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Analysis of Portable Fire Extinguishers and Evacuation Facilities Based on National Regulations

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ABSTRACT

Background: PT. Adi Satria Abadi is a manufacturing enterprise specializing in the production of sheepskin-based golf gloves. The facility stores various hazardous substances, including chemical agents, sheepskin, and other highly combustible raw materials. Consequently, the implementation of a robust fire protection system is imperative to ensure operational safety. Given the intensive nature of production activities within the premises, an adequate fire suppression and prevention infrastructure is essential to mitigate potential fire-related risks. **Method:** This research employs a qualitative approach utilizing a case study design. Data collection was conducted through structured interviews with three key informants: the Occupational Health and Safety (K3) Secretary, a Human Resources Department (HRD) representative, and the Fire Emergency Response Team (Red Team). A purposive sampling technique was utilized, supplemented by direct field observations and comprehensive documentation. **Results:** The findings indicate that the active fire protection systems, specifically portable fire extinguishers (APAR), generally align with the Ministry of Manpower Regulation No. PER.04/MEN/1980, although certain deficiencies persist. Similarly, evacuation facilities—encompassing evacuation routes, emergency exits, corridors, and assembly points largely adhere to the Ministry of Manpower and Transmigration Regulation No. PER.16/MEN/2008, yet require further rectification. **Conclusion:** Therefore, it is recommended that the enterprise immediately replace corroded fire extinguishers and formulate formal organizational policies regarding evacuation facilities to effectively minimize fire hazards.

1. Introduction

Fire incidents represent deleterious events resulting in multifaceted losses, encompassing material damage, fatalities, and environmental degradation. Statistical data from the Indonesian National Police indicates that 5,336 fire cases occurred between May 2018 and July 19, 2023. The incidence rate in Indonesia exhibits an upward trajectory, reaching a peak of 133 cases in June 2023. In light of these occurrences, highly effective management regarding building access planning and environmental design is requisite for fire prevention, rescue operations, and firefighting efficiency. [1] Anthropogenic factors constitute a significant catalyst for fire outbreaks, often stemming from a deficiency in fire mitigation literacy and operational negligence. Such negligence is frequently attributed to environmental

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apathy, lack of routine inspections, absence of fire simulations, diminished cognitive concentration, or compromised physical health. [2] Diverse variables contribute to ignition, prominently including improperly discarded cigarette butts and electrical short circuits. The presence of high concentrations of combustible materials within a structure significantly exacerbates the impact, leading to substantial material and non-material losses. [3] Within industrial environments, the provision of Portable Fire Extinguishers (PFEs) is paramount, as the fire risk profile is considerably higher than in conventional buildings. Industrial facilities typically house various volatile substances such as chemical agents, lubricants, gases, paper, and other production materials which may ignite due to technical malfunctions, human error, or equipment failure. PFEs facilitate rapid initial response prior to fire propagation, thereby mitigating catastrophic losses regarding personnel safety and the destruction of machinery or inventory. [4] Evacuation facilities within factories serve as critical components for life safety and the prevention of chaos during hazardous situations. Under emergency conditions, temporal constraints are severe, and panic is prevalent. Consequently, evacuation infrastructure must be rigorously prepared and organized to ensure a rapid, orderly, and secure rescue process. [5] Fire protection systems must strictly adhere to prevailing statutory requirements, including the Minister of Public Works Regulation No. 26/PRT/M/2008 and the Minister of Manpower Regulation No. PER.04/MEN/1980.

PT Adi Satria Abadi (PT ASA) Yogyakarta is a manufacturing enterprise specializing in the production of sheepskin-based golf gloves. Preliminary studies and interviews with the Human Resources Department at PT ASA reveal that the active fire protection systems comprise PFEs and hydrants, while the passive systems include life safety measures such as egress paths, exit signage, and assembly points. Several identified fire risk factors at PT ASA include the storage of combustible raw materials, such as sheepskin and chemical additives, alongside the operation of thermal-intensive machinery, including industrial drying units. Given the inherent hazards, PT ASA necessitates a comprehensive and standardized fire protection system. Consequently, this study is conducted under the title: “Analysis of Portable Fire Extinguishers and Evacuation Facilities Based on National Regulations at PT Adi Satria Abadi, Bantul Regency.”

2. Methods

This study employs a qualitative methodology utilizing a case study design. The research was conducted at PT Adi Satria Abadi, situated in Banyakan 1, Sitimulyo, Piyungan District, Bantul Regency, Special Region of Yogyakarta. The primary objective of this investigation is to evaluate the fire protection systems implemented within PT Adi Satria Abadi, with the study duration spanning from June to August 2025. Participant selection was executed through a purposive sampling approach to ensure the acquisition of high-quality, relevant data. The designated key informants for this research comprise the Occupational Health and Safety (OHS) Secretary, a representative from the Human Resources Department (HRD), and the Fire Emergency Response Team (locally referred to as Tim Merah).

3. Results and Discussion

3.1. Results

3.1.1. Informant Characteristics

The informants involved in this study were classified based on several parameters: name, designation, age, and educational background. A total of three informants participated in the investigation, as detailed in Table I.

Table 1. Demographic Profile and Characteristics of Research Informants

No.	Designation	Age (Years)	Educational Background
1.	Secretary K3(OSH)	27	S1
2.	HRD	49	S1

No.	Designation	Age (Years)	Educational Background
3.	Red Team	43	SMP

3.1.2. Portable Fire Extinguishers (PFE)

Based on field observations and data synthesis at PT Adi Satria Abadi, the compliance assessment of Portable Fire Extinguishers (PFEs) was conducted in accordance with the Ministry of Manpower and Transmigration Regulation No. 04 of 1980. The evaluation prioritized two critical dimensions: installation and maintenance. Regarding installation, the enterprise generally adheres to established standards, particularly concerning the appropriate mounting height, strategic positioning, and the absence of obstructions hindering access. However, a discrepancy was identified concerning the spatial distribution between units, where the distance exceeded the regulated parameters at certain points. In terms of maintenance, most indicators were satisfied, including monthly routine inspections, the availability of maintenance tags, and the integrity of safety seals and pins. Nevertheless, an analytical finding revealed that several units exhibited corrosion, which fails to meet the required safety standards. The facility maintains 34 PFE units, comprising 29 dry chemical powder units and 5 CO^2 units. While inspections are performed monthly, comprehensive testing and refilling are conducted biannually. These activities are typically integrated with mock drill exercises in collaboration with the local fire department, with refilling services provided by CV. Wahana Tunggal.

3.1.3. Evacuation Facilities

3.1.3.1. Evacuation Routes

The evaluation of evacuation routes was conducted with reference to Regulation No. 26 of 2008, specifically examining whether egress paths are free from obstructions and debris. The observation results are summarized in Table II.

Table 1. Observational Assessment of Evacuation Routes

No.	Requirement (Regulation No.26/2008	Availability		Compliance Level			Remarks
		Yes	No	*Fully Functional*	*Partially Functional*	*Non-Functional*	
1.	Absence of Physical Obstructions in the Means of Egress	√		√			Satisfactory
2.	Absence of mirrors in the vicinity of the exit	√		√			Satisfactory
3.	Presence of scattered debris or loose materials within the means of egress	√			√		Modification Required

These findings demonstrate that while primary egress paths are unobstructed and lack misleading mirrors, there is a systemic issue with the placement of production materials along the path peripheries, which potentially compromises the operational effectiveness of the routes during an emergency.

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3.1.3.2. Exit Doors

Field observations indicate that the condition of exit doors largely conforms to the mandated assessment indicators. Exit signage is prominently displayed, easily recognizable, and visible from a distance of 3–5 meters. Furthermore, these signs are protected from potential damage to ensure functionality during emergencies. The exit doors are equipped with locking mechanisms that facilitate effortless egress from within the room. The mounting height of these mechanisms remains below the 150 cm threshold, ensuring accessibility for all users. Despite these strengths, critical non-compliance issues were identified: several doors lack bidirectional swing capabilities and do not open directly toward the designated evacuation path, representing a significant finding in this assessment.

3.1.3.3. Corridors

The assessment of corridors revealed that current conditions do not fully align with the prescribed safety indicators. While certain aspects such as direct access to exits without traversing intermediate rooms, sufficient illumination for orientation, and clear directional signage are satisfactory, significant deficiencies persist. Specifically, several corridors are utilized for active production processes, which may impede evacuation flow. Moreover, the corridors lack the required one-hour fire resistance rating, a fundamental requirement for industrial fire safety. These deficiencies signify a critical gap in the overall fire protection infrastructure of the facility.

3.1.3.4. Assembly Points

Based on interviews with Informants 1 and 2, the enterprise designates a single assembly point located at the front of the facility. Observations confirm that this area meets several criteria: it is highly accessible, possesses sufficient capacity to accommodate all personnel, and is marked with identifiable signage. However, its effectiveness is significantly undermined by its dual-use as a vehicle parking area. This condition poses a substantial risk to the fluidity and safety of rescue operations during an emergency. Consequently, while accessibility and capacity are adequate, the functional integrity of the assembly point requires immediate rectification.

3.2. Discussion

3.2.1. Portable Fire Extinguishers (PFE)

The findings indicate that the management of Portable Fire Extinguishers (PFEs) at PT Adi Satria Abadi generally aligns with the provisions stipulated in the Minister of Manpower Regulation No. PER.04/MEN/1980. Several technical parameters have been satisfied, including wall-mounting at a height of approximately 120 cm from the floor, maintaining a 15-meter interval between units in most areas, and selecting PFE types appropriate to the specific fire classifications. Furthermore, the enterprise has implemented routine inspections and periodic maintenance. Observations reveal the availability of two PFE agents: Dry Chemical Powder and Carbon Dioxide (CO_2). Dry Chemical Powder is utilized to mitigate Class A, B, and C fires. Despite the appropriateness of the agent types, certain units exhibited suboptimal physical conditions, such as cylinder oxidation (rust). Consequently, these units do not meet the "good condition" criteria as mandated by Article 5, Paragraph (1) of Regulation No. PER.04/MEN/1980. This discrepancy aligns with research by Ashari et al. [7], which noted that out of 15 PFEs examined, only three were in optimal condition; thus, rigorous physical monitoring is imperative to ensure functional reliability during ignition events.

Beyond agent suitability, several indicators demonstrate compliance with critical management provisions. For instance, PFE placement prioritizes accessibility, ensuring units are unobstructed and readily reachable. PFEs are strategically distributed across all operational zones, including high-risk areas such as chemical storage facilities. Physical components, including safety pins and pressure gauges (manometers), were found to be in accordance with statutory requirements. In practice, the enterprise enforces a rigorous internal maintenance standard performing monthly physical inspections, which exceeds the minimum requirement in Article 11,

Paragraph (1). These inspections encompass pressure gauge verification, seal integrity, hose clamps, handles, and overall cylinder condition. To ensure operational efficacy, refilling procedures involve complete cylinder evacuation, often conducted in conjunction with fire mock drills involving the local fire department. As noted by Nurcahyo [8], periodic maintenance and condition monitoring are vital for emergency preparedness. Enhancing PFE management significantly bolsters fire safety system effectiveness, reduces the risk of mechanical failure, and ensures adherence to prevailing safety standards..

3.2.2. Evacuation Facilities

3.2.2.1. Evacuation Routes

Field observations confirm that the egress paths at the facility comply with the Minister of Manpower and Transmigration Regulation No. PER.16/MEN/2008. Egress routes are largely unobstructed, devoid of misleading mirrors near emergency exits, and free from scattered debris that could impede movement during an evacuation. However, certain factors potentially compromise route efficacy. In several areas, materials are staged along the peripheries of the evacuation paths. While these do not completely block the way, they pose a latent risk during high velocity, panic induced egress. Additionally, operational vehicles are occasionally stationed within these routes for logistics purposes, as the egress paths are frequently integrated into daily production workflows.

The dual-use of evacuation routes for operational activities poses a significant risk to emergency fluidity; therefore, stricter supervision and spatial reorganization are requisite to ensure these areas remain safe, clear, and unhindered. This finding mirrors research by Putri [9], which observed that while life safety facilities in steel smelting plants met standards, the presence of parked trucks in corridors and assembly points significantly hindered evacuation. To maintain occupational safety, enterprises must shift from reactive measures to sustainable preventive strategies. The implementation of robust, preventive corporate policies is essential to mitigate these risks. Consequently, a comprehensive review of evacuation route utilization is necessary to prioritize emergency egress over non-evacuation activities, as mandated by regulation.

3.2.2.2. Exit Doors

Observations identified a critical non-compliance issue: several exit doors swing inward rather than outward. According to the Minister of Public Works Regulation No. 26 of 2008, doors must swing in the direction of egress to facilitate rapid evacuation; inward-opening doors can cause congestion and increase the risk of personnel being trapped. This deviation represents a significant flaw in the building's safety evaluation and serves as a primary recommendation for rectification. Given that exit doors are crucial for life safety, their swing directionality specifically outward-opening and self-closing must not be overlooked. Furthermore, doors should remain unobstructed, unlocked, and lead directly to a connecting path, stairwell, or exterior courtyard [10].

Locking mechanisms are installed at heights not exceeding 150 cm and are designed for operation without keys. In scenarios where security necessitates restricted access, implementing keyless preventive mechanisms such as cable tie seals is a crucial step to ensure immediate accessibility during a crisis [11]. Findings indicate that most doors at the facility satisfy these criteria. Nevertheless, management is advised not only to audit swing directions but also to ensure all exit hardware remains functional and compliant with standardized installation heights.

3.2.2.3. Corridors

The facility's corridors serve as primary egress paths leading toward the designated assembly point. Although a single main exit exists, multiple rooms funnel into the same evacuation route, creating a potential for congestion (bottlenecking) during high occupancy emergencies. This observation is consistent with Muhamad et al. [12], who argued that corridors failing to meet minimum width or flow standards require improved evacuation management, such as bifurcating

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movement directions to prevent mass accumulation. Such measures mitigate the risk of accidents occurring in constricted spaces. Directional signage is present throughout the corridors and egress paths, adhering to requirements for visible, clear, and luminous information systems during power failures. Ensuring standard luminous intensity for these signs is strategic for guiding occupants to the nearest exit under crisis conditions [13].

3.2.2.3 Assembly Points

The enterprise maintains a primary assembly point in the front courtyard. While strategically located, its proximity to the building may not fully satisfy the "safe distance" criteria for fire hazards. As noted by Nurulita [14], assembly points situated too close to a structure can introduce additional hazards during collapse or intense heat radiation. This placement is primarily due to spatial constraints, resulting in a relatively limited capacity that may not adequately accommodate all personnel and visitors.

This condition risks overcrowding, which could obstruct traffic flow or emergency vehicle access. Physically, the assembly point is well-maintained and free from debris; however, its frequent use as a parking area significantly reduces its effective capacity and functional integrity during an urgent evacuation. Overall, while technical aspects such as signage and accessibility are addressed, the location's proximity to the building and the dual-use for parking require immediate attention. Reorganizing the assembly point is recommended to ensure maximum protection and a secure area for personnel consolidation and post-evacuation headcounts [15].

4. Conclusion

1. Portable Fire Extinguishers (PFEs)

The management of Portable Fire Extinguishers (PFEs) at the enterprise largely adheres to the standards stipulated in the Ministry of Manpower Regulation No. 04 of 1980. Observational data indicates that while installation and maintenance protocols generally align with regulatory requirements, specific deficiencies persist. Non compliance issues primarily involve the spatial distribution of units, where the distance between certain PFEs exceeds the 15-meter maximum threshold. Additionally, maintenance lapses were identified in the form of corroded extinguisher cylinders, which compromises the functional reliability of the equipment.

2. Evacuation Facilities

The evacuation infrastructure at PT Adi Satria Abadi does not fully comply with the safety requirements established in the Ministry of Manpower and Transmigration Regulation No. PER.26/MEN/2008. Critical discrepancies include the presence of materials staged along egress paths and the dual-use of these routes for production activities. Furthermore, architectural non-compliance was observed, specifically regarding exit doors that swing inward, corridors lacking the mandatory one-hour fire resistance rating, and the utilization of the designated assembly point as a vehicle parking zone. These conditions demonstrate that while foundational evacuation components are present, their overall effectiveness and safety integrity remain compromised. Immediate systemic improvements are requisite to ensure the protection and rapid egress of all personnel during emergency scenarios.

Declaration

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