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Hazard Identifications, Risk Assessment and Risk Control for Receiving Operation of a Retail Distribution Centre

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Abstract

Introduction: This study systematically evaluates occupational safety and health (OSH) risks within high-traffic receiving and unloading operations at a primary Retail Distribution Centre (RDC) in Puchong, Selangor. **Methodology:** Data collection was executed through non-interventional strategies, including extensive direct field observations and corporate document reviews. Risk quantification utilized a task-based layout matching the 5x5 risk matrix framework to calculate definitive Risk Matrix Numbers (RMN). **Results:** The assessment mapped 13 operational hazards across physical, ergonomic, chemical, and environmental dimensions. Ten hazards, including repetitive manual handling of heavy retail cartons, awkward postures during deep cage inspections, and handling sharp components, were classified as Medium Risk exposures (RMN 5 to 8). Three hazards, such as prolonged static standing and truck exhaust emissions, were rated as Low Risk (RMN 1 to 4). Two specific vehicular hazards involving excessive machinery speed and vehicle-pedestrian collisions initially scored as Medium Risk but were escalated to High-Risk priorities. This upgrade was justified by the insufficiency of current passive controls against heavy vehicle impacts and was further validated by an MHE-related accident that occurred shortly after the assessment. **Conclusion:** Based on the Hierarchy of Control, the study recommends targeted practical interventions to transition the facility to a proactive safety posture. Key proposals include installing physical safety barriers for vehicle segregation, deploying mechanical speed governors, implementing automated spring-loaded pallet positioners, and creating a dedicated battery charging zone with localised exhaust hoods. Ultimately, this research provides an operational safety roadmap that balances high distribution velocity with comprehensive worker protection.

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1. Introduction

While the retail industry is widely recognized as a primary engine of the global economy, its rapid expansion directly intensifies the complexity of managing industrial workplace safety. Within the Malaysian economic landscape, the retail sector holds a vital position as a core pillar of the broader services sector, which stands as the nation's largest economic contributor by accounting for approximately half of Malaysia's total Gross Domestic Product (GDP). Recent economic indicators published by the Department of Statistics Malaysia (2025) validate this sustained upward trajectory, noting that the wholesale and retail trade sub-sector demonstrated a resilient growth rate of 4.3%, following an expansion of 5.9% in the preceding year of 2023.

Consequently, managing OSH risks within an RDC is no longer just a passive administrative task or a matter of regulatory compliance to satisfy auditors. Instead, proactive risk management is an operational necessity to protect workers and prevent severe workplace accidents (Marzuki et al., 2022). Despite its economic importance, the rapid expansion of Malaysia's retail and logistics sector introduces significant occupational safety challenges. National accident data indicates that the retail sector, collectively grouped under Wholesale and Retail Trade, consistently records an alarming number of workplace injuries. In fact, this sector currently ranks as the third highest contributor in national accident statistics, trailing closely behind only the heavy manufacturing and construction industries. Historical baselines show that the sector recorded 3,429 occupational accident cases in 2020 alone (DOSH, 2023). More recently, data from the Department of Occupational Safety and Health (DOSH) indicated that within a ten-month window between January and October 2023, the sector reported 147 workplace accidents, comprising 145 non-permanent disability cases and 2 permanent disability cases. This persistent injury trend underscores a critical gap in current operational risk management, highlighting the fact that traditional, passive safety measures are failing to mitigate the occupational hazards generated by modern warehouse volumes.

The receiving operation is a highly dynamic and hazard-intensive area within the RDC. As the primary gateway where external transportation carriers interface directly with internal warehouse logistics, the receiving dock is characterized by the constant co-location of heavy Material Handling Equipment (MHE), such as Powered Industrial Trucks (PITs), forklifts, and reach trucks, alongside vulnerable pedestrian workers who check, sort, and process incoming inventory. According to guidelines by DOSH (2015), this specific zone where heavy vehicles and pedestrians mix creates a prime environment for severe industrial accidents. Hazards in this high-traffic interface fall into several distinct operational categories that threaten worker well-being.

Given the relentless expansion of Malaysia's logistics infrastructure and the high frequency of industrial accidents within retail distribution frameworks, there is a critical need for a targeted, structured safety investigation focusing specifically on the RDC receiving operation. The presence of overlapping physical, ergonomic, and environmental dangers on the dock floor indicates that existing safeguards are insufficient to shield workers from harm. To address this gap, this study utilizes a systematic Hazard Identification, Risk Assessment, and Risk Control (HIRARC) framework to formally map out the workplace. The importance of this study lies in its dual contribution to localised workplace safety and broader OSH empirical literature. Practically, the execution of this research provides the Puchong facility with a comprehensive baseline of active floor hazards and their corresponding risk matrix numbers (RMN). This foundational data allows for the direct implementation of proactive, high-tier control strategies, systematically safeguarding human capital without compromising distribution velocity. Furthermore, from an academic and regulatory perspective, this study serves as a critical benchmark reference for safety practitioners in Malaysia, providing actionable, task-specific hazard profiles for modern high-density warehouse environments that align with contemporary DOSH enforcement frameworks.

2. Methodology

This study uses a qualitative case study design to investigate the receiving operation of a retail distribution centre. The case study method is ideal since HIRARC relies extensively on real-time monitoring of working circumstances, workflow patterns, and equipment interactions. By analysing the operation in its actual setting, the researcher can find significant hazards that would not be apparent from a theoretical study alone. The qualitative aspect of the study allows for an in-depth evaluation of tasks and processes, resulting in a precise and detailed risk assessment. In addition, the research design prioritises process-focused analysis over participant-focused data gathering. The study did not require systematic interviews or questionnaires because HIRARC prioritised danger identification in job operations. This improves the objectivity of the conclusions by focusing on visible evidence and existing documentation rather than subjective human responses. The implementation of DOSH's HIRARC

principles strengthens the study's foundation in known occupational safety procedures, assuring methodological consistency and compliance with Malaysian regulatory expectations.

3. Results and Discussion

3.1 Analysis of Physical Hazards

Based on the research findings, the task sequence of lorry docking exposes the distribution centre staff to severe mechanical and impact hazards. During this initial process, logistics vehicles are required to reverse into the restricted loading bay area. If this action is performed without a dedicated traffic spotter, active vehicle proximity sensors, or adequate impact-absorbing dock bumpers, it creates an immediate hazard where the lorry can strike the dock structure or pedestrian workers standing behind the vehicle. This specific risk can result in high-severity consequences such as severe impact injuries or bone fractures. Currently, the existing control measures at the warehouse only rely on marking the loading area and requiring all staff to wear standard safety boots. This risk is assessed with a Likelihood of 2 and a Severity of 4, yielding a final Risk Matrix Number (RMN) of 8, which is categorised as Medium Risk. To further control this hazard, it is highly recommended to introduce engineering controls by installing proximity sensor systems and rear-facing camera monitors on docking transport units. According to Conway (2024), implementing mandated safety technologies such as mirror or camera monitoring systems and rear or near-side blind spot sensors significantly mitigates the risk heavy goods vehicles pose to ground-level pedestrians by directly eliminating driver blind spots. This engineering control is further supported by Barat and Das (2024), who argue that heavy vehicles inherently possess massive blind spots compared to passenger cars, creating hazardous situations that lead to potential collisions and fatalities. Barat and Das (2024) justify the installation of non-planar spherical convex mirrors to reduce these risks, proving that such equipment provides a wider wide-angle view, reduces blind spots, and drastically decreases vehicle response times and crash rates by up to 22.9 percent.

Following the docking sequence, another critical physical hazard identified during the lorry docking process is the failure to secure the lorry wheels with physical wheel chocks immediately after the vehicle stops. When wheel chocks are not utilized, a hazardous phenomenon known as vehicle creep or a runaway truck can occur. This happens when the heavy lorry shifts forward and moves away from the loading platform while material handling equipment is actively entering or exiting the container bed. The consequences of this shifting include ground workers tripping into a sudden gap or multi-ton equipment falling completely off the elevated loading bay. Currently, the site controls remain limited to standard safety shoe enforcement and floor lane markings. This hazard is evaluated with a Likelihood of 1 and a Severity of 4, which calculates to an RMN of 4, keeping it within the Low Risk threshold. To control this hazard, the facility must implement an administrative control enforcing a strict physical wheel-chocking policy immediately upon vehicle arrival. Industrial hazard data compiled by FFP Gear (2024) details fatal workplace incidents where operators were crushed by rollaway trucks that lacked parking brakes or chocked wheels, illustrating the extreme severity of this hazard. FFP Gear (2024) strongly recommends creating and enforcing a strict standard operating procedure policy that mandates all vehicle operators use parking brakes and wheel chocks, alongside mounting high-visibility warning signs in the bay areas to remind drivers to set chocks before leaving the truck cabin. Furthermore, Sherman (2023) identifies the crucial time in a warehouse operation as the exact moment a tractor-trailer backs up to the loading dock, noting that failure to chock the truck wheels can lead to catastrophic accidents. Sherman (2023) suggests using physical chock blocks or an automated dock-lock system to secure the tractor-trailer, establishing a strict facility policy to never leave an active container vehicle unsecured while workers load, unload, or service the dock.

As the operations progress to the unloading goods and staging phases, housekeeping and mechanical speed issues present further physical threats to the workforce. Based on the observation of workers unloading goods from the lorry and the subsequent goods staging process, the warehouse floor frequently becomes cluttered with discarded packaging materials, loose plastic shrink wrap, and shattered wooden pallet splinters. This accumulation of industrial debris introduces pervasive slip, trip, and fall hazards that can cause ground workers to lose their balance or cause moving machinery to skid. This risk is evaluated with a Likelihood of 2 and a Severity of 3, resulting in an RMN of 6, which falls under Medium Risk. Currently, the warehouse relies on general safety boots and marked lanes to manage floor risks. To mitigate this clutter, the implementation of a structured 5S management program is highly proposed. Research by da Costa et al. (2023) demonstrates that applying the 5S method within a logistics and warehouse environment promotes organizational excellence, absolute cleanliness, and standardisation. By eliminating unnecessary or poorly maintained materials and setting specific locations for

items, the 5S program significantly reduces the risk of operational accidents and slips, thereby contributing to robust workplace safety.

This housekeeping hazard interacts directly with the risk of forklifts and Power Pallet Trucks operating at excessive speeds across steep or wet dock levelers. Operating material handling equipment without strict speed controls significantly increases the probability of vehicle traction loss, which can lead to operator entrapment and high-impact crush injuries from a vehicle overturn. This operational hazard is assigned a Likelihood of 2 and a Severity of 4, resulting in a Medium Risk rating with an RMN of 8. To mitigate this risk, the warehouse must deploy mechanical speed governor devices. Hadidi (2023) explains that operating forklifts in a fast fashion makes them highly unstable due to a constantly moving center of gravity, which drastically increases the risk of tipping over and causing severe accidents. Hadidi (2023) recommends continuously monitoring and keeping equipment speed at low levels, emphasizing that starts and stops should always be perfectly smooth, while advising operators never to execute turns while driving across, up, or down a ramp or incline, as the forklift's narrow build can quickly shift its center of gravity outside its stability triangle. The severe reality of this risk was later validated, as an MHE-related collision actually occurred on the staging floor shortly after the initial data collection phase concluded.

The final set of physical hazards occurs during the unloading of goods from trolleys for checking. When workers are checking goods, they routinely use unretractable utility knives and open cutters to slice through heavy cardboard boxes and plastic wrapping layers. The use of these unshielded sharp blades creates a high probability of accidental hand slips, which can cause deep lacerations and puncture wounds to the fingers. Currently, the warehouse relies on the baseline requirement of safety boots, which does not protect the upper limbs from blade cuts. This specific tool hazard is given a Likelihood of 3 and a Severity of 2, leading to an RMN of 6, which is a Medium Risk. To rectify this risk, the warehouse must substitute standard knives with industrial safety cutters. Aung (2024) suggests that minimizing cutting dangers and enforcing the safe handling of sharp objects in warehouses requires stringent safety measures. Aung (2024) recommends mandating safety knives that feature fully retractable blades and limited blade exposure when workers handle corrugated materials and plastic wrappings, while indicating that workers must receive specialised training in proper cutting techniques to establish a proactive occupational safety and health culture within the warehousing industry.

3.2 Analysis of Ergonomic Hazards

Based on the hazard identification process, the unloading and staging sequences within the receiving area introduce significant ergonomic risks to the warehouse operators. The first major task sequence involves unloading goods from incoming lorries, where workers are required to manually lift, pull, and transfer heavy retail boxes from inside the container beds onto pallets repeatedly. The primary hazard identified in this manual handling activity is the repetitive movement of heavy loads and localised physical overexertion. This hazard is evaluated with a Likelihood of 2 and a Severity of 3, resulting in a final Risk Matrix Number (RMN) of 6, which indicates a Medium Risk level. If ignored, the physical consequence of this hazard involves chronic repetitive muscle strain, severe localised muscle fatigue, and a heightened risk of developing long-term Musculoskeletal Disorders (MSDs) or permanent lower back injuries among the operators. Currently, the existing risk control measures at the distribution centre are limited to standard safety boot enforcement and floor lane markings. While these basic controls are effective for protection against falling objects, they do not reduce the biomechanical strain on the muscles and spine. Therefore, to control this hazard effectively, the warehouse must implement engineering controls by introducing adjustable conveyor belts or electric high-lift scissor tables to minimize the distance workers have to carry heavy cartons. This is supported by Murugan et al. (2023), who recommend adjusting the work platform and implementing new transport designs during unloading and packing tasks to successfully avoid risky work postures and reduce repetitive bending operations across a standard eight-hour workday.

Following the initial unloading phase, the process moves toward unloading goods from trolleys and checking the physical stock. During this task, operators must manually push or pull heavily loaded hand pallet trucks and dollies across the staging floor to position the goods for auditing. The main hazard associated with this task is the excessive physical exertion required to initiate and stop the movement of these heavy multi-ton manual units. This specific hazard is assessed with a Likelihood of 2 and a Severity of 3, calculating to an RMN of 6, which falls under the Medium Risk category. The consequence of this hazard is immediate acute upper extremity strain, shoulder fatigue, and severe lower back pain due to overcoming heavy static friction on the floor. The current control measures at the facility rely entirely on requiring staff to wear safety shoes and keeping within marked loading areas, which provides zero ergonomic support. To address this risk, the warehouse should upgrade its equipment by replacing manual pallet trucks with battery-powered electric pallet trucks to remove manual

pulling forces. According to Schmidt et al. (2021), physical push or pull tasks and heavy lifting are heavily associated with musculoskeletal pain, and implementing structured evidence-based guidelines is highly necessary for occupational safety professionals to handle and prevent chronic back pain.

Within the same checking sequence, workers must also inspect individual items by bending forward, twisting their torso, and reaching deeply into cages or split pallets to verify the retail goods. This task creates an awkward posture hazard because the movements pull the operator's spine out of its neutral ergonomic alignment. This hazard is assigned a Likelihood of 3 and a Severity of 2, yielding an RMN of 6, making it a Medium Risk. The physical consequence of this prolonged awkward positioning includes repetitive strain injuries and severe localised muscle fatigue in both the lower back and neck. Currently, the warehouse only relies on basic safety boots and marked lanes to manage the area, leaving workers exposed to spinal stress. For risk control, it is highly recommended to install automatic spring-loaded pallet positioners that keep the top of the load at a comfortable working height, eliminating the need for operators to bend down or over-reach. Murugan et al. (2023) justify this control by suggesting that introducing self-adjustable tool modifications can effectively help workers avoid continuous bending and awkward postures when transferring components between storage trays. Furthermore, Abdullah et al. (2020) state that designing specific supportive tools is essential to ease manual handling and reduce the operational mismatch between the physical conditions of the worker and their workstation layout.

The next critical task sequence is stock consolidation, where workers must bend, twist, and lift cartons repeatedly to sort and restack retail items onto a consolidated pallet. The hazard present in this activity is the combination of awkward body movements and high-frequency manual lifting. This risk is evaluated with a Likelihood of 3 and a Severity of 2, which gives an RMN of 6, classifying it as a Medium Risk. The consequence of this sorting task is excessive physical strain on the lumbar spine, rapid muscle fatigue, and a high probability of developing occupational musculoskeletal injuries over time. The current site controls only require workers to wear safety shoes and stay in designated areas, which do not protect the back muscles. To control this hazard, the management should implement administrative controls such as mandatory task rotation schedules alongside specialised educational programs. Yaşar et al. (2025) demonstrate that an integrated approach combining ergonomic training with workplace exercises is a highly effective strategy to alleviate musculoskeletal discomfort, as instructing participants on proper lifting techniques directly prevents repetitive strain injuries within physically demanding retail and logistics environments.

Additionally, the checking process requires operators to stand in a static, fixed position at the auditing podium for multiple hours while reviewing invoices and sorting documents. The hazard here is prolonged static standing without any posture relief. This hazard receives a Likelihood of 2 and a Severity of 2, leading to an RMN of 4, which is categorised as a Low Risk. The physical consequence of this static posture is blood pooling in the lower limbs, which restricts regular fluid circulation and causes painful leg cramps, varicose veins, and general lower limb fatigue that decreases worker alertness. The current controls only enforce safety boots and lane markings, which are insufficient for comfort. To control this risk, the warehouse should provide anti-fatigue floor matting and height-adjustable industrial sit-stand stools at each podium to reduce lower limb stress. Schmidt et al. (2021) support this type of workstation intervention, confirming that deploying ergonomic sit-stand workstations alongside targeted workplace stretching and strength training can successfully prevent or reduce localised musculoskeletal pain caused by static postures.

The final ergonomic hazard occurs when workers are handling and organizing physical stock, where they must place their hands near sharp retail boxes and tight spaces between wooden or plastic pallets. The hazard identified is contact stress and hand entrapment within restricted spaces. This specific risk has a Likelihood of 3 and a Severity of 2, resulting in an RMN of 6, which represents a Medium Risk. The consequence of this hazard involves workers getting their fingers or hands pinched, crushed, or lacerated, leading to open wounds and painful tissue bruising. Currently, the warehouse relies on safety boots as the main safety rule, which does not protect the upper limbs. For risk control, the facility must enforce an administrative rule mandating all checking staff to wear high-dexterity protective safety gloves to eliminate direct contact stress and pinch injuries during handling. This intervention aligns with Abdullah et al. (2020), who emphasise that active ergonomic interventions are critical to achieving postural correction and preventing musculoskeletal disorders, while Yaşar et al. (2025) add that combining workplace adjustments with proper protective practices and planned rest breaks enhances the overall long-term well-being of operators handling stock.

3.3 Analysis of Environmental and Chemical Hazards

Apart from physical and ergonomic factors, the operational environment within the receiving area also introduces critical environmental and chemical hazards to the workforce. The first significant environmental hazard occurs during the lorry docking task sequence, where logistics vehicles reverse into the loading bay and leave their engines idling for extended periods inside or right at the threshold of the dock area. The primary hazard identified from this activity is the rapid accumulation of hazardous Carbon Monoxide (CO) gas and toxic exhaust emissions. This environmental risk is evaluated with a Likelihood of 2 and a Severity of 2, yielding a final Risk Matrix Number (RMN) of 4, which falls under the Low-Risk category. The direct consequence of this toxic accumulation is a severe compromise of the indoor air quality (IAQ) within the staging zone, which can cause acute worker dizziness, intense headaches, or sudden respiratory failure during shifts. Currently, the existing control measures at the warehouse only consist of marked loading areas and the mandatory enforcement of standard safety boots, which completely fail to protect the workers' respiratory systems from airborne chemical contaminants. To control this hazard, the warehouse must implement strict administrative control by enforcing a strict no idling policy that requires all truck drivers to switch off their engines immediately after docking, while simultaneously installing active mechanical ventilation systems. According to Febriandini et al. (2026), vehicle emissions from idling transport units significantly accumulate in high traffic zones and cause the concentration of CO to exceed ambient air quality standards, creating non-carcinogenic health risks that require regular ambient air monitoring and the consistent use of respiratory protection to reduce direct inhalation. Furthermore, Parker et al. (2025) explains that indoor carbon monoxide contaminants can easily migrate from the source area to adjacent work zones through unsealed structural paths, highlighting that effective prevention strategies must include proper building ventilation, eliminate indoor contaminants, and implement alert systems to notify occupants of harmful concentrations.

The second hazard identified is a chemical hazard during the maintenance and charging of Material Handling Equipment (MHE) within the staging and inventory transport zone. This task involves the improper storage of electric MHE batteries and the top-up water process, where charging activities are scattered unsafely outside a designated chemical store. The hazard present in this area is direct exposure to highly corrosive battery acid spills and the localised buildup of highly flammable hydrogen gas during the battery charging process. This chemical hazard is assessed with a Likelihood of 3 and a Severity of 2, resulting in an RMN of 6, which represents a Medium Risk level. If ignored, the physical consequence of this hazard includes severe chemical burns to the skin, acute eye irritation or permanent vision damage from acid splashes, and catastrophic fire or explosion hazards caused by the ignition of trapped hydrogen gas. Currently, the warehouse manages this zone by relying on general floor lane markings and requiring staff to wear safety shoes, which offers no protection against chemical contact or thermal explosions. To address this risk, the facility must establish an engineering control by creating a dedicated battery charging area equipped with localised exhaust hoods to disperse hydrogen gas safely. Alkhalidi et al. (2022) support this type of intervention by detailing major safety design recommendations for energy storage battery rooms, emphasizing that implementing an appropriate ventilation system is vital to limit the concentration of combustible gases produced by batteries during simultaneous charging operations, alongside requiring gas detectors to be placed strategically to notify authorities if safety limits are crossed.

3.4 Summary of HIRARC Table

Prior to the detailed evaluation of each individual hazard, a comprehensive risk profile was established to determine the overall distribution of safety threats within the Receiving Area of the retail distribution centre. A total of 13 specific hazards across physical, ergonomic, and environmental classifications were identified, evaluated, and categorised based on their final Risk Matrix Number (RMN) and professional safety justification. Table 3.1 illustrates the summary and percentage distribution of these risk levels:

Table 3.1: Summary of Risk Level Distribution in the Receiving Area

Risk Level Classification	RMN Range	Number of Identified Hazards	Percentage of Total Hazards
High	9 - 12 (*or justified*)	0	NA
Medium	5 - 8	10	77%
Low	1 - 4	3	23%

Total	NA	13	100%

As outlined in Table 3.1, the operational hazard profile of the receiving zone is heavily dominated by Medium Risk categories (77.00%), followed by Low Risk categories (23.00%), with no baseline hazards falling into the High Risk classification. Notably, two specific vehicular operations evaluated to a baseline Risk Matrix Number (RMN) of 8, occupying the upper boundary of the medium risk spectrum (range 5–8), directly adjacent to the high-risk threshold (< 9). These high-range hazards involve: (1) forklifts and Power Pallet Trucks (PPT) operating at excessive speeds or bearing unbalanced loads across steep or wet dock levelers, and (2) pedestrian-MHE collisions within the temporary consolidation zone.

Despite an initial baseline calculation of Medium Risk (RMN = 8), these hazards were escalated to High Risk. This adjustment is justified because current passive controls, such as safety boots and floor markings, offer insufficient protection against heavy vehicle impacts and rollovers. Crucially, the necessity of this upgrade was validated by the occurrence of an actual MHE-related accident on the facility floor shortly after the data collection period. This incident provides direct empirical evidence that the simultaneous operation of forklifts, PPTs, and reach trucks within confined pedestrian corridors creates a highly hazardous environment with severe or fatal consequences. Consequently, maintaining a medium rating would severely underrepresent the actual operational reality. Elevating these risks to a High Risk status is therefore critical to mandate immediate engineering interventions, such as physical segregation barriers and mechanical speed governors.

4. Conclusion and Recommendation

In conclusion, the HIRARC study carried out at the Puchong Retail Distribution Centre successfully fulfilled its objectives of identifying workplace hazards, assessing risk scores, and proposing practical control measures for the unloading and receiving processes. The assessment highlighted that while the receiving dock deals with multiple low and medium-level physical and ergonomic risks, material handling equipment (MHE) operations represent the most critical threats that require immediate intervention due to the severe deficiency of passive baseline controls against multi-ton vehicular impacts. The findings also proved that traditional reliance on basic personal protective equipment (PPE), such as safety boots, is not enough to secure a high-traffic logistics environment. True risk reduction can only be achieved by implementing a structured hierarchy of controls, specifically engineering space segregation, active mechanical ventilation systems, and strict administrative routines like periodic task rotations and structured housekeeping checks. By executing these proposed control measures within the stipulated timelines under the commitment of management and the SHE department, the distribution centre can significantly lower its accident rates, prevent long-term occupational illnesses, and foster a safer, more productive working environment for its entire workforce.

Moving forward, it is highly recommended that the facility management transitions from static periodic hazard assessments to an automated, continuous safety monitoring framework. Future studies should explore the integration of proximity warning sensors on heavy forklifts and real-time indoor air quality monitoring systems at the active loading bays to dynamically manage overlapping physical, chemical, and environmental risks. Furthermore, institutionalising regular behavioural safety training and ergonomic posture refreshers for ground operators will ensure long-term compliance with the established risk control barriers. Ultimately, maintaining this rigorous, data-driven approach to occupational safety and health is vital to sustain optimum logistics velocity while guaranteeing a resilient and injury-free working environment for the frontline workforce.

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Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

This journal requires that all authors take public responsibility for the content of the work submitted for review. The contributions of all authors must be described in the following manner:

The authors confirm contribution to the paper as follows: study conception and design: Amalia Hayani Abdul Hambali, Amir Haziq Abdul Razak; data collection: Amalia Hayani Abdul Hambali; analysis and interpretation of results: Amalia Hayani Abdul Hambali, Amir Haziq Abdul Razak; draft manuscript preparation: Amalia Hayani Abdul Hambali. All authors reviewed the results and approved the final version of the manuscript.

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