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Study Of The Effeciency Of Ammonium Nitrate Loadingand Unloading Operations At Pt Kutai Jaya Pundinusa Bontang

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Abstract *This research aims to evaluate the operational efficiency of the loading and unloading process of Ammonium Nitrate at PT Kutai Jaya Pundinusa in Bontang, East Kalimantan. As a hazardous chemical utilized in the mining sector, handling Ammonium Nitrate necessitates effective and safe operational procedures. The study examines the loading and unloading time, equipment capacity, workforce performance, and the application of workplace safety standards. The methodologies employed include field observations, interviews, and qualitative analysis of operational data over a specific period. The findings are expected to reveal the factors that hinder effectiveness, provide an overview of current performance levels, and formulate recommendations for optimizing the loading and unloading process. The scientific contribution of this study lies in enhancing management approaches for the maritime supply chain concerning hazardous materials, as well as improving safety practices and logistical efficiency at industrial ports.*

Keywords: Operational Efficiency, Loading and Unloading, Ammonium Nitrate, Workplace Safety.

INTRODUCTION

Maritime activity plays a crucial role in the movement of passengers, cargo, and services, supporting essential economic, social, cultural, defense, and safety aspects. Loading and unloading companies are highly instrumental in ensuring the smooth flow of goods transportation in ports. However, the shipment process frequently encounters the risk of non-compliant or excessive costs. Tragic events, such as the 2020 Beirut Port explosion caused by the mismanagement of ammonium nitrate, underscore the critical importance of effective, safe loading and unloading, proper storage, and clear warning signs for dangerous goods. Furthermore, occupational safety is key to managing human resources and preventing potential losses.

To mitigate these inherent risks, qualitative methods are often employed in the handling of dangerous goods within ports. Occupational Health and Safety (OHS) Management Systems have proven effective in reducing unsafe actions. Conversely, unlicensed loading and unloading activities of fuel oil constitute a legal violation subject to sanctions. All cargo handling operations must adhere strictly to the International Safety Management (ISM) Code to guarantee safety. While some ports have adopted standard operating procedures for handling dangerous goods, facility limitations remain a major obstacle to achieving optimal management.

RESEARCH OBJECTIVES

The primary goal of this research is two fold: to comprehensively analyze the effectiveness of the ammonium nitrate loading and unloading activities currently implemented at PT. Kutai Jaya Pundinusa, and subsequently, to precisely identify

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the specific inhibiting factors that may negatively affect the execution and efficiency of these crucial operations at the company.

Research Benefits (Paragraph Format)

This study yields three primary benefits. Firstly, it offers a significant theoretical contribution to the domain of maritime supply chain management. Secondly, the findings provide valuable practical input and recommendations specifically tailored for PT. Kutai Jaya Pundinusa, aiming to enhance their operational safety and efficiency. Finally, this research is intended to serve as a strong policy basis for the development of necessary technical policies and Standard Operating Procedures (SOPs) concerning the safe loading and unloading of hazardous materials.

LITERATURE REVIEW

1. Effectiveness

Validity refers to the extent to which achieved results align with the pre-determined goals of a plan, suggesting that an organization can be deemed successful if its accomplishments are consistent with the initial targets. According to S. P. Siagian (2023), effectiveness is defined as an organization's capability to achieve its objectives within a specific timeframe using the resources that have been specifically allocated. Indicators of effectiveness include the congruence between the initial design and the actual realization (Hasibuan, 2022), as well as the optimal utilization of infrastructure and resources in producing goods or services. In this context, effectiveness illustrates an organization's effort to realize targets according to the established plan, as affirmed by Bromasa (2022) and Handayaningrat (2017), who state that effective goal formulation reflects the ideal position the organization aims to achieve.

The measurement of effectiveness is necessary to provide a comprehensive overview of institutional guidelines and organizational performance (Nurrohim, 2009). Several criteria are used for this measurement, including timeliness, cost efficiency, measurement accuracy, selection meticulousness, thought rationality, process regularity, and clarity of purpose. All these aspects indicate that effectiveness is a crucial element in achieving organizational, activity, or program goals. Thus, effectiveness is not only related to the ability to select the appropriate strategy but also reflects the organization's level of success in reaching specific objectives according to its predefined plan.

2. Stevedoring and Cargo Handling Companies (PBM)

Numerous studies affirm the critical importance of implementing safety, efficiency, and risk control in cargo handling activities across various Indonesian ports. Research indicates that stevedoring companies have established occupational safety standards and Standard Operating Procedures (SOPs) aligned with national legislation, such as Law No. 1 of 1970, Law No. 13 of 2003, and Law No. 152 of 2016. These efforts are reinforced through human resource training, the use of safety

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equipment, and the readiness of emergency response units. Operational effectiveness is also highlighted, with studies suggesting that analyzing delays in the stevedoring process can serve as a basis for improving port services, ensuring timely cargo delivery. Furthermore, an unsafe working environment has been shown to contribute to stress and reduced crew performance, as detailed in the literature. Productivity aspects also receive attention, with findings demonstrating that the Berth Occupancy Ratio (BOR) and container handling performance at Tanjung Emas Port were in the "good" category, based on the Box/Crane/Hour and Box/Ship/Hour achievements between 2021 and 2023.

Other research emphasizes the necessity of risk control and waste elimination. Studies highlight the use of the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method in mitigating work accidents. A separate study identified five dominant factors contributing to high Risk Priority Numbers (RPN): non-compliance with SOPs, short equipment lifetime, unmeasured monitoring, low spare part quality, and suboptimal procurement coordination. Consistent with this, research reveals that risk control in cargo handling activities adheres to the hierarchy of controls, ranging from substitution to the use of personal protective equipment (PPE). In the context of developing the national logistics system, studies stress the need for integration, professionalism, transparency, and accountability based on Good Corporate Governance (GCG). Subsequent research reinforces the focus on operational improvement, including the addition of facilities and coordination of transport services, optimization of container stacking patterns and the use of Rubber Tired Gantries (RTG), reducing ship turnaround time from 10 to 2 days, implementing Lean Six Sigma to minimize demurrage, and strengthening OHS through instruction, work procedures, and complete PPE. Additionally, the implementation of a reward and punishment system has been proposed as a strategy to enhance the compliance and productivity of cargo handling workers, as noted in the research.

3. Cargo Handling Equipment

According to Amrullah's work on ship cargo practices and dangerous goods, ensuring that ship cargo remains undetected is a complex issue. This complexity is often linked to attempts to evade legal regulations, smuggling activities, or covert operations. Various methods are employed to conceal the true nature or existence of the cargo, although these actions are illegal and can lead to serious consequences if discovered. Cargo handling equipment, on the other hand, is specifically designed to transfer cargo from land to the ship or vice versa, and is typically tailored to the type and characteristics of the goods being handled.

4. Ammonium Nitrate

Ammonium Nitrate is also required as a raw material for nitrogen fertilizers. In various

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industries, Ammonium Nitrate is utilized for modifying zeolites to form zeolite catalysts, for the manufacture of dinitrogen oxide anesthetic drugs, and as a rocket propellant component. PT Multi Nitrotama Kimia (MNK), which holds the highest market share in providing explosive services, has yet to fully meet the demand for this product.

According to Rizkha (2018), the use of Ammonium Nitrate is significant due to its large nitrogen content, as nitrogen is an essential nutrient needed by plants and can enrich the soil. Choi (1972) noted that in 1973, Ammonium Nitrate began to be produced as the basic ingredient for nitrogen fertilizer. To this day, Ammonium Nitrate is still used as a raw material for the manufacture of explosives, both for mining and military purposes, with 75% of the raw materials consisting of Ammonium Nitrate (Pittman, 2014). It serves not only as an explosive agent but also as a fertilizer.

RESEARCH METHODOLOGY

The flow of this research process is illustrated in the diagram presented below.

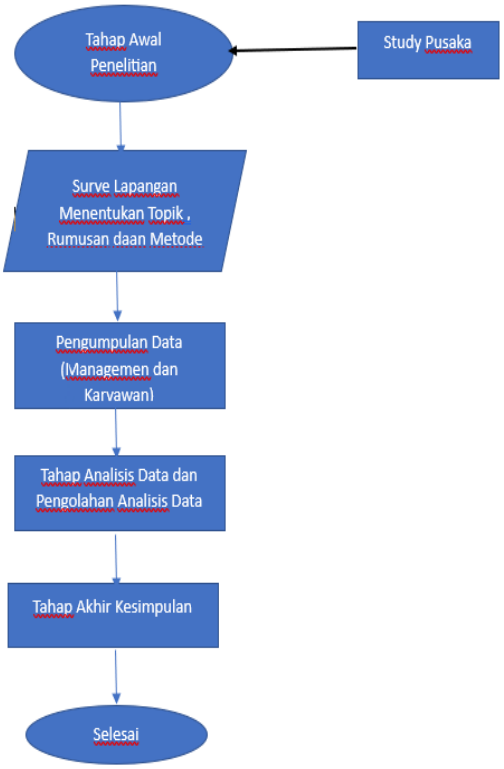

Figure 1. Research Flow Diagram

1. Research Methodology

This study employs a descriptive qualitative research approach. Data were collected through the use of interviews, observation, and documentation studies (triangulation technique) to obtain in-depth data regarding the effectiveness and expedited process of ammonium nitrate loading and unloading at PT. Kutai Jaya Pundinusa, Bontang Branch.

RESULTS AND DISCUSSION

Research Findings

Effectiveness of Ammonium Nitrate Loading and Unloading Activities at PT. Kutai Jaya Pundinusa

Based on direct field observations conducted on the

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research object, it was determined that the ammonium nitrate loading and unloading activities carried out by PT. Kutai Jaya Pundinusa, Bontang Branch, proceeded **effectively and safely**. The following section details the Standard Operating Procedures (SOP) for ammonium nitrate loading at PT. Kutai Jaya Pundinusa, Bontang Branch.

RESEARCH FINDINGS

Based on the research findings, the ammonium nitrate loading and unloading activities at PT. Kutai Jaya Pundinusa are being executed **safely and effectively**. This conclusion is substantiated by several key indicators, specifically:

a. **Low Occupational Accident Rate**

The low accident rate is evidenced by the following data:

Table 1. Work Accident Data of PT. Kutai Jaya Pundinusa

No	Tahun	Jumlah	Keterangan
1	2019	0	Tidak ada
2	2020	0	Tidak ada
3	2021	1	Kecelakaan kerja pada buruh bongkar muat
4	2022	0	Tidak ada
5	2023	0	Tidak ada
6	2024	0	Tidak ada

b. **Low Level of Ammonium Nitrate Damage**

The low level of damage to the ammonium nitrate significantly contributes to high loading and unloading time efficiency, ensuring that the target volume can be achieved successfully and meets the requirements of the shipper.

Figure 2. Hatch Inspection

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a) **Low Loading and Unloading Time**

The effective utilization of a low turnaround time for loading and unloading has yielded results that successfully meet the shipper's demand for expedited operations. The achievement aligns with the targeted completion of ammonium nitrate loading, which is detailed as followTable 2. Loading Rate

No	Vessel Name	Start	Finish	Target (Tonnes)	Loaded (Tonnes)	Difference	Time (Hour)	TPH	Weather	Transport	Other Delay	Net Time	Net TPH	Comments
1	PRIMA J003	9/29/2023 23:45	10/1/2023 11:00	2208	2208	0	35.25	62.6	0.7	15.3	1.8	17.5	126.2	Kuala Jaya-Pundirusa
2	BG TUANKENCANG M04	9/30/2023 14:30	10/2/2023 16:25	3000	3000	0	49.92	60.1	0.8	2.4	18.8	24.25	123.7	Kuala Jaya-Pundirusa
3	KM RIK 3	10/2/2023 22:20	10/3/2023 15:15	1000.8	1000.8	0	16.92	59.2	0.8	6.1	0.3	8.17	122.5	Kuala Jaya-Pundirusa
4	BG KBT 23	10/3/2023 22:35	10/5/2023 00:10	2000.4	2000.4	0	25.58	78.2	0.7	9.3	1.25	12.17	164.4	Kuala Jaya-Pundirusa
5	PRIMA J010	10/5/2023 21:15	10/6/2023 23:30	1500	1500	0	26.25	57.1	0.8	5.7	4.25	15.58	96.3	Kuala Jaya-Pundirusa
6	MV MERATUS SANGATTA	10/11/2023 15:10	10/12/2023 16:30	2000	2000	0	25.33	78.9	0.6	6.3	3.6	14.17	141.2	Kuala Jaya-

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														Pundirusa
7	BG TUANKENCANG M01	10/13/2023 20:25	10/15/2023 12:00	2500.8	2500.8	0	39.58	63.2	3.0	1.6	4.0	14.17	176.5	Kuala Jaya-Pundirusa
8	BG MBS 1	10/16/2023 14:20	10/17/2023 00:05	996	996	0	9.75	102.2	0.3	2.8	1.7	4.95	201.2	Kuala Jaya-Pundirusa
9	PRIMA J011	10/21/2023 13:40	10/22/2023 00:50	1104	1104	0	11.17	98.9	0.3	2.8	2.0	6.07	182.0	Kuala Jaya-Pundirusa
10	PRIMA J012	10/25/2023 19:50	10/26/2023 10:25	2000	2000	0	14.58	137.1	0.7	1.6	4.9	7.42	269.7	Kuala Jaya-Pundirusa
11	BG MBS 1	10/25/2023 20:35	10/26/2023 21:50	1104	1104	0	25.25	43.7	1.9	1.2	5.0	9.32	117.3	

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The low level of precision in determining the time for ammonium nitrate loading and unloading activities carried out by PT. Kutai Jaya Pundinusa Bontang Branch is evidenced by the following indicators: Timeliness in scheduling is paramount for loading and unloading, especially for ammonium nitrate cargo at PT. Kutai Jaya Pundinusa, as it directly impacts company revenue. Accuracy in cost calculation must also be carefully monitored to prevent cost overruns during the operations. Precision in measurement is essential to ensure safety and efficiency, as well as to meet regulatory compliance. Appropriate selection of methods and equipment can prevent accidents leading to substantial losses. Accuracy in judgment (or 'correct thinking') must be prioritized for safety, mandating strict adherence to established procedures. Precise execution of instructions is critical to preventing accidents. Finally, accuracy in defining objectives is key to maintaining operational safety and effectiveness.

b) Inhibiting Factors Affecting Loading and Unloading Effectiveness at PT. Kutai Jaya Pundinusa

This research reveals several factors that significantly influence the effectiveness of ammonium nitrate loading and unloading at PT. Kutai Jaya Pundinusa Bontang Branch. Work System and Culture: The first factor is the presence of an unstructured work system and a negative work culture, which significantly diminishes employee motivation and morale.Natural/Environmental Factors: Secondly, natural elements, such as heavy rain, fog, strong winds, and sea tides, frequently act as operational inhibitors. Inadequate Equipment and Infrastructure: Thirdly, inadequate equipment and infrastructure, including insufficient equipment capacity and frequent machinery breakdowns, also hinder the activities. Labor Shortage: Lastly, a shortage of field personnel serves as an additional constraint on the overall effectiveness of the loading and unloading operations.

RESULTS AND DISCUSSION

The loading and unloading processes at PT. Kutai Jaya Pundinusa's Bontang branch are critical to the company's revenue generation. Research findings, supported by interviews, indicate the presence of issues within the current procedures for loading ammonium nitrate onto vessels.

1. Standard Operating Procedure (SOP) for Ammonium Nitrate Loading at PT. Kutai Jaya Pundinusa

The operational process begins with the reception of a Work Order Letter (SPK) from the shipper after the vessel has berthed. This document must be signed by the port authority to facilitate the submission of the Cargo Handling Activity Plan (RKBM) to the Harbormaster (*Syahbandar*). The cargo handling activity plan is then submitted to the Harbormaster, and permission to load the dangerous goods must be secured from the shipping agent before proceeding. Following this, necessary working equipment,

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including a spreader bar, webbing, duct tape, cable ties, spare bags for potential leakage, and radio communication devices, must be prepared for the activity. The estimated costs for these operations are submitted to the Head Office; if rejected, the application must be resubmitted via email. A QHSE Declaration document is signed to ensure that all equipment and the loading location are safe for handling ammonium nitrate. Once all equipment and documentation are prepared, the loading is executed using a truck system. Finally, the documents confirming the loading report (Berita Acara Pemuatan) and timestamps are confirmed and signed by the vessel's party or Chief Officer.

Figure 3. Stacking of Ammonium Nitrate on The Barge

Effectiveness of Ammonium Nitrate Loading and Unloading Activities at PT. Kutai Jaya Pundinusa

The ammonium nitrate loading and unloading activities at PT. Kutai Jaya Pundinusa, Bontang branch, are operating effectively and safely, as evidenced by several key indicators. Firstly, the operation maintains a low accident rate, which signifies a successful commitment to safety preservation. The management of PT. Kutai Jaya Pundinusa demonstrates a strong commitment to occupational safety through several distinct measures. These include providing regular safety training to all employees, implementing rigorous Safe Operating Procedures (SOPs) for ammonium nitrate handling, and ensuring the use of appropriate Personal Protective Equipment (PPE) to shield employees from hazards. Furthermore, the company conducts periodic health examinations to ensure personnel are in optimal physical condition to work safely with ammonium nitrate.

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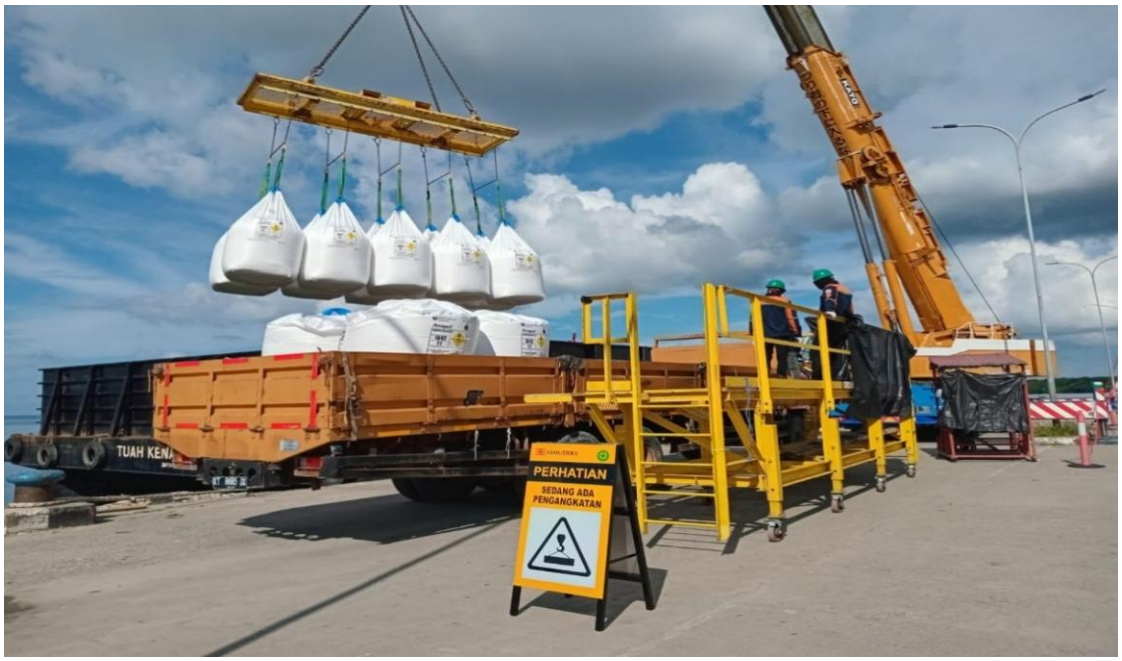

Figure 4. Chek

Personnel at PT. Kutai Jaya Pundinusa's Bontang branch demonstrate a high level of awareness regarding occupational safety. They strictly adhere to the company's safety policies and programs, consistently participate in training, diligently apply Standard Operating Procedures (SOPs), utilize Personal Protective Equipment (PPE), and comply with mandatory health checks. Employees are also proactive in reporting potential hazards to their superiors and actively remind each other to avoid unsafe actions.

The company maintains a strong corporate safety culture. Management provides significant support by allocating necessary resources for safety programs and recognizing high-achieving employees. All stakeholders, from top management to general personnel, are actively involved in safety initiatives. Furthermore, the company fosters open and transparent communication concerning occupational safety, which facilitates easy access to information for employees and encourages the reporting of potential risks.

1) Low Damage Rate of Ammonium Nitrate

The consistently low damage rate of ammonium nitrate at PT. Kutai Jaya Pundinusa can be attributed to several factors, one of the most critical being the effectiveness of the loading and unloading activities. The following key points illustrate the practices contributing to this success:

a. Planning and Preparation:

1) Mature Planning: The preparation of detailed and comprehensive loading and unloading plans, encompassing estimated timelines, required personnel, equipment

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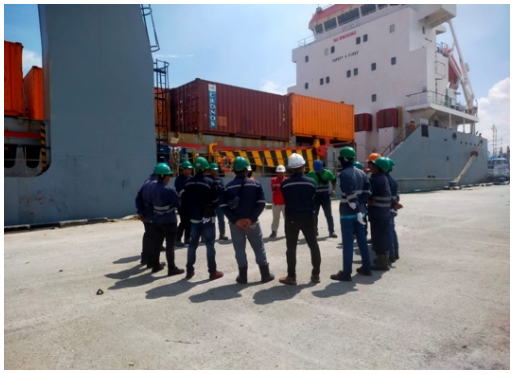
specifications, and specific procedures to be implemented.

2) Equipment Preparation: Ensuring that all loading and unloading equipment is in excellent working condition and fully complies with relevant safety standards.

3) Personnel Training: Providing comprehensive training to personnel on correct and safe loading and unloading procedures, specifically including the proper handling of ammonium nitrate.

b. Implementation of Loading and Unloading Procedures:

1. Careful Handling: Conducting loading and unloading with utmost caution to avoid impacts, friction, or spillage/leakage of ammonium nitrate.
2. Appropriate Equipment Utilization: Employing suitable equipment tailored to the type and packaging format of the ammonium nitrate being handled.
3. Segregation from Other Materials: Storing ammonium nitrate separate from other materials that are highly flammable or may trigger an explosion.
4. Dust Control: Managing and controlling ammonium nitrate dust by using adequate vacuum cleaners or an appropriate ventilation system.



Firgure 5. Loading preparation

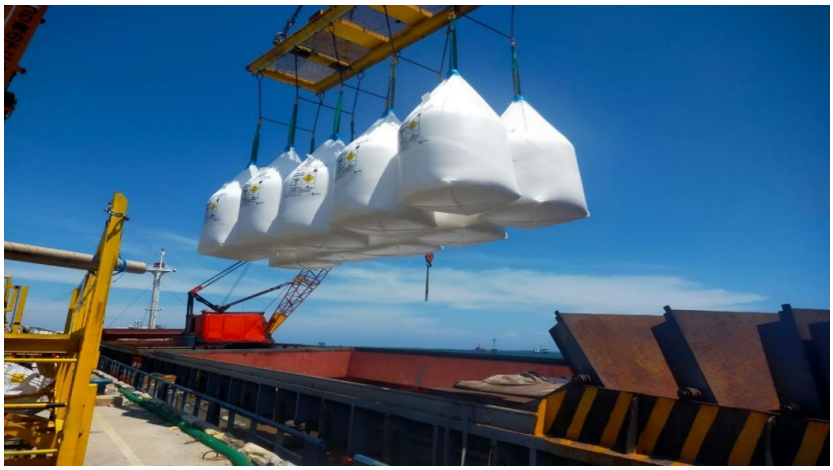


Figure 6. Loading *Ammonium Nitrate*

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c. Safety and Accident Prevention

Implementation of Safety Procedures: Adhering to all applicable safety procedures for the loading and unloading of hazardous materials.Use of Personal Protective Equipment (PPE): Providing and mandating that all personnel utilize appropriate PPE, such as gloves, protective eyewear, and respirator masks.Emergency Response: Establishing a comprehensive emergency response plan to manage spills, fires, or explosions involving ammonium nitrate.

d. Monitoring and Evaluation

Conducting Monitoring: Regularly monitoring loading and unloading activities to ensure strict compliance with procedures and safety standards.Performing Evaluation: Conducting periodic evaluations to identify potential hazards and implement necessary improvements.

e. Optimized Loading and Unloading Time

The overall time required for the loading and unloading of ammonium nitrate at PT. Kutai Jaya Pundinusa is influenced by a combination of factors. The effectiveness of these operations depends on several key elements:Equipment and Infrastructure: Sound equipment and robust infrastructure, such as reliable cranes and strong docks, are essential for accelerating the process.Planning and Communication: Meticulous planning and effective communication among all involved parties can significantly reduce waiting times and support smooth operations.Skilled Manpower: A skilled workforce and continuous training can enhance efficiency in handling ammonium nitrate.Efficient Procedures and Compliance: Adherence to efficient procedures and strict compliance with regulations are crucial to ensuring safety throughout the handling process.Safety Implementation: Finally, the rigorous implementation of safety procedures and the mandatory use of personal protective equipment can minimize the risk of accidents and safeguard the well-being of the workforce.

f. Loading and Unloading Time

The turnaround time for loading and unloading at PT. Kutai Jaya Pundinusa, Bontang branch, is influenced by several indicators, emphasizing the importance of accuracy across various operational aspects. First, the precision of time determination is crucial to ensure product safety, efficiency, and quality, which directly impacts company revenue. With a proper strategy, the company can significantly enhance its performance. Second, accurate cost calculation is essential to prevent cost overruns. Precise cost accounting directly affects profitability and serves as the foundation for setting tariffs, planning budgets, and making sound business decisions. Third, accuracy in measurement is equally vital to guarantee safety and quality. As a hazardous chemical, ammonium nitrate must be handled with utmost care, as errors in measurement can lead to serious consequences.

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Furthermore, precision in decision-making is key to avoiding accidents that could result in substantial losses. Periodic evaluation helps improve efficiency and ensures compliance with regulations. Fifth, precision in judgment during the loading and unloading process is prioritized for safety. Good decisions can minimize risk and maintain product quality. Sixth, accuracy in executing instructions is important to prevent accidents. The right strategy can enhance both operational security and efficiency. Finally, precision in defining objectives is fundamental to maintaining safety and effectiveness. By considering all these factors and implementing the necessary steps, operational performance can be improved, and the safety of all parties can be maintained.

2) Inhibiting Factors Affecting the Effectiveness of Ammonium Nitrate Loading and Unloading Activities at PT. Kutai Jaya Pundinusa

Based on field research, there are several types of factors that inhibit the effectiveness of loading and unloading activities carried out by PT. Kutai Jaya Pundinusa, Bontang Branch, specifically:

A. Work System

The effectiveness of ammonium nitrate loading and unloading operations at PT. Kutai Jaya Pundinusa, Bontang branch, is influenced by several factors, notably the work system. Firstly, an unstructured and disorganized work system can lead to a lack of clear roles and responsibilities for each employee, obscure procedures that are difficult to understand, and ineffective communication. Secondly, the improper use of technology, such as outdated heavy equipment and the lack of an integrated information system, can significantly reduce the speed and accuracy of the activities. Finally, a negative work culture can decrease employee motivation, often rooted in an unsupportive work environment, insufficient recognition, and non-transparent communication practices.

B. Natural Factors

Natural factors are occurrences or events that happen on Earth naturally, without human intervention. These factors influence and shape the surrounding environment. Several examples of natural factors that can affect loading and unloading activities include:

a) Adverse Weather Conditions

Weather significantly impacts life and ecosystems globally. It involves complex interactions between the atmosphere, oceans, and land, creating dynamic and varying conditions.

b) Several types of adverse weather pose risks during the handling of ammonium nitrate.

c) Strong winds can carry dust and significantly increase the risk of explosion.

d) Heavy rain can cause environmental contamination and elevate the risk of

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accidents. Lightning can trigger an explosion if ammonium nitrate is not stored properly. Fog limits visibility, thereby increasing the likelihood of accidents.

e) High waves can increase the risk of material spillage from vessels or barges.

C. Equipment and Infrastructure

Inadequate equipment and infrastructure pose a significant constraint on the efficiency of ammonium nitrate loading and unloading operations at PT. Kutai Jaya Pundinusa. Specifically, insufficient crane capacity can result in prolonged queue lines and extensive waiting times, thereby considerably slowing down the entire handling process.

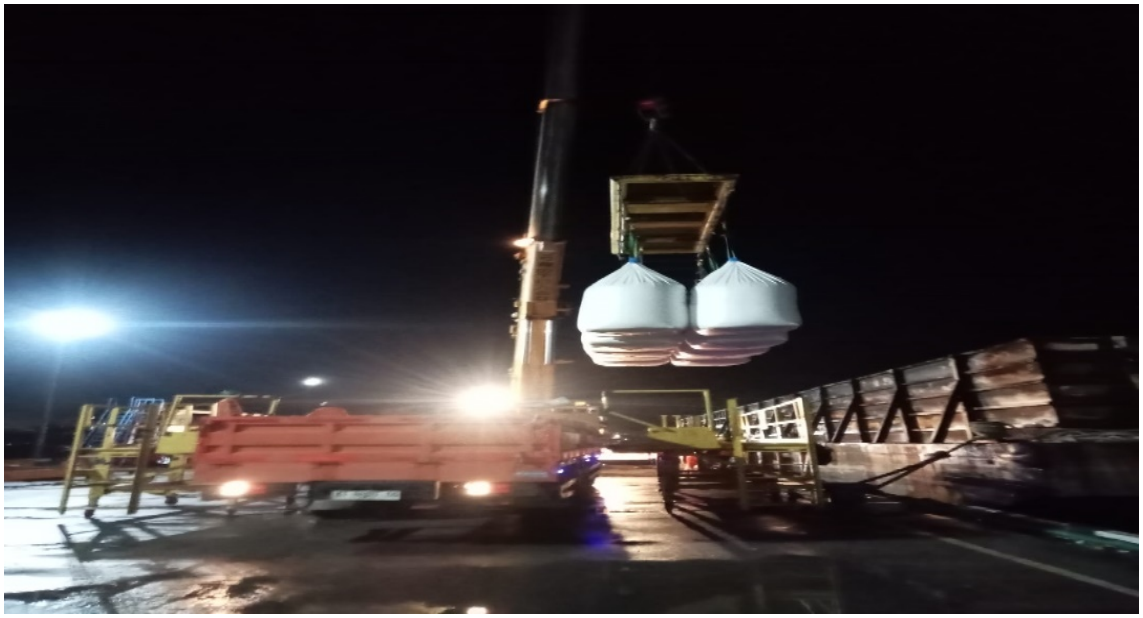

Figure 7. Loading

1. Infrastructure Layout and Design

a) The current layout of the pier (wharf) and the storage warehouse may be sub-optimal for the safe and efficient movement of ammonium nitrate. b) Long distances between the pier and the warehouse, or insufficient road access, can significantly slow down the transportation process and increase the risk of accidents.

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2. Condition of Equipment and Infrastructure
a) The use of aged equipment and infrastructure, coupled with poor road conditions, can impede and slow down the loading and unloading operations. b) These bottlenecks can cause substantial disruptions to cargo handling activities, resulting in increased vessel laytime costs (demurrage) and additional crane rental fees while at the port. Ultimately, these inefficiencies lead to financial losses for both the shipper and the vessel owner.

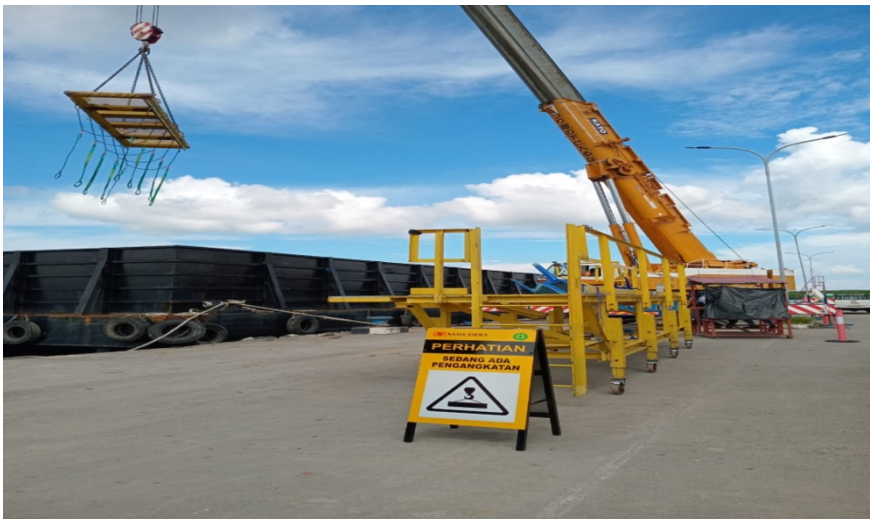

Figure 8. Loading and Unloading Equipment

The Impact of Inhibitors

The inhibiting factors stemming from inadequate equipment and infrastructure can lead directly to a decline in operational efficiency and overall productivity. Slow loading and unloading processes may result in shipment delays and subsequent financial losses. Furthermore, unsafe conditions significantly increase the risk of occupational accidents, which can lead to injuries or fatalities.

Manpower

The effectiveness of ammonium nitrate loading and unloading at PT. Kutai Jaya Pundinusa's Bontang branch is significantly influenced by manpower factors. Insufficient quantity and quality of the workforce can severely impede efficiency. Several issues arising from manpower shortages include cargo accumulation, worker fatigue, and an increased risk of accidents. Additionally, the lack of adequate loading and unloading equipment also serves as a major barrier. Proposed solutions to address these issues include: conducting workforce needs analysis, implementing stringent recruitment processes, enhancing work discipline, establishing a strong safety culture,

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and increasing the number of field operational personnel.

CONCLUSION

Based on the discussion of the results, the ammonium nitrate loading and unloading activities at PT. Kutai Jaya Pundinusa, Bontang branch, are concluded to be effective and safe. This effectiveness is demonstrated by a low rate of work accidents, minimal cargo damage, and high-time efficiency. Nevertheless, several inhibiting factors persist, namely those related to the working system, natural factors (weather/environment), equipment and infrastructure, and human resources (labor). To address these challenges, the company has implemented measures aimed at further mitigating the risks of accidents and injuries.

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