company Documentation 2024

No less important, painting of ship construction is often done outside of main working hours. This painting is done as part of regular maintenance to maintain the physical condition of the ship, prevent corrosion, and meet the safety and seaworthiness standards of the ship. However, painting activities carried out outside of working hours add to the workload of the ship's crew, especially those with daily operational responsibilities.



Figure 6. Painting of Ship Construction by Ship Crew
Source Company Documentation 2024

All of these factors indicate that work fatigue in the crew of PT Dian Ciptamas Agung is caused by a combination of uncertain working hours, a difficult working environment, psychosocial stress, and operational activities that must be carried out outside of rest periods, thus requiring special attention in working time management

and the implementation of safety policies to improve working conditions and reduce the risk of accidents.

The impact of work fatigue on the crew of PT Dian Ciptamas Agung, Berau branch, East Kalimantan, is very significant and affects various aspects of crew performance and welfare. First, fatigue causes decreased performance and productivity because tired crew experience decreased concentration so that work becomes less than optimal. Second, fatigue increases the risk of work accidents because crews who are less focused and have decreased alertness are more susceptible to errors that can trigger incidents or accidents in high-risk work environments. In addition, fatigue also has a negative impact on the health of the crew, who can experience sleep disorders, chronic fatigue, muscle pain, headaches, and an increased risk of mental disorders such as stress and anxiety. The social impact is also not free from the influence of fatigue, where interactions between crew on the ship are disrupted, causing problems in social relationships that can affect teamwork.

To overcome and minimize these impacts, PT Dian Ciptamas Agung Berau branch has made several strategic efforts, including better work and rest time arrangements by providing a minimum of 6 hours of rest time in one 24-hour period divided into a maximum of two rest periods. Furthermore, improving supporting facilities on the ship is also an important concern, such as providing a comfortable rest room and light recreation facilities to reduce crew boredom during rest periods. In addition, training and socialization regarding occupational health are provided routinely to instill the importance of fatigue management, relaxation techniques, and healthy lifestyles that can help improve the physical and mental quality of the crew. No less important, the implementation of a reward system for crew who are able to maintain good work performance and safety is also carried out to motivate and strengthen the crew's commitment to maintaining optimal work standards and safety during ship operations. With these steps, it is hoped that work fatigue can be minimized so that the productivity and work safety of the ship's crew can continue to be maintained.

CONCLUSION

Based on the results of the study on the effect of work fatigue on the risk of incidents on the crew of PT Dian Ciptamas Agung, Berau branch, East Kalimantan, it can be concluded that work fatigue is the main factor that significantly increases the risk of incidents on board ships. This fatigue arises due to long working hours, lack of adequate rest time, and difficult working conditions in a stressful marine environment. The impact of work fatigue on ship crews includes decreased concentration, suboptimal decision making, negligence in following safety procedures, and decreased awareness of hazards in a very dynamic and high-risk work environment. Therefore, companies need to make systematic efforts to organize more balanced work schedules and rest times, provide routine safety and fatigue management training, and closely monitor daily work duration to minimize the risk of incidents. However, to achieve more effective results, continuous evaluation and improvement of fatigue management policies are needed so that incident prevention efforts are truly optimal. In addition, it is important for companies to rearrange the working hours and rotation of ship crew tasks so that the workload is more evenly distributed and in accordance with international standards so that physical and mental fatigue can be minimized. Providing comfortable rest facilities is also an important solution to reduce the negative impact of fatigue, and the implementation of a health monitoring system that can detect fatigue early is a strategic step in maintaining work safety. Overall, the implementation of effective fatigue management with the support of adequate policies and facilities is the main key to improving the performance, productivity, and work safety of ship crews at PT Dian Ciptamas Agung.

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