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OVERVIEW OF HAZARDOUS AND TOXIC SOLID WASTE (B3) MANAGEMENT AT HOSPITAL X IN CENTRAL JAKARTA

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Abstrak

Type B hospitals generate significant volumes of hazardous and toxic solid waste (B3), reaching 230–250 kilograms per day, which, if not properly managed, poses potential risks of infection, injury, and environmental contamination. The management of B3 waste in healthcare facilities is regulated by Minister of Environment and Forestry Regulation (Permen LHK) No. P.56 of 2015 and Permen LHK No. 6 of 2021. This study aims to describe the characteristics, management stages, level of compliance with regulations, and challenges faced in the management of hazardous solid waste at Hospital X in Central Jakarta in 2026.This study employed a qualitative descriptive approach using purposive sampling. Data were collected through in-depth interviews with five key informants, including the head and staff of the environmental health unit as well as three cleaning service staff members, supplemented by field observations using a checklist and document review. Data analysis was conducted thematically through the stages of reduction, presentation, and drawing of conclusions. Hospital X in Central Jakarta generates seven categories of solid hazardous waste, with infectious waste being the most prevalent. Of the 27 observed components evaluated, 26 (96.3%) met applicable regulatory requirements. The only element that was not met was the lack of a dedicated transport route for hazardous waste. The main challenges identified included inadequate waste transfer station (TPS) capacity on weekends, expired personnel competency certifications, internal policies that had not been updated since 2022, and an unstructured monitoring and evaluation system.

INTRODUCTION

Hospitals, as healthcare facilities, play a vital role in the public health system. However, beyond their curative and preventive functions, daily medical services also generate waste with a wide range of characteristics—from ordinary domestic waste to waste classified as Hazardous and Toxic Materials (B3). Hospital B3 solid waste, which includes infectious, sharps, pathological, pharmaceutical, chemical, cytotoxic, and hemodialysis waste, is the most critical category because it contains pathogenic microorganisms, toxic chemicals, and objects that can cause direct injury. If not managed properly, this type of waste can contaminate soil, groundwater, and air, as well as transmit diseases to healthcare workers, patients, and the community surrounding the facility (Arisma, 2021).

At the national level, the issue of medical waste has become a major concern, especially after the COVID-19 pandemic caused a 11 to 246% increase in the volume of hazardous waste (B3) at various hospitals, with infectious waste accounting for more than 90% of the total waste generated (Virlya et al., 2023). In the DKI Jakarta region, this pressure is exacerbated by the large population and high number of hospitals. A study conducted at four major hospitals in Jakarta—RSPI Sulianti Saroso, RSUD Pasar Rebo, RS Medistra, and RS Husada—showed that while the overall technical capacity for managing medical waste is fairly good, several non-technical aspects, such as waste inventory recording, waste data collection, and compliance with permits, still require significant improvement (Virlya et al., 2023). This situation highlights a discrepancy between administrative compliance and actual implementation on the ground.

The Indonesian government has established comprehensive regulations to govern the management of hazardous waste (B3) from healthcare facilities. Regulation of the Minister of Environment and Forestry (Permen LHK) No. P.56 of 2015 specifies the methods and technical requirements for managing hazardous waste (B3) from healthcare facilities, covering the entire process from sorting, storage, and transportation to disposal. This regulation was subsequently reinforced by Minister of Environment and Forestry Regulation No. 6 of 2021, which establishes general provisions regarding the management of hazardous and toxic waste from various sectors, including healthcare facilities. In addition, the Minister of Health's Regulation No. 7 of 2019 on the Management of Medical Waste ( ) and Minister of Health Regulation No. 18 of 2020 also reinforce the obligation of every healthcare facility to manage medical waste in accordance with established standards (Lamusul Afiyah & Author, 2023).

Previous research has shown that compliance rates vary considerably among different facilities. At Batam Hospital, the waste sorting rate reached 93%, but there were still weaknesses in bag-sealing procedures and incinerator temperature (Lamusul Afiyah & Author, 2023). Polewali Regional General Hospital has a fairly comprehensive system, although waste volume increased rapidly during the pandemic (Sukmawati & Dahlan, 2022). At Pertamedika Hospital in Banda Aceh, obstacles such as inadequate final disposal facilities, a lack of oversight from health authorities, and an excessively heavy workload during the pandemic were identified as factors hindering the main process (Budi Fauzan et al., 2024). A study at Dr. Soetomo General Hospital in Surabaya explains that adherence to the formal regulations of Ministry of Environment and Forestry Regulation No. P.56/2015 does not always reflect the actual situation on the ground (Ajeng et al., n.d.).

The identified research gap is the scarcity of studies that comprehensively examine the management of solid hazardous waste (B3) at Type B hospitals in the Central Jakarta region post-pandemic, where waste volumes have increased but infrastructure capacity has not necessarily kept pace. Therefore, this study aims to fill this gap by providing an in-depth description of the conditions surrounding hazardous solid waste management at Hospital X in Central Jakarta, including waste characteristics, management stages, the level of compliance with current regulations, and the challenges faced. These findings are expected to serve as the basis for evidence-based recommendations to improve the hazardous waste management system comprehensively.

LITERATURE REVIEW

The Concept of Hazardous and Toxic Waste (B3) in Hospitals

Hazardous and Toxic Waste (B3) is defined as the residue from a business or activity that contains substances, energy, or other components which, due to their nature, concentration, and quantity—either directly or indirectly—can pollute or damage the environment, or endanger the survival of humans and other living beings (Yurnalisdel, 2023). In the context of healthcare facilities, B3 waste is divided into two major groups: medical or clinical waste and non-infectious B3 waste. The first group includes infectious waste, sharps, pathological waste, pharmaceutical waste, chemical waste, cytotoxic waste, and hemodialysis- ; while the second group includes materials such as used oil, chemical containers, and sludge from wastewater treatment plants (WWTPs).

According to Hazardous Waste Management Theory, solid hazardous waste possesses hazardous properties that require stricter management responsibilities compared to ordinary waste, from the identification stage through final disposal (Communication and Environmental Engineering Development et al., 2024). This theory emphasizes the importance of risk control at every stage of the management chain through the approaches of containment—limiting the spread—and worker protection—safeguarding the personnel involved. Meanwhile, the Administrative and Environmental Management Theory asserts that the management of hazardous waste requires not only adequate physical infrastructure but also a well-organized administrative system, regularly updated internal regulations, and consistent oversight mechanisms (Law and Indonesia, n.d.).

Classification of Hazardous Solid Waste in Hospitals

Infectious waste is the most prevalent type in hospitals, encompassing all materials contaminated with pathogenic microorganisms—such as bacteria, viruses, fungi, or parasites—in concentrations sufficient to cause disease. The primary sources are patient care units, operating rooms, laboratories, and the emergency department. Improper handling of infectious waste can serve as a medium for the transmission of dangerous diseases (Suprema et al., 2019).

Sharps waste—including syringes, surgical blades, ampoules, and glass shards—poses a dual risk: physical injury and the transmission of bloodborne diseases such as HIV, hepatitis B, and hepatitis C. Therefore, sharps must be managed using special puncture-resistant and impermeable safety boxes (Assa Yosi Yosua et al., 2025). Pathological waste, which originates from human or animal body tissues resulting from medical procedures, not only carries a risk of infection but also raises ethical concerns regarding respect for human body parts (Arumdani Intan Sekar, 2024).

Pharmaceutical waste includes expired medications, medication packaging, and

unused medication residues from pharmacy facilities. Although often considered harmless, some types of medications contain compounds that are mutagenic or toxic to aquatic environments if disposed of improperly (Muhammad Rezky Wahyudi et al., 2025). Cytotoxic waste, which originates from cancer treatment via chemotherapy, is the most hazardous type because it is carcinogenic, mutagenic, and teratogenic—therefore, its management requires strict procedures and special protective equipment (Assa Yosi Yosua et al., 2025).

Management of Hazardous Waste in Hospitals

The Waste Management Hierarchy concept serves as the primary theoretical foundation for the management of hazardous waste in hospitals. This hierarchy prioritizes, in order: reduction at the source, reuse, pre-sterilization, recycling, treatment, and final disposal as the last resort. The application of this hierarchy aims to minimize the volume of hazardous waste that must be disposed of while simultaneously reducing costs and environmental risks (Gede & Yoga, n.d.).

The Theory of Planned Behavior (TPB) provides a useful analytical lens for understanding the behavior of personnel in managing hazardous waste. According to this theory, an individual's behavior is influenced by three main determinants: (1) attitudes toward the behavior in question, (2) subjective norms or social pressure from the work environment, and (3) perceived behavioral control, which is an individual's belief in their ability to perform a specific action. When one or more of these factors is weak—for example, due to a lack of training—workers tend to deviate from established standard operating procedures (SOPs) (Sheffani Abbad & Candraning Diyanah, 2022).

The Green Hospital Concept integrates three dimensions—regulation, infrastructure, and human resource development—into a vision for sustainable and environmentally friendly hospital management. This concept emphasizes that regulatory compliance and environmental sustainability are not separate entities but rather mutually reinforcing. The implementation of this concept in Indonesia is expected to enhance compliance with Ministry of Environment and Forestry Regulation No. P.56/2015 while simultaneously reducing the environmental impact of hospital operations (Maharani Anandwita Early & Prakoso Andria Luhur, 2023).

Regulatory Compliance Theory explains that an institution's level of compliance with regulations is influenced by three main variables: understanding of applicable rules, the intensity of oversight by regulatory authorities, and the consequences or sanctions for non-compliance. A study at Dr. Soetomo Regional General Hospital showed that although the level of formal compliance is quite high, there are still challenges related to human resource capacity and infrastructure that hinder the full implementation of regulations (Ajeng et al., n.d.).

Regulations on Hazardous Waste Management in Healthcare Facilities

The primary regulation governing the management of hazardous waste from healthcare facilities in Indonesia is Ministry of Environment and Forestry Regulation No. P.56 of 2015 on Procedures and Technical Requirements for the Management of Hazardous Waste from Healthcare Facilities. This regulation details every stage of management: sorting based on waste type and characteristics, containment using a color-coding system, transportation using safe equipment, temporary storage at licensed transfer stations, and disposal by third parties licensed by the Ministry of Environment and Forestry (Susanti Yenila & Lestari Yuniar, 2022).

Ministry of Environment and Forestry Regulation No. 6 of 2021 expands the

scope of the regulation to cover all industrial sectors that generate hazardous waste, including healthcare facilities. This regulation reinforces reporting obligations through an integrated electronic information system, tightens technical requirements for waste transfer stations (TPS), and clarifies the categories of hazardous waste that must be managed—including non-infectious hazardous waste that was previously often overlooked, such as used oil, wastewater treatment plant (IPAL) sludge, and chemical packaging (Handriyanto et al., 2026). Ministry of Health Regulation No. 18 of 2020 complements this regulatory framework by establishing region-based medical waste management, which enables the optimization of processing capacity at the regional level (Lamusul Afiyah & Author, 2023).

Previous Research

Several relevant studies that form the basis of this research include: Sukmawati and Dahlan (2022) at Polewali Regional General Hospital, who documented a surge in hazardous waste volume to 270 kg/day during the COVID-19 pandemic and identified a relatively comprehensive management system that was nonetheless vulnerable to capacity pressures; Virlya et al. (2023), who analyzed the stakeholder network in hazardous waste management at four hospitals in Jakarta and found that non-technical aspects such as record-keeping and permitting remain weak points; and Budi Fauzan et al. (2024), who identified the determinants of successful hazardous waste management at Pertamedika Hospital in Banda Aceh, including facility adequacy, quality of supervision, and staff workload.

Cahwariwasya et al. (2025), in their evaluation of hospitals in Pontianak, highlighted that insufficient infrastructure capacity and limited staff training are the most common challenges faced by healthcare facilities in Indonesia. Prastian and Purwaningrum (2024) confirmed similar findings and recommended a PDCA (Plan-Do-Check-Act) cycle-based approach for continuous improvement in the medical " " waste management system. Meanwhile, Inayah et al. (2025) emphasized the importance of optimizing all stages of hazardous waste disposal in an integrated manner, from the source to final disposal.

RESEARCH METHOD

This study employs a qualitative descriptive design aimed at producing an in-depth and contextual description of the phenomenon of hazardous solid waste management in accordance with actual existing conditions. A qualitative approach was chosen because it allows researchers to explore the perspectives, experiences, and direct understandings of the parties involved in the waste management process—aspects that cannot be adequately captured through quantitative methods alone. Data collection was conducted using a cross-sectional approach during June 2026 at Hospital X in Central Jakarta.

Informants were selected using purposive sampling, which involves intentionally selecting participants based on their direct involvement and depth of knowledge regarding hazardous waste management at the hospital. The five research informants consisted of: (1) the Head of the Environmental Health Unit as the first key informant (KI-01), who holds full authority and responsibility for the hazardous waste management system; (2) an Environmental Health Unit staff member as the primary informant (IU-01), who is directly involved in daily operations; and (3) three Cleaning Service staff members from different units—the Hemodialysis Unit, the Laboratory, and the Raudah Inpatient Ward—as supporting informants (IP-01, IP-02, IP-03), who transport waste from the source to

the temporary storage point (TPS).

Data collection was conducted using three complementary and mutually validating methods. First, in-depth interviews using structured interview guides tailored to each informant category, aimed at exploring perspectives and firsthand experiences in the hazardous waste management process. Second, structured field observations were conducted using a checklist containing 27 observation components covering all stages of hazardous waste management, from sorting to disposal. Third, a document review was conducted on the hazardous waste management SOPs, TPS logbooks, waste generation reports, manifests, and hazardous waste TPS permits issued by the Ministry of Environment and Forestry (KLHK).

Data validity was ensured through source and method triangulation. Source triangulation was performed by comparing statements from various informants with different positions and functions, thereby identifying and minimizing individual biases. Method triangulation was carried out by cross-checking findings from interviews, field observations, and document reviews. Additionally, member checking was conducted to ensure the accuracy of data interpretation prior to final analysis.

Data analysis utilized the Miles and Huberman thematic analysis model, which consists of three stages: data reduction (selection, focusing, and simplification of raw field data); data presentation (organizing information into patterns and categories that allow for the drawing of conclusions); and the drawing and verification of conclusions. Interview results were categorized into an interview matrix to facilitate comparisons among informants. Field observation results were presented in the form of a compliance summary table, while the document review was analyzed to assess the completeness and currency of hazardous waste management documents.

RESULT AND DISCUSSION

Characteristics of Hazardous Solid Waste at Hospital X in Central Jakarta

Types of Hazardous Solid Waste

Hospital X in Central Jakarta generates seven categories of hazardous solid waste, reflecting the complexity of the medical services provided. These seven categories are: (1) infectious waste, consisting of bandages, gauze, gloves, used IV bottles, and contaminated linens placed in yellow bags; (2) sharps waste, consisting of syringes, lancets, ampoules, and glass shards placed in safety boxes; (3) pathological waste, consisting of tissue remnants and bodily fluids resulting from surgical procedures, which is also packed in yellow bags; (4) pharmaceutical waste, consisting of expired medications (ED), medicine bottles, and leftover medications from the pharmacy, placed in brown bags; (5) chemical waste consisting of laboratory reagents, used disinfectant solutions, toner cartridges, and used chemical containers placed in brown bags; (6) hemodialysis waste consisting of blood lines (tubes) and used dialyzers, which are packaged in yellow bags; and (7) non-infectious B3 waste consisting of used gauze, used generator oil, wastewater treatment plant sludge, and packaging for toxic chemicals, which are stored in brown containers.

Infectious waste is the most prevalent type, consistent with national data showing that Type B hospitals generate infectious waste accounting for 53–60% of total B3 waste (Kurniawan et al., 2022). This was confirmed by a key informant who stated that the majority of waste originated from inpatient care, outpatient care, and general patient treatment processes (IU-01, June 5, 2026). From the perspective of Hazardous Waste

Management Theory, the diversity of these waste categories requires a differentiated management strategy , as each type poses distinct risks—including infection risks, physical injury risks, chemical toxicity risks, and carcinogenic risks from cytotoxic waste (Communication and Environmental Engineering Development et al., 2024).

One important note is the increased attention to non-infectious hazardous waste following a reaffirmation by the Ministry of Environment and Forestry (KLHK) to all healthcare facilities regarding the obligation to record and report this waste category. This reaffirmation is an implementation of Ministry of Environment and Forestry Regulation No. 6 of 2021, which expands the scope of hazardous waste management obligations to categories that had previously received less attention. In accordance with Regulatory Compliance Theory, hospitals' responses to this reaffirmation indicate that the intensity of external oversight has a direct impact on increased compliance (Susanti Yenila & Lestari Yuniar, 2022).

Sources and Volume of Hazardous Solid Waste

Hazardous solid waste at Hospital X in Central Jakarta originates from nine main service units with varying generation rates. The inpatient unit, hemodialysis unit, and operating room are the three largest generators of hazardous waste, with relatively high volumes. The inpatient unit generates infectious waste from every routine medical procedure performed throughout the day. The hemodialysis unit generates large volumes of waste in the form of used blood lines and dialyzers that cannot be reused due to infection control regulations. The operating room generates B3 waste from three categories simultaneously: infectious, sharps, and pathological.

Informants from the hemodialysis unit reported that a single dialysis session can generate three to four large yellow plastic bags of medical waste, primarily from blood lines and dialyzers (IP-01, June 5, 2026). This finding aligns with the Waste Management Hierarchy Theory, which emphasizes the identification of waste sources and characteristics as a crucial first step before determining the appropriate management method (Gede & Yoga, n.d.). The total volume of hazardous waste (B3) generated by this hospital averages 230–250 kilograms per day, with a trend toward increase due to the addition of management obligations for non-infectious hazardous waste (B3) that were previously excluded from the calculation.

This increase in waste volume places pressure on infrastructure capacity, particularly the Temporary Storage Site (TPS), which is one of the main challenges to be discussed in the following section. From the perspective of the Green Hospital s Concept, an increase in waste volume without a corresponding expansion of infrastructure capacity poses an obstacle to achieving the vision of a sustainable hospital (Maharani Anandwita Early & Prakoso Andria Luhur, 2023).

Stages of Hazardous Solid Waste Management

Sorting and Containment

The sorting of B3 waste at Hospital X in Central Jakarta is conducted directly at the point of generation, using a standardized color-coding system: yellow bags for infectious and medical waste, black bags for domestic waste, and brown bags for chemical and pharmaceutical waste. Safety boxes made of thick, puncture-resistant cardboard are used exclusively for sharps waste. At each patient bedside in the hemodialysis unit, two separate waste bins are provided, enabling immediate source separation. All containers are labeled with waste category symbols in accordance with Ministry of Environment and Forestry Regulation No. P.56/2015.

Although the sorting system has been functioning well, this study still identified cases of waste mixing—specifically, domestic waste ending up in the yellow bags. The most frequently cited cause was domestic waste coming into contact with patient fluids, leading staff to classify it as medical waste as a precautionary measure. Follow-up on this finding was conducted through verbal warnings without formal documentation.

Analyzed through the Theory of Planned Behavior, staff members' waste sorting behavior is influenced by three factors: first, attitude—which is generally positive, as evidenced by staff members' understanding of the color-coding system; second, subjective norms—which are supported by informal supervision from supervisors; and third, perceived behavioral control—which still needs to be improved, especially for staff who rarely receive refresher training (Sheffani Abbad & Candraning Diyanah, 2022). The absence of formal documentation of non-compliance findings weakens administrative control functions and has the potential to perpetuate behavior that does not conform to SOPs, as criticized by Ajeng et al. (n.d.) in their study of the PDCA cycle for waste management in a large hospital.

Transporting Waste from Rooms to the Waste Collection Point

The process of transporting hazardous medical waste (B3) from the source to the waste collection point (TPS) is carried out by Cleaning Service staff using special closed carts designed for medical waste, which are visually distinct from the open carts used for domestic waste. The waste transport schedule is set differently for each unit, adjusted to the rhythm of service activities: 11:00 a.m.–12:30 p.m. for the hemodialysis unit (after the dialysis session is complete), around 12:30 p.m. for the Raudah ward, and 1:00 p.m.–2:00 p.m. for the laboratory. This schedule is designed to avoid overlapping with food distribution activities from the nutrition department.

All Cleaning Service staff reported using complete Personal Protective Equipment (PPE)—including rubber gloves, masks, and aprons—during the transport process. However, two minor incidents occurred: one case of waste spillage due to a torn plastic bag, and one case of a puncture injury from a sharp object found in a domestic waste bag. Both incidents were addressed by cleaning with available disinfectant solution.

A critical issue identified was the lack of a dedicated transport route for hazardous waste (B3). This issue was mitigated by scheduling transport times; however, this solution is reactive and does not fully eliminate the possibility of cross-contamination, especially during unexpected emergencies. The Green Hospital Concept explicitly states that the design of sustainable hospital facilities must integrate separate pathways between clean zones and contaminated (waste) zones as a minimum design standard (Maharani Anandwita Early & Prakoso Andria Luhur, 2023). This finding is consistent with the research by Lamusul Afiyah et al. (2023), which identified the absence of dedicated pathways as one of the procedural weaknesses commonly found in various hospitals.

Temporary Storage at the B3 Waste Collection Point

The B3 Waste Collection Point at Hospital X in Central Jakarta has met the technical requirements set by regulations: it is separate from patient care areas, marked with B3 waste symbols, well-ventilated, locked, and kept clean. More importantly, this collection point has obtained an official permit from the Ministry of Environment and Forestry (KLHK)—which was granted after facility improvements were made based on direct consultation with KLHK—and also possesses a Technical Specification (Rintek) document validated by the Jakarta Capital Region Environmental Agency.

The waste tracking system at the TPS operates in a structured manner: each

incoming waste bag is weighed and recorded in a daily logbook by generating unit, then separated into infectious and non-infectious B3 waste and placed in lidded drums (Sulo). Transportation by a third-party hauler is conducted every workday, ensuring waste does not remain overnight.

However, there are significant structural constraints on Saturdays and Sundays. The volume of waste generated over the weekend exceeds the TPS's capacity, while transport by the third-party hauler does not take place until Monday. This situation creates a backlog that potentially violates the technical regulations for the storage of infectious B3 waste, which set specific storage time limits. A key informant confirmed: "The volume of waste generated is greater than the TPS's capacity… the TPS can't handle it because there's a gap" (KI-01, June 5, 2026). Virlya et al. (2023), in their study of four hospitals in Jakarta, also found TPS overcapacity to be a real problem even though administrative licensing requirements had been met—indicating a gap between de jure and de facto compliance.

Disposal by a Licensed Third Party

The disposal of hazardous solid waste is carried out entirely by a licensed third party, currently PT Tenang Jaya Sejahtera (TJS), which was selected through a joint feasibility survey process involving Environmental Health and Infection Prevention and Control teams from all hospitals within the same network. Each transport operation is accompanied by a weighing report and a hazardous waste manifest, which serves as a legal document tracking the waste stream from source to final destination.

Multi-layered oversight is specifically applied to expired pharmaceuticals (ED): photographic documentation at every stage (receipt, weighing, and disposal), as well as the assignment of one Environmental Health officer to directly witness the disposal process at the third-party facility. This oversight mechanism far exceeds the minimum standards required by regulations.

The hospital has also fulfilled its reporting obligations through three integrated information systems: (1) SIKELIM to the Health Department every three months; (2) WASDAL/SKL to the Environmental Agency every three months with the upload of supporting documents; and (3) SIMPEL (Electronic Reporting Information System) to the Ministry of Environment and Forestry (KLHK), which is updated daily. This level of reporting compliance is better than the findings of Virlya et al. (2023), who noted that some hospitals in Jakarta still face challenges in data collection and permitting. Based on Regulatory Compliance Theory, this high level of reporting performance correlates with the intensity of external oversight from the Ministry of Environment and Forestry (KLHK), which encourages more consistent compliance (Susanti Yenila & Lestari Yuniar, 2022).

Compliance with Regulations

An evaluation based on data triangulation from interviews, field observations, and document reviews revealed that out of 27 components examined, 26 components (96.3%) met the requirements of Ministry of Environment and Forestry Regulation No. P.56/2015 and Ministry of Environment and Forestry Regulation No. 6/2021. The only component that was not met was the availability of a dedicated hazardous waste transport route separate from public roads.

This 96.3% compliance rate demonstrates a strong institutional commitment to hazardous waste management. The success in obtaining a new hazardous waste treatment facility (TPS B3) permit from the Ministry of Environment and Forestry (KLHK)

following facility improvements serves as tangible evidence of the hospital's active efforts to meet regulatory standards. Compared to the findings of Lamusul Afiyah and Author (2023), who reported waste sorting compliance rates of 77–93% across various hospitals, Hospital X in Central Jakarta demonstrated superior performance in terms of regulatory compliance.

However, it is important to distinguish between formal compliance and substantive compliance. Formal compliance regarding licensing, documentation, and reporting is already very good. However, substantive compliance—which addresses aspects such as infrastructure capacity (overloaded waste transfer stations on weekends), human resource qualifications (expired certifications), and updates to internal policies (still using the 2022 policy)—still requires serious attention. This distinction aligns with the concept of the compliance dichotomy proposed by Virlya et al. (2023), in which a mismatch between administrative compliance and actual on-site conditions is a pattern frequently observed across various healthcare facilities in Jakarta.

Challenges in Managing Hazardous Solid Waste

Human Resource Challenges

The human resources dimension is the most fundamental and systemically significant constraint. At least three human resource issues have been identified: first, expired competency certifications for hazardous waste management operators—an issue that is not merely administrative but also has legal implications for the legitimacy of waste management operations; second, the position of hazardous waste management manager is not filled by personnel with a background in environmental health; and third, the frequency of waste management training for cleaning service staff is very low and not scheduled on a regular basis.

From the TPB perspective, the lack of periodic training directly impacts a decline in staff's perceived behavioral control—the third component of this theory that is critical to the consistency of procedural compliance in the field. When staff feel uncertain or unskilled in performing proper sorting, the probability of deviations from SOPs increases, particularly under high work pressure (Sheffani Abbad & Candraning Diyanah, 2022). Similar findings were reported by Budi Fauzan et al. (2024) at Pertamedika Hospital, who identified the quality and frequency of training as significant determinants of successful hazardous waste management.

Infrastructure Constraints

Insufficient capacity of the hazardous waste transfer station (TPS B3) to accommodate weekend waste accumulation is the most critical infrastructure constraint. This condition is not merely a technical issue but has the potential to create situations of unintentional regulatory noncompliance—where the established storage time limits for infectious waste may be exceeded without any intention to violate regulations. The lack of dedicated waste transport routes is the second significant infrastructure constraint, especially given that hospitals operate at high activity levels daily.

The storage capacity for non-infectious hazardous waste—specifically wastewater treatment plant sludge and used generator oil—is also insufficient to handle the volumes generated periodically. Since both types of waste are produced in large quantities at once (e.g., during generator oil changes), large-capacity containers are needed, which are currently not sufficiently available. The scarcity of plastic waste bags, which has occurred during long holiday seasons, adds another layer of vulnerability to the waste management supply chain.

Operational Challenges

At the operational level, three main challenges have been identified. First, the monitoring and evaluation system is unstructured and undocumented—inspections are conducted only once a month verbally without formal record-keeping, so findings of non-compliance cannot be systematically tracked or used as a basis for continuous improvement. Second, the internal policy for managing hazardous solid waste (B3) has not been revised since 2022, so it does not yet accommodate the latest regulatory developments, including the " " requirement for the management of non-infectious hazardous waste (B3). Third, the system's vulnerability to external disruptions, as occurred during the riots in Jakarta that prevented third-party transport vehicles from entering the hospital grounds.

The absence of a documented monitoring system is a critical weakness in the context of Administrative and Environmental Management Theory, which emphasizes the importance of a complete PDCA cycle: Planning (through SOPs), Doing (implementation), Checking (inspection and documentation of findings), and Acting (verified follow-up improvements). Without documented Checking and Acting components, the improvement cycle cannot function effectively, and procedural compliance tends to stagnate (Ajeng et al., n.d.; Prastian Muhammad Wahyu Adi & Purwaningrum, 2024).

These constraints are interrelated and form a cycle that can weaken the entire hazardous waste management system. Human resource limitations reduce the effectiveness of oversight; weak oversight increases tolerance for procedural deviations; while outdated policies and undocumented monitoring prevent the improvement cycle from functioning. This systemic pattern is consistent with the findings of Cahwariwasya et al. (2025), who concluded that challenges in medical waste management in Indonesia are generally multidimensional and cannot be resolved in isolation.

CONCLUSION

This study yielded three main conclusions. First, in terms of characteristics, Hospital X in Central Jakarta generates seven categories of hazardous solid waste (B3), dominated by infectious waste, originating from nine service units with a volume reaching 230–250 kilograms per day—a figure that tends to increase as enforcement of regulations on non-infectious B3 waste is strengthened.

Second, in terms of implementation, the management of hazardous solid waste has generally been carried out in accordance with standards, with a compliance rate of 96.3% with Ministry of Environment and Forestry Regulation No. P.56/2015 and Ministry of Environment and Forestry Regulation No. 6/2021. The color-code-based sorting system, labeled containers, transportation using enclosed carts, licensed waste collection points with logbook records, and disposal by licensed third parties with manifest documentation have all been implemented effectively. The three-channel reporting system (SIKELIM, WASDAL/SKL, SIMPEL) is also consistently enforced.

Third, there is a clear gap between formal compliance and actual conditions that needs to be addressed immediately: insufficient TPS capacity on weekends, the lack of dedicated transportation routes for hazardous waste, expired personnel competency certifications, internal policies that have not been updated since 2022, and a monitoring and evaluation system that has not been formally documented. These gaps indicate that compliance is driven more by external oversight pressures than by the institutional

internalization of environmental management values.

BIBLIOGRAPHY

Ajeng, A., Purwanti, Department of Environmental Health, & Faculty of Public Health. (n.d.). Management of Hazardous and Toxic Solid Waste (B3) at Dr. Soetomo General Hospital in Surabaya. Journal of Public Health.

Arisma, N. (2021). An Overview of Solid Medical Waste Management at Hi Muhammad Yusuf Kalibalangan Hospital in Kotabumi in 2019. Ruwa Jurai: Journal of Environmental Health, 15(2), 85. https://doi.org/10.26630/rj.v15i2.2808

Arumdani Intan Sekar. (2024). Management of Medical, Non-Medical, and Sharps Waste at Rembang Hospital. "Suara Forikes" Health Research Journal. https://doi.org/10.33846/sf15421

Assa Yosi Yosua, Sumbu Telly, & Rompas Deizen Devens. (2025). Implementation of Minister of Health Regulation No. 18 of 2020 on Region-Based Medical Waste Management at Pancaran Kasih Hospital in Manado. Lex Crimen, 13(5).

Budi Fauzan, Zakaria Radhiah, & Ariscasari Putri. (2024). Factors Associated with the Management of Hazardous and Toxic Materials (B3) at Pertamedika Hospital in Banda Aceh. Journal of Public Health, 5.

Cahwariwasya, W., Purnaini, R., & Asbanu, G. C. (2025). Evaluation of the Management of Solid Medical Waste Containing Hazardous and Toxic Substances (B3) at 'X' Hospital in Pontianak. Keslingmas Bulletin, 44(1), 52–60. https://doi.org/10.31983/keslingmas.v44i1.12810

Gede, I., & Perdana Yoga. (n.d.). Hospital Legislation on Medical Waste Management as an Effort to Strengthen Environmental Responsibility. Journal of Health Law.

Handriyanto, C. F., Permatasari, E. D., Agustin, A. F., Sabrina, S. D., Setiawati, T. A., Adji, I., & Septian, A. D. (2026). Analysis of Hazardous and Toxic Medical Waste Management at Hospitals. Journal of Environmental Health: Journal and Applications of Environmental Health Engineering, 23(1), 167–174. https://doi.org/10.31964/jkl.v23i1.1113

Inayah, Z., Hasan Shirat, Wahdaniah, K., Sholikhah, S. M., & Wamufiidah, Y. (2025). Optimization of Hazardous and Toxic Waste (B3) Disposal at Hospital X. Indonesian Journal of Health Science, 5(4). https://doi.org/10.54957/ijhs.v5i4.1600

Communication and Environmental Engineering Development, Media., Audhisa Israr, P. S., Mawaddah, N., & Alam, F. C. (2024). Analysis of Solid Medical Waste Management at X Hospital, West Sumatra. Jurnal Presipitasi, 21(1), 210–222.

Kurniawan, D., Ramon, A., Amin, M., & Wati, N. (2022). Based on Ministry of Health Regulation No. 07 of 2019 Concerning Hospital Environmental Health. Journal of Public Health, 2(1).

Lamusul Afiyah, L., & Corresponding Author. (2023). Implementation of Ministry of Health Regulation No. 18 of 2020 on Hospital Medical Waste Management. Journal of Education and Counseling, 6(2). https://doi.org/10.31933/unesrev.v6i2

Maharani Anandwita Early, & Prakoso Andria Luhur. (2023). Medical Waste

Management in Hospitals Oriented Toward Green Hospitals. Health Publisher.

Muhammad Rezky Wahyudi, Hidayatur Rizky, Apriani, U., & Latifah, N. (2025). Review Article: The Impact of Pharmaceutical Waste on the Environment and Efforts to Manage It in Industry. Vitamin: Journal of General Health Sciences, 3(3), 189–198. https://doi.org/10.61132/vitamin.v3i3.1442

Prastian Muhammad Wahyu Adi, & Purwaningrum, S. I. (2024). Medical Waste Management at Hospital X. Journal of Agriculture and Biology, 8(1), 92–98. https://doi.org/10.22437/jpb.v8i1.35871

Sheffani Abbad, R., & Candraning Diyanah, K. (2022). Analysis of Hazardous Medical Waste Management at Dr. R. Sosodoro Djatikoesoemo Bojonegoro Regional General Hospital. Media Gizi Kesmas, 11, 494–499. https://doi.org/10.20473/mgk.v11i2.2022.494-499

Sukmawati, S., & Dahlan, M. (2022). Management of Solid Hazardous Medical Waste During the COVID-19 Pandemic: A Case Study of Polewali Regional General Hospital. Bina Generasi: Health Journal, 13(2), 49–54. https://doi.org/10.35907/bgjk.v13i2.206

Suprema, J. L., Irawan, M. A., Handoyono, S., & Aprina, E. (2019). Legal Analysis of Solid Waste Management at the Technical Implementation Unit of the Community Health Center in North Penajam Paser Regency. https://doi.org/10.12345/lexsuprema.v1i2.291

Susanti Yenila, & Lestari Yuniar. (2022). Implementation of Hazardous Solid Medical Waste Management During the COVID-19 Pandemic. Journal of Environmental Health, 12.

Virlya, E. M., Soesilo, T. E. B., Pakpahan, E. N., & Sakina, N. A. (2023). Stakeholder Network Analysis of Hazardous and Toxic Waste Management at the Jakarta " " Hospital. Indonesian Journal of Environmental Health, 22(3), 294–303. https://doi.org/10.14710/jkli.22.3.294-303

Windarti, S., Almaida, & Kadir, F. (2022). An Overview of Hazardous and Toxic Waste (B3) Management at the Haji General Hospital in Makassar. Indonesian Pelamonia Health Research Journal, 5, 2654–9921.

Yurnalisdel, Y. (2023). Analysis of Hazardous and Toxic Waste (B3) Management in Indonesia. Syntax Admiration Journal, 4(2), 201–208. https://doi.org/10.46799/jsa.v4i2.562