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HIRA (Hazard Identification and Risk Assessment) Analysis to Identify Various Hazards and Occupational Risks at PT XYZ 32, Pakis, Malang

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ABSTRACT: PT XYZ 32, located in Pakis, Malang Indonesia is a company engaged in the aviation industry sector with a focus on creating a work environment free of incidents and accidents. The results of observations conducted at PT XYZ 32, Pakis Malang for 4 years show that attention to occupational health and safety is still lacking. This is evidenced by the presence of many hazard and risk factors that have the potential to cause work accidents. The purpose of this research is to identify risks using the HIRA (Hazzard Identification and Risk Assessment) method by defining the characteristics of hazards that may occur in the area and evaluating the risks that occur. The results show that there are five risks categorized as Extreme, which require immediate attention and handling because of the potential for serious impact. These risks are H13 - Exposure to acid when performing maintenance, H17 - Injury due to falling items when lifting or moving items, H25 - Injury due to errors in routine maintenance causing equipment malfunction, H26 - Exposure to noise from GPU machines that exceeds thresholds and H33 - Injury from handling sharp or hazardous waste without appropriate protection.

KEYWORDS: Aviation industry, Hazzard Identification, HIRA, Risk Assesment.

I. INTRODUCTION

Occupational Health and Safety (OHS) is an effort made to protect workers and other people in the work area from potential work accidents (Ivana et al., 2020). According to information from the Employment Social Security Organizing Agency (BPJS), cases of work accidents in Indonesia are still relatively high. In 2019, 114 thousand work accidents were recorded, while in 2020 the figure increased to 117 thousand cases. Work accidents are unwanted events that cause losses, both in the form of casualties and material, which occur due to contact with potential hazards (Sudalma & Rosnaini, 2020).

The results of observations made at PT XYZ 32, Pakis Malang for 4 years show that attention to occupational health and safety is still lacking. This can be seen from the many hazard and risk factors that have the potential to cause work accidents. Some of the hazard factors found include: lack of personnel awareness of the surrounding environment, non-use of personal protective equipment, slippery floors due to fuel spills during engine repairs, and the condition of the work environment carried out by the maintenance division, GSE, urdal, and warehouse. These hazard factors are the cause of the high number of work accidents at PT XYZ 32, Pakis Malang.

The rate of work accidents and PAK in the company is still relatively high, with 35 cases recorded in a month. The number of cases of work accidents and PAK is not in accordance with the provisions in Law No. 23 of 1992 concerning Health. In this law, it is explained that health is part of the elements of general welfare that must be realized in accordance with the goals of the Indonesian nation as stated in the Preamble of the 1945 Constitution. In addition, companies must also pay attention to the regulation of the Minister of Manpower and Transmigration of the Republic of Indonesia Number 4 of 2018, which regulates guidelines and references for resolving cases of occupational accidents and occupational diseases. Based on the problems that have been described, this research was conducted to analyze the application of OHS with the Total Safety Management (TSM) approach. According to ZHI Xueyi et al. (2018), Total Safety Management (TSM) is an approach that prioritizes an effective safety coordination system through continuous communication. Thus, it is hoped that this research can provide recommendations to companies in the form of regulations that are the basis for changing the safety culture, creating safer working conditions for employees, and reducing the number of work accidents and PAK.

Qingfeng et al. (2021) discusses the development and implementation of equipment maintenance management systems and safety integrity in the process industry. This research focuses on how to improve equipment maintenance efficiency and ensure

operational safety by integrating a better management system. The proposed system aims to minimize the risk of equipment damage that can impact work safety and reduce losses due to downtime or accidents. And than T. Kontogiannis, M.C. Leva, and N. B. (2017) discuss the principles, processes, and methods associated with total safety management (TSM). The article aims to provide insights into how safety management can be implemented organization-wide to achieve better results in terms of accident prevention and risk management.

The HIRA (Hazard Identification and Risk Assessment) method in risk identification has the advantage of being able to identify potential hazards in the work area by defining the characteristics of hazards that may arise and evaluating existing risks through risk assessment using a risk assessment matrix. This matrix is used to analyze system failure in each problem along with the factors that cause it. With the application of the HIRA method, it is expected to answer the characteristics of hazards and their levels, so as to reduce the risk of work accidents at PT XYZ 32, Pakis, Malang.

II. METHODS

1. Data Collection Phase

The data needed in this study are:

a. Standard Operational Procedure (SOP) of work and work regulations and OHS program of PT XYZ 32, Pakis Malang. Data on work SOPs and OHS programs were obtained from the company through interviews with HRD and the team coordinator of the OHS Advisory Committee (P2K3) of PT XYZ 32, Pakis Malang.
b. Potential hazard findings at PT XYZ 32, Pakis Malang. Data on potential hazard findings were obtained from field observations and interviews with the P2K3 coordinator and employees.
c. Likelyhood and Consequence criteria level determination questionnaire. Known potential hazards at PT XYZ 32, Pakis Malang, then a questionnaire was distributed to determine the level of each Likelyhood criteria and Consequence criteria.

2. Data Processing Stage

Understanding Hazard and Risk using the HIRA approach.

a. Risk assessment using the HIRA approach.
    1) Recapitulate the level of each Likelyhood criterion and Consequence criterion.
    2) Calculation of risk relative using formula (1).
    3) Classification of risk relative values based on Table 5.
    4) Get the results of the highest risk relative value.
    5) Conclusion of HIRA approach
b. A review of the existing SOPs and OHS program at PT XYZ 32, Pakis Malang was conducted as a basis for triggering or causing potential hazards contained in the HIRA approach.

III. RESULT AND DISCUSSION

A. Hazard Identification

Risk identification was carried out through data collection from 120 participants. This process covered all operational aspects at PT XYZ 32, Pakis Malang, including the Maintenance division, Logistics division (Warehousing), Ground Support Equipment division (GSE), Internal Affairs division (Urdal), Safety & Security division. Evaluation of the questionnaire results produced a set of risk variables that are relevant in the context of activities in the field. Based on the results of this questionnaire, 35 occupational accident risk variables were identified. The table below summarizes the occupational accident risk variables that are considered to have high significance:

Table 01. Hazard Identification

Activity	Hazard	Risk	Code
Maintenance Division			
Routine asset inspection	Pinned by aircraft component during inspection	Injury/Wound/Amputation	H01
	Hand or finger injury from using an improperly sized tool (e.g., wrench too big)	Injury/Wound/Cut finger	H02
	Injury from broken tools that cause objects to be thrown towards the user	Injury	H03

	Hearing loss from driving machinery or tools operating in high noise levels	Hearing loss	H04
Welding of metals and asset materials	Burns from sparks or hot metal during welding process	Burns	H05
	Exposure to ultraviolet light causing eye or skin damage	Injury/Irritation	H06
	Injury from welding equipment that explodes or breaks off during use	Injury	H07
Electrical system check	Electric shock while checking the electrical system	Injury/Death	H08
Oil & fuel change	Burns from hot oil spills when refilling or transferring fuel	Burns	H09
	Skin irritation or respiratory distress from leaking fuel vapors	Burns/irritation	H10
Hydraulic system parts checking & replacement	Exposure to hazardous chemicals when replacing contaminated parts	Burns/Irritation	H11
	Falling on parts when replacing heavy component.	Injury/Wound	H12
	Exposed to acid when performing maintenance	Injury/Burn/Iritation	H13
Logistics Division (Warehousing)			
Hazardous material storage	Risk of fire or explosion from unsafely stored fuel	Burns/Irritation/ Fatalities	H14
	Inhalation of chemical vapors while packaging or storing hazardous materials	Poisoning/Breathing disorders	H15
	Infection or irritation from contact with items contaminated with pathogens or chemicals	Burns / Irritation	H16
Distribution of goods & materials	Injury due to being crushed while lifting or moving goods	Injury, Wound	H17
	Back or knee injuries from lifting or moving heavy items without assistance	Injury, Wound	H18
	Being crushed or hit by a forklift while moving goods in a congested area	Injury/Wound/Amputation	H19
Goods storage process	Goods falling from high shelves and falling on workers	Injury, Wound	H20
	Injuries from falls from unstable or broken ladders or scaffolding	Injury, Wound	H21
	Respiratory distress from flying dust while moving or storing goods	Respiratory distress	H22
	Skin irritation from contact with deposited dirt or dust	Injury, Wound	H23
Ground Support Equipment Division (GSE)			

GSE vehicle maintenance	Injuries from working tools or moving parts of machinery	Injury/Wound	H24
	Injury due to errors in routine maintenance leading to equipment malfunction	Injury/Wound	H25
Operation of GPU (Ground Power Unit)	Exposure to noise from the GPU engine that exceeds thresholds	Hearing impairment	H26
Heavy equipment handling	Injury from falling or being hit by heavy machinery or equipment during a move	Injury/Wound	H27
Aircraft moving in the hangar	Collision with other aircraft or infrastructure during transfer in the hangar	Injury/Injury/Fatalities	H28
Internal Affairs Division (Urdal)			
Environmental cleaning	Respiratory distress from flying dust during the cleaning process	Respiratory distress	H29
	Skin injury or irritation from strong cleaning chemicals	Injury/Irritation	H30
	Skin irritation or allergies from exposure to deposited dirt or dust	Injury/Irritation	H31
	Health problems from exposure to fumes or hazardous materials without adequate ventilation	Respiratory distress	H32
Garbage or waste management	Injury from handling sharp or hazardous waste without appropriate protection	Injury/Irritation	H33
	Exposure to health risks from improperly managed waste	Injury/Irritation	H34
Safety & Security Division			
Aviation safety supervision	Accidents due to non-compliance with safety procedures	Injury/Injury/Fatalities	H35

(**Source: processed by the author, 2025)**

B. Risk Assessment

Then, an assessment is carried out on the risks that have been identified above. Risks are measured based on likelihood and consequence values using Standards Australia/Standards New Zealand/AS/NZS 4360:1999, (2023). Each risk has obtained a score obtained from the average value of the respondents. Risk assessment is carried out by finding the value of the risk relative. According to Ambarani & Tualeka, (2017) risk relative is the result of multiplying the likelihood value with the severity value of each hazard. The detailed assessment results can be seen in the following table.

Tabel 4.2. Risk Assessment

Code	Hazard	Likelyhood		Consequence		Risk Matrix	
		Value	Category	Value	Category	Value	Category
Maintenance Division							
H01	Pinned by aircraft component during inspection	5	Rarely	7	Moderate	35	Medium
H02	Hand or finger injury from using an improperly sized tool (e.g., wrench too big)	5	Moderate	7	Moderate	35	Medium
H03	Injury from broken tools that cause objects to be thrown towards the user	7	Moderate	8	Heavy	56	High

Code	Hazard	Likelyhood		Consequence		Risk Matrix	
		Value	Category	Value	Category	Value	Category
H04	Hearing loss from driving machinery or tools operating in high noise levels	3	Frequently	10	Light weight	30	Medium
H05	Burns from sparks or hot metal during welding process	2	Rarely	8	Light weight	16	Low
H06	Exposure to ultraviolet light causing eye or skin damage	7	Moderate	9	Heavy	63	High
H07	Injury from welding equipment that explodes or breaks off during use	4	Rarely	9	Very Heavy	36	Medium
H08	Electric shock while checking the electrical system	5	Moderate	3	Moderate	15	Low
H09	Burns from hot oil spills when refilling or transferring fuel	6	Rarely	3	Moderate	18	Low
H10	Skin irritation or respiratory distress from leaking fuel vapors	7	Rarely	2	Light weight	14	Low
H11	Exposure to hazardous chemicals when replacing contaminated parts	5	Rarely	4	Heavy	20	Low
H12	Falling on parts when replacing heavy component.	4	Moderate	3	Moderate	12	Low
H13	Exposed to acid when performing maintenance	8	Very Frequent	10	Heavy	80	Extreme
Divisi Logistik (Warehousing)							
H14	Risiko kebakaran atau ledakan dari bahan bakar yang tidak disimpan dengan aman	5	Rarely	8	Moderate	40	Medium
H15	Terhirup uap bahan kimia saat melakukan pengemasan atau penyimpanan bahan berbahaya	5	Rarely	8	Moderate	40	Medium
H16	Infeksi atau iritasi akibat kontak dengan barang yang terkontaminasi patogen atau bahan kimia	8	Rarely	2	Light weight	16	Low
H17	Cedera akibat tertimpa barang saat mengangkat atau memindahkan barang	8	Happens Very Often	10	Heavy	80	Extreme
H18	Cedera punggung atau lutut akibat mengangkat atau memindahkan barang berat tanpa bantuan	8	Rarely	6	Very Heavy	48	Medium
H19	Terjepit atau tertabrak forklift saat memindahkan barang di area yang padat	8	Frequently	6	Light weight	48	Medium
H20	Barang jatuh dari rak tinggi dan menimpa pekerja	8	Frequently	9	Moderate	72	High
H21	Cedera akibat jatuh dari tangga atau perancah yang tidak stabil atau rusak	9	Rarely	8	Moderate	72	High
H22	Gangguan pernapasan dari debu yang terbang saat memindahkan atau menyimpan barang	8	Moderate	6	Moderate	48	Medium
H23	Iritasi kulit akibat kontak dengan kotoran atau debu yang	7	Moderate	5	Moderate	35	Medium

Code	Hazard	Likelyhood		Consequence		Risk Matrix	
		Value	Category	Value	Category	Value	Category
	mengendap						
Divisi Ground Support Equipment (GSE)							
H24	Cedera akibat alat kerja atau bagian mesin yang bergerak	6	Frequently	5	Light weight	30	Medium
H25	Cedera akibat kesalahan dalam perawatan rutin yang menyebabkan kegagalan fungsi peralatan	8	Happens Very Often	10	Heavy	80	Extreme
H26	Paparan kebisingan dari mesin GPU yang melebihi ambang batas	9	Frequently	9	Heavy	81	Extreme
H27	Cedera akibat kejatuhan atau tertabrak alat berat atau peralatan saat pemindahan	8	Happens Very Often	8	Moderate	64	High
H28	Tabrakan dengan pesawat lain atau infrastruktur selama pemindahan di hanggar	8	Moderate	9	Very Heavy	72	High
Divisi Urusan Dalam (Urdal)							
H29	Gangguan pernapasan dari debu yang terbang saat proses pembersihan	7	Frequently	4	Ringan	28	Medium
H30	Luka atau iritasi kulit akibat bahan kimia pembersih yang kuat	8	Moderate	3	Moderate	24	Low
H31	Iritasi atau alergi kulit akibat paparan kotoran atau debu yang mengendap	9	Rarely	3	Moderate	27	Medium
H32	Gangguan kesehatan akibat paparan asap atau bahan berbahaya tanpa ventilasi yang cukup	6	Rarely	9	Moderate	54	High
H33	Cedera dari penanganan limbah yang tajam atau berbahaya tanpa perlindungan yang sesuai	9	Frequently	10	Heavy	90	Extreme
H34	Paparan risiko kesehatan dari sampah yang tidak dikelola dengan benar	9	Moderate	3	Moderate	27	Medium
Divisi Safety & Security							
H35	Kecelakaan karena ketidakpatuhan terhadap prosedur keselamatan	7	Moderate	9	Very Heavy	63	High

(Source: processed by the author, 2025)

C. HIRA Description Analysis

Based on the results of the risk identification carried out, 5 risks were found to have the highest risk matrix value so that they are included in the Extreme category. These risks have the potential for serious impacts, such as serious injury, health problems, and others. The following are details of the 5 Extreme category risks.

1. H13 - Exposure to acid while performing maintenance: This risk can cause serious burns to the skin and eyes, and can cause permanent damage if inhaled.
2. H17 - Injury from being crushed while lifting or moving goods: The risk of being crushed by heavy items can lead to serious injuries, such as broken bones, head trauma or spinal cord injuries.
3. H25 - Injury due to errors in routine maintenance that cause equipment malfunction: Equipment malfunctions due to errors in routine maintenance can lead to accidents, such as being crushed, pinched, or cut.
4. H26 - Exposure to noise from GPU machines that exceeds the threshold: Excessive noise exposure that exceeds the threshold can cause permanent hearing loss to workers.

5. H33 - Injury from handling sharp or hazardous waste without appropriate protection: Handling sharp or hazardous waste without appropriate protection can lead to puncture wounds, infection or contamination.

In general, it can be concluded that the OHS program at PT XYZ 32, Pakis Malang may not have been implemented comprehensively and effectively. There are still weaknesses in aspects such as hazardous materials management, ergonomics, equipment maintenance, noise control, and waste management. This results in Extreme category occupational risks can still occur in the work environment. Therefore, improvement and strengthening of the overall OHS program is needed to mitigate these risks. Furthermore, researchers use the SECI (Socialization, Externalization, Combination, and Internalization) approach to be applied in strengthening occupational safety and health (OSH) programs. Through the SECI approach, it is expected that OHS knowledge and practices can be disseminated, documented, combined, and internalized by all workers so that a strong OHS culture can be formed in the work environment of PT XYZ 32, Pakis, Malang.

IV. CONCLUSION

Through HIRA (Hazard Identification and Risk Assessment) analysis, this study identified significant hazards and risks at PT XYZ 32, Pakis, Malang. There are five risks categorized as Extreme, which require immediate attention and handling due to their potential serious impact. The identification of these risks shows that PT XYZ 32, Pakis Malang faces diverse hazards that have the potential to threaten worker safety and organizational operations. These risks are:

1. H13 - Exposure to acid while performing maintenance
2. H17 - Injury due to falling items when lifting or moving goods
3. H25 - Injury due to errors in routine maintenance causing equipment malfunction
4. H26 - Exposure to noise from GPU machines that exceeds thresholds
5. H33 - Injury from handling sharp or hazardous waste without appropriate protection

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