



Study of Waste Management at the Jatibarang Landfill, Semarang City

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Abstract. The hundreds to thousands of tons of waste generated every day by Semarang City residents has resulted in an increase in waste generation at the landfill, including the Jatibarang landfill. This condition will continue to increase along with waste management that is not carried out in accordance with existing laws and regulations. Waste management must be carried out in a systematic, comprehensive, and sustainable manner, including its reduction and handling. This study aims to determine the extent to which waste management at the Jatibarang Landfill is implemented according to regulations related to waste management. This research generally conducts studies to compare actual conditions with existing policies. Jatibarang landfill, which is still implementing the Open Dumping system, has not been able to solve the problem of waste generation. Various efforts such as waste sorting activities, processing waste into fertilizer, the existence of a methane gas canteen, and a leachate processing pond that have been carried out to manage waste at the Jatibarang landfill have not fully shown maximum results. This causes various impacts, including the decline in environmental quality, pollution of the water quality of the Kreo River, and the decline in the health of humans and other living creatures. The results of this study indicate that the waste management process at the Jatibarang landfill has not fully implemented the Laws and Regulations concerning waste management.

Keywords: waste · management · impact · open dumping · Jatibarang landfill

1 Introduction

Improper waste management will cause major environmental problems. The piling up of garbage in the Jatibarang landfill of Semarang City certainly has an impact on soil pollution and also damages the quality of the surrounding groundwater. The phenomenon of the mountain of garbage that occurs in the Jatibarang landfill indicates the inability of the Semarang City government to manage and process the waste produced by the community. This condition has been going on for a long time and still, no effective formulation has been found to overcome it. Subsequent paragraphs, however, are indented.

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Edhisono (2015), in his study showed that the solid waste in Semarang City that enters the Jatibarang landfill is around 800 tons per day. This number continues to increase in line with the increase in population and changes in people's consumption patterns which lead to an increase in the volume of waste. Data on the achievement of regional policies and strategies (Jakstrada) in 2019 stated that the amount of waste generated in Semarang City was 1276 tons/day and that transported to the Jatibarang landfill was 1071 tons/day, equivalent to 83.9%. The amount of waste is predicted to reach 1437 tons/day in 2025 [1].

Landfill Jatibarang which accommodates waste sources from 16 sub-districts in Semarang City has an area of 460,183 m². The area of the Jatibarang landfill is divided into several areas consisting of 276,470 m² of waste area, 46,018 m² of cover land, 46,018 m² of green belt area, 46,018 m² of leachate ponds, and complementary infrastructure of 46,018 m². The composition of waste in the Jatibarang landfill is $\pm 50\%$ consisting of plastic waste, wood, tissue, textiles, and other waste [2]. If the addition of waste occurs every day without being accompanied by the final processing of waste, this can cause the capacity of the landfill to decrease, so that the landfill is no longer able to accommodate waste. The Head of the Semarang City Environmental Service on Semarang Radar Jawa Pos (2022) said that the Jatibarang landfill has four zones that in total are already overloaded. This has been predicted in 2010 when the landfill with an area of 46 hectares can accommodate a load of 5.75 million/m³ it must accommodate more loads so that the landfill will not be able to survive in the following years to accommodate more waste [3]. These conditions will have an impact on various aspects of life, including environmental, social, and economic aspects.

Regional Regulation Number 6 of 2012 concerning Waste Management in the City of Semarang is the basis for implementing waste management at the Jatibarang landfill. The Regional Regulation is a derivative of Law Number 18 of 2008 concerning Waste Management. However, if you look at the conditions at the Jatibarang landfill, it indicates that waste management at the final waste processing stage has not fully implemented or implemented the regulation. Through previous research conducted (Rizani, 2010) it is known that the existence of the Jatibarang landfill is deemed not to be following the standards for choosing a location for final disposal so that it can have an impact in the form of environmental degradation [4].

Landfill is defined as a place to process and return waste to environmental media safely for humans and the environment. Methods that can be applied to the final processing of waste according to Government Regulation Number 81 of 2012 concerning Management of Household Waste and Types of Household Waste include (i) the controlled landfill method; (ii) the Sanitary backfill method and/or (iii) Use of environmentally friendly technology.

Activities at the Jatibarang landfill to manage waste include Composting, Utilization of Methane Gas (CH₄), Livestock Herding, and Methane Gas Canteen with a payment system using plastic [5]. However, the efforts made have not been able to solve the problem of piling up piles of garbage. According to the World Bank, Semarang City received a score of 43/100 based on the criteria for waste management. The criteria consist of 6 assessment parameters, namely (1) Landfill capacity and/or available land until 2025; (2) Waste collection performance; (3) Alternative funding sources for investment (donor

projects or private sector); (4) KLHK Adipura assessment; (5) Priority ranking of KLHK and Ministry of PUPR experts and (6) Local Government Expenditure per ton of waste [6].

This study aims to examine the extent to which the implementation of regulations and legislation on the waste management system at the Jatibarang landfill Semarang City. Through this study, it is hoped that it can provide recommendations regarding the management of the Jatibarang landfill in overcoming the mountain of waste.

2 Research Method

Research on the Study of Waste Management at the Jatibarang landill in Semarang City was carried out at the Jatibarang landfill. The location of Jatibarang is in Kedungpane Village, Mijen Regency, Semarang City (Fig. 1).

Observation location coordinates:

- 1) PLTsa → Latitude: $7^{\circ} 1'20.49''S$, longitude: $110^{\circ}21'30.10''E$
- 2) PT. Narpati Agung Karya Persada Lestari → Latitude: $7^{\circ} 1'18.18''S$, longitude: $110^{\circ}21'25.98''E$
- 3) Leachate Reservoir → Latitude: $7^{\circ} 1'43.14''S$; Longitude: $110^{\circ}21'36.65''E$
- 4) Landfill Jatibarang Office → Latitude: $7^{\circ} 1'18.96''S$; Longitude: $110^{\circ}21'30.88''E$
- 5) Water Intake (West Semarang) → Latitude: $7^{\circ} 1'48.28''S$; Longitude: $110^{\circ}21'34.76''E$

The method used in this research is descriptive qualitative, with primary and secondary data collection. Primary data is done by field observation and secondary data by

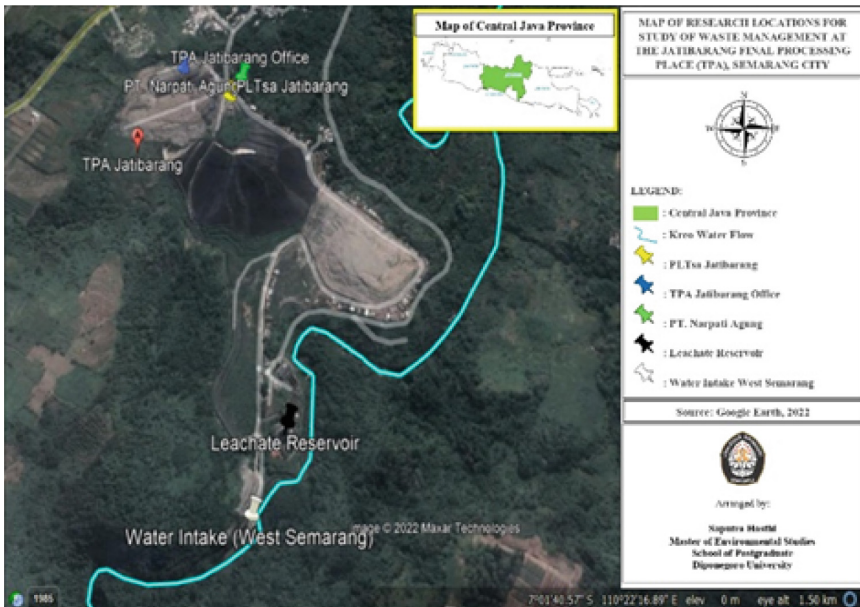


Fig. 1. Mapping of research location

document review. The data obtained is then analyzed for the level of compliance with the regulations and legislation on waste management. The observation method is carried out by observing, evaluating, drawing conclusions, and providing comments on interactions that occur in the field [7]. Observations must be carried out systematically, directed, and on a scientific basis [8].

3 Result and Discussion

3.1 Legal Basis on Waste Management

Waste management is a mandatory requirement that must be met in overcoming waste problems. Waste management practices are carried out to protect the environment from pollution and degradation [9]. Legislation has an important meaning as a legal basis in the implementation of waste management, including in the city of Semarang. The legal instruments that form the basis for hierarchical waste management are presented in Fig. 2.

Waste management regulations are divided into five categories, namely (1) Laws; (2) Government Regulations; (3) Presidential Regulations; (4) Ministry Regulations, and (5) Regional Regulations. At the regional level, Central Java Province has Regulation Number 3 of 2014 concerning Waste Management in Central Java as the legal basis for implementing waste management in the province of Central Java, and Semarang City

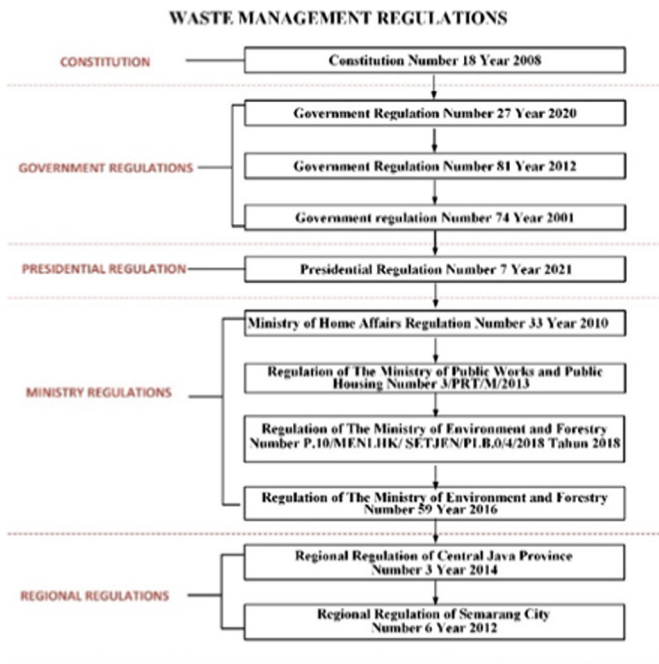


Fig. 2. Waste regulation chart

has regulations governing waste management, namely Regional Regulation Number 6 of 2012. All regulations regional government is based on Law Number 18 of 2008 concerning Waste Management. Based on the laws and regulations, waste management is defined as a systematic, comprehensive, and sustainable activity that includes waste reduction and handling. Waste is grouped into three types, namely (i) household waste; (ii) Waste similar to household waste, and (iii) specific waste.

Waste management consists of reducing and handling activities, which in its implementation cannot be mixed between the management of household waste and other types of household waste with specific waste. Specific waste includes waste containing toxic hazardous materials (B3) requiring special management in its implementation, so it is regulated separately in Government Regulation Number 27 of 2020 concerning Management of Specific Waste and Government Regulation Number 74 of 2001 concerning Management of Toxic Hazardous Materials. Regarding the regulation on the management of household waste and similar household waste, it is regulated separately in Government Regulation No. 81 of 2012.

The government in carrying out waste management has the authority, one of which is to establish national policies and strategies for waste management, which is further regulated in Presidential Regulation Number 7 of 2021 concerning National Policies and Strategies for the Management of Household Waste and Similar Household Waste. Then as a guide for waste management, it is regulated in the Minister of Home Affairs Regulation Number 33 of 2010. Furthermore, for the implementation of the management of household waste and similar household waste, there are regulations regarding the implementation of waste infrastructure and facilities (PSP), namely the Minister of Public Works Regulation Number 3/PRT/M/2013.

Under certain conditions, the pile of garbage that gets water will form leachate. Leachate is organic material resulting from the biological decomposition process, in waste management, there are rules regarding leachate quality standards. The leachate quality standard is a measure of the acceptable level of pollutant elements that will be released into water sources from activities carried out at the landfill. The regulation that regulates leachate quality standards is the Regulation of the Minister of Environment and Forestry Number P.59/Menlhk/Setjen/Kum.1/7/2016 concerning Leachate Quality Standards for Businesses and/or Activities of Final Waste Processing Places.

3.2 Jatibarang Landfill Waste Management

Waste management activities at the Jatibarang landfill include final waste processing, leachate management, utilization of methane gas, and livestock grazing activities. Observations that have been made in reviewing waste management at the Jatibarang landfill, show the following results:

1. Waste final processing method

Activities in handling waste at the landfill are in the form of final waste processing. Although the Semarang City Regional Regulation Number 6 of 2012 does not mention methods for final waste processing, Central Java Provincial Regulation Number 3 of 2014 has explained that the methods used for final waste processing include: (i) Controlled landfill method; (ii) the sanitary landfill method; and/or (iii) Environmentally friendly

technology. However, from the visible conditions, the observation results show that the method used in the Jatibarang landfill is still open dumping.

By definition, open dumping is a simple system of disposing of waste in a basin without being covered or filled with soil and without further management [10, 11]. Due to the absence of further management, this open dumping system has a negative impact on the environment and humans. Open dumping systems can threaten groundwater resources, soil, human and animal health, and soil productivity [12]. Thus, it can be concluded that the handling of waste at the Jatibarang landfill is not by the laws and regulations regarding waste management (Fig. 3).

2. Leachate management

The Jatibarang landfill accommodates hundreds to thousands of tons of waste per day which can produce large amounts of leachate. Leachate contains pollutants such as ammonia–nitrogen, heavy metals, inorganic salts, and organic discolorations [13]. Leachate is a liquid with an unpleasant odor and a dark color. Leachate is formed in piles of garbage that dissolve compounds and can cause water pollution, both ground and surface water, so there needs to be handling or management [14].

One of the activities at the landfill is to manage leachate so that the quality of the leachate discharged into water sources does not exceed the leachate quality standard as stated in the Minister of Environment and Forestry Regulation Number P.59/Menlhk/Setjen/kum.1/7/2016 concerning Leachate Quality Standards for Sharing. Waste landfill Business and/or Activities. From the observations, the Jatibarang landfill already has a leachate storage pond (Fig. 4a) which will be processed and disposed of in water sources. However, real conditions indicate that the leachate storage pond is almost full but the processing is stopped due to the lack of energy sources driving the leachate



Fig. 3. Open dumping system

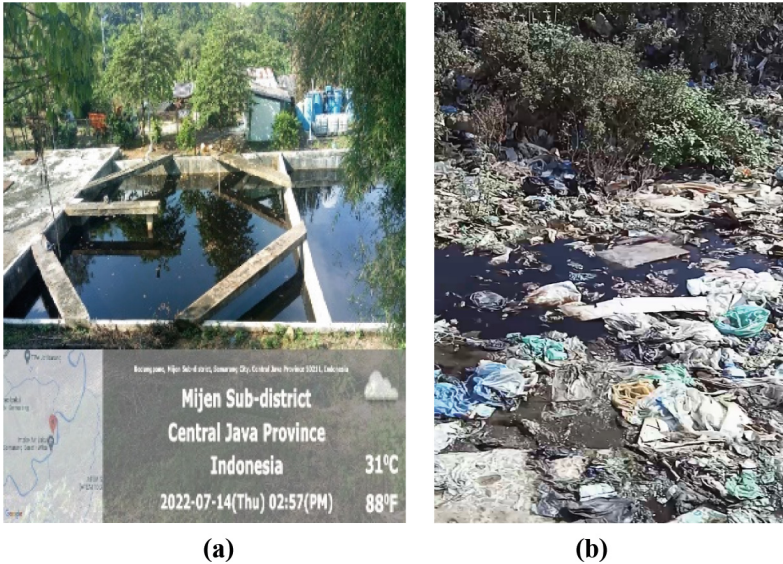


Fig. 4. (a) Leachate reservoir and (b) Leachate flow

processing machine. In addition, there is leachate that does not flow into the pipeline but is spread over the soil surface accordingly (Fig. 4b).

The impact of not running leachate processing and the flow of leachate not through pipes is polluting groundwater and soil in the Jatibarang landfill area. Groundwater in the Jatibarang landfill area contains Hexavalent Chromium (Cr6), Cadmium (Cd), and Lead (Pb) which have exceeded the quality standard [15]. In addition, leachate also pollutes the water quality of the Kreo River [16]. Based on these conditions, it can be said that the handling of waste at the Jatibarang landfill related to leachate management has not fully implemented the laws and regulations regarding waste management and leachate quality standards.

3. Use of methane gas

Methane gas is part of carbon compounds and is the main component of natural gas. Garbage can produce methane gas. The government to reduce and handle waste, innovates processing methane gas into electrical energy. Based on Semarang Mayor Regulation Number 69 of 2018, it is stated that the management of waste processing facilities into methane gas which is processed into electrical energy at the Jatibarang landfill is carried out by PT Bhumi Pandanaran Sejahtera (PERSERODA). However, through the results of field observations that have been carried out, it was conveyed by the waste management officer at the Jatibarang landfill that the processing of methane gas into electricity was constrained due to jammed equipment and spare parts that were not yet available. So that this causes waste management to be hampered and becomes one of the factors for the accumulation of waste (Fig. 5).



Fig. 5. The mountain of waste

4. Cattle grazing

The apprehensive condition at the Jatibarang landfill is not only shown by the accumulation of garbage but also by cattle herding activities. Activities that should not be carried out at the final waste processing Place have become a phenomenon due to the decrease in land for cattle grazing. Cattle flocking to forage in the garbage heap and drinking water contaminated by leachate (Fig. 6). The practice of cattle grazing in the landfill environment is considered capable of reducing the amount of waste, especially organic waste, but this will have a negative impact, especially on the health of cows and humans as beef consumers, because it is seen from the condition of the Jatibarang landfill location which does not separate organic and inorganic waste.

The operation of the landfill and grazing cattle which have the potential to contain harmful elements that accumulate in the organs or tissues of the cow's body. In previous studies, it was stated that cattle grazing at the Jatibarang landfill contains heavy metals



Fig. 6. Cows consumption waste and water contaminated by leachate

Lead (Pb), Mercury (Hg), and Cadmium (Cd) [17]. Heavy metal elements contained in the body of cows can harm the health of cows and humans who consume beef. The content of cadmium in the body of cows eaten by humans if accumulated in the human body can cause disorders of the kidneys, and stomach, damage to the central nervous system, damage to the immune system, reproductive disorders, bone fractures, and DNA damage [18]. Lead (Pb) that accumulates in the human body can interfere with the male reproductive system, reduce hemoglobin, increase the risk of anemia, and can cause liver function disorders, and mercury (Hg) content can lead to an increase in the prevalence of abnormal menstruation and dysmenorrhea [19]. So it is not feasible if the landfill is used as a place for grazing livestock such as cows.

4 Conclusion

The Jatibarang Landfill has not yet fully implemented the laws and regulations related to waste management. This is indicated by the failure to achieve the function of the landfill as a place to process and return waste to environmental media safely for humans and the environment because what happens is the opposite, namely causing environmental degradation in the form of pollution of water resources (groundwater and Kreo River water), soil pollution, and environmental degradation. Threaten human and animal health due to exposure to heavy metals. The Jatibarang Landfill, which still uses an open dumping system, must immediately be replaced with environmentally friendly technology, such as incinerator technology.

References

1. Bappeda Kota Semarang. (2020), <https://bappeda.semarangkota.go.id/kategori/1/buku-putih-semarangkelolasampah#:~:text=Salah%20satunya%20adalah%20sampah%20yang,ke%20LANDFILL%20Jatibarang%20setiap%20harinya>, last accessed 2022/9/15.
2. Sembiring, L. A., Priyambada, I. B., Samudro, G., Lokahita, B., Wardhana, I. W., Hadiwidodo, M., Syafrudin, S.: Potensi Material Sampah Combustible pada Zona II landfill Jatibarang Semarang sebagai Bahan Baku RDF (Refuse Derived Fuel). *Jurnal Teknik Mesin* 7(1), 19 (2018).
3. Pradana, A. E.: Public-Private Partnership in the Framework of Waste Management into Electrical Energy in Jatibarang Landfill, Semarang City. *Journal of Local Government Issues (Logos)* 3(2), 130–144 (2020).
4. Rizani, M. D.: Kajian Pengelolaan Limbah Perkotaan (Studi Kasus Tempat Pemrosesan Akhir (LANDFILL) Jatibarang). *Jurnal Teknik UNISFAT* 6(83), 26–33 (2010).
5. Harjanti, I. M., Anggraini, P.: Pengelolaan Sampah Di Tempat Pembuangan Akhir (LANDFILL) Jatibarang, Kota Semarang. *Jurnal Planologi* 17(2), 185 (2020).
6. USAID. Clean Cities, Blue Ocean Initial Solid Waste Management Assessment (ISWMA), Indonesia. Tetra Tech. (2021), https://pdf.usaid.gov/pdf_docs/PA00XWPP.pdf
7. Ciesielska, M., Jemielniak, D.: Qualitative methodologies in organization studies. *Qualitative Methodologies in Organization Studies* 2(December), 1–264 (2017).
8. Mirhosseini, S.-A.: Collecting Data through Observation. *Doing Qualitative Research in Language Education* January 2012, 61–84 (2020).

9. Bacinschi, Z., Rizescu, C. Z., Stoian, E. V., Necula, C.: Waste management practices used in the attempt to protect the environment. International Conference on Engineering Mechanics, Structures, Engineering Geology, International Conference on Geography and Geology - Proceedings March 2015, 378–382 (2010).
10. Jayanti, A., Santoso, K., MDE Purnomo, S.: Tempat Pembuangan Akhir (LANDFILL) Kaliori Sebagai Wisata Edukasi Di Kabupaten Banyumas Dengan PENEKANAN Desain Pada Pengolahan Sekuen Ruang. *Jurnal ArPlacektura* 14(2), (2016).
11. Jehan, R. I.: Analisis Strategis Pemko Medan Dalam Melakukan Sistem Pengelolaan Sampah Berbasis Open Dumping Menjadi Sanitary Landfill. *Jurnal Ilmu Sosial, Politik, Humaniora* 4(2), 109–117 (2020).
12. Ali, S. M., Pervaiz, A., Afzal, B., Hamid, N., Yasmin, A.: Open Dumping of Municipal Solid Waste and Its Hazardous Impacts on Soil Open dumping of municipal solid waste and its hazardous impacts on soil and vegetation diversity at waste dumping Places of Islamabad city. *Journal of King Saud University - SCIENCE* June 2016, (2013).
13. Nofiyanto, E., Soeprbowati, T. R., Izzati, M.: Fikoremediasi Kualitas Lindi LANDFILL Jatibarang Terhadap Efektifitas Lemna minor L dan Ipomoea aquatica Forkks. *Jurnal Ilmu Lingkungan* 17(1), 107 (2019).
14. Hadiwidodo, M., Oktiawan, W., Primadani, A. R., Parasmita, N., Gunawan, I.: Pengolahan Air Lindi Dengan Proses Kombinasi Biofilter Anaerob-Aerob Dan Wetland. *Jurnal Presipitasi* 9(2), 84–95 (2012).
15. Chandra, D., Purba, V., Kamil, M.: Tanah Dangkal Akibat Lindi Di Sekitar Tempat Pemrosesan Akhir (Landfill) Jatibarang , Semarang Analysis Of Heavy Metal Distribution In Unsaturated Zone Due To Leachate Around Jatibarang Landfill. *Jurnal Teknik Lingkungan* 21(2), 149–158 (2015).
16. Nilasari, P. R., Khumaedi, Supriyadi. Dengan Menggunakan Metode Geolistrik. 7, 1–5 (2011).
17. Wahyono, S.: Analisis Dampak Penggembalaan Sapi Di Landfill (Studi Kasus Di Landfill Piyungan – Yogyakarta. *Jurnal Teknologi Lingkungan* 11(2), 293 (2016).
18. Nangkiawa, T., Detha, A., Ndaong, N.: Identification Of The Content Of Heavy Metal Cadmium (Cd) In Beef Cattle In Landfill Area Of Alak, Kupang). *Jurnal Kajian Veteriner* 3(Cd), 53–61 (2016).
19. Pratiwi, D. Y.: Dampak Pencemaran Logam Berat (Timbal, Tembaga, Merkuri, Kadmium, Krom) Terhadap Organisme Perairan Dan Kesehatan Manusia. *Jurnal Akuatek* 1(1), 59–65 (2020).

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