

Strategic Measure to Prevent Short Cargo During Coal Loading and Unloading Operations: A Case Study

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ABSTRACT

Short cargo refers to a condition where the quantity of cargo unloaded does not match the amount loaded or specified in the stowage plan. This discrepancy poses a significant challenge for shipping companies, as it not only leads to financial losses but also damages their reputation. This study aims to analyze the causes, impacts, and prevention strategies of short cargo incidents during the coal loading and unloading process at a shipping company. A qualitative research method with a case study approach was employed. Data were collected through interviews, observations, and document analysis, with key informants including the Operational Manager, Shipping Agent, and Ship Captain. Fault Tree Analysis (FTA) was used to identify the root causes of the problem. The findings indicate that the primary factors contributing to short cargo include adverse weather conditions, human error, criminal activities, and equipment malfunctions during loading and unloading operations. The consequences of short cargo extend beyond financial losses to include reputational damage and a decline in customer trust. To mitigate these risks, the company has implemented various preventive strategies, such as enhancing supervision during operations, utilizing more efficient unloading equipment, conducting training for crew members and stevedores, and strengthening coordination among relevant stakeholders. With these measures in place, the company aims to reduce the occurrence of short cargo and improve the overall effectiveness and efficiency of its coal handling operations.

Keywords: Coal, Fault Tree Analysis (FTA), Loading, Prevention Strategies, Loading and Unloading.

ABSTRAK

Short Cargo merupakan kondisi dimana jumlah muatan yang dibongkar tidak sesuai dengan muatan yang dimuat atau stowage plan. Hal ini merupakan tantangan bagi perusahaan angkutan laut untuk memastikan jumlah muatan sesuai antara yang dimuat dengan yang dibongkar. Berkurangnya muatan tidak hanya berdampak pada kerugian finansial tetapi juga reputasi perusahaan pengangkutan. Penelitian ini bertujuan untuk menganalisis faktor penyebab, dampak, serta strategi pencegahan terjadinya short cargo dalam proses bongkar muat batu bara di salah satu perusahaan angkutan laut. Metode penelitian yang digunakan adalah kualitatif dengan pendekatan studi kasus. Metode pengumpulan data menggunakan wawancara, observasi, dan studi dokumentasi, dengan sumber informan yaitu Manajer Operasional, Agen, dan Nahkoda. Fault Tree Analysis (FTA) digunakan untuk mengidentifikasi akar permasalahan. Hasil penelitian menunjukkan bahwa faktor utama penyebab terjadinya short cargo meliputi cuaca, kesalahan manusia, kejahatan, kerusakan alat bongkar muat. Dampak dari short cargo tidak hanya menyebabkan kerugian finansial bagi perusahaan, tetapi juga menurunkan reputasi perusahaan serta kepercayaan pelanggan terhadap layanan pengangkutan. Sebagai upaya pencegahan, perusahaan menerapkan berbagai strategi, seperti peningkatan pengawasan selama proses bongkar muat, penggunaan alat bongkar muat yang lebih efisien, pemberian pemahaman kepada awak kapal dan tenaga bongkar muat, serta peningkatan koordinasi antara pihak terkait. Dengan strategi yang tepat, perusahaan

dapat mengurangi resiko short cargo dan meningkatkan efektivitas serta efisiensi dalam proses bongkar muat batu bara.

Kata Kunci: Bongkar Muat, Batu Bara, Fault Tree Analysis (FTA), Short Cargo, Strategi Pencegahan

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1. INTRODUCTION

Short cargo is a condition where the amount of cargo loaded at the port of loading or unloaded at the port of unloading or on a larger ship (transshipment) is not in accordance with the amount stated in the stowage plan document (loading document). The causes of short cargo include communication with loading and unloading personnel (TKBM), weather, natural disasters, ship feasibility, human error, and lack of crew skills (Niken, 2023).

Short cargo causes the amount of coal cargo received at the final destination or unloading site to be less than the amount of cargo listed during the loading process or the agreed amount. The shortage of the amount of cargo occurred due to several factors. In the event of a short cargo, the carrier company is responsible for the cargo. According to the Hague Visby Rules in Muhammad (2020), the responsibility as a carrier is left to the carrier to be loaded onto the ship until the time of unloading at the destination port. The carrier has obligations, among others, to load, arrange and then dismantle the goods properly to the destination.

This research was conducted in one of the companies engaged in sea transportation located in South Jakarta. In the company, the incident of short cargo, namely a reduction in coal cargo, occurred on one of the shipping routes, namely at Muara Berau or the Samarinda route, East Kalimantan. Reduced load conditions

can result in losses to the shipper (carrier) because the owner of the goods has paid freight (shipping costs) in accordance with the cargo written in the Stowage plan. This causes the sender or the owner of the cargo to consider the carrier not responsible for the cargo. The reduction of cargo during the transportation process is the responsibility of the carrier, where the carrier is obliged to ensure that the cargo transported from the port of loading to the port of unloading remains intact and in accordance with the loading documents and agreements that have been agreed upon by both parties. The resulting losses not only have an impact on the financial aspects of the company, but can also affect the reputation of the transport company because it can damage the trust of the shipper or the owner of the goods, so it is very important to maintain the integrity and safety of cargo throughout the journey from the loading point to the unloading point. If there is a loss, namely loss, damage, or delay, the owner of the goods can report to the carrier (Ketut et al., 2019).

Therefore, knowledge of strategies to prevent the occurrence of short cargo cargoes, especially coal, is an important thing to know by transport companies, ship crews, loading and unloading personnel (TBKM), port workers or operators and the company's operational division. Likewise, the supervision of the loading and unloading process and any things that can cause short coal cargo, so that it can support the effectiveness and efficiency of the coal loading and unloading process.

2. METHOD

According to Sugiyono (2020), the qualitative descriptive approach method is research based on the philosophy of postpositivism is used to conduct research on natural objects where the researcher plays the role of a key instrument. In this study, the researcher used a qualitative descriptive approach method. The researcher wants to describe and get an overview related to the occurrence of short cargo problems during the coal loading and unloading process in a sea transportation company which is researched by triangulation data collection techniques, which are a combination technique of several methods.

Research with a qualitative descriptive approach aims to provide an overview, describe, explain, and provide detailed answers about the problems that

are being researched in depth either for individuals, groups/organizations, or relevant events.

The research was conducted at one of the sea transportation companies located in Jakarta. This research was conducted while the researcher carried out an internship or work practice at the company, starting from August 2023 to July 2024. To collect data, the researcher used a semi-structured interview technique involving the Operational Manager, Agent, and Captain of the ship. Observation is carried out by observing data such as ship loading and unloading documents, reports related to the occurrence of short cargo, and actions taken that can cause short cargo problems such as discussions during weekly meetings. The researcher also collected several documents to be analyzed, such as documents and photo results, namely minutes related to short cargo, namely burning cargo, cargo theft, and the occurrence of cargo spills either during loading and unloading activities or on the way to the unloading site, photos of the ship crew during the handling of the loaded fire, photos before and after the theft of cargo, photos of the burning cargo, as well as photos of load spills during the loading and unloading process. To analyze the data, the researcher used Fault Tree Analysis (FTA).

According to Priyanta in Ariyanty (2021), FTA is a data analysis technique used to identify risks that play a role in the occurrence of failure. The FTA method identifies the relationship between the causative factors and is displayed in the form of an error tree. Fault Tree Analysis is one of the methods used to analyze the root cause of work failure. This method uses a top-down approach, which begins by predicting the failure of the top event and then detailing the causes of a peak event to a root cause. This top event is an undesirable event or wants to find out the cause. The creation of fault trees is carried out by interviewing parties involved in the coal loading and unloading process and conducting direct observations of the coal loading and unloading process in the field. Furthermore, the sources that cause the occurrence of short cargo are described in the form of a fault tree. Identification of the causes of short cargo is carried out using previously obtained data through interviews and observations.

In this study, the researcher used the triangulation technique as a data validity technique. Researchers compared data and information with different methods. The results of the interviews were compared with the results of the

researchers' observations and data from the documents that had been collected, including minutes and loading and unloading documents.

3. RESULTS AND DISCUSSION

Through data management during the research using interview, observation, and documentation study techniques, the researcher will present the results of the research from the strategy to prevent the occurrence of short cargo during the coal loading and unloading process in one of the sea transportation companies as follows:

1. Factors that cause short cargo in the coal loading and unloading process

In compiling the fault tree, the researcher conducted observations, documentation studies, and interviews with the Operational Manager of the sea transportation company, Agent, and Captain of the ship. Furthermore, the factors that cause the occurrence of short cargo during coal loading and unloading are described by the researcher in the form of a fault tree model. Identifying the factors that cause short cargo during the coal loading and unloading process is to arrange components that are at risk of causing short cargo which is input in making error trees. Figure 1 shows the root cause of short cargo using the Fault Tree Analysis method.

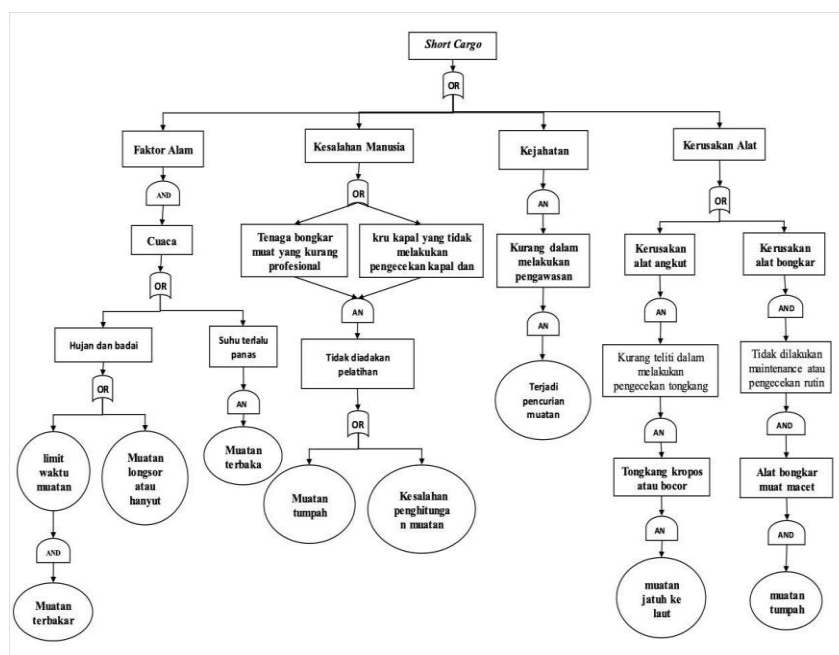


Figure 1 Fault Tree Analysis (FTA) Diagram

From the Fault Tree Analysis (FTA) diagram in Figure 1, it is found that several factors cause short cargo during the coal loading and unloading process as follows:

a. Natural Factors (Weather)

Changing weather conditions are often difficult for humans to predict. Unfavorable weather conditions may result in short cargo:

1) Rain and Storms

Continuous rain conditions can also cause short cargo. The Operations Manager said that one of the impacts of bad weather was heavy rain that caused coal to landslide and flow into water drains. This is also reinforced by the Agent's statement, which explains that bad weather, especially large waves, is often the main cause of short cargo. Large waves make barges drift, so that part of the coal cargo falls into the sea. Meanwhile, Captain added that another factor that also affects short cargo is the limited time of cargo durability. He explained that the durability of coal loads is generally only about 10 days. If it exceeds this time limit, the charge begins to show signs of damage, such as the appearance of hot spots, smoke, and even burns. If there is bad weather that causes the ship to take shelter or stop, it causes the loading and unloading time of coal to be longer. Those who are at risk of coal will burn on their own.

2) Hot weather

Too high a hot temperature can cause self-combustion so that the coal load will be reduced when it arrives at the destination. The Operations Manager said that in addition to heavy rain, overheated weather can also trigger self-combustion (self-burning) of coal, especially if the coal has a high sulfur content. The agent also added that too long loading and unloading time can increase the risk of coal cargo burning. The same thing was also conveyed by Captain, who said that the coal load was in a safe condition during the initial loading

process, but during the trip it began to burn, especially when hot weather conditions also aggravated the situation. Figure 2 shows a barge transporting a cargo of coal that had an incident. Where there was smoke coming out of the cargo. Around the cargo there were several people who inspected and handled the incident that occurred. Smoke that arises from coal loads indicates the potential for fires that will occur in coal loads due to spontaneous oxidation because they are not managed properly.



Figure 2. Coal Load Fire

Source: Company Documentation

Coal burning, or commonly called spontaneous combustion, is a phenomenon where coal burns on its own without an external trigger. This occurs due to an oxidation reaction between coal and oxygen, which produces heat. If this heat is not properly managed, the temperature of the coal will rise until it reaches the flash point, which triggers spontaneous combustion. In the study (Bunga et.al., 2021) there are several factors that affect the self-combustion potential of coal, including:

a) Coal quality

Low-rated coal, such as sub-bituminous, has a higher volatile matter content, which makes it susceptible to spontaneous combustion.

b) Sulfur content

The presence of sulfur, especially in the form of pyrite, can increase the risk of self-combustion because the oxidation of pyrite also produces additional heat.

c) Moisture content

The high moisture content in coal can affect oxidation practices and, under certain conditions, can accelerate the oxidation process.

The results of the documentation study on the occurrence of short cargo caused by weather can be seen in figure 3. In figure 3 there is a report containing a report that the cargo on one of the barges was smoky and burned during the loading and unloading process, which was the cause of the short cargo. Coal that undergoes spontaneous oxidation can cause overheating, potentially catching fire or smoking during travel. In addition, the minutes can also be used as material for evaluation and improvement of safety procedures to prevent similar incidents in the future.

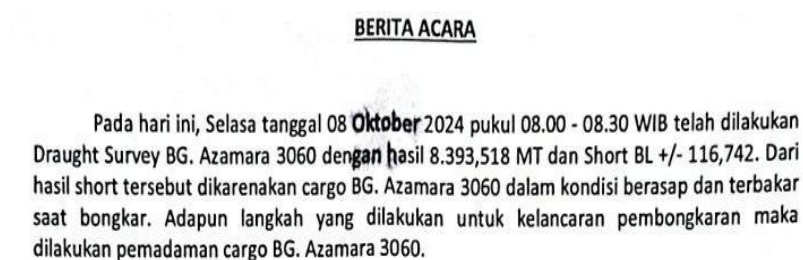


Figure 3. Burn Load Minutes Cut

Source: Company Documentation

In the loading survey draft document (Figure 4), several important data related to coal loading were found, such as the weight of the ship before loading 1,286,603 MT/LT, after loading the ship's weight coal to 9,796,863 MT/LT. So the load weight that has been loaded according to the draft survey is 8,510,260 ML/LT. The draft survey document (Figure 5) shows the

occurrence of short cargo. As we can see in figure 5, the amount of coal unloaded amounted to 8,393,518, which previously amounted to 8,510,260. The comparison of this amount has a difference of 116,742 MT, it can also be seen that in the draft survey there is a record of self-combustion which means that there is self-combustion of coal

• Others		MT/LT	MT/LT
16.	Net Displacement	1.286.603	MT/LT 1.706.863
17.	Cargo loaded / discharged	8.510.260	MT/LT
Remarks & Sea State :			
Acknowledged by TB. [Redacted] Master/Chief Officer PT. Sucofindo Surveyor/Draughtsman *) Pilih satuan ukuran dan berat yang sesuai (coret yang tidak sesuai)			

Figure 4. Sample survey draft document Load
Source: Company Documentation

• Others		MT/LT	MT/LT
16.	Net Displacement	8.721.323	MT/LT 1.327.805
17.	Cargo loaded / discharged *)	8.393.518	MT/LT
Remarks & Sea State : SELF COMBUSTION			
Acknowledged by TB. [Redacted] Master/Chief Officer PT. Sucofindo Surveyor/Draughtsman *) Pilih satuan ukuran dan berat yang sesuai (coret yang tidak sesuai)			

Figure 5. Fragments of Draft Survey Unloading documents
Source: Company Documentation

b. Human error

Human error in the coal loading and unloading process is also one of the main factors causing short cargo. The Operations Manager said that one of the internal factors that caused the occurrence of short cargo was the lack of supervision from the ship crew or captain, who should be responsible for the loading and unloading process on the ship. Some of the factors that cause short cargo caused by human error are as follows:

1) Unprofessional loading and unloading personnel

If there are unskilled loading and unloading personnel, either from the crew themselves or an external party who is less

competent, it can result in the occurrence of short cargo. There is a possibility of errors in the process of moving cargo, which as a result makes the coal load spill or the occurrence of load calculation errors.

2) Crew members who do not check the ship and draft

Ship checks and survey drafts that are not done properly can cause discrepancies between the recorded and actual load amounts. The Operations Manager said that before the loading process, the captain must know the physical condition of the ship thoroughly. He explained that guard officers, crew, and helmsmen need to check the condition of the barge, especially checking the draft to ensure whether it is suitable or not. This inspection is important to find out if there are any remaining cargo or leaks on the barge, so that cleaning or repair can be carried out immediately before the loading process begins. If no checks are carried out first, there will be a discrepancy in the amount of cargo to be loaded due to barge leakage due to the barge being crushed or there is residual cargo, which is due to a lack of cleaning process.

c. Crime

The loss of coal cargo can be caused by criminal acts such as theft by some individuals. The Operations Manager said that one of the external factors that caused the occurrence of short cargo was cargo theft. He added that the water area that is classified as very prone to theft is the Samarinda area, where cargo theft incidents often occur and cause losses for the transporter and shipper. The theft of new coal cargo carried out by several individuals occurred when the ship crossed vulnerable waters. The person committed the theft by driving a small boat, which was attached to a barge and carrying part of the coal cargo. Figure 6 shows a barge transporting a cargo of coal, a pile of coal can be seen piling up on top of the barge. However, if you pay close attention, there are indications of a reduction in the load or loss of part of the coal load, from the description of the picture

mentions the theft of coal. Theft of coal cargo on barges often occurs in the waters of Samarinda. The action of coal theft usually occurs when the ship crosses an open shipping area, the cargo thief commits theft using a small boat and carries out his action by approaching the barge to take part of the cargo.



Figure 6. Reduced Coal Load

Source: Company Documentation

d. Appliance Damage

Loading and unloading equipment that experiences congestion is one of the causes of short cargo. In case of damage to loading and unloading equipment such as grab Cranes, conveyors, hoppers can cause the suspension of loading and unloading activities which can cause new coals to oxidize so that they will experience self-combustion. Equipment congestion also has an impact on the occurrence of short cargo, namely if when carrying out loading and unloading activities, suddenly the loading and unloading equipment such as grab cranes cannot be closed tightly, causing coal cargo to spill into the sea or to the deck of the mother vessel.

In Figure 7, we can see a coal loading and unloading device called grab. Grab is used to move coal loads from ships to jetties or land and vice versa. In figure 7, the grab appears to be hanging with a slightly open position, which the tool should have closed tightly to hold the load from spilling during the transfer process. Such an event can cause the coal to fall before reaching its destination.



Figure 7 Grab Not Closed Meeting
Source: Company Documentation

Figure 8 shows the condition of the mother vessel's deck which was covered by a coal spill. The spill was caused by the loading and unloading process, especially because the grab crane was not tightly closed, as described in figure 7.



Figure 8. Coal Spill on Mother Vessel Deck
Source: Company Documentation

2. The impact that occurs due to the occurrence of short cargo during the coal loading and unloading process

In an interview, the Operations Manager said that if there is a large amount of short cargo, this will cause compensation claims from customers

due to the loss of goods or mismatches in the amount of cargo. In addition, companies must incur additional costs for investigations, audits, and reshipments. Another impact is a decrease in customer confidence, because the company is considered unable to handle cargo properly, resulting in short cargo.

The shortage of coal in the distribution process can have a significant operational impact on the company. When the amount of coal is unloaded, the company is forced to make additional deliveries to make up for the shortage. This leads to disruption of supply chain activities and operational activities, which consequently has an impact on the overall decline in productivity.

A lack of cargo (short cargo) can cause distribution delays, increased costs and reduced customer trust in the company (Rifaitulloh, 2021). In addition, operational efficiency in the coal industry is greatly influenced by the timeliness of loading and unloading and shipping cargo. In the event of problems such as a shortage of cargo, the delivery schedule will be disrupted, which has a lasting effect in the coal logistics system on the transporting company. Financial losses also include the impact of the occurrence of short cargo problems.

Companies must incur additional costs to deal with short cargo issues, including reshipment costs, additional labor for checking and reloading to cover the difference in cargo (Sari et. al.2024).

Financial losses for companies occur because companies have to incur additional costs to deal with the shortage of cargo. This affects the company's profits, because the costs incurred by the company to handle the problem of short cargo reduce the profits obtained by the company. Reduced quantities of goods during delivery can lead to customer dissatisfaction, which can lead to decreased orders and decreased revenue.

Another impact of short cargo is that companies that are less able to manage cargo properly, are often considered incompetent by customers, business partners, and investors. Load mismatches, such as lack of load, can cause distrust in the company's ability to carry out its operations efficiently and reliably. As a result, the company's image in the shipping market can

decline drastically, which has the potential to reduce competitiveness compared to other shipping companies that have better cargo management systems.

In the long run, this bad reputation not only impacts lost customers, but can also hinder customers' efforts in attracting new investors. Investors will prefer to invest their capital in companies that have a stable operational management system and minimal risk. If the company continues to experience problems in cargo management, then the opportunity to get investment to develop the business is getting smaller. Thus, the problem of short cargo in coal distribution not only has an impact on operational aspects, but also has an impact on the company's finances and business continuity. Therefore, companies need to implement strategies that can minimize the occurrence of short cargo during the coal loading and unloading process.

3. Efforts made by the company to minimize the occurrence of short coal cargo

Based on the FTA (Fault Tree Analysis) diagram discussed in the previous section, the efforts made by the company to minimize the occurrence of short cargo during the coal loading and unloading process include several main factors related to natural factors (weather), human error, crime, and damage to loading and unloading equipment.

The following is an explanation of the steps that have been taken by the company to reduce the potential for short cargo during the coal loading and unloading process. The first effort is related to weather factors. Previously, it was explained that weather factors can cause short cargo such as coal spills, coal landslides, coal falling into the sea, and self-combustion. The following are some of the efforts that have been made by the company to overcome the problem of short cargo. First, pay attention to the mountains (piles of cargo) of coal that are not too close to the side boat, given a distance of approximately 70 centimeters to one meter, so that when shaken the coal is not thrown out or falls into the sea. Second, ensure that the barge is not porous, the side boat does not have holes, so that when exposed to rainwater, the coal does not landslide and come out of the barge hole

because of that. Third, ensure that the drainage (water flow path) is not too wide so that the cargo is not wasted into the sea. Fourth, so that the coal does not burn, the coal is treated by spraying liquid chemical.

Furthermore, efforts are made to minimize the occurrence of short cargo caused by human error, namely ensuring that the crew can read the draft and count the load, remind them to check the condition of the barge, the loading and unloading process and always monitor everything during the unloading and loading process. In addition, briefing the crew every month when visiting the port. Based on the researcher's observations, the Operations Manager gave a briefing to the crew of the ship. The briefing was carried out as an effective step in preventing and dealing with short problems cargo, which can occur due to various factors such as weather, theft, operational errors or equipment malfunctions. The crew appeared to be wearing work uniforms and gathered in the ship's control room, which showed that the briefing took place in a professional and organized work environment. The purpose of the briefing is to ensure that all crew members know and understand safety procedures, as well as measures to prevent short cargo. This effort shows the company's commitment to maintaining operational efficiency and integrity, especially in the shipping industry which requires high precision and expertise. In addition, this routine briefing aims to increase the awareness and responsibility of the crew of the ship on the importance of securing cargo, to avoid company losses caused by the occurrence of short cargo.

As for the efforts made to minimize the occurrence of short cargo caused by crimes, namely related to the problem of cargo theft, the company hired a security party to escort the cargo during the trip. This effort is not cheap, where in one escort the company spends Rp. 5,000,000 – Rp. 10,000,000.

Efforts are made to minimize the occurrence of short cargo caused by equipment damage, namely carrying out routine maintenance or periodic checking of tools on loading and unloading equipment to ensure that all equipment functions properly before use. Perform real-time monitoring and

recording according to the condition of the tool and the volume of the load being moved to prevent potential loss of load due to undetected spills.

In addition, the company also routinely holds weekly meetings held by the operational department. This weekly meeting aims to evaluate operational activities, identify obstacles that may arise, and find solutions to problems that occur, especially the short cargo problem discussed in this study. This weekly meeting serves as a communication forum between various related parties within the company, so that coordination between teams can run well. With regular meetings like this, companies can ensure that operations remain efficient, problems can be solved immediately, and team performance can continue to be improved according to the goals that have been determined.

As a follow-up step in an effort to minimize the occurrence of short cargo, the company implements several additional strategies to increase the effectiveness of the coal loading and unloading system as follows:

- a. Conducting more systematic coal load planning. In the loading process, the company ensures that the coal pile is in accordance with the standard (stowage plan). This aims to avoid spills due to shocks while the ship is sailing. In addition, the load arrangement system such as the height of the coal mountains, the distance of the mountains from the side the boat is also evaluated to be more stable so that the risk of landslides or coal falling into the sea can be minimized.
- b. Supervise and verify the delivery system. The step that must be taken is to ensure that the crew has a good understanding of the draft and the calculation of the load more carefully, so that mistakes can be avoided. In addition, before loading, the crew is obliged to check the condition of the barge to ensure that there are no leaks or damage that cause loss of cargo. The ship crew must also supervise directly during the loading and unloading process, in order to minimize errors and if there are any problems, the crew is immediately aware of them.
- c. Maintaining the quality and consistency of loading, the company must carry out supervision during the loading and unloading process. Each stage is monitored to ensure that the volume of cargo sent corresponds

to the volume of cargo received. In addition, the barge drainage system is also considered not too wide, so that coal is not thrown into the sea due to rainwater flow.

- d. Improving the monitoring system by monitoring the condition of the loading and unloading process in real-time to ensure that no cargo is lost due to undetected spills. Recording of moved cargo is carried out regularly to identify possible suspicious cargo shrinkage early on.
- e. Monitoring the condition of cargo and security by hiring a security party in charge of escorting shipments on routes prone to coal theft. To reduce the potential for coal self-burning, the company conducts special treatment for coal that will be loaded by spraying chemical liquid on coal, whose function is to reduce the sulfur content in coal to reduce the potential for coal self-burning.
- f. Provide briefings to the crew regarding safety procedures and short cargo prevention. Provide education related to the importance of checking barge conditions and monitoring during the loading and unloading process.

4. CONCLUSION

Based on the results of the research on strategies to prevent the occurrence of short cargo during the coal loading and unloading process, it was concluded that short cargo is caused by several factors, namely natural factors or weather factors such as heavy rain that can cause landslides and cargo to fall into the sea, while weather that is too hot can trigger the occurrence of self-combustion (Swabakar). In addition, human error is also a factor affecting the occurrence of short cargo, where lack of control from the ship crew and unprofessional loading and unloading personnel often cause errors during the loading process. Coal theft is also a problem that often causes short coal cargo, especially in vulnerable water areas such as the shipping channel of the Samarinda area. On the other hand, the condition of loading and unloading equipment, such as grab cranes that are not tightly closed, can also cause the coal that is being moved to spill or fall into the sea. Weather factors are the most dominant factor causing short cargo during the coal loading and unloading process.

The impact of short cargo for companies includes financial and operational impacts. Financial losses occurred due to additional expenses for reshipment costs, loading and unloading labor costs and other related issues. In addition, the owner of the goods can lose trust in the company if the short cargo incident continues to be repeated, which can affect the company's reputation. Operationally, the occurrence of short cargo can cause delivery delays and disruptions in meeting customer needs. If the problem of short cargo occurs repeatedly, it can affect the company's image and reputation in the shipping industry, sea freight services.

To minimize the occurrence of short cargo, the company has made several efforts. In dealing with weather factors, the company ensures that the loading method is carried out with good procedures, as well as treating the coal to be loaded to minimize the occurrence of self-burning. In addition, the company also improves the competence of the ship crew by providing regular briefings on the correct loading and unloading procedures, as well as ensuring that the ship is always checked by the ship crew before loading. In terms of security, the company has taken steps by hiring security parties to carry out escorts to minimize the risk of theft of coal cargo. Another effort is to ensure that the loading and unloading equipment is in good condition by carrying out periodic maintenance and checks, so that it can function optimally. In addition, the company also holds weekly meetings to conduct regular evaluations to discuss the obstacles that occur during the loading and unloading process and find the right solutions to improve operational efficiency.

5. REFERENCES

- Ariyanty, R. (2021). Penerapan metode FMEA dan FTA dalam mengidentifikasi penyebab kerusakan mesin vertical shaft pada PT. Prima Karya Manunggal Pangkep [Tugas akhir]. Sistem Informasi, Akademi Teknologi Industri Makassar. <https://sisformik.atim.ac.id/media/filejudul/369ABSTRAK%20RESKY%20ARIYA%20NTY.pdf>
- Bunga, W., Nugroho, T. T., & Sakdillah, H. (2021). Studi pencegahan swabakar (self combustion) pada stockpile di PT Baramulti Sukses Sarana (Prevention study of spontaneous combustion in stockpile at PT Baramulti Sukses Sarana). *Tetrahedron Letters*, 28(44), 1–3. <https://idoc.pub/documents/swabakar-batubara-2nv81goo50lk>
- Gusti, I. K., Mandala, P. W., Adhya, P. T., & Prima Bali, A. (2019). Tanggung jawab hukum perusahaan jasa pengangkutan barang dalam terjadinya wanprestasi (Studi kasus PT. Adhya Avia Prima Cabang Bali). *Jurnal Analisis Hukum*, 2(2), 2620–3715. <http://journal.undiknas.ac.id/index.php/JAH/index>
- Kevin, A. M. (2021). Antisipasi terjadinya death freight muatan curah batubara pada MV. Santa Paulina di Muara Berau Anchorage [Skripsi Diploma, Politeknik Ilmu Pelayaran Semarang]. <http://repository.pip-semarang.ac.id/id/eprint/3598>
- Muhammad, R. A. (2020). Tanggung jawab para pihak dalam perjanjian pengangkutan barang melalui laut. *Quarterly Journal of Health Psychology*, 8(32), 73–92. http://hpj.journals.pnu.ac.ir/article_6498.html
- Niken, D. R. (2023). Analisa penyebab short cargo pada pemuatan batubara dari area open stockpile. *Saintara: Jurnal Ilmiah Ilmu-Ilmu Maritim*, 7(1), 1–5. <https://doi.org/10.52475/saintara.v7i1.171>
- Rifaitulloh, M. A. (2021). Strategi mitigasi risiko rantai pasok pada produksi trailer penunjang industri pertambangan [Skripsi, Universitas Mercu Buana]. <https://repository.mercubuana.ac.id/81783/>
- Sugiyono. (2020). Metode penelitian kualitatif, kuantitatif dan kombinasi (mix metode) (Edisi ke-2). *Alfabeta*.

- Sari, W. E., & Sarda, S. A. (2024). Analisis financial distress pada perusahaan pertambangan yang terdaftar di Bursa Efek Indonesia. *Indonesian Journal of Management and Accounting*, 7, 1–10. <https://ejournal.almaata.ac.id/index.php/IJMA/article/view/4391>
- Yuli Susanto, Dedy Rusmiyanto, & Kalmah. (2023). Analisis penyebab terjadinya shortage cargo pada kegiatan transshipment batu bara di vessel pada PT. Sedayu Makmur Abadi. *Jurnal Universal Technic*, 2(1), 42–50. <https://doi.org/10.58192/unitech.v2i1.671>