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Management and Level of Understanding of Hazardous and Toxic Waste Management (B3) Among Large Workshop Business Owners in Landasan Ulin Barat Subdistrict, Banjarbaru City

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ABSTRACT

In Banjarbaru City, specifically in Landasan Ulin Barat Village, 29 businesses have been identified as potentially producing hazardous and toxic waste, four of which are large, regularly operating workshops with environmental documentation. This research aims to analyze the management conditions and level of understanding of hazardous and toxic waste management among large workshop business actors in Landasan Ulin Barat Village, Banjarbaru City. This research was conducted in Banjarbaru City, Landasan Ulin Barat Subdistrict, South Kalimantan Province, considering that the area is an industrial area with many large workshops producing hazardous waste. The research location was determined by purposive sampling. Data analysis and discussion in this study used a qualitative descriptive approach. The obtained data were presented in the form of tables and graphs. The data analysis technique for this study was measured using a Likert scale. The management conditions and level of understanding of large workshop business actors in Landasan Ulin Barat Village are categorized as very good. All large workshops have implemented B3 waste management in accordance with Government Regulation No. 22 of 2021 and Ministerial Regulation of the Environment and Forestry No. 6 of 2021, from the container and labeling stage, temporary storage, and transportation of B3 waste are carried out by licensed management parties.

Keywords: *Management; Waste (B3); business owners; Banjarbaru City*

INTRODUCTION

Banjarbaru City, the capital of South Kalimantan Province, is experiencing rapid growth, particularly in the infrastructure, education, and government sectors. This development has driven increased public mobility, which has directly increased the number of motorized vehicles, particularly four-wheeled vehicles. Data from the Banjarbaru Regional Public Works Agency (UPPD) in 2024 recorded that the number of four-wheeled vehicles reached 35,546 units, a 6.47% increase from the previous year (BPS Banjarbaru, 2024). This growth has led to an increased need for vehicle maintenance services, which in turn has driven an increase in the number of automotive repair shops in the region. These vehicle maintenance and repair activities generate not only domestic

waste but also hazardous and toxic waste, which poses significant risks to the environment and human health.

B3 waste generated by automotive repair shops includes flammable used oil, oil filters containing hydrocarbons, corrosive used batteries, and used tyres contaminated with hazardous chemicals. Government Regulation No. 22 of 2021, B3 waste is waste containing hazardous and toxic substances that can cause environmental pollution and health problems if not managed properly. In Banjarbaru City, specifically in Landasan Ulin Barat Village, 29 businesses have been identified as potentially producing hazardous and toxic waste, four of which are large, regularly operating workshops with environmental documentation. This situation indicates a high potential for hazardous and toxic waste generation in the area, necessitating waste management in accordance with statutory standards to avoid negative environmental impacts.

The issue of hazardous and toxic waste management in automotive workshops remains a serious challenge. Widyanor et al. (2025) found that B-type motorcycle workshops in Banjarbaru City produced an average of 8.24 liters of used oil per day, 0.40 used oil filters per day, 2.53 used sheets of rags per day, and 15.33 used oil bottles per day, but these were not managed in accordance with regulations. Wardana et al. (2025) in North Samarinda also found that unofficial workshops produced approximately 200 liters of used oil per month, but some of the waste was unrecorded and not properly handled. Kristanti et al. (2022) in Lamongan found that the average oil waste reached 9.6 liters per day, and most workshops did not manage the waste according to regulations. The results of this study illustrate the persistent gap between regulations and field practices in hazardous and toxic waste management.

This gap may arise from the low level of understanding of hazardous and toxic waste management among business operators and minimal oversight by relevant agencies. However, according to Ministerial Regulation No. 6 of 2021, every producer of hazardous and toxic waste is required to sort, store, label, record, and hand over the waste to a licensed waste manager. In Landasan Ulin Barat Village, a growing hub for automotive businesses in Banjarbaru City, understanding and compliance with these regulations by large workshops is crucial for preventing the risk of environmental pollution. Without proper waste management, potential hazards such as soil, surface water, and groundwater pollution, fire risks, and exposure to heavy metals for workers and the surrounding community can increase.

The management and understanding of hazardous and toxic waste management among large workshop operators in Landasan Ulin Barat Village is highly relevant. The research aims to analyze the management conditions and level of understanding of hazardous and toxic waste management among large workshop business actors in Landasan Ulin Barat Village, Banjarbaru City.

MATERIALS & METHODS

This research was conducted in Banjarbaru City, Landasan Ulin Barat Subdistrict, South Kalimantan Province, considering that the area is an industrial area with many large workshops producing hazardous waste. The research location was determined by purposive sampling.

Data analysis and discussion in this study used a qualitative descriptive approach. The data obtained were presented in the form of tables and graphs. The data analysis technique for this study was measured using a Likert scale. This Likert scale is useful for measuring workshop managers' knowledge of waste, workshop managers' attitudes towards workshop waste, and workshop managers' behavior in managing workshop waste. The data processing and analysis process used the Microsoft Excel application, the results of which were in the form of tables. From the tables obtained, a qualitative descriptive approach was then carried out regarding B3 waste management

in large workshops in Landasan Ulin Barat Village, Banjarbaru City. The scoring technique starts from five for positive question items and starts from one for negative question items.

RESULT

Conditions of B3 Waste Management in Large Workshops

Hazardous and toxic waste management (B3) in large workshops is a crucial aspect in preventing environmental pollution caused by motor vehicle maintenance and repair activities. Field observations and interviews with business owners and employees of four large workshops in Landasan Ulin Barat Village revealed that all workshops have managed B3 waste in accordance with the provisions of Ministerial Regulation of the Environment and Forestry No. 6 of 2021 concerning Procedures and Requirements for B3 Waste Management. The classification of workshop business scale also influences environmental document requirements. Large workshops are required to prepare a Technical Approval (Pertek) and have a permit for a temporary storage area (TPS) for B3 waste, as they have the potential to produce large amounts of hazardous waste. Marwan (2016) stated that large-scale automotive workshops must strictly comply with regulations regarding B3 waste management to reduce the risk of environmental pollution. Aspects of B3 waste management begin with containerization and labeling, storage, and transportation.

a. Hazardous and Toxic Waste Container/Packaging and Labeling

The packaging and labeling stages of hazardous and toxic waste (B3) are a crucial part of the waste management system to ensure safety during storage, transportation, and processing. B3 waste labeling is the process of marking or affixing a label directly to the packaging of B3 waste. Field observations and questionnaires conducted with large workshop operators in Landasan Ulin Barat Village revealed that all workshops have implemented packaging and labeling processes in accordance with the standards stipulated by Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 6 of 2021 concerning Procedures and Requirements for Hazardous Waste Management.

B3 waste packaging is carried out using packaging such as drums, jumbo bags, intermediate bulk containers (IBC) tanks, containers, packaging, or other containers according to the characteristics of the B3 waste. Each workshop has packaged B3 waste such as used lubricating oil, used batteries, used filters, and used rags into special containers that meet the technical criteria stipulated in the regulation. The containers used are generally sealed metal drums and leak-proof jerry cans placed in Temporary Storage Areas (TPS) for B3 Waste with waterproof bases and protective roofs. All containers are equipped with identification labels containing information on the type of waste, hazard symbols, and the date of placement, thus facilitating the monitoring and control process by environmental officers.

Containment and labeling are crucial aspects of B3 waste management, as labeling can reduce the risk of contamination and facilitate monitoring (Nurlina, 2021). Deanova et al., (2022) state that proper packaging plays a crucial role in minimizing the potential hazards of B3 waste. Packaging filled with B3 waste must comply with the requirements, namely being marked with symbols and labels in accordance with Ministerial Regulation of the Environment and Forestry No. 13 of 2014 concerning Symbols and Labels for Hazardous and Toxic Waste (B3). Examples of symbols and labeling are provided in Ministerial Regulation No. 6 of 2021:

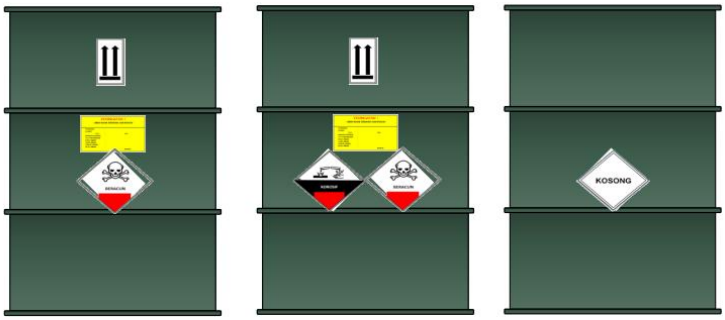

Figure 1. Example of Symbols and Labels for B3 Waste Packaging (Minister of Environment and Forestry Regulation No. 6 of 2021)

Figure 2. Containerization and Labeling of Used Lubricating Oil Using Drums

Figure 3. Containerization and Labeling of Used Batteries

Figure 4. Used Filter Container

Figure 6. Container for Used Majun Cloth

This situation indicates that large repair shop operators in the research area have a fairly good awareness of the importance of proper packaging and labeling systems. Dahlan et al. (2023) stated that implementing standardized packaging and labeling can reduce the risk of spills and environmental contamination and facilitate environmental audits by authorized agencies.

The implementation of a labeling system in accordance with Appendix II of Ministerial Regulation No. 6 of 2021 demonstrates the workshop's commitment to fulfilling legal obligations regarding hazardous and toxic waste management. Red labels are used for flammable waste such as used oil, while yellow labels are used for toxic waste such as used batteries and contaminated cloth. This practice also supports transparency efforts in risk identification and waste source tracing. Nurcahyo et al. (2020) examined the implementation of a labeling system in medium-scale automotive businesses.

b. Hazardous Waste Storage/Collection

The second aspect of hazardous waste management is the storage/collection of hazardous waste, which refers to the provisions stipulated in Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 6 of 2021 concerning Procedures and Requirements for the Management of Hazardous and Toxic Waste. Field observations indicate that all large workshops studied have a Temporary Storage Area (TPS) for hazardous waste. These storage facilities meet the technical requirements of Regulation of the Minister of Environment and Forestry No. 6 of 2021, which stipulates that every producer of hazardous waste is required to have a temporary storage facility designed to prevent environmental pollution and risks to human health.

A temporary hazardous waste storage area (TPS LB3) is a special room used to temporarily store hazardous and toxic waste (B3) from operational activities, which is then managed by a third party. Data regarding hazardous waste storage at the PT. Astra International Tbk – UD Truck Sales Operation Banjarmasin Branch workshop, and the PT. Astra International Tbk – TSO Auto 2000, PT. Serasi Autoraya (TRAC) workshop, and PT. Global Bara Unggul workshop:

Table 1. Hazardous Waste Storage Data at PT. Astra International Tbk – UD Trucks Sales Operation Banjarmasin Branch Workshop

Ministerial Regulation of the Environment and Forestry Number 6 of 2021	Suitable	Not Suitable
B3 waste storage locations are not prone to natural disasters.	✓	
Firefighting equipment and emergency response tools are appropriate.	✓	
The roof, walls, and floor construction of the building are resistant to corrosion and fire.	✓	
B3 waste is protected from rain and direct sunlight.	✓	
A ventilation system for air circulation and lighting.	✓	

The floor is waterproof, not wavy, and prevents rainwater from entering from outside.	✓	
B3 waste spill collection channels and containers are provided.	✓	
Equipped with the appropriate B3 waste symbol.	✓	
Packaging is in the form of a 200-liter metal drum with a pallet.	✓	
The distance between the stack of packaging and the roof is at least 1 (one) meter.	✓	
Storage is allowed for a maximum of 90 days for B3 waste generated >= 50 kg/day.	✓	

B3 waste storage data at the UD Trucks workshop shows that the B3 waste storage location is flood-free. The TPS LB3 building is in accordance with applicable regulations where the roof, floor, and walls of the building are resistant to corrosion and fire. The roof frame of the building is made of WF 150 steel and the roof material is made of galvalum, the walls of the building are made of brick masonry and 12 threaded iron trellis, and the floor is paved with concrete and is waterproof K225 towards the reservoir. TPS LB3 at the UD Trucks workshop is located at the rear of the main building to the right of the PT. Astra International Tbk – UD Trucks SO Banjarmasin area with an area of approximately 22 m2 with dimensions of 4.91 m long, 5.90 m wide, and 3.51 m high. The coordinates of TPS LB3 are at 03 ° 26'42.1" LT – 114 ° 41'77.1" LS. TPS LB3 has been equipped with a 24x24x50 cm container tank, the container tank functions as a final container pool to accommodate spills, spills or water resulting from cleaning B3 waste. Supporting facilities at TPS LB3 at the UD Trucks workshop, as follows: APAR (light fire extinguisher), eyewash/sink, B3 labels and symbols, handling of sawdust spills, first aid kit, SOP for LB3 storage and management, LB3 storage logbook.

Figure 7. TPS for B3 Waste at PT. Astra International Tbk Workshop - UD Trucks SO Banjarmasin Branch

Figure 8. Reservoir at TPS LB3 PT. Astra International Tbk - UD Trucks SO Banjarmasin Branch

Tabel 2. Data Penyimpanan Limbah B3 Bengkel PT. Astra International Tbk- TSO Auto 2000

Ministerial Regulation of the Environment and Forestry Number 6 of 2021	Suitable	Not Suitable
B3 waste storage locations are not prone to natural disasters.	✓	
Firefighting equipment and emergency response tools are appropriate.	✓	
The roof, walls, and floor construction of the building are resistant to corrosion and fire.	✓	
B3 waste is protected from rain and direct sunlight.	✓	
A ventilation system for air circulation and lighting.	✓	
The floor is waterproof, not wavy, and prevents rainwater from entering from outside.	✓	
B3 waste spill collection channels and containers are provided.	✓	
Equipped with the appropriate B3 waste symbol.	✓	
Packaging is in the form of a 200-liter metal drum with a pallet.	✓	
The distance between the stack of packaging and the roof is at least 1 (one) meter.	✓	
Storage is allowed for a maximum of 90 days for B3 waste generated >= 50 kg/day.	✓	

B3 waste storage data at the TSO Auto 2000 workshop shows that the B3 waste storage location is flood-free. The TPS LB3 building complies with applicable regulations where the roof, floor, and walls of the building are resistant to corrosion and fire. The roof material is made of multiroof and the floor is paved with concrete. The TPS LB3 at the TSO Auto 2000 workshop is located at the rear of the PT. Astra International Tbk – TSO Auto 2000 Banjarmasin building with an area of approximately 12 m2, the coordinates of the TPS LB3 are at 03 ° 26'11.96'' LT – 114 ° 41'35.27'' LS. The TPS LB3 has been equipped with a watertight container measuring 30x30x50 cm. Supporting facilities at the TPS LB3 at the TSO Auto 2000 workshop, as follows: APAR (light fire extinguisher), eyewash/sink, B3 labels and symbols, sawdust spill handling, first aid kit, SOP for LB3 storage and management, LB3 storage logbook. The physical form of the TPS LB3 at the UD Trucks workshop:

Figure 9. Hazardous Waste Disposal Site at PT. Astra International Tbk Workshop – TSO Auto 2000 Banjarmasin

Table 3. Hazardous Waste Storage Data at PT. Serasi Autoraya (TRAC) Workshop

Ministerial Regulation of the Environment and Forestry Number 6 of 2021	Suitable	Not Suitable
B3 waste storage locations are not prone to natural disasters.	✓	
Firefighting equipment and emergency response tools are appropriate.	✓	
The roof, walls, and floor construction of the building are resistant to corrosion and fire.	✓	
B3 waste is protected from rain and direct sunlight.	✓	
A ventilation system for air circulation and lighting.	✓	

The floor is waterproof, not wavy, and prevents rainwater from entering from outside.	✓	
B3 waste spill collection channels and containers are provided.	✓	
Equipped with the appropriate B3 waste symbol.	✓	
Packaging is in the form of a 200-liter metal drum with a pallet.	✓	
The distance between the stack of packaging and the roof is at least 1 (one) meter.	✓	
Storage is allowed for a maximum of 90 days for B3 waste generated >= 50 kg/day.	✓	

B3 waste storage data at the Serasi Autoraya workshop shows that the B3 waste storage location is flood-free. The TPS LB3 building complies with applicable regulations where the roof, floor, and walls of the building are resistant to corrosion and fire. The roof material is made of zinc, the building walls are made of concrete, and the floor is paved with concrete. TPS LB3 PT. Serasi Autoraya (TRAC) is a permanent building with an area of 12 m2 (4 m x 3 m). The coordinates of TPS LB3 are at 03 ° 26'2.2874'' LT – 114 ° 41'22.32297'' LS. TPS LB3 has been equipped with a storage tank measuring 30x30x50 cm. Supporting facilities at the LB3 TPS at the Serasi Autoraya workshop include APAR (light fire extinguisher), eyewash/sink, mat or pallet for B3 waste packaging, B3 labels and symbols, first aid kit, SOP for LB3 storage and management, LB3 storage logbook. The physical form of the LB3 TPS at the Serasi Autoraya workshop:

Figure 10. Hazardous Waste Disposal Site at PT. Serasi Autoraya Workshop

Table 4. Hazardous Waste Storage Data at PT. Global Bara Unggul Workshop

Ministerial Regulation of the Environment and Forestry Number 6 of 2021	**Suitable**	**Not Suitable**
B3 waste storage locations are not prone to natural disasters.	✓	
Firefighting equipment and emergency response tools are appropriate.	✓	
The roof, walls, and floor construction of the building are resistant to corrosion and fire.	✓	
B3 waste is protected from rain and direct sunlight.	✓	
A ventilation system for air circulation and lighting.	✓	
The floor is waterproof, not wavy, and prevents rainwater from entering from outside.	✓	
B3 waste spill collection channels and containers are provided.	✓	
Equipped with the appropriate B3 waste symbol.	✓	
Packaging is in the form of a 200-liter metal drum with a pallet.	✓	
The distance between the stack of packaging and the roof is at least 1 (one) meter.	✓	
Storage is allowed for a maximum of 90 days for B3 waste generated >= 50 kg/day.	✓	

B3 waste storage data at the PT. Global Bara Unggul workshop shows that the B3 waste storage location is flood-free. The LB3 TPS building complies with applicable regulations where the roof, floor, and walls of the building are resistant to corrosion and fire. The roof material is made of zinc, the building walls are made of brick masonry, and the floor is paved with concrete. LB3 TPS PT. GBU has a building area of 12 m2 with a building height of 2 m. The coordinates of the LB3 TPS are at 03 ° 26'18.80'' LT – 114 ° 41'33.20'' LS. The LB3 TPS has been equipped with a spill container with a diameter of 58 cm x 50 cm made of waterproof metal. Supporting facilities at the LB3 TPS at the PT. GBU consists of APAR (light fire extinguisher), eyewash/sink, mat or pallet for B3 waste packaging, B3 labels and symbols, first aid kit, SOP for LB3 storage and management, LB3 storage logbook. The physical form of the TPS LB3 workshop of PT. GBU:

Figure 11. B3 Waste from PT. Global Bara Unggul Workshop

c. Transportation and Handover to Licensed Management Parties

The transportation and handover of hazardous and toxic waste (B3) is a subsequent process after storage and labeling. The purpose is to ensure that the waste is safely managed by parties holding official government permits. Based on observations and questionnaires conducted with large workshop operators in Landasan Ulin Barat Village, it was found that all workshops carried out the transportation and handover of B3 waste in accordance with applicable regulations.

All workshops had valid environmental documents, such as a Statement of Commitment to Environmental Management and Monitoring (SPPL), which serves as the legal basis for their operations. The existence of these documents demonstrates compliance with the regulations stipulated in Government Regulation Number 22 of 2021 concerning the Implementation of Environmental Protection and Management, which requires every business activity that produces B3 waste to have an environmental permit and to report its management activities periodically.

The transportation and handover of B3 waste from the large workshops used in the study were carried out using the services of a third party that held an official permit from the Ministry of Environment and Forestry (KLHK). This third party is responsible for transporting the waste to a licensed hazardous waste management or disposal facility, such as an incinerator or final processing facility that meets technical standards. This collaboration between the workshop and the third party demonstrates business actors' awareness of the importance of a safe, measurable, and sustainable waste management system.

Suryani and Nugraha (2022) state that collaboration between business actors, licensed management parties, and local governments is key to the success of a hazardous waste management system in the automotive services industry. With a structured collaborative mechanism, waste

transportation can be carried out safely, avoid the risk of spills, and be administratively recorded through a hazardous waste manifest sheet, as mandated by Ministerial Regulation of the Environment and Forestry Number 6 of 2021. Information on hazardous waste transportation by third parties can be found in the appendix.

2. Level of Understanding of B3 Waste Management among Business Actors

The level of understanding of large workshop operators regarding hazardous waste management was measured using three indicators: knowledge, attitudes, and actions, summarized in 23 questions. The questionnaire was completed by eight key informant respondents from four large workshops in Landasan Ulin Barat Village, consisting of two people per workshop.

The results of the study showed that the knowledge of large workshop operators regarding hazardous waste management was 96.82%, the attitude of large workshop operators regarding hazardous waste management was 97.50%, and the action of large workshop operators regarding hazardous waste management was 98.57%. These three values indicate that the level of understanding of workshop operators regarding hazardous waste management, in terms of knowledge, attitudes, and actions, falls within the "Very Good" category. These results indicate that all workshop operators involved in this study have a very good understanding of the hazards of hazardous waste and implement management in accordance with applicable regulations. This understanding is reflected in important aspects of hazardous waste management, such as the use of appropriate storage containers, the application of labels and symbols to hazardous waste, the existence of a TPS (Terminal Sewa Sampah/Plastic Waste Disposal Site), and collaboration with third parties for hazardous waste transportation.

a. Business Actor Knowledge

The knowledge assessment of workshop business actors was conducted to determine their understanding of the technical and administrative requirements for hazardous waste management. A total of 11 questions were used to assess knowledge, covering aspects of waste hazards, containerization, labeling, technical storage requirements, and risk mitigation efforts. Tabulation of questionnaire results from 8 respondents:

Table 5. Tabulation of Questionnaire Answers on Business Actors' Knowledge of Hazardous Waste Management

Question	STM	Percentage	TM	Percentage	RR	Percentage	M	Percentage	SM	Percentage
P1	0	0%	0	0%	0	0%	1	12,5%	7	87,5%
P2	0	0%	0	0%	0	0%	1	12,5%	7	87,5%
P3	0	0%	0	0%	0	0%	2	25%	6	75%
P4	0	0%	0	0%	0	0%	3	37,5%	5	62,5%
P5	0	0%	0	0%	0	0%	2	25%	6	75%
P6	0	0%	0	0%	0	0%	0	0%	8	100%
P7	0	0%	0	0%	0	0%	2	25%	6	75%
P8	0	0%	0	0%	0	0%	0	0%	8	100%
P9	0	0%	0	0%	0	0%	1	12,5%	7	87,5%
P10	0	0%	0	0%	0	0%	1	12,5%	7	87,5%
P11	0	0%	0	0%	0	0%	1	12,5%	7	87,5%

Description:
STM = completely unaware
TM = unaware
RR = uncertain
M = aware
SM = completely aware

The table measures the level of knowledge of large workshop operators regarding hazardous and toxic waste management, consisting of 11 questions (P1-P11). The Likert scale used included the categories "very unaware" (STM), "don't know" (TM), "uncertain" (RR), "aware" (M), and "very aware" (SM). The results showed that no respondents fell into the "very unaware" (STM), "uncertain" (TM), or "uncertain" (RR) categories. The majority of respondents chose the "aware" and "very aware" categories, with the proportion of "very aware" reaching 62.5% to 100%. This indicates that operators have a good understanding of the fundamental aspects of hazardous and toxic waste management in accordance with regulations.

The total questionnaire score is the sum of the scores for each observation item multiplied by the weighted score based on the Likert scale. The maximum score is the maximum score on the Likert scale multiplied by the number of questions, 5 x 11 = 55. The expected score is the maximum score multiplied by the number of respondents, so 8 x 55 = 440. Calculation of the questionnaire scores for respondents on the knowledge level indicator for large repair shop owners in Landasan Ulin Barat Village:

Table 6. Percentage and Scoring Results for the Knowledge Indicator

No	Questions	Score				
		STM	**TM**	**RR**	**M**	**SM**
1	Business actors are aware of the dangers of hazardous waste.				1	7
2	Sufficient containers are available for storing hazardous waste.				1	7
3	Containment/packaging of hazardous waste is provided with symbols and labels.				2	6
4	Separate hazardous waste storage/collection buildings are available.				3	5
5	The hazardous waste storage location is flood-free and not prone to disasters.				2	6
6	Emergency fire extinguisher (APAR) equipment is available.				0	8
7	Hazardous waste is protected from rain and direct sunlight.				2	6
8	Ventilation and lighting systems are available.				0	8
9	Watertight floors have drainage channels in the hazardous waste storage area and are not wavy.				1	7
10	Has drainage channels in the hazardous waste storage area.				1	7
11	Has a maximum storage period of 90 days for hazardous waste.				1	7
Total		**0**	**0**	**0**	**14**	**74**
Total Score		**0**	**0**	**0**	**56**	**370**
Score		**426**				
Percentage (%)		**96,82**				

The total knowledge score of respondents from large workshop operators in Landasan Ulin Barat Village, with a total questionnaire score of 426 (96.82%), out of the expected score of 440 (100%). A score of 426, representing 96.82%, is categorized as very good, indicating that large workshop operators have a very good understanding of various aspects of hazardous and toxic waste management, particularly regarding basic and technical knowledge of hazardous and toxic waste.

The operators have identified hazardous and toxic waste and are aware of its hazards. The containerization and storage of hazardous and toxic waste comply with applicable regulations stipulated in Ministerial Regulation No. 6 of 2021. The operators also demonstrated a good understanding of the importance of ensuring storage locations are free from flooding and natural disasters, as well as the use of safe facilities, such as ventilation and watertight drainage systems.

b. Attitudes towards Hazardous Waste Management

Table 7. Tabulation of Questionnaire Responses on Business Actors' Attitudes Towards Hazardous Waste Management

Question	SS	Percentage	S	percentage	RR	Percentage	TS	Percentage	STS	Percentage
P1	7	87,5%	1	12,5%	0	0%	0	0%	0	0%
P2	7	87,5%	1	12,5%	0	0%	0	0%	0	0%
P3	7	87,5%	1	12,5%	0	0%	0	0%	0	0%
P4	7	87,5%	1	12,5%	0	0%	0	0%	0	0%
P5	7	87,5%	1	12,5%	0	0%	0	0%	0	0%

Description:
SS = strongly agree
S = agree
RR = undecided
TS = disagree
STS = strongly disagree

The table shows the attitudes of large workshop business owners toward hazardous and toxic waste management, consisting of five questions (P1-P5). The Likert scale used included the categories "strongly agree" (SS), "agree" (S), "uncertain" (RR), "disagree" (ST), and "strongly disagree" (STS). The results show that no respondents chose "strongly disagree" (STS), "disagree" (TS), or "uncertain" (RR). The majority of respondents chose "strongly agree," with 87.5% of respondents in the "strongly agree" category. This indicates that business owners have a positive attitude toward the fundamental aspects of hazardous and toxic waste management in accordance with regulations.

The total questionnaire score is the sum of the scores for each observation item multiplied by the weighted score based on the Likert scale. The maximum score is the maximum score on the Likert scale multiplied by the number of questions (5 x 5 = 25). The expected score is the maximum score multiplied by the number of respondents, so 8 x 25 = 200. Calculation of the questionnaire scores for respondents on the attitude indicator for large repair shop owners in Landasan Ulin Barat Village:

Table 8. Percentage and Scoring Results for the Attitude Indicator

No	Questions	Score				
		SS	S	RR	TS	STS
1	The business actor collaborates with a third party that holds an official permit for the transportation and processing of hazardous and toxic waste.	7	1			
2	The business actor has a temporary storage facility (TPS) for hazardous and toxic waste that complies with regulations.	7	1			
3	The business actor has emergency response equipment for hazardous and toxic waste spills or accidents.	7	1			
4	The business actor has a Standard Operating Procedure (SOP) for hazardous and toxic waste management.	7	1			
5	The business actor is committed to complying with all regulations related to hazardous and toxic waste management.	7	1			
Total		**35**	**5**	**0**	**0**	**0**
Total Score		**175**	**20**			
Score		**195**				
Percentage (%)		**97,50**				

The total attitude score for large workshop operators in Landasan Ulin Barat Village, based on the questionnaire results, was 195 (97.50%), out of the expected score of 220 (100%). A score of 195, or 97.50%, is categorized as very good, indicating that large workshop operators have very good attitudes regarding various aspects of

hazardous waste management, particularly regarding matters related to basic and technical knowledge of hazardous waste.

Business operators at all large workshops studied in Landasan Ulin Barat Village demonstrated very good attitudes. Observations showed that all large workshops had B3 waste disposal sites (TPS) and collaborated with third parties licensed by the Ministry of Environment and Forestry (KLHK). They had signed MOUs with third parties and possessed emergency response equipment, demonstrating business awareness of the importance of B3 waste management in accordance with regulations.

a. Actions in Hazardous Waste Management

Table 9. Tabulation of Questionnaire Responses on Business Actor Actions Regarding Hazardous Waste Management

Question	SL	Percentage	SR	Percentage	KK	Percentage	J	Percentage	TP	Percentage
P1	8	100%	0	0%	0	0%	0	0%	0	0%
P2	7	87,5%	1	12,5%	0	0%	0	0%	0	0%
P3	7	87,5%	1	12,5%	0	0%	0	0%	0	0%
P4	8	100%	0	0%	0	0%	0	0%	0	0%
P5	7	87,5%	1	12,5%	0	0%	0	0%	0	0%
P6	7	87,5%	1	12,5%	0	0%	0	0%	0	0%
P7	8	100%	0	0%	0	0%	0	0%	0	0%

Description:
SL = always
SR = often
KK = sometimes
J = rarely
TP = never

The indicator table for large workshop business operators' actions regarding hazardous waste management consists of 7 questions (P1-P7). The Likert scale used includes the categories always (SL), often (SR), sometimes (KK), rarely (J), and never (TP). The results show that no respondents chose the categories sometimes (KK), rarely (J), or never (TP). The majority of respondents chose the "strongly agree" category, with the proportion of "always" being 87.5% - 100%. This indicates that business operators have implemented effective practices regarding the fundamental aspects of hazardous waste management in accordance with regulations.

The total questionnaire score is the sum of the scores for each observation item multiplied by the weighted score based on the Likert scale. The maximum score is the maximum score on the Likert scale multiplied by the number of questions, 5 x 7 = 35. The expected score is the maximum score multiplied by the number of respondents, so 8 x 35 = 280. Calculation of the questionnaire scores for respondents on the action indicator for large workshop business owners in Landasan Ulin Barat Village:

Table 10. Percentage Results and Scoring for the Action Indicator

No	Questions	Score				
		SL	SR	KK	J	TP
1	Placing hazardous waste at the hazardous waste disposal site (TPS)	8				
2	Labeling and packaging hazardous waste according to regulations	7	1			
3	Recording incoming and outgoing hazardous waste at the TPS in a logbook/manifest	7	1			
4	Reporting the quantity and type of hazardous waste to the Banjarbaru City Environmental Agency within the specified timeframe	8				
5	Renewing the hazardous waste MoU with licensed hazardous waste collectors periodically	7	1			

6	Maintaining the tidiness and cleanliness of the TPS	7	1			
7	Conducting hazardous waste emergency response training/simulations for employees on a regular basis	8				
Total		**52**	**4**	**0**	**0**	**0**
Total Score		**260**	**16**			
Score		**276**				
Percentage (%)		**98,57**				

The total score for large workshop operators in Landasan Ulin Barat Village, based on the questionnaire results, was 276 (98.57%), out of the expected score of 280 (100%). A score of 276, or 98.57%, is categorized as very good, indicating that large workshop operators have excellent practices in various aspects of hazardous waste management, particularly regarding basic and technical knowledge of hazardous waste. In terms of practical hazardous waste management practices, these operators consistently carry out hazardous waste management activities, routinely depositing hazardous waste in the appropriate waste disposal sites (TPS), recording incoming and outgoing hazardous waste, and maintaining cleanliness and tidiness at the hazardous waste disposal sites (TPS). All large workshops studied also reported their hazardous waste records to the Banjarbaru City Environmental Agency, indicating that they not only comply with internal procedures but also involve authorities in hazardous waste management.

Widyanor et al. (2025) found that B-type motorcycle repair shops in Banjarbaru City produce an average of 8.24 liters of used oil per day, yet many still fail to meet the packaging, storage, and licensing requirements for transporting hazardous waste. The study found a significant improvement in hazardous waste management practices among large repair shops, indicating a higher level of awareness and a more structured system compared to medium- or small-scale repair shops.

Wardana et al. (2025) found that many unofficial repair shops are unable to accommodate all used oil; some waste is spilled, unrecorded, and potentially polluting the environment. Workshops can only accommodate 30 of the 100 liters of monthly oil waste, with the remainder leaking or going unrecorded. Meanwhile, large repair shops in Landasan Ulin Barat Village demonstrated much more disciplined management practices; no leaks or unrecorded waste were found, and the entire waste management process followed formal procedures. This comparison confirms that business legality, repair shop size, and level of supervision significantly influence the quality of hazardous waste management.

Aminuddin et al. (2024) stated that the knowledge level of motorcycle repair shop managers in Makassar City is only in the "good" category, but B3 waste management practices are not entirely up to standard. Although there is an understanding of the benefits of recycling or reusing used oil, management practices in the field are still limited to identification, collection, and simple efforts without comprehensive compliance with official regulations. Large repair shops in Landasan Ulin Barat Village not only understand the procedures but have also implemented B3 waste management in a comprehensive and structured manner in accordance with government regulations. This indicates that the level of understanding at your research location is not only in the good category, but has developed into excellent and consistent implementation.

Dahlan et al. (2023) found that the types of hazardous waste produced were similar, such as used rags, used oil, and waste bottles. Management practices in motorcycle and car repair shops are not yet fully compliant with Minister of Environment and Forestry Regulation No. 6 of 2021, especially at the sampling and temporary storage stages. Many repair shops in Jakarta still require improvements, from packaging, recording, to labeling. This condition is very different from your findings, where all large repair shops have complied with all regulatory

stages. Alimuna et al. (2022) and Kristianti et al. (2021) reported much better results in terms of understanding and behavior in hazardous waste management. Most mechanics in Kendari are still in the "doubtful" knowledge category, and only a few sub-districts demonstrate consistent hazardous waste management behavior. Oil waste is quite large, averaging 9.6 liters per day, but is still limited to the storage and utilization stages of oil waste without following all the required government-mandated hazardous waste management standards. A large workshop in Landasan Ulin Barat Village has implemented all official procedures, demonstrating a much stronger level of understanding and consistent implementation. This suggests that your research area could serve as a model for best practices in hazardous waste management in the automotive workshop sector.

CONCLUSION

The management and understanding of large workshop operators in Landasan Ulin Barat Village are classified as very good. All large workshops have implemented hazardous and toxic waste management in accordance with Government Regulation No. 22 of 2021 and Ministerial Regulation No. 6 of 2021. All stages of hazardous and toxic waste collection and labeling, temporary storage, and transportation are handled by licensed operators.

Declaration by Authors

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