International Journal of Community Service
ISSN: 3083-9696

Community Service in Banda Aceh: Case Studies of Hazardous and Toxic Materials at PT DIPO

Bahagia[1], Meta Keumala[2], T. Khairol Razi[3], Erdiwansyah[4,5], Juliansyah Harahap[6]

[1]Department of Environment Engineering, Universitas Serambi Mekkah, Banda Aceh, 23245, Indonesia
[2]Department of English Education, Faculty of Teacher Training and Education, Universitas Serambi Mekkah, Banda Aceh 23245, Indonesia
[3]Department Sanitation Study Program, Jabar Ghafur College of Health Sciences (STIKes), Sigli, Aceh, Indonesia
[4]Department of Natural Resources and Environmental Management, Universitas Serambi Mekkah, Banda Aceh, 23245, Indonesia
[5]Centre for Automotive Engineering, Universiti Malaysia Pahang Al Sultan Abdullah, Malaysia
[6]Department of Environmental Engineering, Universitas Islam Negeri Ar-Raniry, Banda Aceh, Jl. Syeikh Abdur Rauf Kopelma Darussalam, Banda Aceh, Aceh, 23111, Indonesia

Corresponding author: bahagia@serambimekkah.ac.id

Abstract

Managing hazardous and toxic materials (HTW) in the automotive industry is essential for maintaining environmental sustainability and public health. PT Dipo Internasional Pahala Otomotif has implemented various strategies to ensure that B3 waste management is carried out safely and following regulations. This study analyzes three main initiatives the company implemented: training programs for students, provision of infrastructure and equipment, and financial and environmental sustainability strategies. The training program aims to improve students' understanding of waste management procedures, applicable regulations, and best practices in the industry. Students can observe the storage, transportation, and processing of HTW at the company's facilities. Meanwhile, infrastructure support, such as oil separators and mini laboratories, demonstrates the company's commitment to ensuring that waste is managed safely before being further processed. In addition to technical aspects, PT Dipo Internasional Pahala Otomotif implements sustainability strategies by optimizing waste reuse and collaborating with recycling companies. This approach reduces environmental impacts and creates economic efficiency in waste management. By integrating training, technology, and circular economy strategies, the company contributes to environmental protection efforts and raises awareness of the importance of responsible waste management.

Article Info
Received: 26 March 2025
Revised: 29 April 2025
Accepted: 05 May 2025
Available online: 30 June 2025

Keywords
Hazardous and toxic waste
Automotive industries
Waste management
Sustainability

1. Introduction

Hazardous and Toxic Waste (HTW) is an activity residue containing dangerous and/or toxic substances. Due to its nature, concentration, and quantity, this waste can pollute or damage the environment,

endanger health, and threaten the survival of humans and other living things, directly and indirectly. This definition has been regulated in Government Regulation No. 101 of 2014 concerning the management of HTW [1–4]. HTW waste has unique characteristics that distinguish it from ordinary waste. Some of the main properties of this waste include being explosive, flammable, reactive, toxic, infectious, and corrosive. In addition, HTW waste can also cause acute or chronic toxic effects that affect human health in the short and long term [5–8].

In its management, HTW waste requires special handling that includes collection, storage, transportation, processing, and final disposal stages. Unlike non-HTW waste, which is easier to handle, HTW waste must first go through an identification process to determine the appropriate management method [9–12]. A good understanding of HTW is crucial for all parties involved in its management, whether in the industrial, health, or public sectors. With the proper knowledge, the risk of adverse impacts of HTW on the environment and health can be minimized through management following applicable regulations. Indonesia has a comprehensive legal framework for HTW waste management [13–16]. The primary legal basis is Law No. 32 of 2009 concerning Environmental Protection and Management, a guideline for its derivative regulations. One of the principal technical regulations is Government Regulation No. 101 of 2014 concerning HTW Waste Management, which regulates in detail the identification, management, and monitoring of HTW. This regulation replaces PP No. 18 of 1999 and PP No. 85 of 1999, which were previously in effect.

The Ministry of Environment and Forestry (MEF) has also issued various technical regulations related to HTW, such as Regulation of the Minister of MEF No. P.56/Menlhk-Setjen/2015, which regulates the procedures and technical requirements for managing HTW from health service facilities, and Regulation of the Minister of Environment and Forestry No. P.95/MENLHK/SETJEN/KUM.1/11/2018 discusses licensing in the management of HTW. These regulations provide specific guidance for the industrial sector and various types of HTW [17–19]. There are different technical regulations regarding the HTW identification procedure at the operational level. One of them is the Decree of the Head of Bapedal No. KEP-03/BAPEDAL/09/1995, which regulates the technical requirements in the management of HTW, including methods for sampling, testing, and identifying waste characteristics. In addition, the Indonesian National Standard (INS) also regulates the process of testing the characteristics of HTW, such as SNI 8455:2017, which determines the method of testing waste characteristics to assess its hazard status.

HTW management also involves cross-sectoral regulations, for example, the Regulation of the Minister of Transportation, which regulates the transportation of hazardous materials, the Regulation of the Minister of Health regarding medical waste, and the Regulation of the Minister of Industry which discusses the management of industrial waste [20–23]. In addition to national regulations, Indonesia has also ratified international agreements, including the Basel Convention on the control of transboundary movements and disposal of hazardous waste, which was then adopted in the national policy regarding the export and import of HTW. The HTW identification process consists of several systematic stages to ensure that the characteristics of the waste can be determined accurately [5,24–26]. The first stage involves an initial study of the sources and processes that produce waste. In this stage, the raw materials, production process, and possible contaminants are analysed. The Safety Data Sheet (SDS) of the materials used in the production process is the primary reference in this analysis. The results of this initial study will provide an initial picture of the characteristics of the waste produced.

The next stage is waste sampling, which is essential because the accuracy of identification results depends on the sample's representativeness. The sampling method must follow established standards, such as SNI 6989.59:2008 or USEPA SW-846. Several factors that must be considered in this stage include waste homogeneity, sampling location, number of sample points, and proper preservation techniques. Samples that have been collected must be stored in containers appropriate to the nature of the waste and equipped with labels containing complete information about the sample.

2. Methodology

This study uses a qualitative research approach with a case study analysis method to evaluate the impact of the HTW management program on the environment in Banda Aceh City. This study aims to understand the effectiveness of the HTW management system implemented at PT Dipo Internasional Pahala Otomotif and how the system contributes to environmental sustainability. Data collection was carried out through various methods, including field observations to observe the waste management process in automotive workshops directly, in-depth interviews with the management of PT Dipo Internasional Pahala Otomotif and workers involved in the waste management process, and a review of the periodic semester reports submitted by the company to the Banda Aceh City Government. With this approach, the study not only focuses on the technical aspects of waste management but also includes institutional aspects, compliance with regulations, and community involvement in environmental conservation efforts. In the case study analysis, this study evaluates the B3 waste management program based on several main aspects, such as objectives, implementation strategies, challenges, and results achieved. The main aim of this program is to reduce the negative impact of HTW on the environment and public health through the application of environmentally friendly technology.

3. Result & Discussion

To understand the impact of HTW management services on the environment and surrounding communities, three case studies can be analyzed:

Skills Development and Training Program for Students in HWT of Management

PT Dipo Internasional Pahala Otomotif has initiated a training program for students to improve their skills in managing HTW. This program is designed to provide a deeper understanding of the technical aspects and regulations related to industrial waste management. Through direct visits to company facilities, students can see how B3 waste management is carried out professionally and following applicable standards. This training covers various important aspects, such as monitoring HTW generation, safe storage procedures in temporary storage areas HTW, and waste transportation mechanisms by third parties with official permits. By understanding the entire series of these processes, students are expected to develop skills relevant to the industry's needs and have a higher awareness of the importance of responsible waste management.

In addition to technical aspects, students are also given insight into environmental regulations in force in Indonesia, including regulations from the Ministry of Environment and Forestry (KLHK). They are introduced to best practices in industrial waste management, including efforts to reduce waste production and increase efficiency in resource utilization. Thus, this program focuses on technical skills and builds a comprehensive understanding of environmental regulations and policies. Through this program, PT Dipo Internasional Pahala Otomotif hopes to contribute to producing competent workers in the environmental and industrial fields. Students who take part in this training are expected to bring the knowledge they gain to the world of work and help companies implement better waste management strategies. In addition, this program is also a form of corporate social responsibility in supporting education and human resource development in the environmental field.

Infrastructure and Equipment Support in HTW Management

To improve efficiency and safety in HTW management, PT Dipo Internasional Pahala Otomotif has provided various adequate facilities and equipment. Students who participated in the industrial visit were introduced to a waste storage system that complies with strict safety standards. This facility is designed to ensure that HTW is stored safely before being transported to the appropriate processing facility. One of the leading facilities introduced is an oil separator, which separates oil waste from water and other substances that can pollute the environment. By using this technology, companies can reduce the negative impact of oil waste and ensure that the garbage that is disposed of has gone through an adequate purification process. In addition, students are also invited to understand how this tool works and the importance of its use in the automotive industry.

In addition to the oil separator, PT Dipo Internasional Pahala Otomotif has a mini laboratory to test waste quality before further processing. This laboratory allows companies to analyze waste content and determine the most appropriate processing method. Students are permitted to observe firsthand how this testing is carried out so they can understand the importance of laboratory analysis in HTW management. The infrastructure and equipment support provided by PT Dipo Internasional Pahala Otomotif demonstrates the company's commitment to implementing responsible waste management. By introducing students to this facility, the company hopes to offer broader insight into the importance of using technology in industrial waste management. In addition, this visit is also a valuable experience for students to see how best practices are applied in the industrial world.

Program Keberlanjutan Finansial dan Lingkungan

PT Dipo Internasional Pahala Otomotif understands that B3 waste management is related to regulatory compliance and financial and environmental sustainability. Therefore, the company has developed a strategy integrating cost efficiency with environmentally friendly waste management practices. This approach allows the company to reduce financial burdens while maintaining high environmental standards. One of the strategies implemented is optimizing the reuse of waste that still has utility value. For example, some types of HTW can be reprocessed and used as raw materials in specific production processes. By implementing the principle of a circular economy, the company reduces the amount of waste that must be disposed of and creates economic value from the waste produced.

In addition, PT Dipo Internasional Pahala Otomotif collaborates with recycling companies that have official permits. This partnership allows HTW that cannot be processed internally to be sent to appropriate processing facilities. This way, the company can ensure that the waste produced does not pollute the environment and is processed correctly. Students who take part in this program are given an understanding of how collaboration with third parties part of a sustainability strategy in waste management can be. This financial and environmental sustainability program shows that HTW management can be done responsibly without sacrificing economic efficiency. By involving students in this process, PT Dipo Internasional Pahala Otomotif hopes to inspire the younger generation to develop innovative solutions in waste management. This approach also proves that companies can contribute to creating a cleaner and more sustainable environment through the right strategies. The following table contains the characteristics and types of HTW from PT Dipo Internasional Pahala Otomotif' s car workshops and showrooms.

Table 1: Characteristics and types of B3 waste

Waste Source	Waste Type	Waste Characteristics	Environmentally hazardous	Form (Solid/Liquid/Gas)
Used oil	Waste polishing oil	Flammable, toxic, pollutes water	Yes	Liquid
Used batteries	Waste battery	Contains lead (Pb), sulfuric acid, corrosive	Yes	Congested
Used brake pads	Brake friction waste	Contains asbestos, can be dusty	Yes	Congested
Used oil filters	Waste oil filter	Contains oil, metal, and plastic residues	Yes	Congested
Paint and thinner waste	Waste paint and solvent	Readily volatile, toxic, flammable	Yes	Liquid
Used tyres	Waste rubber	Not easily decomposed, it can pollute the environment	Yes	Congested
Majun cloth waste	Waste oily cloth	Contains oil, flammable	Yes	Congested
Brake fluid waste	Waste brake fluid	Toxic, corrosive	Yes	Liquid

Waste Source	Waste Type	Waste Characteristics	Environmentally hazardous	Form (Solid/Liquid/Gas)
Plastic packaging waste	Waste used liquid packaging plastic	Difficult to decompose, pollutes soil	Yes	Congested
Metal waste from used spare parts	Waste iron and aluminium	Can rust, pollute the environment	Yes	Congested
Sawdust	Wood dust contaminated with used oil	Flammable, toxic, pollutes water	Yes	Congested

This table shows that most of the waste from car workshops has characteristics that are hazardous to the environment, primarily because of its toxic, flammable, or difficult-to-decompose nature. Therefore, B3 waste management must follow the correct procedures to avoid polluting the environment. Hazardous and Toxic Materials generated from the PT Dipo Internasional Pahala Otomotif car workshop come from various sources, such as used oil, oil filters, batteries, brake fluids, paint, and residual fuel. These wastes have numerous characteristics, ranging from flammable and toxic to corrosive. Therefore, management must follow regulations so as not to pollute the environment and endanger human health.

In HTW management, the first step is sorting and temporarily storing things in a safe and standard place. Liquid waste such as used oil, brake fluid, and thinner must be stored in watertight and leak-proof containers. Meanwhile, solid waste such as oil filters, used batteries, and oil-contaminated majun need to be stored in closed and separate containers to prevent cross-contamination. All waste must be clearly labelled according to its type and hazard. HTW storage must not be carried out for too long. Based on regulations, HTW can be temporarily stored at the waste-generating location with a maximum time limit of 90 days before being handed over to a licensed management party. During this storage period, the company must ensure that the storage location has an adequate security system, such as good ventilation, is not exposed to direct sunlight, and has a drainage system to prevent leaks that pollute the soil and groundwater.

Figure 1: Visit to disposal site for hazardous and toxic materials PT Dipo Internasional Pahala Otomotif

After the storage period, HTW must be transported by a third party with a permit from the Ministry of Environment and Forestry (KLHK). Transportation must use a special vehicle appropriate for the type of waste being transported, and it must be equipped with a waste manifest document to ensure that the waste is sent to the relevant processing or disposal facility. This transportation must be carried out carefully to prevent spills or accidents during the trip. The final process of HTW management is processing or disposal at a facility with an official permit. Waste that still has economic value, such as scrap metal and batteries, can be recycled.

In contrast, other toxic and hazardous waste, such as used oil and brake fluid, must be destroyed using environmentally friendly methods, such as incineration or stabilization. With good management, HTW from car workshops and showrooms can minimize its environmental and public health impact. The following is documentation of a field visit to the Temporary HTW Storage Place of PT Dipo Internasional Pahala Otomotif.

Figure 2: Field visit to PT Dipo Internasional Pahala Otomotif

4. Conclusion

PT Dipo Internasional Pahala Otomotif has taken proactive steps in B3 waste management by prioritizing student training, providing adequate infrastructure, and implementing sustainability strategies. The training programs offered not only equipped students with technical skills in waste management but also introduced them to environmental regulations and best practices in the automotive industry. This shows the company's commitment to increasing awareness and competence of the younger generation in hazardous waste management. The provision of facilities and equipment such as oil separators, namely oil traps, proves that PT Dipo Internasional Pahala Otomotif is serious about ensuring that B3 waste is managed safely before being further processed in the Wastewater Treatment Plant (IPAL) and discharged into the surrounding environment. This infrastructure not only reduces negative impacts on the environment but also increases efficiency in waste management. With these facilities, the company can minimize pollution and improve compliance with applicable safety standards and environmental regulations. The sustainability strategy implemented by PT Dipo Internasional Pahala Otomotif shows that B3 waste management can be carried out with an approach that is beneficial both environmentally and financially. By implementing circular economy principles and working with third parties, companies can reduce the waste that must be disposed of and create added value from the waste produced. This approach improves the company's operational efficiency and contributes to broader environmental conservation efforts.

Acknowledgement

The author would like to acknowledge the financial support in the form of a research grant by Ministry of Science & Technology under the research grant number 000223

References

[1] D.I. Prasetyo, E. Puspitasari, Hazardous and Toxic Waste (HTW) Management Liability in The Perspective of Civil Law, SRAWUNG (Journal Soc. Sci. Humanit. 3 (2024) 87–100.
[2] W. Sumbodo, M. Yasar, M.I. Maulana, A. Khalid, Heavy Metal Analysis in Biocoke Fuel Derived from Empty Fruit Bunch (EFB) Waste, Int. J. Energy Environ. 1 (2025) 17–23.
[3] A. Gani, Erdiwansyah, E. Munawar, Mahidin, R. Mamat, S.M. Rosdi, Investigation of the potential biomass waste source for biocoke production in Indonesia: A review, Energy Reports. 10 (2023) 2417–2438. https://doi.org/https://doi.org/10.1016/j.egyr.2023.09.065.
[4] M. Nizar, M. Muhibbuddin, W. Maawa, Community Empowerment through the Utilization of Agricultural Waste as Environmentally Friendly Biocoke Fuel, Int. J. Community Serv. 1 (2025) 10–18.
[5] L.A.S.M. Exposto, I.N. Sujaya, The impacts of hazardous and toxic waste management: a systematic review, Interdiscip. Soc. Stud. 1 (2021) 103–123.
[6] S. Yana, N. Nelly, R. Radhiana, F. Hanum, P. Mauliza, Optimization of On-Grid Microgrid Systems for Rural Communities to Increase Energy Resilience, Int. J. Community Serv. 1 (2025) 19–29.
[7] X. He, C.C.Y. Ling, Z. Sun, X. Xu, S.F.Y. Li, X. Wang, H.T.W. Tan, M.L.M. Yusof, S. Ghosh, C.-H. Wang, Sustainable management of water hyacinth via gasification: Economic, environmental, and toxicity assessments, J. Clean. Prod. 372 (2022) 133725.
[8] M. Yasar, S. Anis, R. Rusiyanto, F.R. Yamali, Improving Farmers' Welfare through Empty Fruit Bunch-Based Product Diversification in Oil Palm Plantation Areas, Int. J. Community Serv. 1 (2025) 29–38.
[9] D. Junger, V. Wohlgemuth, Design and implementation of a lecture for teaching current Green Coding approaches and practices at the HTW Berlin, (2023).
[10] Y. Muchlis, I. Iqbal, T. Rahardjo, Education and Implementation of Community-Based Waste Management to Reduce Heavy Metal Pollution, Int. J. Community Serv. 1 (2025) 39–47.
[11] M.I. Maulana, R. Febrina, F.R. Yamali, Strategy for Strengthening the Local Economy through Renewable Energy-Based Micro Enterprises in Rural Communities, Int. J. Community Serv. 1 (2025) 48–56.
[12] N. Nelly, S. Yana, R. Radhiana, J. Juwita, E. Surya, Implementation of SWOT Analysis in the Development of Green Energy-Based Social Businesses in Local Communities, Int. J. Community Serv. 1 (2025) 57–67.
[13] E. Herliana, F. Qainvincena, Evaluation of hazardous and toxic wastes management by a pharmaceutical company in Bandung, Indonesia, in: IOP Conf. Ser. Earth Environ. Sci., IOP Publishing, 2025: p. 12077.
[14] B.S. Riyadi, S. Alhamda, S. Airlambang, R. Anggreiny, A.T. Anggara, Environmental damage due to hazardous and toxic pollution: A case study of citarum river, west java, Indonesia, Int. J. Criminol. Sociol. 9 (2020) 1844–1852.
[15] R. Radhiana, S. Yana, N. Nelly, C.W.M. Noor, R. Rusiyanto, Community-Based Waste Management Innovations for Sustainable Environmental and Economic Development, Int. J. Community Serv. 1 (2025) 79–87.
[16] R. Febrina, R.E. Sardjono, F. Khoerunnisa, R.R. Dirgarini, P. Selvakumar, Strengthening Local Livelihoods through the Circular Economy: Agricultural Waste Utilization for Green Energy, Int. J. Community Serv. 1 (2025) 88–95.
[17] Q. Hu, J. Jung, D. Chen, K. Leong, S. Song, F. Li, B.C. Mohan, Z. Yao, A.K. Prabhakar, X.H. Lin, Biochar industry to circular economy, Sci. Total Environ. 757 (2021) 143820.
[18] M. Nizar, S. Syafrizal, A.-F. Zikrillah, A. Rahman, A.E. Hadi, H. Pranoto, Optimizing Waste Transport Efficiency in Langsa City, Indonesia: A Dynamic Programming Approach, Int. J. Sci. Adv. Technol. 1 (2025) 10–17.
[19] S.M. Rosdi, G. Maghfirah, E. Erdiwansyah, S. Syafrizal, M. Muhibbuddin, Bibliometric Study of Renewable Energy Technology Development: Application of VOSviewer in Identifying Global Trends, Int. J. Sci. Adv. Technol. 1 (2025) 71–80.
[20] J.M. Chisholm, R. Zamani, A.M. Negm, N. Said, M.M. Abdel daiem, M. Dibaj, M. Akrami,

Sustainable waste management of medical waste in African developing countries: A narrative review, Waste Manag. Res. 39 (2021) 1149–1163.
[21] M. Muhibbuddin, M.A. Hamidi, D.F. Fitriyana, Bibliometric Analysis of Renewable Energy Technologies Using VOSviewer: Mapping Innovations and Applications, Int. J. Sci. Adv. Technol. 1 (2025) 81–91.
[22] M.M. Islam, The Management of Medical Waste in Bangladesh: A Policy and Practices Analysis, (2023).
[23] D.F. Fitriyana, R. Rusiyanto, W. Maawa, Renewable Energy Application Research Using VOSviewer software: Bibliometric Analysis, Int. J. Sci. Adv. Technol. 1 (2025) 92–107.
[24] N. Khalisha, I. Caisarina, S.Z. Fakhrana, Mobility Patterns of Rural Communities in Traveling Traveling from The Origin Area to the Destination, Int. J. Sci. Adv. Technol. 1 (2025) 108–119.
[25] M.I. Muzakki, R.K.H. Putro, Greenhouse Gas Emission Inventory at Benowo Landfill Using IPCC Method, Int. J. Sci. Adv. Technol. 1 (2025) 18–28.
[26] H. Pranoto, R. Rusiyanto, D.F. Fitriyana, Sustainable Wastewater Management in Sumedang: Design, Treatment Technologies, and Resource Recovery, Int. J. Sci. Adv. Technol. 1 (2025) 38–46.