

B3 Waste Management at PT Kereta Api Indonesia: A Literature Review

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Abstract

The amount of B3 waste sourced from the Locomotive Depot, Station, and Balai Yasa office of PT Kereta Api Indonesia (Persero) which is not managed properly and correctly will cause problems later both for the surrounding environment, passengers, and water quality that is close to the location of the waste source. This study aims to determine the management of B3 Waste carried out at all PT Kereta Api Indonesia stations. This type of research is research using the literature review method. The stages of literature collection used in this study refer to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines. This stage has four procedures, namely: identification, screening, eligibility, and acceptance. This study shows that the management of hazardous waste at several stations from the articles that have been reviewed is found to be inconsistent with the workmanship and management based on applicable regulations. It can be concluded that hazardous waste at some of these stations does not meet the requirements in terms of grouping, storage, and management.

Keywords: Waste management; PT Kereta Api Indonesia; hazardous waste, railway

INTRODUCTION

A train is a vehicle that has the power of motion that runs either alone or together with a series of other railway facilities. The carriage is a railway vehicle that is pulled or driven by a locomotive used to transport people or goods (Government Regulation of the Republic of Indonesia Number 56 of 2009 concerning the Implementation of Railways) (FAUZI, 2019).

A railway is a transport system consisting of infrastructure, facilities, human resources (HR), and regulations used to regulate railway traffic. The purpose of railway transport is to facilitate the mass movement of people and/or objects more easily, safely, comfortably, quickly, and on time. The development of the times also has an impact on Indonesian railways, where railway operators began to emerge offering optimal service facilities in many cities.

The advantages and features of railways are significantly used in the development of integrated transport systems. In its implementation from design and construction, operation, maintenance, inspection and testing, and operation must be managed as well as possible which

ultimately improves the provision of rail transport services for the movement of people and goods safely, securely, comfortably, quickly, and accurately regularly at an affordable price considering the purchasing power of the community (Sakti, 2022).

According to PP 22 of 2021, "Hazardous and toxic materials, commonly known as B3, are wastes that contain hazardous and toxic substances. According to the regulation, B3 waste is categorized according to its characteristics such as flammable, explosive, reactive, infectious, flammable, toxic, and corrosive. PP 22 of 2021 also regulates the determination, storage, reduction, transport, collection, and treatment of hazardous waste (HAKIM, 2017).

Hazardous waste is generated by human activities but poses a threat to human health and the environment. These negative impacts must be reduced through proper management. However, a large amount of waste generated, coupled with the high cost of disposal in developed countries due to strict general regulations, has led to uncontrolled waste generation, usually in developing countries since 1970.

Which creates problems for developing countries (Deviyanti & Prasasti, 2015).

METHOD

2.1 Research Type

This type of research is research using the literature review method. A literature review is a research method that identifies, evaluates, and interprets research findings related to a particular research topic or phenomenon that is the subject of research by evaluating scientific articles in a structured and planned manner (Barbara Kitchenham, 2014).

2.2 Research Procedures

The literature collection step used in this study refers to the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) guidelines. This stage consists of four procedures: identification, screening, eligibility, and acceptance. In the identification stage, article sources were searched on the internet (article search) or from other literary sources. Then, at the screening stage, duplicate articles were screened and the eligibility assessment process was carried out by extracting information from the title and summary of each article. Eligible articles were those that related to the research questions and objectives of this literature review. In other words, after the acceptance stage, a full reading of the article content was conducted to identify articles that met the pre-determined inclusion criteria and were suitable for use in the qualitative and quantitative synthesis (Liberati et al., 2009).

2.3 Inclusion Criteria

This study used five inclusion criteria, including an introduction to railway liquid waste, and the importance of railway liquid waste management. Articles were written in Bahasa Indonesia or English, either original research articles or literature reviews and non-literature studies within the last 10 years.

2.4 Article Selection Research

Then, the information obtained through the literature search was synthesized without meta-analysis or qualitative synthesis (Synthesis Without

Meta-analysis) (Campbell M et al., 2020). Qualitative synthesis is made with a comprehensive summary of research findings and a descriptive description of the results. The qualitative synthesis describes the characteristics of the research and synthesizes the amount, and source of railway effluent management in preventing environmental pollution.

RESULTS AND DISCUSSION

Result

A search for articles in this database identified 804 articles. Subsequently, the title and abstract of each identified article were reviewed for 995, and found 8 relevant articles for identification of articles that met the inclusion criteria and were suitable for qualitative and quantitative synthesis. The 8 relevant articles were then read in full text to obtain 6 articles that met the criteria and acceptability. The stages and process of selecting articles from identification to determination of articles can be seen in Figure 1.

Discussion

Based on the results of the literature review, articles that meet the eligibility criteria in this systematic review are original scientific articles or not the results of reviews within the last 10 years. The results of the literature review obtained an explanation of Hazardous Waste Management from several stations in PT Kereta Api Indonesia. A summary description of the included research results can be seen in Table 1.

When applied to support waste management at service centers, depots, offices, and stations, the following conditions apply:

- Every open or closed workplace where waste is likely to be generated must have a container for organic and inorganic waste that must always be closed.
- Waste at service centers, depots, offices, and stations is occasionally disposed of at the nearest temporary storage site (TPS) and then transported by the local sanitation agency to the final disposal site (TPA).

- Waste should not be buried in the ground or burned.
- Each service center, depot, and station must have an environmental document and then must have an environmental permit to apply for an environmental protection and management permit.
- Provide temporary storage for B3 solid waste such as used components, scrap metal, batteries, TL lamps, and others which will be sent to the warehouse.
- Hazardous waste storage facilities must fulfill the requirements under applicable regulations.
- Hazardous waste weighing more than 50 kg, it can be stored for 90 days starting from the first day of waste

- generation, while for waste weighing less than 50 kg, it can be stored for 180 days.
 - Hazardous waste labels contain the name of the hazardous waste, the hazardous waste producer, the date of hazardous waste production, and the date of hazardous waste packaging as well as symbols and labels.
- Waste handling on trains is carried out under the following conditions:
- Waste generated during train and passenger restoration is separated into organic and inorganic waste.
- After arriving at the destination station, the waste is sent to the station's TPS ((Persero), 2022).

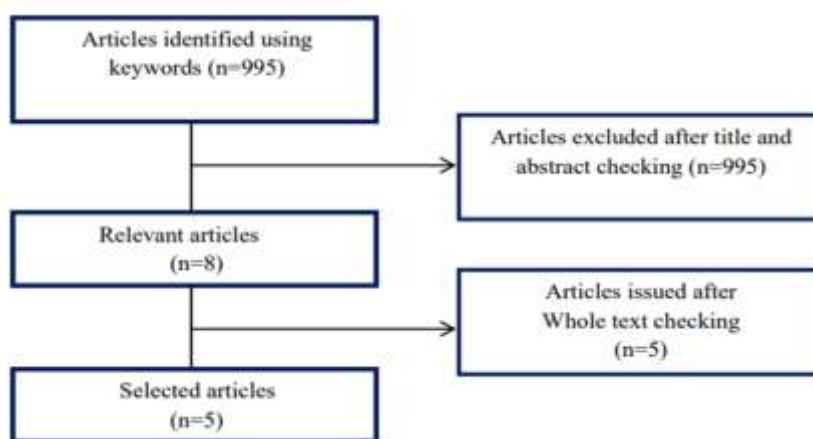


Figure 1. The stages and process of selecting articles

Tabel 1. A summary description of the included research results

Title	Author/Year	Methods	Results
Planning for Hazardous and Toxic Waste Management at Lempuyangan and Tugu Stations in Yogyakarta	(Birullah, 2019).	This research aims to Plan hazardous waste management. System by applicable regulations using the sampling method as a reference for identification, then distributing questionnaires and conducting checklists to evaluate hazardous waste management sothat planning management at the station can be carried out. The research location was conducted at Lempuyangan Station and Tugu Station in Yogyakarta City. The object of this research is Hazardous and Toxic Waste	Hazardous waste results from research. This comes from the process of repairing and maintaining locomotives and railway carriages of the lower and upper frame groups of each station producing B3 waste, consisting of components, lathe waste, and residual production waste. All B3 waste containers use iron drums and are not palletized. All containers containing B3 waste are not placed in the B3 waste TPS because each station does not have a B3 waste TPS but is placed next to the railway tracks.

		(B3) generated from the repair and maintenance of locomotives and railway carriages located at Lempuyangan Station and Tugu Station Yogyakarta.	In addition, improvements are also needed in the storage process, namely to provide labels and symbols as well as the type of hazardous waste stored in iron drums so that the management of hazardous waste at each station is good and safe according to BAPEDAL number KEP-01/BAPEDAL/09/1995 and BAPEDAL/09/1995. Government Regulation number 101 of 2014.
Evaluation and Inventory of hazardous waste management in PT KAI Yogyakarta's service station	(Hakim, 2017).	This research aims to plan a hazardous waste management system under applicable regulations by using the sampling method as a reference to evaluate hazardous waste management so that better planning of hazardous waste management systems can be carried out. sampling method as a reference for evaluating hazardous waste management so that better planning of hazardous waste management systems can be carried out.	The results of the research related to hazardous waste show that most of the hazardous waste generated in the process of activities at Balai Yasa Yogyakarta consists of waste: used lubricants (oil), used bulbs, used paint packaging, used diluent packaging, contaminated masks, and gloves. contaminated, contaminated masks, and gloves hand contaminated. There is only one type of waste that is subject to management, namely waste oil. Other than that. Improvements are needed in the storage process at the TPS, namely to provide labels and symbols, as well as adding types of waste. B3.
Hazardous and Toxic Waste Management at PT Kereta Api Indonesia Daop 7 Madiun	(Wardani, 2021).	The methods used were field observations, interviews, documentation, and literature studies. The analysis method used is to compare and evaluate data with laws and regulations related to hazardous waste management and check the logbook and balance sheet of hazardous waste.	Maintenance activities at UPT Depo Lokomotive generate B3 waste, namely gloves, mop, used oil, used diesel, electronic waste, used B3 packaging. The management of B3 waste at the UPT Depo Lokomotive includes data collection of types of B3 Waste, weighing and recording B3 Waste, packaging and labelling and symbols of B3 Waste, storing B3 Waste in TPS, reporting

			B3 Waste to GP SGU, transporting B3 Waste which has been carried out by UPT Depo Lokomotive not in accordance with applicable regulations. The performance of hazardous waste management is not good because facility staff do not understand the regulations and technicalities. Hazardous waste management.
Management Planning Specific Solid Waste Balai Yasa PT KAI Yogyakarta	(Wicaksono, Putut Jati Nugrahayu & Iresha, 2018).	The type of research conducted is direct observation of specific solid waste management and specific solid waste composition at Balai Yasa PT KAI Yogyakarta. Observation of the type and composition of specific solid waste is based on the criteria determined by UNIFE 2013 on the Recyclability and Recoverability Calculation Method. Recyclability and Recoverability Calculation Method Railway Rolling Stock and previous research on End-of-life Railways and conducting interviews to obtain data with the officers working as recyclers to obtain data with officers who work in waste management. specific solid in the Balai Yasa PT.KAI area Yogyakarta. Determination of sample objects using the purposive method. The train samples to be taken are 3 samples. As well as collecting specific solid waste management data, and then conducting a survey data analysis.	B3 components that have been collected in the pre-treatment process are then forwarded to the TPS according to their characteristics of waste. Reusable components that have met the standards and can be used directly and components that need to be repaired are forwarded to the spare parts storage warehouse. While recyclable components that have been grouped are then transported to a temporary storage area to be collected. Transporting components that have been grouped are transported using a forklift according to the type of component. it's a waste group.
Waste Management at the South Sumatra LRT Depot	(Sakti, 2022).	This research uses interviews and direct observation methods to evaluate hazardous waste management.	Based on the hazardous waste assessment, several wastes have not been managed effectively, including used lubricants (oil), used lamps, contaminated rags, masks contaminated, contaminated

			gloves, used solvent cans, and consumable parts. The implementation of waste collection and storage does not yet have an SOP by PP No. IX.101 Year 2014. As well as licensing for implementation is not by PP No.5 of 2021, namely the absence of a stipulation. business activity standards.
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The results of several review articles can find out that in the field of B3 waste management, the work is often carried out not by the specified rules. B3 waste can be generated from Dipo, Station, and Balai Yasa at PT Kereta Api Indonesia (Persero). From the results of the review that has been carried out, several of the same problems are obtained, including the provision of labels, symbols, and types of waste for information on the B3 waste, this is to determine the identity of the waste stored in temporary storage in the location closest to the source of the waste. In addition, several types of B3 waste are not grouped or all combined without being separated first. And the other is that there are several types of B3 waste but only 1 waste is processed.

The above has explained how waste management on trains, but when compared with the data from the review results some differences cause less efficient management of hazardous waste at the Station, Depot, and Balai Yasa.

CONCLUSION

Based on the literature review of research articles that have been conducted, it can be concluded that the management of B3 Waste at PT Kereta Api Indonesia related to the results of the review conducted by PT KAI has been running quite well, although there are still some shortcomings but can be improved in the future. This literature review is only carried out on the example of B3 Waste cases. For future researchers, it is recommended to add comparisons with

other wastes generated in the environment around PT Kereta Api Indonesia.

BIBLIOGRAPHY

- PT Kereta Api Indonesia (Persero). (2022). Sustainability Report. Annual and Sustainability Report, 42.
- Barbara Kitchenham. (2014). Procedures for Performing Systematic Reviews. Keele University Technical Report, 33(2004), 1-26.
- Birullah, M. Y. (2019). Hazardous and Toxic Waste Management Planning at Lempuyangan and Tugu Stations Yogyakarta. Thesis. Islamic University of Indonesia.
- Campbell M, Je, M., Sowden A, Sv, K., Se, B., Ellis S, Hartmann-Boyce J, Ryan R, Shepperd S, Thomas J, Welch V, & Thomson H. (2020). Synthesis Without Meta-analysis (SWiM) reporting items. <http://dx.doi.org/10.1136/bmj.l6890>
- Deviyanti, E., & Prasasti, C. I. (2015). Sanitation of Pasundan Economic Train and Passengers' Health Complaints. Environmental Health, 1(1), 13-24. <http://journal.unair.ac.id/download-full-papers-pkl62a304f1c22full.pdf>
- Fauzi, M. A. (2019). Waste Management Planning at Lempuyangan Station and Tugu Station Yogyakarta. <https://dspace.uui.ac.id/handle/123456789/16845%0Ahttps://dspace.uui.ac.id/bitstream/handle/123456789/16845/05.4chapter4.pdf?sequence=7&isAllowed=y>
- HAKIM, L. (2017). Planning for Integrated

- Management of Railway Wastewater at Surabaya City Station. [Institut Teknologi Sepuluh Nopember. <http://repository.its.ac.id/3240/>
- Liberati, A., Moher, D., Tetzlaff, J., Altman, D. G., & Group, T. P. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine*, 6(7), 1-6. <https://doi.org/10.1371/journal.pmed.1000097>
- Sakti, F. B. (2022). Waste Management at the South Sumatra LRT Depot. Politeknik Transportasi Darat Indonesia-STTD.
- Wardani, Y. P. (2021). Hazardous and Toxic Waste Management at PT Kereta Api Indonesia Daop 7 Madiun. *College of Vocational Studies*, 1-7.
- Wicaksono, Putut Jati Nugrahayu, Q., & Iresha, F. M. (2018). Management Planning of Specific Solid Waste Management of Balai Yasa PT Kereta Api Indonesia D.I Yogyakarta. *Environmental Engineering, Faculty of Civil Engineering and Planning, Universitas Islam Indonesia*, 1-10.