

Analysis of Facility and Safety Management Implementation for Hazardous Materials at Hospital X

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ABSTRACT

Background: The management of hazardous and toxic materials is an essential component of Hospital Occupational Safety and Health standards. In addition, it is included in the Hospital Accreditation Standards, specifically in Facility and Safety Management Standard No. 5. However, in practice, some hospitals—including Hospital X—still do not meet these requirements.

Objectives: This study aims to evaluate the implementation of facility and safety management standard elements related to hazardous and toxic materials at Hospital X in order to provide appropriate recommendations for improvement.

Methods: This study employed a descriptive observational design. Data were collected through observations and interviews with relevant staff across 15 service units assessed against the facility and safety management standard elements for hazardous and toxic materials, as outlined in the Ministry of Health Regulation No. HK.01.07/MENKES/1596/2024. The study was conducted from June to August 2025 at Hospital X.

Results: Service units that met the facility and safety management standard elements for hazardous and toxic materials (>80%) included radiology (87.50%), hemodialysis (95.65%), pharmacy (95.65%), laundry (95.65%), Occupational Safety and Health (OSH) & sanitation (95.65%), emergency department (91.30%), central surgical unit (91.20%), and Intensive Care Unit (ICU) (91.30%). Units that did not meet the standard elements (<80%) were nutrition (39.13%), laboratory (65.21%), inpatient care (60.86%), outpatient care (65.21%), forensic (60.86%), medical rehabilitation (34.78%), and IPSRS (34.78%).

Conclusion: Only 8 out of 15 service units met the facility and safety management standard elements for hazardous and toxic materials. Therefore, improvement efforts should prioritize the provision of MSDS, proper material inventory recording, classification-based labeling, and chemical segregation according to their characteristics.

Keywords: Facility and Safety Management, Hazardous and Toxic Materials, Hospital Occupational Health and Safety

INTRODUCTION

The *BPJS Ketenagakerjaan* annual report shows that in 2019 there were 210,789 cases of work-related accidents and occupational diseases in Indonesia, with 4,007 resulting in death. In 2021, the number increased to 234,370 cases, with 6,552 resulting in death (Kemenaker, 2022). These data illustrate an increasing trend in work-related accidents and illnesses in Indonesia from 2019 to

2021, indicating that Occupational Health and Safety (OHS) issues still require serious attention. Strengthening OHS efforts is necessary to reduce the number of work-related accidents and illnesses across all sectors, including hospitals (Kemenaker, 2022).

Hospitals are institutions that provide inpatient, outpatient, and emergency health services.

In delivering these services, hospitals must ensure Occupational Health and Safety to prevent and control various potential hazards within the hospital environment. Hospital Occupational Health and Safety (HOHS) is implemented to protect hospital staff, patients, visitors, and the surrounding community from accidents and occupational diseases. The implementation of OHS is carried out through the Hospital Occupational Safety and Health Management System, which is essential to ensuring safety, efficiency, and smooth hospital operations (Kementerian Kesehatan RI, 2016).

The implementation of HOHS encompasses risk management, hospital security and safety, occupational health services, hazardous and toxic materials (B3) management, fire prevention and control, hospital infrastructure management, medical equipment management, and emergency or disaster preparedness. Hospital accreditation standards serve as a reference for hospital management to ensure the implementation of HOHS in accordance with statutory regulations. These accreditation standards cover hospital management, patient-focused services, patient safety goals, and national programs (Kementerian Kesehatan RI, 2016).

One crucial aspect is the management of hazardous substances. Hazardous substances are materials, energy sources, and/or other components which, due to their nature, concentration, or quantity, can directly or indirectly endanger human and animal health and pollute or damage the surrounding environment. Examples of B3 include chemicals, medicines, reagents, antiseptics and disinfectants, infectious waste, radioactive materials, insecticides, pesticides, cleaners, detergents, medical gases, and non-medical gases (Nazila, 2022). B3 constitutes one of the major potential hazards in hospitals. The International Labour Organization (ILO) (2018) states that exposure to hazardous chemicals is one of the main causes of occupational diseases, particularly in the healthcare sector. Therefore, these materials must be managed optimally, effectively, efficiently, and sustainably. From an OHS perspective, the management of hazardous substances aims to minimize risks associated with their use and with hazardous waste for hospital staff, patients, companions, visitors, and the hospital environment (Kementerian Kesehatan RI, 2016).

The management of hazardous and toxic materials (B3) constitutes an accreditation element for hospitals under the hospital management group within Facility Management and Safety Standard No. 5. This standard requires hospitals to manage hazardous and toxic materials through adequate documentation, safe storage facilities, trained personnel, and sufficient supporting infrastructure. These requirements are regulated in the Minister of Health Decree No. HK.01.07/MENKES/1596/2024 (Kementerian Kesehatan RI, 2024). Although

regulations related to B3 management are in place, implementation in the field still faces obstacles. Several studies show that the implementation of B3 management in various health facilities in Indonesia remains suboptimal. Research by Anggraini et al. (2024) found that two assessment elements were not fulfilled in a health facility in Pontianak City. Similarly, a study by Deviani et al. (2024) reported that only 3 out of 5 assessment aspects related to B3 management were met. The main problems lie in inventory management, storage, documentation, and the lack of training for staff, all of which increase the risk of work accidents and environmental pollution (Anggraini et al., 2024; Deviani et al., 2024). These findings confirm the existence of a gap between regulations and field implementation.

Hospital X, a referral hospital, continues to experience similar challenges in managing hazardous and toxic materials. A preliminary study conducted by the researchers revealed that several healthcare units in the hospital did not meet accreditation standards, particularly those related to hazardous and toxic materials management. Therefore, research is needed to evaluate the facility and safety management of hazardous and toxic materials and identify factors influencing compliance with its implementation so that appropriate recommendations can be formulated for hospital management. Accreditation standards will be used as a reference to ensure quality hospital services and patient safety, particularly regarding hazardous and toxic materials management (Kementerian Kesehatan RI, 2024). Furthermore, meeting these standards supports the implementation of the Hospital Occupational Health and Safety Management System, which aims to minimize risks to health workers, patients, and the environment (Kementerian Kesehatan RI, 2016).

Based on this background, this study aims to analyze the implementation of facility and safety management for hazardous and toxic materials at Hospital X and to provide recommendations aligned with the identified problems. This is necessary not only because B3 management is closely related to occupational health and safety but also because suboptimal management affects the achievement of the Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), which emphasizes improving health and well-being, and SDG 12 (Responsible Consumption and Production), which promotes sustainable hazardous waste management. Strengthening B3 management is also expected to support accreditation compliance and improve the overall quality of health services provided to the community.

METHODS

This study used a descriptive observational design with a quantitative approach supported by

qualitative data. This approach was chosen to provide both a numerical overview of compliance levels and an in-depth understanding of the implementation of facility and safety management for hazardous and toxic materials at the hospital. The purpose of this research was to evaluate the level of compliance of each service unit with the Facility and Safety Management (MFK 5) standards for hazardous and toxic materials and to identify factors influencing their implementation, thereby enabling the formulation of appropriate recommendations for improvement.

The study was conducted from June to August 2025 at Hospital X and involved 15 service units as the study population. These units included nutrition, laboratory, inpatient, outpatient, radiology, hemodialysis, forensic, pharmacy, laundry, Occupational Health and Safety (OHS) & sanitation, medical rehabilitation, IPSRS, emergency department, central surgical unit, and Intensive Care Unit (ICU). All 15 service units were included as the total population (N=15), and informants were selected using purposive sampling based on their knowledge of and direct involvement in the implementation of facility and safety management for hazardous and toxic materials within their respective units.

Data collection techniques included passive participant observation, semi-structured interviews with relevant staff, and documentation in the form of notes and photographs from all 15 service units. The instruments used in this study were the standard element checklist for facility and safety management of hazardous and toxic materials, interview guidelines, field notes, and smartphones for voice recording and photography. Observations and interviews were conducted with reference to the standard elements set out in the Minister of Health Decree No. HK.01.07/MENKES/1596/2024. These standards include essential elements such as Material Safety Data Sheets (MSDS), inventory records, Standard Operating Procedures (SOPs), safe storage facilities, trained personnel, and emergency response equipment. The evaluation of hazardous and toxic material management in each service unit was based on these elements.

Quantitative analysis was performed by calculating the percentage of compliance with the facility and safety management standard elements for hazardous and toxic materials in each service unit. A service unit was considered compliant if it achieved a score of $\geq 80\%$ of the total standard elements, in accordance with the guidelines outlined in the Decree of the Director General of Health Services Number HK.02.02/D/43961/2024 concerning Guidelines for Hospital Accreditation Surveys (Dirjen Pelayanan Kesehatan, 2024).

Qualitative analysis was conducted through data reduction by sorting, summarizing, and aligning the information obtained with the study's focus. The

data were then presented in tables and narratives to facilitate interpretation and to understand their relationship with applicable standards. To ensure the accuracy and credibility of the data, triangulation of sources and methods was performed.

This research was conducted after obtaining ethical approval from the Research Ethics Commission of the Faculty of Dentistry, Airlangga University (Approval No. 0951/HRECC.FODM/IX/2025). Data collection was carried out after participants provided informed consent. The research overview was explained to all participants prior to obtaining their signatures on the consent form. The research team ensured participant protection and adhered to all required ethical guidelines.

RESULTS AND DISCUSSION

Overview of the Implementation of Facility and Safety Management for Hazardous and Toxic Materials at Hospital X

The hospital conducted an assessment to evaluate how well each service unit complied with B3 facility and safety management protocols by examining document availability, storage facilities, trained personnel, and supporting infrastructure. Before beginning observations, the researchers used a three-color classification system: red, yellow, and green to categorize the service units. The assessment results are presented in Table 1 below.

Table 1 presents the percentage of compliance with the standard elements of the Facility and Safety Management of Hazardous and Toxic Materials (MFK 5) at Hospital X. Based on Table 1, only 7 of the 15 service units met the required elements for the implementation of facility and safety management for hazardous and toxic materials. These compliant units include radiology, hemodialysis, pharmacy, laundry, OHS sanitation and cleaning services, the emergency department, the central surgical unit, and the ICU. Meanwhile, the units that did not meet the standards were the nutrition unit, laboratory, inpatient unit, outpatient unit, forensic unit, medical rehabilitation unit, and IPSRS.

The lowest compliance rates were found in the medical rehabilitation and IPSRS units (34.78%), while the highest compliance rates were found in the hemodialysis, pharmacy, laundry, and sanitation and cleaning service units. When categorized based on hazard risk mapping, 3 out of 8 red-category service units and 4 out of 6 yellow-category service units still did not meet the standards. Additionally, observations conducted in each unit revealed the following:

a. Units with Low Compliance (<60%)

1. Medical Rehabilitation (34.78%) and IPSRS (34.78%): no material inventories, MSDS, SOPs, or standard storage facilities were available. Officers also perceived the

materials used as “harmless,” resulting in low prioritization.

2. Nutrition Installation (39.13%): disinfectants and cleaning materials were stored without labels, ordinary plastic cabinets were used for storage, and spill kits were unavailable.

b. Units with Moderate Compliance (60–79%)

1. Laboratory (65.21%): most chemicals lacked MSDS, storage was mixed, and fireproof cabinets were unavailable.
2. Inpatient (60.86%) and Outpatient (65.21%) Units: storage was makeshift, labeling was inconsistent, and inventories were not documented.
3. Forensic Facility (60.86%): formalin and tissue preservatives were found without risk labels; some bottles were left open without secure caps; no specific procedures for handling exposure were in place, posing long-term health risks for staff.

c. High Compliance Units (≥80%)

1. Radiology, CT Scan, MRI, Cath Lab, Ultrasound (87.50%): generally compliant, with dedicated B3 storage facilities (contrast media, developers, disinfectants), MSDS availability, and staff who had received basic training. However, gaps remained in relabeling chemicals transferred to secondary containers and in detailed radioactive spill response procedures.
2. Hemodialysis, Pharmacy, Laundry, OHS Sanitation (95.65%): SOPs were available, inventory was well-organized, MSDS were complete, storage facilities met standards, and personnel received regular training.
3. Emergency Department (ED), Central Surgery, ICU (91.30%): generally compliant, though deficiencies persisted in labeling and eyewash availability.

Overall, most service units at Hospital X did not meet the standard elements required for the implementation of facility and safety management of hazardous and toxic materials, as stipulated in the Decree of the Minister of Health of the Republic of Indonesia No. HK.01.07/MENKES/1596/2024 concerning Hospital Accreditation Standards (Kementerian Kesehatan RI, 2024). Based on the evaluation results, only 7 out of 15 service units (46.7%) met the standard elements, indicating that more than half failed to comply with the required standards.

These findings are consistent with research by Endistasari et al. (2019), which reported that hospitals had not reached 80% readiness for accreditation, largely due to incomplete documentation related to B3 management. Additionally, this study aligns with research by Syamsiah et al. (2024), which explained that non-compliance is influenced by several factors,

including inadequate supporting facilities and the absence of routine evaluations.

Factors Affecting the Implementation of Facility and Safety Management for Hazardous and Toxic Materials at Hospital X

The research findings from observations and interview data show several elements that influence non-compliance with hazardous and toxic materials management standards in hospital service units. These factors include facilities and infrastructure, documentation and procedures, human resources, management, systems, and material-related issues. The identified factors serve as the basis for developing appropriate recommendations.

a. Facilities and Infrastructure

The study found that the Nutrition Unit, IPSRS, and Medical Rehabilitation Unit use plastic storage cabinets and lack essential safety equipment such as eyewash stations and spill kits. The limited facilities in these units fail to meet B3 management standards, increasing the risk of exposure and fire hazards. These findings align with Haryandi et al. (2024), who reported that effective B3 management requires adequate facilities and infrastructure as core safety components. Many institutions establish facilities based on operational needs rather than compliance with standards, often due to financial constraints. Hospitals with sufficient financial resources tend to achieve better compliance with routine maintenance programs (Rahim et al., 2023). Limited funding hinders organizations from providing adequate facilities and infrastructure, reducing their ability to meet B3 management requirements.

b. Documents and Procedures

The Nutrition Unit, Laboratory, and IPSRS did not meet document requirements for Standard Operating Procedures (SOPs) and Material Safety Data Sheets (MSDS). Officers in these units are exposed to risks due to inadequate training and the absence of clear procedures for handling hazardous and toxic materials. Haryandi et al. (2024) found that SOPs often become accessible only during accreditation assessments. According to the Minister of Health Regulation No. 18 of 2020 on Medical Waste Management in Regional Health Service Facilities, SOPs are essential for preventing and controlling workplace accidents. The regulation requires that MSDS and hazard labels be available to enable staff to classify hazardous materials safely and independently. Continuous internal and external monitoring is necessary to ensure that all B3 materials have corresponding SOPs and MSDS (Anggraini et al., 2024; Nawawi et al., 2023).

Table 1. Percentage of Implementation of Facility and Safety Management for Hazardous and Toxic Materials at Hospital X

No	Unit	Percentage of Compliance (%)	Status	Risk Mapping	Recommendation
1	Nutrition Unit	39,13	Not Compliant	Red	Provide MSDS, standard chemical storage cabinets, and proper labeling for disinfectants and cleaning agents.
2	Laboratory Unit	65,21	Not Compliant	Red	Complete MSDS for all chemicals, separate storage by hazard class, and ensure fireproof cabinets are available.
3	Inpatient Unit	60.86	Not Compliant	Yellow	Improve labeling and documentation of B3 inventory; provide spill kits and safety instructions.
4	Outpatient Unit	65.21	Not Compliant	Yellow	Standardize chemical labeling, improve storage areas, and train staff on B3 handling procedure.
5	Radiology, CT Scan, MRI, Cath Lab, Ultrasound	87.50	Compliant	Green	Maintain documentation; update labeling on secondary containers and ensure radioactive spill procedures are available.
6	Hemodialysis	95.65	Compliant	Red	Continue regular training; review chemical segregation practices and waste recording.
7	Forensic Facility	60.86	Not Compliant	Yellow	Ensure formalin and preservative labeling; use sealed containers and develop SOPs for chemical exposure response.
8	Pharmacy	95.65	Compliant	Red	Maintain MSDS completeness; ensure regular inspection and refresh staff training.
9	Laundry	95.65	Compliant	Red	Continue good storage practices; ensure ventilation and chemical separation remain compliant.
10	OHS Sanitation and Cleaning Service	95.65	Compliant	Red	Maintain documentation; conduct routine audits on cleaning chemical usage and safety compliance.
11	Medical Rehabilitation and Medical Rehabilitation Workshop	34.78	Not Compliant	Yellow	The organization needs to create Standard Operating Procedures (SOPs) for material handling while providing Material Safety Data Sheets (MSDS) to train staff members about hazardous substance recognition.
12	IPSRS (Generator Room, Hydrant Room, Transformer Room, Workshop)	34.78	Not Compliant	Red	The organization needs to maintain inventory records while using correct labeling methods and following all safety guidelines for material storage.
13	Emergency Room Installation	91.30	Compliant	Yellow	Add eyewash stations and update safety signage; conduct refresher training on chemical emergency response.
14	Central Surgery Installation	91.30	Compliant	Red	Maintain compliance; ensure periodic checks of chemical storage and emergency equipment.
15	ICU	91.30	Compliant	Yellow	Maintain labeling consistency; verify emergency facilities such as eyewash stations are functional.

c. Human Resources

The Occupational Health and Safety (OHS) team at Hospital X operates independently from the human resources department, creating capacity limitations. The study found that staff lacked training in hazardous materials management, and no personnel were specifically responsible for B3 control in high-risk service areas. The absence of dedicated training programs resulted in knowledge gaps among staff, leading to unsafe handling practices and incomplete inventory records. Reassigning staff without proper handover procedures further widens knowledge gaps and disrupts continuity of operations (Fauziah et al., 2025). These results are consistent with previous findings that staff competencies significantly influence compliance (Anggraini et al., 2024; Munandar & Situmorang, 2025).

d. Management

Hospital management plays a central role in policy development and resource allocation to fulfill Facility and Safety Management requirements (Lestantyo, 2023). However, the findings show that Hospital X's management demonstrates minimal commitment to monitoring, evaluation, and budget allocation. Unit heads reported that B3 management policies rarely receive attention from hospital leadership, and no established framework exists to address these issues. Inadequate oversight by the Health Office enables unsafe work practices to persist (Deviani et al., 2024). Research also shows that hospital management often responds to staff requests without assessing compliance with standards (Haryandi et al., 2024).

e. System

Hospital X lacks an integrated system for tracking hazardous and toxic materials. Each unit maintains its own records using manual systems with separate documentation processes. This fragmented approach slows monitoring efforts and makes it difficult for staff to track material usage. It also hinders coordination and prevents the OHS team from receiving accurate reports. An integrated system is essential for effective risk identification (Munandar & Situmorang, 2025). Digital systems can improve compliance by 20–30% (Sinar et al., 2022) and facilitate coordination across units in managing hazardous materials (Wahyono, 2024; Wulandari, 2023).

f. Material

The inventory and labeling of hazardous materials at Hospital X were inconsistent and incomplete. The nutrition, inpatient, and forensic departments stored expired materials without identification labels. The presence of expired and unidentified substances creates significant risks due to potential chemical reactions and staff exposure. Proper documentation enables staff to

understand material hazards (Tyas & Pujilestari, 2024). The Globally Harmonized System (GHS) provides clear, visual labeling for effective hazard communication (Sardi, 2018). Poor labeling and documentation practices at Hospital X demonstrate insufficient internal oversight by management and the OHS team.

Service units with high compliance—such as hemodialysis, pharmacy, laundry, and sanitation services—performed well across all six evaluation factors. These units had adequate facilities, complete documentation, trained staff, supportive management, systematic inventory processes, and proper material identification. In contrast, the medical rehabilitation and IPSRS units performed poorly across all evaluation factors. The varying performance among units indicates the need for additional resources to enhance overall compliance.

The findings of this study are specific to Hospital X, as data collection was limited to a single healthcare facility. The reliance on interviews and observations introduces potential biases based on personal perspectives. Additionally, the use of univariate analysis at a single time point limits the ability to observe changes over time. Future research should involve multiple hospitals and employ longitudinal designs to better explore influencing factors and track improvements.

Recommendations

The research findings revealed six essential elements that influence hazardous and toxic materials management at Hospital X, indicating that improvement efforts should focus on these six components. The proposed initiatives are divided into two time-based categories: immediate actions and future-oriented strategies. The hospital should implement short-term operational improvements to enhance service unit adherence to established standards, while the long-term strategy aims to develop a comprehensive system that supports sustainable hazardous and toxic materials safety and facility management.

In the short term, the hospital needs to strengthen operational aspects by providing infrastructure that meets safety requirements. This includes installing dedicated storage cabinets for hazardous and toxic substances, eyewash stations, spill kits, and standardized chemical labels. Service units must also have access to Standard Operating Procedures (SOPs) and Material Safety Data Sheets (MSDS) for hazardous and toxic materials to maintain safety standards. The hospital should conduct regular training sessions on hazardous and toxic materials management for all staff members to enhance their competence. Periodic inventory checks of hazardous materials (B3) should also be conducted as a risk control measure to prevent unsafe handling.

For the long term, the hospital should develop a comprehensive digital framework to support efficient and secure management of hazardous and toxic materials and safety protocols. The hospital management team must strengthen their commitment by developing clear written policies, providing sufficient funding, and implementing continuous evaluation programs. An integrated system for tracking hazardous material inventories and incident reporting is needed to improve coordination across service units. Sustainability of the program can be ensured through internal hospital audits that generate annual reports on OHS management, including facility and safety management for hazardous and toxic materials. Additionally, the hospital must foster a culture of safety supported by all staff members. Establishing an Occupational Health and Safety (OHS) award program may encourage service units to maintain high compliance with OHS standards.

The research design employed a combination of quantitative analysis and qualitative methods to achieve its results. This approach provided Hospital X with an in-depth understanding of its current facility and safety management practices for hazardous and toxic materials. The researchers assessed all service units, allowing comparison of compliance levels across the hospital. However, the study has limitations: it was conducted in only one hospital, limiting its generalizability to other healthcare facilities. Data collection through observations and interviews may introduce bias if the information obtained is incomplete or overly subjective. Furthermore, because the study did not use a longitudinal design, changes in compliance over time could not be assessed.

CONCLUSION

Based on this study, it can be concluded that only 7 service units (46.7%) met the standards for the facility and safety management of hazardous and toxic materials at Hospital X. Six factors contributed to this level of compliance: limited facilities and infrastructure, incomplete documents and procedures, low human resource competency, lack of management support, the absence of an integrated B3 inventory system, and material management practices that did not meet standards.

Therefore, the recommended improvements include providing facilities that meet safety standards, ensuring the availability of Standard Operating Procedures (SOPs) and Material Safety Data Sheets (MSDS), delivering regular training and simulation activities, strengthening management commitment, developing an integrated B3 inventory system, conducting continuous evaluations, and fostering a safety culture—such as by giving awards to units that consistently meet these standards.

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Conflict of Interest and Funding Disclosure

"None."

Author Contributions

MSKH: conceptualization, investigation, methodology, supervision, writing–review and editing; RBBEK: methodology; formal analysis, writing–original draft; and AWS: writing–original draft, writing–review and editing.

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