



# Environmental Management System for Solid Medical Waste Management In Pariaman City Hospital

Raidhatul Fiqra<sup>1\*</sup>, Yudi Antomi<sup>1</sup>

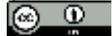
<sup>1</sup>Program Pascasarjana Ilmu Lingkungan, Universitas Negeri Padang, Kota Padang, Indonesia

Received: August 11, 2023  
Revised: October 10, 2023  
Accepted: October 25, 2023  
Published: October 31, 2023

Corresponding Author:  
Raidhatul Fiqra  
[raidhatulfiqra1@gmail.com](mailto:raidhatulfiqra1@gmail.com)

DOI: [10.29303/jppipa.v9i10.4954](https://doi.org/10.29303/jppipa.v9i10.4954)

© 2023 The Authors. This open access article is distributed under a (CC-BY License)



**Abstract:** This study aims to ensure the conformity of medical waste management with the Government Regulation of the Republic of Indonesia Number 7 of 2019 and to determine the implementation process of solid medical waste management of hospitals in Pariaman City, as well as to determine the value of environmental performance based on ISO14001. This research is descriptive qualitative research conducted in February - March 2022 at a hospital in Pariaman City. Sample collection techniques through interviews, filling out environmental performance assessment sheets based on ISO 14001, and documentation. The interview is conducted using a list of questions that have been prepared in advance. Next, descriptive statistical analysis was carried out. The results of this study are The process of solid medical waste management of hospitals in Pariaman City has referred to the Government Regulation of the Republic of Indonesia Number 7 of 2019, although the results are not all appropriate.

**Keywords:** Environmental Management System; Environmental performance; ISO 14001; Solid medical waste; Waste management

## Introduction

Increasing demand for medical services, single-use protective products (masks, gloves, goggles, isolation suits and protective clothing) are being consumed rapidly, leading to a global explosion in medical waste production (Domingo et al., 2020). Hospital data services will certainly produce medical waste which is one type of Hazardous and Toxic Material (B3) waste (Wu et al., 2020). Medical waste is defined as waste generated in the diagnosis, treatment, and immunization of humans and animals, as well as related research, biological production, and testing (Mahyari et al., 2022). Medical waste produced by hospitals (RS) includes radioactive waste, infectious waste, pathology and anatomy, cytotoxin waste, chemical and pharmaceutical waste (Minister of Health Regulation 7 of 2019 concerning Hospital Environmental Health). So trash cans containing this waste must be collected as soon as possible to minimize negative impacts on the environment and human life (Piccoli et al., 2020). The

medical waste management system in Indonesia is regulated based on Minister of Health Regulation no. 7 of 2019 concerning rules and procedures for managing medical waste in hospitals (Van Demark et al., 2018). B3 waste management is one of the most serious problems in health facilities because medical waste, especially infectious waste, is very potential in transmitting infectious diseases either through direct or indirect contact with environmental media. Therefore, medical waste should not be disposed of directly into environmental media without being treated first. Every hospital must have a comprehensive waste management strategy that takes into account the principles that have been regulated. Regulations that regulate include Permenkes RI Number 7 of 2019 concerning environmental health requirements, one of which mentions hospital management. ISO 14001 is an international standard for Environmental Management Systems (QMS). In the application of ISO 14001, it must be able to identify environmental aspects and impacts

### How to Cite:

Fiqra, R., & Antomi, Y. (2023). Environmental Management System for Solid Medical Waste Management In Pariaman City Hospital. *Jurnal Penelitian Pendidikan IPA*, 9(10), 8852–8863. <https://doi.org/10.29303/jppipa.v9i10.4954>

caused by activities on aspects of the surrounding environment.

An environmental management system is a coordinated effort to integrate "environmental protection" into an organization (Isroqunnajah et al., 2022). Environmental protection measures are designed to persist despite personnel changes. Environmental management systems should be reviewed periodically to help ensure compliance and to monitor continuous improvement (Hasan 2016); Wardah & Astini 2018). The implementation of SML will reduce environmental pollution (Risnawati et al., 2015), process efficiency will increase (Muktiono & Soediantono, 2022), management performance will be better (Kurnianto, 2019), and consumer satisfaction will increase (Kurnianto, 2019). The advantage of implementing ISO 14001-based SML will be easier in compiling a system because there are international guidelines (Mirnawati & Aisyah, 2018).

Data from hospitals in the United States produces more than 4 billion tons of waste every year (6,600 tons per day). Approximately 70% of this amount is generated from operating rooms and delivery rooms (Delmonico et al., 2018). There are problems that occurs at Pariaman City Hospital is that environmental management has not been optimally implemented to manage solid medical waste safely and sustainably. Sorting and storage of solid medical waste has been carried out, but it is not fully by following per under with its type, for example, hazardous medical waste, sharp waste, or non-hazardous waste is still mixed. Storage of solid medical waste has been carried out but the closure process has not been maximized, even though this is very important to prevent contamination and the spread of disease.

The process of transporting and handling solid medical waste at Pariaman City Hospital has been carried out well, although some are not suitable, such as officers who do not use masks and gloves or use special equipment by following per under the Minister of Health Regulation Number 7 of 2019. Furthermore, if based on ISO 14001 on environmental management, the Hospital already has environmental policies that meet the standards but not all are implemented. Previous research conducted by Raidhatul Fiqr (2018) at 'Aisyiyah Pariaman Hospital in 2018 revealed that more than half of health workers' knowledge is low (60.9%), more than half of health workers' attitudes are negative (67.4%) and more than half of health workers' actions are poor (60.9%) in solid medical waste management. So it can be assumed that SML in one of the private hospitals in Pariaman City has run SML by following per under Minister of Health Regulation Number 7 of 2019 and ISO 14001, but is constrained by the knowledge and attitude of officers about hospital waste management.

The results of research conducted by (Adrian et al., 2016) revealed that the successful implementation of medical waste management should be carried out in collaboration with third parties. (Amelia et al., 2020) also revealed that for the implementation of management to run well, standard operating procedures are needed on how to manage waste at source, training on waste sorting techniques according to their type and management of operating permits for the use of incinerators. Research conducted by (Yulinto et al., 2017) concluded that the poor management system of Hospital waste management is due to inadequate human resources in the Hospital, adequate facilities and infrastructure, funds have been allocated well, at the sorting stage there is still mixing of medical and non-medical waste, at the collection stage it is according to standards, at the shelter stage it is according to standards, At the stage of transportation it is up to standard, and at the stage of destruction it is not up to standard. (Utami, 2016) also revealed that the hospital's environmental management is not good because of the hospital's lack of commitment to implementing a good waste management system, including supporting facilities in the form of trolleys, waste storage container tubs, personal protective equipment for cleaning service officers, and immunization for solid medical waste management officers that have never been given.

Furthermore, (Chrisyanti & Suryono, 2018) that will affect the environmental performance of the Hospital is to make a clear transportation schedule with third parties, and clarify the dirty path marks for waste transportation to the TPS. (Rahno et al., 2015); (Syarifuddin, 2019) revealed that the obstacles faced in implementing the environmental management system are the lack of management support in the form of inadequate availability of regulations/policies, SOPs, budgets, and facilities/equipment. The number of sanitarians is sufficient, but there is no clear division of tasks. Puskesmas Borong has not carried out solid medical waste management according to the provisions, such as sorting, collection/storage, transportation, destruction and final disposal. Furthermore, (Mianna & Fitri, 2019) revealed that hospitals can make standard operating procedures in solid medical waste management to trigger standard rules set for the creation of a healthy and safe hospital environment.

Management of solid medical waste in hospitals is a critical issue related to environmental and public health aspects. The importance of QMS implementation to manage solid medical waste in hospitals has been increasingly emphasized as one of the holistic and sustainable approaches. However, at present, there are still several some many research gaps that need to be explored to understand more deeply the potential and challenges in the application of SML for solid medical

waste management in hospitals, especially in the context of modern hospitals. This research will explore the level of readiness of hospitals in implementing SML for solid medical waste management.

The study also identified how regulations and policies related to solid medical waste management affect the implementation of SML in hospitals. Studies will explore barriers and opportunities arising from existing legal frameworks, as well as understand the role of government in driving the effective implementation of QMS. Furthermore, this study conducted a comparative study between hospitals with various levels of solid medical waste management. Through an in-depth exploration of the research gaps above, it is hoped that this research will provide a more comprehensive insight into the potential and challenges in implementing Environmental Management Systems in solid medical waste management in hospitals. The results of this research are expected to be the basis for decision making, policy development, and sustainable efforts in maintaining environmental sustainability and public health in the future.

This research is important because solid medical waste can contain dangerous materials, such as syringes, chemicals, expired medicines, and organic medicine. If not managed properly, this waste can become a source of disease spread that endangers public health. Research in solid medical waste management aims to reduce the risk of disease transmission and protect public health (Dewi et al., 2022) (Mihai, 2020). Solid medical waste that is not managed properly can pollute the environment. This includes land, air and air pollution. Hazardous chemicals in medical waste can damage air sources, damage ecosystems, and disturb wildlife, creating biological and chemical risks such as infection by contaminated materials, disease epidemics, and chemical and radioactive poisoning (Wu et al., 2020).

Problems regarding medical waste include waste produced in large quantities being thrown away carelessly which pollutes the environment. Wrong waste management practices can increase the risk of contamination from certain diseases which pollute the environment in developing countries, among the urban poor living in informal settlements or pollute clean water sources, sanitation, and even pollute the rural environment (Laelasari, 2021). So environmental management helps develop more environmentally friendly waste management methods.

Many countries have regulated solid medical waste management to protect the environment and public health. Research in environmental management systems helps healthcare facilities and related parties to understand these regulations, comply with waste management standards, and avoid potential legal

sanctions or fines (Afifa & Adisasmito, 2021). This research can help identify management methods that are more efficient and economically sustainable. This can help healthcare facilities to reduce solid medical waste management costs and allocate resources better.

Research can encourage the development of innovation and new technology in managing solid medical waste. With appropriate technological developments, solid medical waste can be processed and recycled more efficiently, reducing environmental impact and reducing dependence on unsustainable waste disposal. Research in this field can also help in education and awareness of the public and medical personnel about the importance of safe and responsible management of solid medical waste.

Research on Environmental Management Systems for Solid Medical Waste Management is very important because it involves factors of public health, environmental desires, regulations, efficiency, innovation, education, and awareness. With robust research in this area, we can reduce the negative impact of solid medical waste on the environment and society and promote safer and more responsible management of solid medical waste.

## Method

The type of research used in research is qualitative research using a descriptive approach. Qualitative research to obtain an overview of the environmental management system on solid medical waste management of the Hospital in Pariaman City. Qualitative research in this study is expected to uncover, describe and understand the phenomena that occur in the background and object of research in connection with the environmental management system. Furthermore, the approach used in this study is a descriptive approach (Creswell & Creswell 2018). This research was conducted in February - March 2022 at two hospitals in Pariaman City, namely Government Hospitals and Private Hospitals.

The data used in this study are secondary data and primary data. Secondary data is data obtained from installations related to medical waste management which includes: hospital profiles, human resource data handling medical waste management, methods used in medical waste management, and reports or documentary evidence in medical waste management. Primary Data is a form of primary data collection in this study by observation, interview and documentation. Field observations were obtained by filling in a checklist that has been prepared about the management implementation process carried out from the sorting and processing process, transportation and storage to the

processing process carried out by following per under the Regulation of the Minister of Health of the Republic of Indonesia Number 7 of 2019 concerning Hospital Environmental Health. The performance of the environmental management system is carried out by checking the elements of the environmental management system. This checklist was adapted from the Global Environmental Management Initiative (GEMI) (Wicaksana & Hatini 2014). Each principle has one or more questions, which are made in such a way as to correspond to the actual circumstances. There are 5 principles and 17 elements in ISO 14001 and generate 31 questions.

To validity of the data in this study, researchers used the source triangulation technique. What is meant by the source triangulation technique is to compare by checking back the degree of confidence of information obtained through different times and tools in qualitative methods (Barlian, 2020). This triangulation technique can be achieved: (a) Comparing observational data with

interview results. (b) Comparing what people say in general.

## Result and Discussion

### Result

This study is to analyze the solid medical waste management of Pariaman City Hospital in by following per under policy, namely Permenkes No. 7 of 2019. This study is also to analyze the implementation process of solid medical waste management of Pariaman City Hospital. Furthermore, this study is to determine the value of environmental performance based on the solid medical waste management process in accordance with the environmental management system, namely ISO 14001. The suitability of solid medical waste management of Hospitals in Pariaman City is presented in Table 1.

**Table 1.** Conformity of Hospital Waste Management in Pariaman City with Permenkes No. 7 Year 2019

Management stage	Government	Private
Hospital Policy	In accordance with Permenkes No. 7 Year 2019	In accordance with Permenkes No. 7 Year 2019
Collection	Already in accordance with Permenkes No. 7 Year 2019	Already in accordance with Permenkes No. 7 Year 2019
Storage	Has been in accordance with Permenkes No. 7 Year 2019	Has been in accordance with Permenkes No. 7 Year 2019
Transportation	Has been in accordance with Permenkes No. 7 Year 2019	Has been in accordance with Permenkes No. 7 Year 2019
Disposal	Has been in accordance with Permenkes No. 7 Year 2019	Has been in accordance with Permenkes No. 7 Year 2019

Furthermore, the solid waste management process of hospitals in Pariaman City is presented in Table 2.

**Table 2.** Solid Medical Waste Management Process of Hospitals in Pariaman City

Management stages	Government	Private
Hospital Policy	Government hospitals have an SOP for solid medical waste management based on Permenkes no 7 of 2019 concerning Hospital Environmental Health Requirements. There has been no update of the SOP in requirements. The policy has been socialized to all medical personnel and workers in the Hospital who are in direct contact with solid medical waste.	Private hospitals have an SPO for solid medical waste management based on Permenkes no 7 of 2019 concerning Hospital Environmental Health Requirements. There has been no update of the SOP in requirements. The policy has been socialized to all health workers who are in direct contact with solid medical waste.
Collection	The collection is carried out by CS officers on duty in each room. Collection is done when the waste container is 2/3 full. There is still mixing of medical waste with non-medical waste in medical waste containers. Transportation of medical waste with a closed trolley to the Waste TPS.	The collection is carried out by cleaning service officers who will transport waste to the hospital's TPS. Non-medical waste is still found to be included in medical waste. And the transportation is done with an open trolley.

Management stages	Government	Private
Storage	There is already a licensed B3 Waste TPS building and cold storage that can store waste for 90 days at 00C.	The storage of B3 waste production volume in the B3 Waste TPS has the potential to cause disease transmission due to the accumulation of more than 2 days and then transported by a third party for destruction. Freezer with a temperature of 80C with inadequate storage capacity because there is still solid medical waste outside the freezer.
Transportation	On-site transportation uses a trolley/solo that is closed and separated between medical and non-medical waste twice a day. Off-site then B3 waste is transported using a truck that has a hazard symbol on the truck container, which is transported once a month.	The transportation of medical waste still uses an open trolley which is transported by CS officers to the B3 Waste TPS, transportation is carried out twice a day. and then B3 waste is transported using a truck by a third party periodically twice a week.
Destruction	Has collaborated with PT Tenang Jaya Sejahtera for final processing.	Has collaborated with PT Andalas Bumi Lestari and PT Artama Sentosa Indonesia for the final treatment of hazardous waste.

The performance assessment of solid medical waste management of hospitals in Pariaman City based on the ISO 14001 environmental management system is presented in Table 3.

**Table 3.** Results of Environmental Performance Assessment Based on Environmental Management System

Environmental Management System Indicators	Total Score	
	Government Hospital	Private Hospital
Environmental Policy	13	9
Planning	9	5
Implementation and Operation	16	14
Inspection	7	7
Management Review	2	2

requirements of the standard. The policy takes into account most aspects of the environment well, both inside and outside the organization. For Planning Principles, Government Hospitals are 9 while Private Hospitals are 5. It explains that most (if not all), of the procedures needed exist to identify activities, and products on environmental impacts and to keep up to date on regulatory changes. Measurable targets and objectives have been set at most (if not all) appropriate levels of the organization; Existing program efforts to ensure their achievement.

On the other hand, if it is clear, the documentation of targets and objectives has not been established based on a sufficiently complete identification of all aspects of the business environment, environmental program efforts may overlook certain key issues of concern. Furthermore, the Principle of Application and Operation of Government Hospitals is 15 while Private Hospitals are 14. It explains that many procedures for achieving policy objectives and targets are already in place, but they may not cover emergencies situations. Responsibility and accountability for implementation have been established for the most part, but not all required resources are in place.

Furthermore, the principle of examination of Government Hospitals is 7 while private hospitals are 7. This explains that this organization has established many of the measurement and evaluation procedures required by the standard and may have some essential elements to deal with nonconformity situations. Some important records are organized, and an SML audit is possible. However, many improvements are still needed to conform to the standard. And finally for the Management Review Principle of Government Hospitals and Private Hospitals is 2. This explains that the organization always conducts periodic Environmental System management reviews and there



**Figure 1.** Interviews with respondents in government hospitals and private hospitals

Based on the results of interviews and observations using checklists, the total score generated for Policy Principles and Commitment of Government Hospitals is 13 while Private Hospitals are 9. It explains that top management has established and complied with environmental policies that meet most of the

is documentation regarding top management reviews carried out as evidence that the organization periodically conducts management reviews.

### Discussion

That according to the Regulation of the Minister of Health of the Republic of Indonesia Number: 7 of 2019 concerning Hospital Environmental Health Requirements. The scope of environmental maintenance actions in accordance with this regulation includes: (1) Maintenance of hospital buildings and grounds; (2) Food and drink sanitation hygiene; (3) Monitoring water quality; (4) Waste management; (5) Maintenance of linen washing facilities (laundry); (6) Control of insects, mice and nuisance animals; (7) Decontamination process through sterilization and disinfection; (8) Monitoring the impact of radiation. All of these actions aim to keep the hospital environment healthy and safe for patients, staff and the surrounding community.

### *Compatibility of Solid Medical Waste Management in Pariaman City with Minister of Health Regulation No. 7 of 2019*

#### *Solid Medical Waste Management Policy in Pariaman City*

Policies on solid medical waste management in the form of SPO have been disseminated to workers in Government and Private Hospitals directly related to solid medical waste. Socialization is needed so that solid medical waste management activities are carried out properly and sustainably. To reduce the risk of health problems for hospital workers, the community around the hospital, and the environment.



**Figure 2.** Solid Waste Container

Plans for all activities at the sorting and collection stage have been included in the RAT (Annual Budget Activity Plan) which has been planned from the beginning of each year. Assessment of organization, Pariaman City Hospital has compiled organizational structure and distribution of duties and officers have special competencies. Assessment of implementation,

Pariaman City Hospital officers have carried out according to the planned SOP and sorting activities are on schedule. Assessing supervision, Pariaman City Hospital has been made supervision of solid medical waste management.

In hospitals in Pariaman City, waste management policies have been guided by Minister of Health Regulation No. 7 of 2019, namely The process of sorting and reducing waste should be a continuous process whose implementation must consider the smooth handling and collection of waste, volume reduction by separating B3 and non-B3 waste treatment and avoiding the use of B3 chemicals, packaging and clear labeling of various types of waste for cost efficiency, clerk and disposal. In medical waste management, it is required to sort according to waste and store it in plastic bags that vary according to the characteristics or type of waste. Common waste is put into black plastic and infectious waste is into yellow plastic bags. In addition, hospitals are required to have a temporary storage area for their waste by following per under the requirements stipulated in Permenkes RI No. 07 of 2019. The requirements for a good waste container according to Permenkes RI No.07 of 2019 are qualified if the trash can is leak-proof and puncture-proof, has a lid and is not opened by people, solid medical waste to be used must go through sterilization, medical waste containers using labels (color of plastic containers), highly infectious waste using yellow, and infectious waste, Pathology and anatomy use yellow.

#### *Solid Medical Waste Stacking in Hospitals in Pariaman City*

A medical waste container is a type of waste container that is available and used as a place to dispose of waste, both medical and non-medical waste, which has criteria so that it is suitable for use as a container for medical and non-medical waste (Pyopyash et al., 2019). Based on the results of the study that solid medical waste containers in hospitals in Pariaman City which are in each room, the form of the container is by following per under Permenkes RI No.07 of 2019 concerning health requirements, namely the waste container used is made of plastic material that is not easy to leak, watertight, light enough to have a cover that is easy to open with the consideration that it is easy to clean and the trash can in each hospital room is distinguished between medical and non-medical waste which is equipped with plastic bags according to the characteristics of the type of waste. The containers used by each hospital in Pariaman City are containers that pay attention to feasibility or meet health requirements with the consideration that these containers are by following per under national health standards set out in Permenkes RI No. 07 of 2019 and refer to WHO standards.



Figure 3. B3 Waste Cart

The results of the study are in line with the guidelines from Permenkes RI No. 07 of 2019, Requirements and technical guidelines for hospital environmental health procedures, where the requirements for containers are as follows: made of materials that are not easy to leak, watertight, rustproof, not easy to puncture, light enough and smooth surface inside the waste container. Has a cover that is easy to open and close again without dirtying hands. Each room in the hospital must have at least one waste container for each room. Each waste collection point must be equipped or coated with plastic so that it is easy to lift, fill, empty and clean. The criteria for the type of plastic used according to the waste are as follows: infectious waste (yellow plastic bags) and non-infectious and general waste (black plastic bags).

#### *Transportation of Solid Medical Waste in Hospitals in Pariaman City*

The results revealed that the process of transporting solid medical waste has referred to Permenkes RI Number 7 of 2019. The transportation process of hospitals in Pariaman City is carried out in the morning between 10.00-11.00 WIB and the waste transportation route does not go through public routes so as not to interfere with hospital activities. Transportation of solid medical waste is carried out using a closed trolley and then transported to a temporary shelter (TPS) behind the hospital. The results of the study are in line with Permenkes RI No. 07 of 2019, namely the collection of solid medical waste from each waste-producing room using a special closed trolley and directly transported to a temporary shelter (TPS B3).

#### *Solid Medical Waste Collection in Hospitals in Pariaman City*

The results revealed that the collection of solid medical waste in Pariaman City Hospital already has a storage location for health service waste. Waste, whether in bags or containers, has been separated by area, room,

or building based on its size according to the quantity of waste generated and the frequency of collection. Unless a refrigerated room is used, the temporary side time for healthcare waste (e.g. waiting time between production and management) should not be excessive. Furthermore, the process of transportation and collection at the TPS has been carried out, the implementation is done every day, the bags are changed, the TPS is equipped with a cover, and the waste has been segregated.



Figure 4. TPS B3

The results of this study are in line with the process of collecting solid medical waste in a good hospital according to Permenkes RI No. 7 of 2019. Regarding the requirements and technical guidelines for hospital environmental health procedures, where the requirements for Temporary Shelters (TPS B3) are as follows: Waste storage is not permanent. Temporary Shelter (TPS B3) is equipped with a cover. Located in a location that is easily accessible by vehicles and emptied and cleaned. Based on Permenkes RI No.07 of 2019 concerning Hospital Environmental Health, solid medical waste in the infectious, pathological, sharp object category must be stored in TPS B3 with a temperature smaller than or equal to 0 ° C for up to 90 days or solid medical waste in the infectious, pathological, sharp object category must be stored in TPS B3 with a temperature of 3 ° C to 8 ° C for up to 7 days.

#### *Destruction and Final Disposal of Hospital Solid Medical Waste in Pariaman City*

Based on the results of research at the Hospital in Pariaman City, the process of destruction and final disposal of waste was found to be for ordinary waste directly disposed of to the Final Disposal Site (TPA) with the help of the City Sanitary Service car and for medical waste that the processing of medical solid waste carried out at the Hospital in Pariaman City still needs to be improved and refined. The process of burning solid,

infectious and hazardous medical waste in hospitals in Pariaman City is carried out by a third party.

Destruction and disposal of solid medical waste in a good hospital according to Permenkes RI No.07 of 2019 concerning requirements and technical guidelines for hospital environmental health procedures, where the requirements for the Final Disposal Site (TPA) are as follows: cytotoxic waste and pharmaceutical waste must be destroyed using an incinerator at a temperature above 100°C and general waste is disposed of in a place managed by the local government or other agencies by following per under applicable legislation.

*The implementation process of hospital solid medical waste management in Pariaman City.*

*Solid Medical Waste Collection at Pariaman City Hospital*

Waste collection carried out by public and private hospitals is still found to be mixed with non-medical waste due to solid medical and non-medical waste containers being positioned close together so that patient waiters and visitors in the inpatient room dispose of their waste without looking at the container label. Pariaman City Hospital also has a written policy regarding hospital waste management where the policy contains hospital responsibilities that are adjusted to the applicable rules and regulations, namely the Decree of the Indonesian Minister of Health No. 7 of 2019 concerning environmental health in hospitals which contains each container given a plastic bag according to the characteristics of medical waste.

According to Pyopyash et al. (2019) containerization should be done by providing different packaging for each type of waste and not near non-medical containers for patients and visitors. Collection is done to prevent contamination of general waste by medical waste which has the potential to provide infectious diseases for workers who handle general waste. In addition, realizing the implementation of solid medical waste minimization at the source can reduce the waste generated by the hospital. Based on the Decree of the Indonesian Minister of Health no. 7 of 2019, the collection of solid medical waste from each waste-producing room must use a special closed trolley. This stage consists of a planning assessment, namely already sorting between medical waste and non-medical waste by separating plastic containers and colors, even medical waste is also sorted between sharps medical waste by placing it in a safety box.

*Storage of Solid Medical Waste in Pariaman City Hospital*

Storage of solid medical waste in public and private hospitals has been carried out and is guided by Permenkes RI No.7 of 2019 even though it has not been fully implemented. For temporary storage schedules, it is not by following per under existing policies, this is

because private hospitals only have freezers with a temperature of 80C with inadequate capacity with storage for 3 and/or 4 days in the B3 Waste TPS. TPS experiences accumulation and day discrepancies in the duration of storing medical cime. Whereas according to Permenkes RI No. 7 of 2019, medical waste in the infectious, pathological, sharps category must be stored in TPS with a temperature smaller than or equal to 00C for up to 90 days and/or with a temperature of 3 to 80C for up to 2 days.

*Transportation*

The process of transporting solid medical waste in government hospitals has been carried out based on Permenkes RI No. 7 of 2019, although it has not been fully carried out. This is because the transportation of waste using trolleys has not been separated between solid medical and non-medical waste to the B3 Waste TPS, and Private Hospitals still use open trolleys. Pariaman City Hospital has collaborated with vendors who have KLHK licenses for the transportation and destruction of medical waste. Based on the Decree of the Indonesian Minister of Health No. 7 of 2019, the transportation of solid medical waste must use a special closed trolley that must not be combined with non-medical and must be cleaned daily with disinfectant. The bags to be transported can be sealed by making knot ties. Sharps containers are put in yellow bags before being transported from the Hospital wards.



**Figure 5.** L3 Carrier Fleet

The requirements for the transportation of waste leaving the hospital TPS based on Permenkes RI No. 7 of 2019, namely (1) Bags of solid medical waste before being put into a vehicle must be placed in a strong and closed container or can be directly placed in a transport vehicle; (2) Officers who handle medical waste must use PPE consisting of: hats or helmets, masks, eye

protection, long clothes, industrial aprons, foot protectors or boots and special gloves; (3) Transportation must be accompanied by a medical waste handover form or manifest; (4) Using a special infectious waste transport vehicle that is closed and has a hazard symbol or infectious waste symbol on the outside of the vehicle or container.

#### *Destruction*

Destruction carried out by public and private hospitals is by following per under existing policies as seen from the cooperation agreement with a permit from the Ministry of Environment. Based on Permenkes RI No. 7 of 2019, hospitals that do not have incinerators must destroy solid medical waste through cooperation with third parties and carry out destruction at most once in 24 hours if stored at room temperature. At this stage Pariaman City Hospital collaborates with third parties. Government hospitals use 1 vendor, namely PT Tenang Jaya Sejahtera, while private hospitals use 2 vendors, namely PT Andalas Bumi Lestari and PT Artama Sentosa Indonesia as transporters. This collaboration already has SOPs and an MOU, as well as a special blank for monitoring that the transported waste has been treated and destroyed by the third party by providing evidence called manifests to the Pariaman City Hospital.

#### *Environmental Performance in Solid Medical Waste Management Based on Environmental Management System*

The results showed that the top management of hospitals in Pariaman City has a high commitment to the environment. Evidence of top management's commitment to the environment is the certification of the environmental management system. The hospital is determined to carry out environmentally sound business activities based on human potential, prevent pollution and environmental damage, and comply with legislation and other requirements to be accepted by stakeholders by continuously making continuous improvements through the implementation of an environmental management system.

Environmental management planning is by identifying environmental aspects and impacts in the company with an assessment according to their impact so that they are easily identified according to the impact that will be caused and prioritizing aspects that have a very polluting impact on the environment by forming a team with a special program and determining the goals and objectives of environmental programs that are evaluated in a year which does not rule out the possibility of being revised by following per under environmental conditions that are inseparable from the company's vision. The management of Government Hospitals and Private Hospitals have carried out environmentally sound business activities that are

always guided by and comply with laws and regulations and other applicable requirements and evaluate other regulations every year as evidenced by the existence of a permit to dispose of waste treatment results.

The results of research on the implementation and operation of environmental management systems in government hospitals and private hospitals have shown the existence of resources by appointing employees who have attended training and are responsible for reducing various kinds of activities that have an impact on the environment in their respective work areas. Regarding the competence, training and awareness of employees towards the environment where it is proven that training is carried out every year according to the needs desired by the company and ensuring employees shorts who do not attend training with jobs that have an impact on the environment, namely by conducting in house training so that they follow work instructions.

The results of the research, inspection and corrective actions of hospitals in Pariaman City have been carried out including monitoring and measurement carried out to evaluate goals and objectives and identify aspects related to waste management. Furthermore, the results of the research, and the management review of government hospitals and private hospitals have been carried out by holding meetings and agendas, namely audit results, compliance with regulations and requirements, communication from external parties, environmental performance, level of achievement of goals and objectives, status of corrective and preventive actions, follow-up with previous management reviews, changes in existing conditions, development of applicable regulations and requirements, proposed improvements, customer feedback, process and program suitability, recommendations for improvement to management and management reviews that can be revised if they are not relevant to the policy and by following per under company needs so that continuous conformity occurs.

From the results of the study if we look from the point of view of the health of both employees and the community where this environmental management system plays a role in balancing the process of activities carried out by the company with the environmental impact that will be generated so that it runs according to an ecosystem that does not harm the community such as water, air, soil pollution with identification and reporting carried out by the company so as not to harm the community to create a healthy community environment. The pollution that occurs can also cause various kinds of diseases that can adversely affect the company's image so that this environmental management system regulates the process of running the company's activities in the aspect of environmental pollution which automatically takes precautions so that

the impact on environmental pollution does not exceed the threshold that protects all aspects that include internal and external companies including employees which indirectly employees are well organized in various activities through the supervision of environmental supervisors which contribute to increasing employee productivity and being able to work neatly and awareness in maintaining an environment that creates a comfortable company atmosphere.

Beautiful and safe work environment because this system protects workers from environmental impacts caused by machines or things that have an impact on the environment that can harm employees such as noise, odors that can interfere with employees in the process of working and exposure to environmental pollution, This system protects workers from environmental impacts caused by machines or things that have an impact on the environment that can harm employees such as noise, unpleasant odors that can interfere with employees in the process of working and exposure to existing environmental impacts that can result in disruption of the health of workers, this environmental management system is a system that regulates the process of reducing pollution and environmental damage, reducing the use and disposal of hazardous waste, creating a healthy environment, workers who feel comfortable at work and saving resources.

Referring to the opinion (Adisasmito, 2017) regarding the Environmental Management System, solid medical waste management is important because medical waste that is not managed properly can pose health risks to hospital workers, patients and the general public. Therefore, hospitals must have strict medical waste management policies and ensure that their staff are trained to follow these procedures. Overall, the environmental management system in a hospital aims to plan, implement, achieve, assess and align environmental policies with the hospital's vision. It involves various components, such as management support, planning, implementation, inspection, action, human resources, money, machines, and methods. By implementing an effective environmental management system, hospitals can fulfill their environmental responsibilities, comply with regulations, and protect the environment and public health.

## Conclusion

Based on the research results, it was concluded that: (1) The policy on solid medical waste management is in the form of SPO which refers to Permenkes RI No. 7 of 2019 concerning environmental health requirements in hospitals. In the process of managing solid medical waste, hospitals in Pariaman City have referred to

Permenkes RI No. 7 of 2019 concerning environmental health requirements in hospitals, although the results are not all in accordance; (2) The solid medical waste management process at Pariaman City Hospital is in the collection process found solid medical waste mixed with non-medical waste. Pariaman City Hospital storage is by following per under existing policies with the existence of a cold storage policy and/or regular transportation of waste with vendors. Transportation of solid medical waste to TPS B3 Waste Private Hospitals still use open trolleys and Pariaman City Hospital does not have a special trolley for transporting medical waste. Destruction has been carried out properly in collaboration with several vendors who have complete licenses from the MOE; (3) The results of the analysis of the environmental management system for solid medical waste management in Pariaman City Hospital against the principles of SML can be seen as follows principles of Policy and Commitment. The score for this principle is 0 - 14. The total score generated for the Policy and Commitment principle of the Government Hospital is 13. While the Private Hospital is 9, the score for this principle is 0 - 10. The total score generated for the Planning principle for government hospitals is 9. While private hospitals are 5, implementation and Operation Principles. The score for this principle is 1 - 26. The total score generated for the Implementation and Operation principle for government hospitals is 16 while the private hospital is 14, the score for this principle is 1 - 10. The total score generated for the principles of Examination and Corrective Action of Government Hospitals and Private Hospitals is 7 and management Review Principle. Specific to the Management Review principle, in any case, an organization cannot substantially meet this requirement if it does not periodically review the previous principles on which the SML is based.

## Acknowledgments

Thank you for the guidance from the lecturers at Padang State University and the support for research data provided by research sources to researchers so that this journal can be completed well. Thank you also to friends, family and colleagues who were extraordinary in carrying out this research.

## Author Contributions

Raidhatul Fiqra: methodology, writing—original draft preparation, formal analysis, investigation, and visualization. Yudi Antomi: writing—review and editing, formal analysis, investigation, visualization, and editing.

## Funding

This research used the researcher's personal funds.

## Conflicts of interest

The authors declare no conflict of interest.

## References

- Adrian, A., Thamrin, T., & Copriady, J. (2016). Implementasi Manajemen Operasional Limbah Medis Padat Di Rumah Sakit Pt. Chevron Pacifik Indonesia. *Jurnal Ilmu Lingkungan*, 10(1), 87–97. <http://dx.doi.org/10.31258/jil.10.1.p.87-97>
- Afifa, T. D., & Adisasmito, W. B. B. (2021). Analisis Manajemen Risiko Penularan Virus COVID-19 Pada Dokter Dan Perawat Di Rumah Sakit X. *Jurnal Manajemen Dan Administrasi Rumah Sakit Indonesia (MARSI)*, 5(2), 164–172. <https://doi.org/10.52643/marsi.v5i2.1487>
- Amelia, A. R., Ismayanti, A., & Rusydi, A. R. (2020). Pengelolaan Limbah Medis Padat Di Rumah Sakit Umum Daerah Mamuju Provinsi Sulawesi Barat. *Window of Health. Jurnal Kesehatan*, 73–85. <http://dx.doi.org/10.33368/woh.v0i0.255>
- Barlian, E. (2020). *Metodologi Penelitian Kualitatif*. Sukabina Press.
- Chrisyanti, Y. T., & Suryono, H. (2018). Manajemen Pengelolaan Limbah Medis Padat Di Rumah Sakit Islam Surabaya Ahmad Yani Tahun 2018. *Gema Lingkungan Kesehatan*. 16(3). <https://doi.org/10.36568/kesling.v16i3.899>
- Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. In *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE Publications.
- Demark, R.E. Van (2018). Lean and Green Hand Surgery. *Journal of Hand Surgery*, 43(2), 179–181. <https://doi.org/10.1016/j.jhsa.2017.11.007>
- Delmonico, D. V. de G., Santos, H. H. dos, Pinheiro, M. A., de Castro, R., & de Souza, R. M. (2018). Waste management barriers in developing country hospitals: Case study and AHP analysis. *Waste Management & Research: The Journal for a Sustainable Circular Economy*, 36(1), 48–58. <https://doi.org/10.1177/0734242X17739972>
- Dewi, O., Sari, N. P., Raviola, R., Herniwanti, H., & Rany, N. (2022). Simulation Design of Dental Practice Medical Waste Management Using Dynamic System Model Approach. *Jurnal Penelitian Pendidikan IPA*, 8(5), 2483–2492. <https://doi.org/10.29303/jppipa.v8i5.2353>
- Domingo, J. L., Marquès, M., Mari, M., & Schuhmacher, M. (2020). Adverse health effects for populations living near waste incinerators with special attention to hazardous waste incinerators. A review of the scientific literature. *Environmental Research*, 187, 109631. <https://doi.org/10.1016/j.envres.2020.109631>
- Hasan, A. (2016). Green Management System. *Media Wisata. Jurnal Media Wisata*, 14(1). <https://doi.org/10.36276/mws.v14i1.233>
- Isroqunnajah, I., Mustikawan, A., & Rofiq, Z. (2022). Analisis sistem manajemen lingkungan UIN Malang menuju green campus: perspektif EMS ISO 14001. *Evaluasi: Jurnal Manajemen Pendidikan Islam*, 6(2), 221–239. <http://dx.doi.org/10.32478/evaluasi.v6i2.940>
- Kurnianto, A. (2019). Penerapan Sistem Manajemen Lingkungan ISO 14001: 2015 PT. "X." *Jurnal Sains & Teknologi Fakultas Teknik Universitas Darma Persada. Jurnal Sains dan Teknologi*. 9(2), 67–73. Retrieved from <https://unsada.ejournal.id/jst/article/view/70>
- Laelasari, E. (2021). Manajemen Pengelolaan Limbah Medis Rumah Tangga Era Pandemi Covid-19 Di Indonesia: Narrative Literature. *Prosiding Penelitian Pendidikan Dan Pengabdian 2021*, 1(1), 447–458. Retrieved from <http://prosiding.rcipublisher.org/index.php/prosiding/article/view/174>
- Mahyari, K. F., Sun, Q., Klemeš, J. J., Aghbashlo, M., Tabatabaei, M., Khoshnevisan, B., & Birkved, M. (2022). To what extent do waste management strategies need adaptation to post-COVID-19? *Science of the Total Environment*, 837, 155829. <https://doi.org/10.1016/j.scitotenv.2022.155829>
- Mianna, R., & Fitri, J. A. (2019). Sistem Pengelolaan Limbah Medis Padat di Rumah Sakit Umum Daerah (RSUD) Dr. Rm. Pratomo Bagansiapiapi Kabupaten Rokan Hilir. *Al-Tamimi Kesmas: Jurnal Ilmu Kesehatan Masyarakat (Journal of Public Health Sciences)*, 8(1), 26–34. Retrieved from <https://jurnal.ikta.ac.id/index.php/kesmas/article/view/134>
- Mihai, F.-C. (2020). Assessment of COVID-19 Waste Flows During the Emergency State in Romania and Related Public Health and Environmental Concerns. *International Journal of Environmental Research and Public Health*, 17(15), 5439. <https://doi.org/10.3390/ijerph17155439>
- Mirawati, M., & Aisyah, S. (2018). Mewujudkan Organisasi Spiritual Melalui Sistem Pengendalian Manajemen Mutu Iso 14001: 2015 Berlandaskan Spiritualisme. *Assets: Jurnal Ekonomi, Manajemen Dan Akuntansi*, 8(2), 142–155. <https://doi.org/10.24252/.v8i2.7254>
- Muktiono, E., & Soediantono, D. (2022). Literature Review of ISO 14001 environmental management system benefits and proposed applications in the defense industries. *Journal of Industrial Engineering*

- & *Management Research*, 3(2), 1-12. <https://doi.org/10.7777/jiemar.v3i2.271>
- Piccoli, G. B., Cupisti, A., Aucella, F., Regolisti, G., Lomonte, C., Ferraresi, M., Claudia, D., Ferraresi, C., Russo, R., La Milia, V., Covella, B., Rossi, L., Chatrenet, A., Cabiddu, G., & Brunori, G. (2020). Green nephrology and eco-dialysis: a position statement by the Italian Society of Nephrology. *Journal of Nephrology*, 33(4), 681-698. <https://doi.org/10.1007/s40620-020-00734-z>
- Rahno, D., Roebijoso, J., & Leksono, A. S. (2015). Pengelolaan Limbah Medis Padat Di Puskesmas Borong Kabupaten Manggarai Timur Propinsi Nusa Tenggara Timur. Indonesian. *Journal of Environment and Sustainable Development*, 6(1). Retrieved from <https://jpal.ub.ac.id/index.php/jpal/article/view/173>
- Syarifuddin, H. (2019). Analisis Sistem Pengelolaan Limbah Medis Padat Berkelanjutan di Rumah Sakit Umum Raden Mattaheer Jambi. *Jurnal Pembangunan Berkelanjutan*, 2(1), 40-52. <https://doi.org/10.22437/jpb.v2i1.6436>
- Utami, I. T. (2016). *Pelaksanaan pengelolaan limbah medis padat di rumah sakit ortopedi Prof. Dr. R. Soeharso Surakarta*. Universitas Sebelas Maret .
- Van Demark, R. E., Smith, V. J. S., & Fiegen, A. (2018). Lean and Green Hand Surgery. *The Journal of Hand Surgery*, 43(2), 179-181. <https://doi.org/10.1016/j.jhsa.2017.11.007>
- Wardah, S., & Astini, Y. (2018). Pemahaman Manajemen Rumah Sakit Tentang Pentingnya Kinerja Lingkungan dalam Pembangunan Berkelanjutan. *Valid: Jurnal Ilmiah*, 15(2), 99-111. Retieved from <https://journal.stieamm.ac.id/index.php/valid/article/view/67>
- Wicaksana, R. F. S., & Hatini, S. (2014). Analisis Pelaksanaan Sistem Manajemen Lingkungan Berdasarkan Sertifikasi ISO 14001 Di PT Bartec Utama Mandiri. *Industrial Engineering Online Journal*, 3(4), 1-9. Retrieved from <https://ejournal3.undip.ac.id/index.php/ieoj/article/view/6707>
- Wu, H., Tao, F., & Yang, B. (2020). Optimization of Vehicle Routing for Waste Collection and Transportation. *International Journal of Environmental Research and Public Health*, 17(14), 4963. <https://doi.org/10.3390/ijerph17144963>
- Yulinto, B., Kursani, E., & Aristi, R. I. (2017). Manajemen Pengelolaan Limbah Medis Padat di Rumah Sakit Umum Daerah Kota Dumai. *Jurnal Bahana Kesehatan Masyarakat (Bahana of Journal Public Health)*, 1(2), 96-105. Retrieved from <https://journal.poltekkesjambi.ac.id/index.php/JBKM/article/view/3>
- Zhao, H. (2021). Comparative life cycle assessment of emergency disposal scenarios for medical waste during the COVID-19 pandemic in China. *Waste Management*, 126, 388-399, ISSN 0956-053X, <https://doi.org/10.1016/j.wasman.2021.03.034>
- Zhao, H. (2021). Comparative life cycle assessment of emergency disposal scenarios for medical waste during the COVID-19 pandemic in China. *Waste Management*, 126, 388-399, ISSN 0956-053X, <https://doi.org/10.1016/j.wasman.2021.03.034>