

Table 3. Risk assessment matrix

Consequence (C)	Likelihood (L)				
	5	4	3	2	1
5	25	20	15	10	5
4	20	16	12	8	4
3	15	12	9	6	3
2	10	8	6	4	2
1	5	4	3	2	1

Source: (Madill, 2003)

Table 4. Description of risk assessment

Grade	C x L	Category	Action
A	(15-20)	High	Priority action, senior management attention required
B	(8-12)	Medium	Management responsibility must be specified
C	(1-6)	Low	Manage by routine procedures

Source: (Madill, 2003)

b. Hazard Control

At this stage, carry out hazard and risk control from the previous assessment

c. Provision of information

At this stage, notification of information, education, training, and monitoring of hazards and risks to all employees is carried out

d. Doing Review

At this stage, a review of the hazard assessment and control process is carried out so that the small risk can be further assessed or analyzed.

4. Data Collection

After observations, literature studies, and interviews with related workers. The analysis results of the identification of activities and risks posed in the warehouse area are shown in Table 5 below.

Table 5. Hazard Identification and Risk Assessment – Aspect Impact Warehouse Area at PT FMM

No	Activity	Hazard	Risk	Risk Assessment			
				L	C	RR	Cat
1	Administration office <i>Area: Indoor</i>	Paper usage	Resource-saving	0	0	0	L
		PC/Laptop screen light	Eye irritation	2	1	2	L
		Use of ATK with sharp sides (scissors, cutter)	incision wound	2	1	2	L
		Use of electricity (for PC, Laptop, AC, Lamp, etc.)	Waste of resources	2	2	4	L
			Resource-saving	0	0	0	L
		Electrocution (Electrical installation)	Loss of consciousness	2	3	6	L
		Electric short circuit	Fire	2	4	8	M
		Printer ink (Cartridge and Toner)	Environmental pollution	2	2	4	L
		Exposure to dust	Eye irritation and respiratory problems	2	1	2	L
2	Official Travel <i>Area: Outdoor</i>	Completeness of official letter & vehicle	Violation of traffic rules administration	1	2	2	L
		No caution	- Minor to significant injuries	3	5	15	H
			- Vehicle damage				
		Vehicle maintenance	Vehicle damage	2	2	4	L
		Emission	Vehicle good condition	0	0	0	L
		Air pollution	2	3	6	L	

No	Activity	Hazard	Risk	Risk Assessment			
				L	C	RR	Cat
3	Use of Forklift: - Loading & Unloading - Allocation - Asset transfer <i>Area: Outstorage, Hall A, Hall B dan Hall C</i>	Lifting unit	The unit is broken	1	2	2	L
		Hit by unit	Minor to major injuries	2	4	8	M
		Crashing	- Minor to major injuries - Asset damage	2	5	10	M
		Blind Spot when lifting goods	Operator view is limited; damaged goods	3	3	9	M
		Blind spot at the pedestrian crossing	Injured people, damaged goods	3	3	9	M
		Engine vibration	Minor injuries	3	2	6	L
		Emission	Air pollution	3	3	9	M
4	Use of table saw Wood cutting process Wood packing process <i>Area: Outstorage, Hall B and Workshop Area</i>	Sharp work tool	Wound	2	3	6	L
		Sound when cutting	Hearing loss and comfort	2	3	6	L
		Exposure to wood dust	Eye irritation and respiratory distress	2	2	4	L
		Wooden side (if there are sharp fibres)	Wound	1	2	2	L
		Wind spikes (93 dB)	Hearing loss	3	3	9	M
		Unit height >1.8 m	Fall	2	2	4	L
		Reuse of packing waste	Resource-saving	0	0	0	L
5	Chemical storage (Ethanol "microscope lens cleaner" and Xylene "reagent") <i>Area: Snap on Area</i>	Flammable	Fire	2	4	8	M
		Glass bottle container (handling)	Broke, Spill	2	3	6	L
		Room temperature is not maintained	Chemical reaction	2	4	8	M
		direct contact	Skin irritation, Eyes, Breathing	2	3	6	L
6	Oil Storage <i>Area: Hall B</i>	Drops, splatters, oil spills	Polluting the environment (soil)	2	4	8	M
7	Preparation of goods that ready to send/picking list						
7.1	Pick up goods on shelves with a height of > 1.8 meters	Stumbled, Fell	- Minor injury - Asset damage	2	2	4	L
		Dropped by goods < 10 Kg	- Minor injury - Asset damage	2	2	4	L
		Room temperature is not maintained	Chemical reaction	2	4	8	M
7.2	Goods packing	Stumbled, Fell	- Minor injury - Asset damage	2	2	4	L
7.3	Handling heavy goods >25 Kg – 100 Kg	Lifting goods using a trolley	Asset damage	3	3	9	M
8	Handling heavy goods > 100 Kg – 1 ton <i>Area: Hall A</i>	The hand pallet failed to operate	Asset damage	3	3	9	M
9	Emergency Condition <i>Area: Indoor (Office)</i>	Fire, Earthquake, Medical Emergency	Death, disability, burns, damage to equipment and property	5	2	10	M

Note: Cat = Category; L = Likelihood; C = Consequence; RR = Risk Rating

5. Results and Discussion

5.1 Hazard Control

Hazard control is divided into two categories, namely the current control and control suggestions derived from residual risk, producing a very low hazard category. Residual risk is the level of risk that remains after the risk control method has been selected and implemented (ISO/IEC, 2014). The following is a hazard control result from the current risk matrix and the results from residual risk in Table 6.

Table 6. Hazard Control in every activity of PT FMM's Warehouse Area

No	Activity	Current Control	Residual Risk				Suggestion Control
			L	C	RR	Cat	
1	Administration office	- Does not use stacked plugs - Make sure there are no chipped cables	2	2	4	L	Make sure conditions are safe before work
	Area: Indoor	- Running a pest control program Electrical installation is certified once a year	2	2	4	L	
2	Official Travel	- Obey traffic rules - Drive carefully	1	2	2	L	-
	Area: Outdoor	- Perform routine vehicle maintenance - Conduct emission tests for monitoring	2	2	4	L	-
3	Use of Forklift: - Loading & Unloading - Allocation - Asset transfer	Make sure the forklift used is according to the lifting capacity	2	2	4	L	-
		The lifting area must be clear	1	2	2	L	Additional personnel/guide assistance (as needed)
	Area: Outstorage, Hall A, Hall B, and Hall C	- The forklift operator is a competent and authorized person	1	2	2	L	Additional personnel/guide assistance (as needed)
		- The forklift operates at a safe speed	2	2	4	L	-
		- Adding personnel/guide assistance	2	2	4	L	-
		- Make sure the rotary lamp works	2	2	4	L	-
		- Adding personnel/guide assistance	2	2	4	L	-
		- Added forklift lane markings	2	2	4	L	-
	- Perform routine forklift maintenance - Conduct emission tests for monitoring	2	2	4	L	-	
4	Wood packing process	Using earplugs with an NRR of 25 dB	2	2	4	L	-
	Area: Hall B, workshop area, and Outstorage						-
5	Chemical storage (Ethanol "microscope lens cleaner" and Xylene "reagent")	- Storage location using air conditioning/AC setting the temperature not more than 20°C - Keep away from heat sources	2	2	4	L	-
		- Keeps the room temperature cool	1	2	2	L	-

No	Activity	Current Control	Residual Risk				Suggestion Control
			L	C	RR	Cat	
	Area: Snap on Area	- Installing MSDS - Implement access control Use PPE, rubber gloves, and masks	2	2	4	L	-
6	Oil storage Area: Hall B	- MSDS: no specific hazard - Make sure there is no leaking packaging - Provided Oil Spill Kit in Hall B area	2	3	6	L	-
7	Preparation of goods that ready to send/picking list						
7.1	Pick up goods on shelves with a height of > 1.8 meters send	- Keeps the room temperature cool - Implement access control	1	2	2	L	-
7.2	Handling heavy goods >25 Kg – 100 Kg	Do not pile up items that block the worker's view	2	2	4	L	-
7.3	Handling heavy goods > 100 Kg – 1 ton	Do not pile up items that block the worker's view	2	2	4	L	-
8	Emergency Condition Area: Indoor (Office)	Available emergency alarms, public speakers, APAR, emergency response team, evacuation routes; Induction rules for guests and new employees; Simulation plan once a year; Collaboration with the nearest hospital.	2	1	2	L	-

5.2 Proposed Improvement

Based on the results of the conducted risk assessment, it shows that of the overall activities in the warehouse area of PT FMM, there are 15 activity categories consisting of 38 hazards and 42 risks, with details of 25 low-risk activities, 14 medium-risk activities, and 1 high-risk activity. If based on the percentage, it can be seen in Figure 5.1 with details of 62% of activities with low risk (low risk), 35% of activities with medium risk (medium risk), and 3% of activities with high hazard, this can be seen in Figure 1.

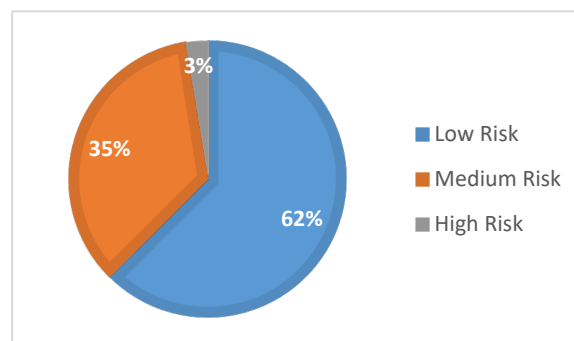


Figure 1. Occupational Health and Safety Risk Assessment at Warehouse Area PT FMM

The high hazard in PT FMM's warehouse area activities is on business trips with the hazard of not being aware; this is because the potential hazards on the trip can cause mild to severe injuries and can even cause death. Thus, the frequent type of risk in the warehouse area is low-risk, so handling and controlling hazards can be carried out on an ongoing basis with the activities carried out by related workers in their daily lives .

Based on the risk assessment, two controls aim to reduce risk to the lowest level. It can be seen in Figure 2, wherein the first risk assessment, the number of activities with low-risk was 25 activities, 14 medium-risk activities and 1 high-risk activity, which then carried out more profound control to produce 19 low-risk activities and no more risk activities, neither medium nor high. It aims to achieve an acceptable level of risk and can be controlled directly in order to avoid further harm or risk.

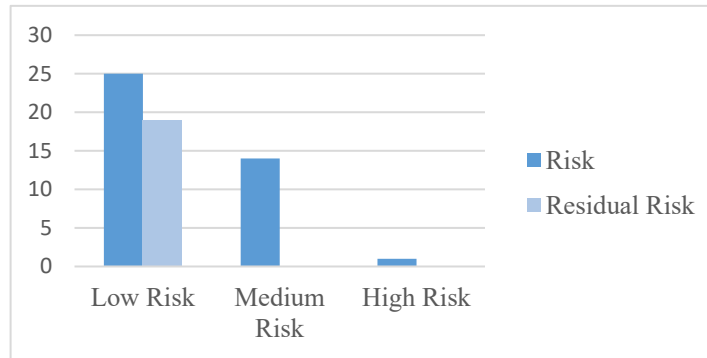


Figure 2. Risk control comparison

5.4 Organization Implication

This research provides important lessons about the risk for the company's management and external parties to the company. The reason is that it can reduce disruption to business processes, resulting in losses for the company itself. Occupational safety and health are important in maintaining the stability of activities or activities in the work environment. Enforcement of standard work procedures, work instructions, and hazard control forms are tools that can be used in an organization or company to control hazards and risks. The results of this research indicate that hazard control using the HIRA-AI method can reduce the frequency of disturbances in the company and ensure a safe and healthy working environment and conditions. This is evidenced by the amount of risk that can be reduced and can be well controlled in the company.

6. Conclusion

Life after the COVID-19 pandemic has forced all economic sectors to change dynamically. The business processes still need to run flawlessly in order to meet the demands. The call for warehouses increases along with rapid changes in buying and selling environment, such as from online/conventional methods were mostly changed to online. Therefore, it is vital to analyze the risks in the warehouse so that business processes can run well. The carried out risk identification includes occupational safety and health risks with a risk matrix assessment that produces 40 risks. Although the residual risk generated has been reduced from 40 to 19 risks, the risk remains the organization's responsibility. Occupational safety and health in this organization or company also include company policies as stated in the company's QHSE policy.

This research is closely related to the balance of workers' work and a work environment that will create safe and comfortable conditions. It is hoped that with this risk identification and analysis, the achievement of company goals will be optimal.

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