International Journal Publishing
INFLUENCE: International Journal of Science Review
Volume 5, No. 3, 2023
https://influence-journal.com/index.php/influence/index

Specific Waste Handling Pattern Strategies West Java Province Through The Approach In Policy Of Domestic Waste And Dangerous Toxic Materials

Mayang Manguri Rahayu[1], Machrunnisa[2], Johan Budiman[3], Ira Rumiris Hutagalung[4], Tetty Andriani[5]
[1,2,4,5]Teknik Lingkungan, Universitas Islam Syekh Yusuf Tangerang
[3]Teknik Sipil, Universitas Islam Syekh Yusuf Tangerang
Email: rmayang260818@gmail.com

Abstract

Domestic waste is the largest contributor to the amount according to waste criteria. So according to Law Number 18 of 2008 concerning Waste Management, household waste has special specifications in its handling patterns, the use of cleaning materials generally causes households to produce toxic and dangerous waste which is designated as specific waste. Specific waste itself is regulated in Government Regulation Number 27 of 2020 concerning Specific Waste Management. The urgency of specific household waste management is that the correlation between the two policies has not been studied. The analysis of the approaches to these two policies aims to implement the most appropriate pattern for handling domestic hazardous and toxic waste. Based on calculation results, the generation of hazardous and toxic household waste in the Regency/City of West Java Province is estimated at 416.47 tons/day and there is no special handling yet. The integrated handling pattern is still not operational because these two policies do not yet have a relationship study, because the special characteristics of these two types of waste are in contrast to their decomposition properties.

Keywords: *West Java, Domestic Waste, Dangerous Toxic Materials.*

A. INTRODUCTION

Various literature defines waste as any solid waste originating from human and animal activities, discarded because it is either no longer useful or unwanted (Tchobanoglous, Theisen & Vigil, 1993). Meanwhile, in Government Regulation No. 101 of 2014 concerning the Management of Hazardous and Toxic Waste, waste is generally defined as residual material from a production activity and/or process.

The concept of waste has experienced a transformation in recent times, with a noticeable omission of the disposal aspect. There is currently a trend towards not haphazardly getting rid of waste but rather, emphasizing efforts to maximize recycling. This shift is evident in Law No. 18 of 2008 on Waste Management. As per this law, waste is defined as the residue resulting from human daily activities and/or natural processes in a solid state. Government Regulation No. 81 of 2012 further specifies household waste as waste originating from daily household activities, excluding feces and specific waste. Correspondingly, similar household waste encompasses waste from commercial areas, industrial areas, special areas, social facilities, public facilities, and/or other facilities.

In line with the waste management regulations outlined in Government Regulation No. 81 of 2012, as well as Regional Regulation of West Java Province No. 12 of 2010 concerning Waste Management and Regional Regulation No. 1 of 2016 concerning Amendments to West Java Provincial Regulation No. 12 of 2010 concerning Waste Management, the provincial government is obligated to devise Waste Management Policies and Strategies (Jakstrada). The formulation of waste management policies and strategies holds utmost importance as the

foundation for defining programs and activities aimed at achieving Indonesia Bebas Sampah 2025 (Indonesia Free of Waste 2025), as advocated by the Ministry of Environment and Forestry of the Republic of Indonesia. Article 7 of Government Regulation No. 81 of 2012 stipulates that the creation of Jakstrada must be guided by the National Policies and Strategies on Waste Management. With the issuance of Presidential Regulation No. 97 of 2017 on National Policies and Strategies for Household Waste and Similar Household Waste Management on October 24, 2017, this regulation can now serve as a reference in crafting Waste Management Jakstrada in West Java. Similarly, the progress of waste management in West Java, within its jurisdiction, centers on Regional TPAS (Final Processing and Treatment Sites) for Waste.

The regulations governing waste management, including Government Regulation No. 81 of 2012, Regional Regulation of West Java Province No. 12 of 2010 on Waste Management, and Regional Regulation No. 1 of 2016 amending West Java Provincial Regulation No. 12 of 2010 on Waste Management, comprehensively cover the handling of household waste and similar waste. Nevertheless, there is a notable absence of specific waste management policies derived from Law No. 18 of 2008.

Specific waste, as stipulated in paragraph (1) letter c of Law No. 18 of 2008, encompasses;

a. Waste containing hazardous and toxic substances (B3);
b. Waste containing hazardous and toxic material residues (LB3);
c. Waste resulting from disasters;
d. Debris from building demolition;
e. Technologically unprocessable waste; and/or
f. Periodically generated waste.

SPECIFIC WASTE MANAGEMENT AND FEASIBILITY STUDY

Specific waste, as stipulated in paragraph (1) letter c of Law No. 18 of 2008, encompasses:

a. Waste containing hazardous and toxic substances (B3);
b. b. Waste containing hazardous and toxic material residues (LB3);
c. c. Waste resulting from disasters;
d. d. Debris from building demolition;
e. e. Technologically unprocessable waste; and/or
f. f. Periodically generated waste.

Under Law No. 32 of 2009 concerning Environmental Protection and Management, Article 59 specifically addresses the management of Hazardous and Toxic Waste (LB3). This article stipulates that the handling of Hazardous Waste (B3) is regulated by Government Regulation No. 101 of 2014 on the Management of Hazardous and Toxic Waste. According to the provisions in Government Regulation No. 101 of 2014, Hazardous Waste (B3) is described as the remnants of an activity or business containing hazardous and toxic substances in the form of substances, energy, and/or other components. These components, due to their nature, concentration, and/or quantity, have the potential to directly or indirectly pollute and/or damage the environment or pose a threat to the environment, health, and the survival of humans and other living beings. The management of Hazardous Waste (B3) encompasses activities such as reduction, storage, collection, transportation, utilization, processing, and/or disposal.

Two laws serve as the legal basis for specific waste management, namely Law No. 18 of 2008 and Law No. 32 of 2009. Therefore, careful consideration and thorough studies are required in formulating policies and strategies for specific waste management in accordance with

regulations. The inventory and analysis of specific waste generation data (B3 waste), reduction and utilization at the source, sorting, waste transportation systems, and final processing become key considerations in preparing the feasibility of specific waste management. This becomes crucial in the management of specific waste (B3 waste) in West Java, necessitating a Feasibility Study for the Construction of a Domestic Hazardous Waste Management Center in West Java.

B. METHOD

This research employs a qualitative method, specifically utilizing the qualitative descriptive research method. Through this approach, the researcher aims to generate descriptive data from policy studies to reveal the causes and processes of Domestic Hazardous and Toxic Waste (B3) in West Java. The regional coordination function approach is employed through a territorial method, and the data obtained in the research emphasize how policies on Domestic B3 Waste in West Java originate from various sources, using policy collection techniques. These policies are then considered to be correlated in the research conclusions and are carried out quantitatively, resulting in saturated policy data points.

A. General Description Of The Location As A Regional Methodology

West Java Province is one of the provinces in Indonesia with a population of 50,025,605 people in the year 2023, making it the most populous province in Indonesia. The capital city is Bandung. West Java Province is composed of 18 regencies and 9 cities. Initially, the West Java region also included Banten Province. However, on October 17, 2000, a portion of the West Java region was separated to form Banten Province (https://perkim.id/profil-pkp/profil-provinsi/profil-perumahan-dan-kawasan-permukiman-provinsi-jawa-barat/) Geographically, the province has the following boundaries:

- North: Bordering the Java Sea
- South: Bordering the Indian Ocean
- West: Bordering Banten Province and DKI Jakarta
- East: Bordering Central Java Province

Figure 1. Map of West Java Province

Administratively, since 2008, there are 26 regencies/cities in West Java Province, consisting of 17 regencies and 9 cities, with 625 districts and 5,877 villages/urban wards.

West Java is divided into 4 Regional Government Coordination Bodies (Bakor PP) as follows:

- Region I Bogor includes Bogor Regency, Bogor City, Depok City, Sukabumi Regency, Sukabumi City, and Cianjur Regency..
- Region II Purwakarta includes Purwakarta Regency, Subang Regency, Karawang Regency, Bekasi Regency, and Bekasi City.
- Region III Cirebon includes Cirebon Regency, Cirebon City, Indramayu Regency, Majalengka Regency, and Kuningan Regency.
- Region IV Priangan includes Bandung Regency, Bandung City, Cimahi City, West Bandung Regency, Sumedang Regency, Garut Regency, Tasikmalaya Regency, Tasikmalaya City, Ciamis Regency, and Banjar City. The Organizational Structure of the West Java Provincial Government consists of 1 Regional Secretariat with 12 Bureaus and the Regional People's Representative Council (DPRD) Secretariat, 20 Agencies, 17 Boards, 17 Technical Institutes, 3 Other Institutions, 3 Regional Hospitals, 121 Regional Technical Implementation Units, and 1 Technical Implementation Unit of the Board

B. METHODOLOGICAL APPROACH

The approach used is a qualitative method of legal study, as presented in points B.1 and B.2, which are policy considerations used for the study of Domestic Hazardous and Toxic Waste (B3) in West Java Province. The policy study on Domestic B3 Waste in Indonesia was first conducted in West Java

B.1 STUDY OF WASTE MANAGEMENT LEGISLATION

As per the definition outlined in Law Number 18 of 2008 concerning Waste Management, waste is characterized as the residual byproduct stemming from both human daily activities and/or natural processes in a solid state. This encompasses various categories, namely household waste, similar household waste, and specific waste. The origins of waste are attributed to the generation of waste by individuals and/or the outcomes of natural processes that yield waste. Household waste arises from routine activities within residences, excluding feces and specific waste. Similar household waste, on the contrary, is generated from commercial areas, industrial zones, special areas, social facilities, public facilities, and/or other facilities. Specific waste, distinguished by its nature, concentration, and/or volume, necessitates specialized handling.

Specific waste as mentioned includes:

a. Waste containing hazardous and toxic substances
b. Waste containing hazardous and toxic waste
c. Waste arising from disasters
d. Debris from building demolition
e. Waste that cannot be processed technologically, and/or
f. Waste that arises periodically

Specific waste beyond the provisions regulated in the above-mentioned rules is governed by the minister responsible for environmental affairs.

Figure 2. Scope of Waste Management

As outlined in Law Number 18 of 2008 concerning Waste Management, the process of waste management is a systematic, comprehensive, and ongoing endeavor encompassing waste reduction and proper handling. Temporary storage serves as the location where waste is stored prior to its transportation to recycling centers, processing facilities, and/or integrated waste treatment facilities. Integrated waste treatment facilities, on the other hand, serve as sites where various activities, including collection, sorting, reuse, recycling, processing, and final waste processing, are carried out. The final processing site is designated for the processing of waste, ensuring its safe return to the environment.

Individuals involved in household waste and similar waste management are obligated to minimize and handle waste in an environmentally conscious manner. Waste management is structured on principles such as responsibility, sustainability, benefit, justice, awareness, togetherness, safety, security, and economic value. The objective of waste management is to enhance public health and environmental quality while transforming waste into a valuable resource. An emergency response system entails a series of activities aimed at controlling and preventing accidents resulting from improper waste management.

Concerning managers and producers, various areas, including residential, commercial, industrial, special, public, and social facilities, among others, must provide waste sorting facilities. Additionally, every producer is required to incorporate labels or symbols related to waste reduction and proper handling on their packaging and/or products. In cases where the packaging is non-biodegradable, producers must manage packaging and/or products that cannot decompose naturally or are challenging to decompose.

Management of household waste and similar waste consists of:

a. Waste reduction; and
b. Waste handling.

Waste reduction activities include:

a. Limiting waste generation;
b. Recycling waste; and/or
c. Reusing waste.

Business entities implementing these activities use materials that are designed to generate minimal waste, are reusable, recyclable, and/or easily decomposable through

natural processes. In the implementation of waste reduction initiatives, the community opts for materials that possess the potential for reuse, recycling, and/or easy decomposition by natural processes. The government bears the responsibility for specific waste management, and the activities related to waste handling, as specified in the regulations, encompass a range of measures and practices:

a. Sorting through grouping and separating waste according to type, quantity, and/or characteristics;
b. Collection comprises the extraction and transfer of waste from its origin to temporary storage or integrated waste treatment facilities;
c. Transportation entails conveying waste from its source and/or from temporary waste storage or integrated waste treatment facilities to the ultimate processing site;
d. Processing encompasses altering the characteristics, composition, and quantity of waste; and/or
e. Final waste processing entails the secure reintroduction of waste and/or remnants from prior processing into the environment.

Anyone engaging in waste management activities requires obtaining permission from the head of the region within their designated authority. The granting of this permission adheres to government regulations, and additional details regarding the procedures for obtaining such permission are specified by regional regulations within their jurisdiction. Decisions related to waste management permits must be publicly announced. Further regulations, including specifics on the types of waste management businesses requiring permits and the procedures for public announcements, are outlined in regional regulations.

PROHIBITIONS for every citizen of Indonesia related to waste management, as stipulated in Law Number 18 of 2008, are:

a. Importing waste into the territory of the Unitary State of the Republic of Indonesia.
b. Importing waste.
c. Mixing waste with hazardous and toxic waste.
d. Managing waste that causes pollution and/or environmental damage.
e. Disposing of waste in places not designated and provided.
f. Conducting waste handling through open dumping at the final processing site; and/or.
g. Burning waste that does not comply with technical requirements for waste management.

B.2 METHODOLOGY CRITERIA THROUGH GOVERNMENT AUTHORITY

The study encompasses the comprehensive analysis of waste management, encompassing the stages of collection, transportation, and processing within landfill sites. The criteria for the study, both general and specific to domestic hazardous and toxic waste, are essential considerations in the implementation of waste management techniques. The waste collection system refers to the method or process of gathering waste from storage locations or waste repositories, starting from the source of waste generation to temporary collection points or transfer stations, and ultimately to the final disposal site, typically a landfill. Collection activities are generally carried out by city cleanliness officers or community volunteers, which may include waste sources, private entities, or community organizations. The community's active participation in waste management is largely contingent on the city's capacity to address its waste

management challenges. Both the government and regional authorities bear the responsibility of ensuring effective and environmentally conscious waste management practices, aligning with the objectives outlined in relevant laws.

a. Fostering and improving public awareness in waste management.
b. Engaging in research, developing technologies for waste reduction, and enhancing waste handling methods.
c. Facilitating, developing, and executing initiatives to diminish, manage, and repurpose waste.
d. Coordinating collaboration among government agencies, the community, and the business sector to ensure an integrated waste management approach.
e. Executing waste management practices and facilitating the provision of waste management infrastructure and facilities.
f. Promoting and supporting the utilization of benefits derived from waste processing.
g. Facilitating the adoption of specific local technologies developed within the community to minimize and manage waste.

A. Government Authority

a. Setting national waste management policies and strategies.
b. Establishing norms, standards, procedures, and criteria for waste management.
c. Facilitating and developing interregional cooperation, partnerships, and networks in waste management.
d. Coordinating, guiding, and supervising the performance of regional governments in waste management.
e. Setting policies for resolving disputes between regions in waste management.

B. Provincial Government Authority

a. Setting policies and strategies for waste management in accordance with government policies.
b. Facilitating interregional cooperation within a province, partnerships, and networks in waste management.
c. Coordinating, guiding, and supervising the performance of regencies/cities in waste management.
d. Facilitating the resolution of waste management disputes between regencies/cities within one province.

C. Regency/City Government Authority

a. Setting policies and strategies for waste management based on national and provincial policies.
b. Organizing waste management at the regency/city scale in accordance with norms, standards, procedures, and criteria set by the government.
c. Coaching and supervising the performance of waste management carried out by other parties.
d. Determining the location of temporary storage, integrated waste treatment facilities, and/or final waste processing sites.
e. Monitoring and evaluating periodically every 6 (six) months for 20 (twenty) years for landfill sites with open dumping systems that have been closed.
f. Developing and implementing an emergency response system for waste management within its authority

B.3 Qualitative Method Of Waste Management Implementation

This method approaches several criteria inferred from government authority. Figure 3 illustrates Household Waste and Similar Household Waste Management.

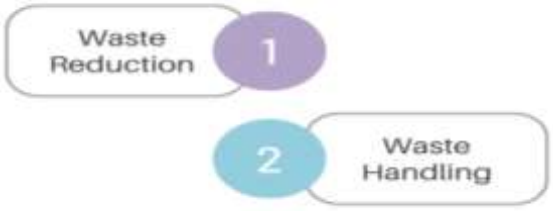

Figure 3. Waste Management Implementation

C. RESULT AND DISCUSSION

The challenge of waste management intensifies, particularly in urban areas, owing to the intricacy of the issues encountered and the high population density. Consequently, waste management is frequently given priority in urban settings. Waste is acknowledged as a significant problem, and virtually all residential areas, businesses, as well as city and regency governments encounter similar hurdles in waste management in Indonesia. The obstacles include:

1. Management system.
2. Legal or regulatory aspects.
3. Institutional or organizational aspects.
4. Funding support for management.
5. Support from developers, companies, city/regency governments, and community participation.
6. Operational facilities/infrastructure.

West Java stands out as the most densely populated province in Indonesia. Within West Java, various cities and regencies form direct synergies with the capital, Jakarta, encompassing places like Bogor, Depok, and Bekasi, and extending further to include Karawang, Purwakarta, and Cianjur. The urban and metropolitan areas in this region are characterized by highly active consumption patterns. Given the current economic growth achievements, there is a growing need for a shift in the production and consumption of goods and resources. The role of the community in sustainable consumption involves efforts to efficiently use energy, water, and food. The availability of water is essential for economic growth, and together with other support such as labor and transportation networks, water availability has boosted industrial and housing growth, especially in urban areas. However, this development often leads to pollution from waste and garbage disposal (Rahman, 2018).

Waste is a critical issue, especially for urban communities, due to several factors:

1. The volume of waste is very large, exceeding the capacity of collection points (TPS) and landfills (TPA).
2. TPA land is shrinking due to other purposes.
3. Suboptimal waste management technology leads to an increase in waste volume from decomposition.
4. Matured waste or compost is not removed from the landfill.
5. Ineffective waste management.
6. Waste management is perceived to have no positive impact on the environment.

7. Lack of government policy support.

C.1 REGULATIONS REGARDING WASTE MANAGEMENT AND B3 MANAGEMENT

Effective waste management strategies are used for analysis, regulated in Article 1, points 2-4 and 6-9:

Point 2: Similar household waste, in this context, refers to waste generated from commercial areas, industrial zones, special areas, social facilities, public facilities, and/or other similar facilities.

Point 3: Waste management is a methodical, all-encompassing, and sustainable practice involving both the reduction and proper handling of waste.

Point 4: Waste sources are the origins of waste generation.

Point 6: Temporary storage places, abbreviated as TPS, are places before waste is transported to recycling, processing, and/or integrated waste processing locations.

Point 7: Integrated waste processing facilities, known as TPS 3R, are locations that adhere to the 3R principle (reduce, reuse, recycle). At TPS 3R sites, various activities take place, including waste collection, sorting, reuse, and regional-scale recycling.

Point 8: Integrated waste processing locations, abbreviated as TPST, are places where activities such as waste collection, sorting, reuse, recycling, processing, and final waste processing are carried out.

Point 9: Final processing places, abbreviated as TPA, are places to process and return waste to the environment.

If this article is used as a study criterion, then TPS and TPA in West Java should ideally follow the 3R pattern (reduce, reuse, recycle). With this criterion, waste becomes easier to manage, and the risk of environmental pollution is low. This article automatically encourages people to separate their waste at home, reducing 70% of organic waste as it is turned into compost. The separation of economically valuable waste to waste banks, including Household Hazardous and Toxic Waste (B3), makes it easier for the next stage: transportation. Waste collection trucks will be more economical and environmentally friendly, as there is a reduction in maneuvering waste collection trucks.

C.2 TECHNICAL CRITERIA FOR SPECIFIC WASTE

As per Law No. 18 of 2008, Domestic Hazardous and Toxic Waste (B3 Domestik) is the outcome of classifying specific waste. Figure 4 offers an overview of the categorization of specific waste.

Figure 4: Categorization of Specific Waste

In the collection, storage, and transportation, Specific Waste should receive special treatment. Table 1 below outlines the waste collection pattern as a starting point for analysis. For storage, the method depends on the placement location, where communal storage patterns are implemented. The communal collection strategy is either direct or indirect, and there is no more individual collection. Storage is done based on the location, within a specific spatial area, as shown in Figure 5.

- Storage Level 1: This is a waste container that collects waste directly from its source, usually placed in visible and easily accessible locations. In this strategy, level 1 collection is done at homes within a housing settlement.
- Storage Level 2: Serving as a temporary collector, this container gathers waste from both level 1 containers and directly from the source. This container is typically placed at the neighborhood (RT) level. The level 2 container is considered communal.
- Storage Level 3: This is a central container, usually of large volume, which collects waste from level 2 containers. It is placed according to the waste transportation system, typically at the sub-district (RW) or neighborhood level.

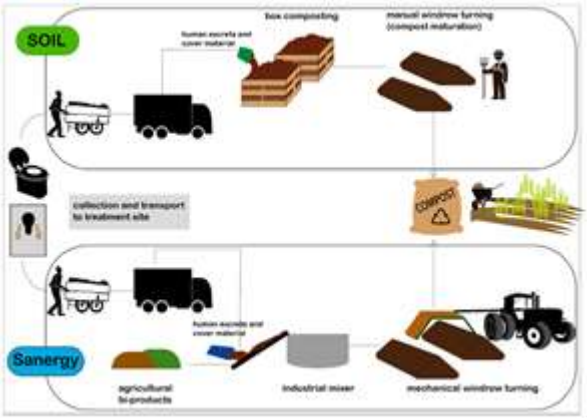

Figure 5. Containers Based on Spatial Scope

Storage should be separated from level 1 to facilitate community-scale management, especially in coordinating waste collection from narrow (household) to wide (neighborhood) spatial areas.

Figure 6. Sorting Waste

Figure 6 shows that the red waste bins indicate the separation of specific waste with a tendency towards hazardous and toxic waste (B3). Article 23, paragraph (1), outlines that the management of specific waste is the responsibility of the Government. Paragraph (2) is further detailed in Government Regulation Article 2 of the draft Regulation on the Management of Specific Waste

• Which involves organizing environmentally sustainable management of specific waste as a manifestation of the duties, obligations, and responsibilities of both the central government and local governments. In this context, West Java Province is obligated to implement specific waste policies.

• Providing legal foundations for organizing the management of specific waste to prevent environmental pollution and damage.

• Promoting the role and participation of the community in managing specific waste based on households, communities, and businesses.

The Implementation of Specific Waste Management includes:

- Waste containing hazardous and/or waste containing B3 waste:
- Reduction: Restriction of waste generation
- Handling: Sorting, Collection, Transportation, Utilization, Processing, Storage
- Waste arising from disasters:
- Handling: Collection, Transportation, Temporary Storage, Sorting, Reuse, Recycling, and Final Processing
- Debris from building demolition:
- Reduction: Recycling and reuse
- Handling: Sorting, Collection, Transportation, Processing, Final Processing
- Waste that is technologically unprocessable:
- Reduction: Restriction of use
- Handling: Sorting, Collection, Transportation, Final Processing
- Non-periodic waste:

a. Mass activities: Restriction of waste generation, Sorting, Collection, Transportation, Processing, Final Processing .

b. Waste from rivers, coasts, and/or beaches, and open waters: Restriction of waste generation: Collection, Transportation, Final Processing.

c. Large-sized waste and vehicle scrap: Restriction of waste generation, recycling, reuse, Handling: Collection, Transportation, Sorting, Processing, Final Processing.

d. Agricultural waste: Restriction of waste generation, recycling, reuse Handling: Collection, Transportation, Processing, Final Processing, In the operational technical aspect of waste management, the cost for waste collection activities can reach up to 40% of the total operational cost. Therefore, efforts need to be made to implement effective and efficient waste collection techniques, including considerations for waste storage locations, to minimize operational costs as much as possible.

Waste collection can be fundamentally categorized into two patterns:

a. Direct Individual Pattern

Collection is executed by sanitation workers who visit each building or source of waste directly (door to door) and transport the waste directly to the Final Disposal Site. Regular waste trucks, dump trucks, or compactor trucks are typically employed for this collection pattern.

b. Indirect Individual Pattern

This pattern is generally applied in organized residential areas, commercial areas, public places, streets, and parks. It involves Transfer Depots of Type I, Type II, or Type III, depending on the area's size and the availability of land.

c. Direct Communal Pattern

Waste collection is done individually by waste generators (households, etc.) to communal waste collection points provided or directly to waste trucks that visit these collection points.

d. Indirect Communal Pattern

Waste collection is done individually by waste generators (households, etc.) to designated communal waste collection points (bins/communal waste bins) or directly to waste carts/cycle rickshaws stationed at communal collection points. Sanitation workers with their carts then collect the waste from these communal collection points and take it to temporary storage or a transfer depot before transporting it to the final disposal site using waste trucks. If the waste collection point is a cart, the worker simply transports it to the temporary storage or transfer depot to transfer the waste onto the truck.

Waste containment is a method of storing waste before it is collected, transferred, transported, and disposed of in the final disposal site. The main goal of containment is :

- To prevent scattered waste that may disrupt the environment in terms of health, cleanliness, and aesthetics.
- Facilitate the waste collection process and ensure the safety of waste collection personnel, both municipal workers and those from the local community.
- In the operation of waste collection, containment issues play a crucial role. Therefore, waste containment is the responsibility of individuals generating waste (waste sources), and each waste source should ideally have its own container. Waste storage at the source is necessary to contain the generated waste, preventing it from being scattered or spread. The volume depends on the amount of waste produced per day by each waste source and the frequency and pattern of the collection..

Meanwhile, in waste transportation, for waste collection using the Direct Individual pattern, the vehicle used for collection is also directly used for transportation to the landfill. From the pool, the vehicle goes directly to the collection points (waste sources), and after being filled from the last collection point (in a certain route or trip). After unloading the waste at the landfill, the vehicle returns to the first collection point for the next route or trip. After being filled from the last collection point on that route, it goes directly to the landfill, and so on, until finally returning directly to the pool from the landfill.

Transportation from Transfer Station (TD) type I and type II, for waste collection with the indirect individual pattern (using waste carts/carts and Transfer Station type I or II), the waste transport is as follows:

- The transport vehicle leaves the pool directly to the TD location, and the waste is transported to the landfill.
- From the landfill, the vehicle returns to the TD for the next collection/transportation on the route or trip. The last route path is as specified (the amount of waste to be transported completely), and the vehicle directly returns to the pool.
- It can happen after the waste in one TD is finished picking up waste from another TD or from TPS/TPSS/LPS.
- In addition, transportation can also be arranged to alternate with other TDs so that there is no idle time for the Dump Truck. The elaboration above regarding waste collection, containment, and transportation becomes the material for analysis for the study criteria.

In addition, transportation can also be arranged to take turns with other TDs so that there is no idle time for the Dump Truck. The elaboration above regarding waste collection, containment, and transportation becomes the material for analysis for the study criteria.

C3. Source And Composition Of Domestic Hazardous And Toxic Waste (B3)

Here are the characteristics of B3 waste based on Government Regulation No. 85 of 1999 on Hazardous and Toxic Waste, including:

1. Easily Explodable: The waste described, at standard temperature and pressure (25 degrees Celsius, 760 mmHg), has the potential to explode or generate gases with high temperature and pressure through chemical and/or physical reactions. This process can pose a rapid and significant threat to the surrounding environment.
2. Easily Flammable: Waste characterized as easily flammable possesses properties of being a liquid with an alcohol content of less than 24% by volume and/or having a flashpoint not exceeding 60 degrees Celsius. Such waste is prone to ignition upon contact with fire, sparks, or other sources of ignition under atmospheric pressure of 760 mmHg. It is not in liquid form, which, at standard temperature and pressure, can easily cause a fire through friction, water vapor absorption, or spontaneous chemical changes. When burned, it can cause continuous and pressurized combustion, and it is waste that is easily flammable and an oxidizing waste.
3. Reactive: Refers to waste that is not stable under normal conditions and can undergo changes without exploding. The substance, when in contact with water, exhibits a strong reactive nature and has the potential to cause explosions. Additionally, the reaction may result in the production of toxic gases, vapors, or smoke in quantities that can be harmful to both human health and the environment. Cyanide, sulfide, or ammonia waste can produce toxic gases, vapors, or smoke under conditions of pH between 2 and 12.5, posing a danger to human health and the environment.
4. Toxic: Waste containing pollutants that are toxic to humans or the environment can lead to severe illness or death if they enter the body through respiration, skin contact, or ingestion.
5. Infectious: Medical laboratory waste or other waste infected with disease-causing microorganisms that can be transmitted. This waste is hazardous because it contains disease-causing microorganisms such as hepatitis and cholera that can be transmitted to workers, street cleaners, and the community around waste disposal sites.
6. Corrosive: Waste exhibiting any of the specified characteristics is as follows: induces skin irritation (burns), results in corrosion on steel plates at a rate exceeding 6.35 mm/year at 550 degrees Celsius, possesses a pH equal to or below 2 for acidic waste, and has a pH equal to or exceeding 12.5 for basic waste.

According to Toxic Link (2008), 21st-century household waste contains hazardous and toxic chemicals. The disposal of household B3 waste, which uses many products that may contain various hazardous substances, includes insecticides, pesticides, and fungicides; wood preservatives; damaged FL, tube lamps; paints, thinners, stains, and varnishes; adhesives; medications, cosmetics, acetone; batteries; various cleaners and polishes; and various electrical and electronic goods.

Household B3 waste categories, according to US EPA 2014, include various household and garden chemicals that can be presented in full or partially empty containers of products that still have residual contents and are disposed of in the environment without proper selection. The USEPA has coded household B3 waste commonly used in Figure 7.

LoW Code and Description	
20 01 14* acids, e.g. corrosive floor cleaners	 
20 01 15* alkalines, e.g. bleach	
20 01 19* pesticides	
20 01 29* detergents containing dangerous substances	
20 01 31* cytotoxic and cytostatic medicines	
20 01 32 medicines other than those mentioned in 20 01 31	

Figure 7 Potential Household Hazardous Waste Codes (USEPA, 2014)

Types of hazardous household waste include detergents, disinfectants, and surface cleaners for tables/chairs. Corrosive waste includes chlorine bleach, peroxide, hypochlorite, and some fertilizers (fire hazard by producing oxygen). According to USEPA and PENSTATE (2008), most hazardous household waste is eventually buried or burned (incineration causes pollution), disposed of directly into the soil, or enters septic systems or sewers. Disposing of hazardous household waste in these ways threatens environmental quality.
Negative effects occurring in each disposal/management pattern are as follows:

1. Open landfill sites are not isolated; They have connections to the environment, where wind, dust, and rainwater infiltrate landfills, mingling with their contents, including hazardous waste. When hazardous waste dissolves in water, it transforms into leachate. In cases where it doesn't dissolve, it remains intact, potentially seeping into groundwater. Leachate percolates through waste layers and, without barriers, can infiltrate the environment. Landfills, however, are not specifically designed to manage hazardous waste. Some hazardous waste types can damage synthetic liners, rendering them ineffective. Leachate contaminated with hazardous waste may not be thoroughly treated at wastewater facilities before discharge. Consequently, leachate, carrying hazardous waste, holds the potential to enter the water cycle. Moreover, water within landfills can react with various hazardous waste types; for instance, lithium, present in dry cell batteries, can undergo strong reactions when in contact with water.

2. Incineration: Every technology has its advantages and disadvantages, including incineration technology. Advantages of incineration technology include a) reducing waste volume by up to 90%, b) energy recovery, c) if managed properly, the released air pollution will be low, d) minimal land requirements (Margarida J. Quina, et al., 2011). However, incinerator weaknesses include a) producing hazardous waste (APC residue) that requires safe disposal, b) producing slag, c) producing large volumes of exhaust gas, d) high investment and operating costs, e) high maintenance costs, f) requiring expert staff, g) requiring a suitable composition for autocombustion (Margarida J. Quina, et al., 2011).

Despite the presence of pollution control devices in incinerators, effectively capturing certain pollutants found in hazardous waste proves challenging. Components of household hazardous waste, especially during high-temperature incineration, pose difficulties in

containment. For instance, mercury, present in some dry cell batteries, neon bulbs, and old paint, can transform into gas and be released through the incinerator stack. Debates surround the efficacy of incinerators in capturing all pollutants, with some asserting that existing air pollution control equipment, like scrubbers, effectively captures pollutants before their release. However, even the most efficient technologies, such as dry spray/fabric filters, can only eliminate 75–85 percent of mercury. Airborne mercury can dissolve in water, entering bodies of water like lakes, rivers, and groundwater, where pollutants may infiltrate the food chain. Residual ash from incinerator combustion may also contain concentrations of hazardous chemicals. Once released into the air, hazardous substances can undergo reactions with other contaminants, form new compounds, dissolve in water droplets, and eventually descend to the ground as rain or larger particles. The duration a material remains in the atmosphere is contingent on its stability, with unstable compounds like carbon monoxide having a short-lived presence, while stable compounds persisting in the atmosphere for an extended period can cause considerable damage, particularly contributing to global warming.

There is a regulation in Indonesia regarding Incineration, stipulated in Law No. 18 of 1999, Article 34. The key points of this article are as follows:

(1) Treatment of hazardous and toxic waste (B3) can be conducted through thermal, stabilization, and solidification processes, as well as through physical, chemical, biological, and/or other methods in accordance with technological advancements.

(2) The selection of locations for B3 waste treatment must comply with the following conditions:

a. Free from flooding, disaster-prone, and not within protected areas;

b. Designated as an industrial zone based on spatial planning.

(3) Treatment of B3 waste through stabilization and solidification must adhere to the following requirements:

a. Conduct an analysis using extraction procedures to determine the mobility of organic and inorganic compounds (Toxicity Characteristic Leaching Procedure);

b. Implement the storage of stabilization and solidification results in accordance with the regulations for B3 waste storage (landfill).

(4) Physical and/or chemical treatment of B3 waste resulting in:

a. Liquid waste must meet the standards for liquid waste quality;

b. Solid waste must comply with regulations regarding the management of B3 waste.

(5) Treatment of B3 waste through thermal processes using incinerators must meet the following requirements:

a. Possess incinerators with specifications suitable for the characteristics and quantity of processed B3 waste;

b. Have incinerators that can achieve a minimum combustion efficiency of 99.99%.

The legislation in Indonesia regarding the management of Hazardous and Toxic Waste (B3), as referred to in Government Regulation No. 101 of 2014, plays a crucial role. To support the analysis, several standards in B3 waste management are highlighted in Article 1:

- Paragraph (13) The activity by B3 Waste Generators to reduce the quantity and/or hazardous and toxic properties of B3 Waste before its generation from a business and/or activity.
- Paragraph (14) B3 Waste Generator: Any individual who, due to their business and/or

activities, produces B3 Waste

- Paragraph (15) B3 Waste Collector: A business entity engaged in the collection of B3 Waste before it is sent to B3 Waste Processing, B3 Waste Utilization, and/or B3 Waste Landfill.
- Paragraph (16) B3 Waste Transporter: A business entity engaged in the transportation of B3 Waste.
- Paragraph (17) B3 Waste Utilizer: A business entity engaged in the utilization of B3 Waste.
- Paragraph (18) B3 Waste Processor: A business entity engaged in the processing of B3 Waste.
- Paragraph (19) B3 Waste Landfill: A business entity engaged in the landfilling of B3 Waste.
- Paragraph (22) B3 Waste Utilization: The activity of reusing, recycling, and/or reclaiming aimed at transforming B3 Waste into products that can be used as a substitute for raw materials, auxiliary materials, and/or fuels that are safe for human health and the environment.
- Paragraph (23) B3 Waste Processing: The process of reducing and/or eliminating hazardous and/or toxic properties.
- Paragraph (24) B3 Waste Landfilling: The activity of placing B3 Waste in a landfill facility with the intention of not endangering human health and the environment.

It is impractical to implement these processes for Small-Scale B3 Waste, necessitating the establishment of a Domestic B3 Waste Management System, starting from households. This system is further supported by a Support System, such as a Waste Bank, in accordance with Environmental Ministry Regulation No. 13 of 2012.

The Waste Management Plan for West Java 2019-2023 is structured based on existing issues, needs, and strategic considerations related to waste management, taking into account the province's authority in waste management. Key issues related to the limitations of waste management facilities and infrastructure, institutions, and community participation will lead to financial aspects of the waste sub-sector. The waste management carried out by the West Java province requires an implementative strategy, supported by policies at the central, provincial, and regional levels to achieve the waste management target indicators outlined in Figure 8.

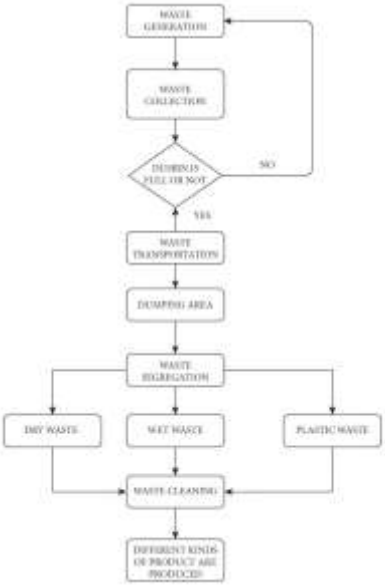

Figure 8. Flowchart for the Development of the Waste Management Plan for West Java 2019-2023

C4. Strategy And Policy Direction Of The West Java Waste Sub-Sector

The strategy in the waste management system in West Java needs to be implemented gradually, focusing on optimizing waste services in serviced areas, expanding waste service coverage, reducing the impacts caused by waste, and implementing a new paradigm in waste management, as illustrated in Figure 5.1 below.

Figure 9. New Paradigm in Waste Management

The new paradigm views waste as a resource with economic value that can be utilized, for example, for energy, compost, fertilizer, or as raw materials for industries. Waste management with this new paradigm is carried out through waste reduction activities, including restriction, reuse, recycling, and waste handling activities, which involve sorting, collection, processing, and final processing.

D. CONCLUSION

The primary strategy for sorting domestic hazardous waste involves raising public awareness that domestic waste, in general, requires different handling compared to specific or household hazardous waste (B3). Several strategies to implement the management of specific waste include:

1. Sorting at the household and community levels to be transported to Temporary Collection Points (TPS).;
2. Specific sorting designated for transportation so that specific waste can be processed before entering the Landfill (TPA).
3. Regular awareness campaigns for the community, involving stakeholders such as the government and private companies, to facilitate the proper collection of specific waste.
4. Transportation of household hazardous waste through collaboration with TPS using compactors to be gathered at licensed B3 collectors and subsequently collected by B3 waste processors.
5. Implementation of a gather-transport-dispose approach has proven to relocate the problem, moving waste away from the city but causing issues at landfill locations. Environmental pollution spreads in almost every landfill location where specific waste poses a threat to the environment. This is often overlooked due to the absence of a clear legal framework that regulates both types of waste characters: domestic and B3

Therefore, a gradual paradigm shift is needed in waste management, transitioning from the gather-transport-dispose paradigm to the minimization of waste buried in landfills by increasing efforts to reduce waste at the source and at each stage of the waste management process. This shift should be implemented gradually, considering that each city in West Java must simultaneously enhance its service capacity in waste management.

REFERENCES

1. Anggarini NH, Stefanus M, dan Prihatiningsih. 2014. PENGELOLAAN DAN KARAKTERISASI LIMBAH B3 DI PAIR BERDASARKAN POTENSI BAHAYA. Majalah Ilmiah Aplikasi Isotop dan Radiasi ISSN 2087-5665 BETA GAMMA TAHUN 2014 Vol. 5 No. 1 Februari 2014
2. Chaerul M., Tanaka M., Shekdar A. V. 2007. Municipal Solid Waster Management in Indonesia: Status and Strategic Action. Journal of The Faculty of Environmental Science and Technology, Okayama University, 12 (I): 41-49.
3. Christopher Murray and Alan Lopez, "Evidence-Based Health Policy ~ Lessons from the Global Burden of Disease Study," Science, Vol. 274 (November 1, 1996), p. 742.
4. Damanhuri, E. dan Padmi, T. 2016. Pengelolaan Sampah Terpadu. Penerbit ITB, Bandung
5. Diane D. Edwards, Gordon A. McFeters, and M. Indira Venkatesan (1998): "Distribution of Clostridium perfringens and Fecal Sterols in a Benthic Coastal Marine Environment Influenced by the Sewage Outfall from McMurdo Station, Antarctica". Appl Environ Microbiol, July, p. 2596- 2600, Vol. 64, No. 7
6. Dina, F.P., 2017. Kajian Teknologi Pengolahan Sampah Bahan Berbahaya dan BeracunRumah Tangga (SB3-RT) Di Kota Padang (Doctoral dissertation, Universitas Andalas).
7. Dinas Lingkungan Hidup, 2019, 5R Penanganan Sampah, dilihat 30 Juni 2020, &lt ;https://dlh.jepara.go.id/2019/01/23/5r-penanganan-sampah/>.
8. W. J. Van Niel,l K. J. Appeldoorn, A. J. B. Zehnder, and G. J. J. Kortstee (1998) "Inhibition of Anaerobic Phosphate Release by Nitric Oxide in Activated Sludge". Applied and Environmental Microbiology, August 1998, p. 2925-2930, Vol. 64, No. 8
9. Faaz, L.S. dan Trihadiningrum, Y., Studi Pengelolaan Sampah B3 Permukiman Di Kecamatan Wonokromo Surabaya.
10. Fahreza, R.N., Sunoko, H.R. and Syafrudin, S., 2016. Strategi Pengelolaan Sampah dan Limbah B3 Rumah Tangga Menuju Pengelolaan Sampah Terintegrasi dan Berkelanjutan Kecamatan Cilacap Utara (Doctoral dissertation, Postgraduate Program).

11. HB, H. and Trihadiningrum, Y., KAJIAN PENGELOLAAN SAMPAH B3 RUMAH TANGGA DI KECAMATAN TANDES KOTA SURABAYA.
12. Ign. Suharto, Prof DR. 2011. Limbah Kimia Dalam Pencemaran Udara dan Air, Jakarta.
13. Lembaga Demografi FE-UI. 2010. Dasar-Dasar Demografi (Edisi 2). Penerbit Salemba Empat, Jakarta.
14. Johen R. Holmess (1984): "Managing solid wastes in developing countries". Johen Wiley &Sons Ltd, UK
15. Manggali, A.A. and Susanna, D., 2019. Current management of household hazardous waste (HHW) in the Asian region. Reviews on environmental health, 34(4), pp.415- 426.
16. Matthew Gandy (1994) "Recycling and the politics of urban waste". Earthscan Publication Limited, London
17. Menteri Pekerjaan Umum Republik Indonesia. Peraturan Menteri Pekerjaan Umum Indonesia Nomor 03/PRT/M/2013 tentang Penyelenggaraan Prasarana dan Sarana Persampahan Dalam Penanganan Sampah Rumah Tangga dan Sampah Sejenis Sampah Rumah Tangga.
18. Pemerintah Republik Indonesia. Peraturan Pemerintah Republik Indonesia Nomor 27 Tahun 2020 tentang Pengelolaan Sampah Spesifik.
19. Pemerintah Republik Indonesia. Peraturan Pemerintah Republik Indonesia Nomor 81 Tahun 2012 tentang Pengelolaan Sampah Rumah Tangga dan Sampah Sejenis Sampah Rumah Tangga.
20. Pemerintah Republik Indonesia. Peraturan Pemerintah Republik Indonesia Nomor 101 Tahun 2014 tentang Pengelolaan Limbah Bahan Berbahaya dan Beracun.
21. Pemerintah Republik Indonesia. Undang-Undang Republik Indonesia Nomor 18 Tahun 2008 tentang Pengelolaan Sampah.
22. Prasetyaningrum, N.D.K., Joko, T. and Dewanti, N.A.Y., 2017. Kajian Timbulan SampahBahan Berbahaya dan Beracun (B3) Rumah Tangga di Kelurahan Sendangmulyo Kecamatan Tembalang Kota Semarang. Jurnal Kesehatan Masyarakat (e-Journal),5(5), pp.766-775.
23. Purwaningrum, P. and Pusparani, A., 2011. Perencanaan Pengumpulan Dan Pengangkutan Sampah Di Kecamatan Tangerang, Kota Tangerang. Indonesian Journal of Urban and Environmental Technology, 5(6), pp.207-214.
24. Rahim, I.R., dkk. Studi Pengelolaan Sampah B3 Rumah Tangga di Kelurahan MangasaKecamatan Tamalate Kota Makassar.
25. Ruslinda, Y. and Yustisia, D., 2013. Analisis timbulan dan komposisi sampah Bahan Berbahaya dan Beracun (B3) rumah tangga di Kota Padang berdasarkan tingkat pendapatan. Jurnal Lingkungan Tropis, 7(1), pp.21-30.
26. SNI 19-2454-2002. Tata Cara Teknik Operasional Pengelolaan Sampah Perkotaan. Badan Standardisasi Nasional.
27. SNI 19-3983-1995. Spesifikasi Timbulan Sampah Untuk Kota Kecil dan Kota Sedang di Indonesia. Badan Standardisasi Nasional.
28. SNI 3242:2008. Pengelolaan Sampah di Pemukiman. Badan Standarisasi Nasional.
29. Tampuyak, S., Anwar, C. and Sangadji, M.N., 2016. Analisis proyeksi pertumbuhan
30. penduduk dan kebutuhan fasilitas persampahan di Kota Palu 2015-2025. Jurnal Katalogis, 4(4), pp.94-104.
31. Tchobanoglous, George & Kreith,Frank. 2002. Handbook of Solid Waste Management Second Edition. In: NIGHTINGALE, D. & DONNETTE, R. (eds.) Chapter 10-Household Hazardous Waste. New York: McGraw-Hill Companies.
32. **U.S. EPA** (U.S. Environmental Protection Agency). **2014**. Inventory of U.S. greenhouse gas emissions and sinks: 1990–2012. EPA 430-R-14-003.

33. UU Nomor 22 Tahun 1999 tentang Pemerintah Daerah, Bapedal, 1999.
34. Wardana, Y.N., Syafrudin, S. and Rezagama, A., Sistem Perencanaan Pengelolaan Sampah B3 Rumah Tangga Di Kecamatan Semarang Barat, Kota Semarang (Doctoral dissertation, Diponegoro University).