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Analysis of Pollutant Sources from Community Health Center Activities in Mataram City

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Abstract: Health centers are health service facilities that produce waste containing microorganisms, toxic chemicals and radioactive materials that are dangerous and can pose risks to health and the environment. The purpose of this study was to determine the sources of health center waste and the types of waste from health center activities. This research method is a type of cross-sectional study, and data collection is done by filling out a questionnaire. The results of the study are the sources of health center waste, namely from the activities of the dental clinic, laboratory, Maternal and Child Health room, and the Emergency Unit room. The types of health center waste are liquid, domestic, solid medical, and toxic and hazardous. For the processing of liquid waste, all health centers in Mataram City have adequate wastewater treatment plants, either with a biofilter wastewater treatment plant system or other types of wastewater treatment plants, from 11 health centers, which have carried out sorting and have temporary storage places, namely 8 health centers. Managing medical waste involves sorting, transportation, storage and final processing with a third party. The weak point of B3 waste management is in the recording and sorting system of B3 solid waste and routine reporting of environmental management efforts and environmental monitoring efforts to related agencies that have not been able to be carried out by all existing health center agencies.

Keywords: B3 Waste; Health Center Medical Waste Management; Liquid Waste.

Introduction

Regional and national are essentially an integrative process both at the planning, implementation and control levels which are carried out on an ongoing basis to realize community welfare. Given its very broad scope, development activities are not solely the government's responsibility but must be supported by all components of society [1].

Quality health services are a crucial factor in improving community welfare. Health facilities are first-level health service facilities that act as initial service milestones, namely being the gateway to advanced health services, especially in the current era of national health insurance. The number of health facilities is increasing from year to year. In 2023 the number of hospitals will reach thirteen hospitals and 11 community health centers and 16 supporting community health centers. Of course, these health facilities, in the process of their activities, will produce waste, both liquid waste and solid waste, which can pollute the environment if they are not managed properly.

Waste from hospital/health center activities is called medical waste or medical waste. Garbage or medical waste is the waste product of a medical activity [2]. This medical waste contains various kinds of medical waste which are dangerous to human health if not processed properly, and storage is the last option if the waste cannot be processed immediately. Most medical waste is contaminated with bacteria, viruses, toxins and radioactive materials which are dangerous for humans and other environmental creatures. The negative impact of medical waste on society and the environment occurs due to poor management. The impact of medical waste can give rise to pathogens that can have bad consequences for humans and the environment [3]. Apart from medical waste, community health center activities also produce liquid waste and solid waste which can pollute the environment too, if management is not carried out. To anticipate this, research was carried out on analysing sources of pollution from Community Health Center activities in Mataram City.

Research Methods

This research is a type of cross-sectional or observational study, namely a study to describe the condition of an object at a certain time. The study population is all businesses and/or activities of health facilities (11 health centers) that have the potential to produce operational sources of pollutant materials in Mataram City. This study design is a form of study to determine in real terms the conditions of the types and characteristics of pollution sources, both from rubbish and liquid and solid waste in health service facilities in Mataram City in 2023. Data collection is by filling out a questionnaire. The questionnaire is given 3 days to complete and is taken on the third day so that the community health center management can complete the data requested in the questionnaire. All data is analyzed descriptively to get a true picture of the types and characteristics of pollutant sources produced from all existing health centers, then the data is presented in tabular form.

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Results and Discussion

Liquid Waste Management

High levels of water pollution are a serious problem in various regions, and community health centers are one of the main sources of waste containing microorganisms, toxic and radioactive chemicals that are dangerous and can pose risks to health and the environment. Sources of community health center waste are activities in dental clinics, laboratories, Maternal and Child Health rooms, and Emergency Unit rooms [4]. Processing liquid waste from community health centers is important to reduce its negative environmental and public health impact [5]. All Mataram City health centers process liquid waste using the Anaerobic Aerobic Biofilter system, as in Table 1. In the wastewater treatment process with aerobic bacteria, organic pollutants and other chemical compounds such as sulfide and ammonia will be broken down into compounds that are stable and safe for the environment. [6].

Tabel 1. Liquid Waste Management results

No	Health Center	Number of Visitors (Average People/day	Waste Water Discharge (m^3/day)	Existence of WWTP (existing (√) /not (x))	WWTP capacity (m^3/hari)	WWTP Operating System	Effluent Testing Time Interval
1	Karang Pule	150-175	-	√	5 m3	-	-
2	Karang Taliwang	125	-	√	8 m3	AAB	-
3	Cakranegara	150-200	2 L	√	2 m3	AAB	-
4	Babakan	80	3,36 m^3	√	5000 m3	AAB	-
5	Tanjung Karang	150	200 L	√	10,900 m3	AAB	1 x a year
6	Mataram	120	500 L	√	5000 m3	AAB	
7	Selaparang	80	-	√	4,62 m3	Septic tank	1 x 6 months
8	Pejeruk	-	2 m^3	√	1500 m3	AAB	1 x 3 months
9	Perawatan Ampenan	180	4,784 m^3	√	5 m3	AAB	1 x 3 months
10	Pagesangan	130-160	3,76 L/day	√	5 m3	AAB	-
11	Dasan Agung	90	-	√	-	-	-

Information: AAB = Anaerobic-Aerobic Biofilters

Most community health centers have an average of 100 visitors per day. From the existing data three community health centers have an average of visitors below 100 people per day, 8 other community health centers have an average of visitors above 100 people/day (range 120-200 person/day). With this relatively large number of visitors, if the daily water requirement is estimated to be 50% of the total water requirement for toilets according to SNI, namely 120 liters/person [7], then the average liquid waste from each community health center can reach 7,200-12,000 liters/day and if we refer to the daily water requirement according to WHO, namely 80 liters/person per day, the average water requirement for most health centers is 4,800-8,000 liters per day. If it is predicted that around 80% will become liquid waste that is wasted into the environment, then for the two references for water demand, 5,760-9,600 liters of waste will be wasted per day (SNI reference) and 3,840-6,400 liters per day (WHO reference). From this data, the pollutant load from liquid waste to the environment will be quite large if the waste water is not managed.

Based on research results, all community health centres have adequate IPALs, both with biofilter IPAL systems and other types of IPALs; in general, they have demonstrated efforts to manage liquid waste well so as not to pollute the environment, especially water bodies. The results of water sample tests from 2 community health centers that were sampling locations showed that most of the quality standards required for domestic liquid waste according to Minister of Environment and Forestry Regulation No. p 68 concerning quality standards for domestic liquid waste. However, for one of the sample health centers it has not met two quality standard categories, namely the TSS quality standard value for the Pagesangan health center exceeds the quality standard, namely with a TSS test result value of 57 (quality standard 30) and biological parameter test results in the form of coliforms of ≥ 240,000 (quality standard 3,000) . For this reason, it is necessary to carry out supervision and assistance so that the Pagesangan Community Health Center can meet all the required quality standards in the future. The high content of Total Suspended Solid (TSS) is the one of the parameters of river pollution. High TSS content in rivers has the potential to cause siltation, So the management of hospital wastewater is very important [8].

Coliformini bacteria are characterized as rod-shaped facultative aerobic bacteria, classified as gram-negative bacteria, and do not form spores. Coliformini bacteria are divided into 2 groups, namely fecal and non-fecal. Faecal coliforms, such as Escherichia coli, while non-faecal types, such as Enterobacter and Klebsiella. Coliform bacteria in water that exceeds the threshold limit can cause water pollution. If humans consume the water without proper processing, it will cause diseases such as diarrhoea, poisoning, pneumonia and urinary tract infections [9].

Domestic Waste Management

In Law No. 18 of 2008 concerning waste management [10], it is explained that waste is the remainder of daily activities or natural processes in solid or semi-solid form, in the form of inorganic or organic materials that can be decomposed or cannot be decomposed and are considered no longer helpful and thrown away in the environment [11]. One of the efforts made by the Mataram city government in terms of waste management is identifying waste sources, and the results obtained in this research are as follows.

Table 2. Domestic Waste Management

No	Health Center	Number of Visitors (Average People/day	Domestic Waste Volume (kg/day)	Sorting organic and inorganic waste (yes (√) /no (x))	Availability of temporary shelter (Is there (√) /not(x)	Temporary shelter capacity	Management collaboration with institutions	Freight Ritual
1	Karang Pule	150-175	<50	x	√	-	MCES	every day
2	Karang Taliwang	125	<50	√	√	1.5 m^3	-	every day
3	Cakranegara	150-200	50-100	√	√	1.5 m^3	-	every day
4	Babakan	80	<50	√	x	-	GTBD	3-4 x a week
5	Tanjung Karang	150	<50	x	√	4x2	-	2 x a week
6	Mataram	120	< 50 kg	√	x	-	MCES	every day
7	Selaparang	80	< 50 kg	√	x	-	MCES	every day
8	Pejeruk	-	-	√	√	-	FLAP	2 x a week
9	Perawatan Ampenan	180	< 50 kg	x	√	2 x 2 m^2	Ward	every day
10	Pagesangan	130-160	50	√	√	1,5 x 1 m^2	-	every day
11	Dasan Agung	90	550 kg	√	√	-	-	-

Information: MCES = Mataram City Environmental Service
GTBD = Garbage Transporter from Babakan Sub-District
FLAP = Freight From Local Area Paid

An increase in waste generated without being accompanied by poor waste processing will shorten the life of final waste disposal sites. This can cause serious environmental problems, such as causing health problems in humans [12]. Garbage heaps become nests for vectors and diseases. Rats flies, and mosquitoes will breed rapidly and can even reduce the aesthetic value of the environment [13].

Based on the data obtained in Table 2, there are two health centers whose waste volume is more than 50 kg/day, while the others have less than 50 kg/day. The waste generation/volume level from community health center activities can be used to estimate the impact of development on local waste flows. Meanwhile, the sorting of organic and inorganic waste has been carried out by eight health centers, out of a total of 11 health centers, the number that has temporary shelters is the same as the number of health centers that carry out sorting, namely 8 health centers, even though they have not done the sorting and do not have temporary shelters, these three health centers Management has been carried out in collaboration with the Mataram City Environmental Service, as well as with local sub-districts, then containment is carried out every day and 2 to 4 times a week. The efforts made by the community health center management can help protect the environment of Mataram City, so that it remains sustainable and can achieve sustainable development.

Management of Solid Medical Waste

The sorting of solid medical waste at the Community Health Center is carried out by all officers in each section that produces solid medical waste. In each room, there is a container or trash can. The container or trash can has a yellow plastic bag for medical waste, a black plastic bag for domestic waste, and a yellow box/safety box for medical waste for sharp objects. Reduction and sorting at the Puskesmas is carried out directly by officers in each room, and this is done directly under the supervision of the Puskesmas health care/sanitarian officers.

Based on the data (Table 3) obtained from filling out the questionnaire, it can be stated that the waste for the community health center category is relatively greater than the volume of waste produced by the clinic category. This is because community health centers have larger medical service units than clinics. Apart from that, the types of activities available at the puskesmas are also greater. A type of activity at the health center that most clinics do not have is an inpatient patient unit. The existence of this inpatient service unit can increase the generation of liquid waste and solid waste, both domestic solid waste and medical B3 waste, infectious B3 waste [14]. Waste generated from medical efforts such as health centers, polyclinics and hospitals is a type of waste that is included in the biohazard category, namely a type of waste that is very dangerous to the environment, where there are many waste viruses, bacteria and other harmful substances so roads must destroy it was burned at temperatures above 800 0C [15]. Management of solid medical waste is a serious problem because it can potentially spread infectious diseases through direct or indirect contact with environmental media. Therefore, solid medical waste must be processed properly before being

disposed of into environmental media so that it does not risk the environment and society [16].

Table 3. Results of Solid Medical Waste Management

Health Center	Volume (kg/day)	Medical and non-medical separation (yes (√) /no (x))	Availability of temporary shelter (Is there (√) /not(x)	Management collaboration with institutions	Freight Ritual
Karang Pule	<50	√	√	PT ASI	1 x a week
Karang Taliwang	<50	√	√	PT ASI	1 x a week
Cakranegara	<50	√	√	PT ASI	1 x a week
Babakan	<50	√	√	PT ASI	1 x a week
Tanjung Karang	100-200	√	√	PT ASI	1 x a week
Mataram	1/2	√	√	PT ASI	every day
Selaparang	< 50	√	√	PT ASI	2 x a week
Pejeruk	1-2	√	√	PT ASI	2 x a week
Perawatan Ampenan	3	√	√	PT ASI	1 x a week
Pagesangan	50	√	√	PT ASI	1 x a week
Dasan Agung	-	√	√	PT ASI	-

Information: PT ASI = PT. Artama Sentosa Indonesia

Based on Table 3, the system for reducing and sorting medical waste in the Mataram City environment has been carried out under PERMEN LHK No. 56 of 2015 [17]. Activities for the reduction and sorting stages that Community Health Center Officers have carried out in the Mataram City area and under the regulations, namely for the reduction stage at the Community Health Center in Jambi City, all Community Health Centers have eliminated the use of medical devices that contain mercury, for example the use of blood pressure monitors and thermometers and replaced them with those does not contain mercury. At the sorting stage, the Community Health Center in Mataram City has carried out separation between medical and non-medical waste by providing bags/containers for medical and non-medical waste, providing containers for medical waste for sharp objects, placing containers for medical & non-medical waste side by side/adjacent, containers for medical & non-medical waste. It is also easily visible and affordable, places medical waste containers safely out of reach of patients/visitors, and provides containers for chemical, heavy metal & pharmaceutical waste [18].

Impact of Hospital Waste on the Environment and Health. The influence of hospital waste on environmental quality and health can cause various problems such as [19]:

1. Disturbances to human health, can be caused by various types of bacteria, viruses, chemical compounds, pesticides, and heavy metals such as Hg, Pb and Cd which come from dentistry,
2. Genetic and reproductive disorders.
3. Poor hospital waste management will become a good place for disease vectors such as flies and mice.
4. Dengue hemorrhagic fever is increasing because the disease vector lives and reproduces in used cans or standing water.
5. If unsanitary hospital waste is burned, the smoke will disturb breathing, vision and reduce air quality.

Management of toxic and hazardous waste

Based on table 4, it shows that the large volume of B3 waste produced in Mataram city health centers, Karang Pule health center produces the largest volume of B3 waste compared to other health centers. B3 waste generated from health centers in Mataram City comes from medical service and support activities. The types of waste produced are sharps waste in the form of syringes, clinical pathology waste in the form of body tissue, toxic pharmaceutical waste in the form of chemical waste originating from laboratory activities and expired medicines, infectious waste in the form of contaminated gauze, contaminated cotton, tissue, handscoen, body fluids. , bottles and infusion tubes. Management of B3 waste at Mataram city health centers includes sorting, packaging, collection and storage. Transportation and processing are handed over to third parties who collaborate with PT. Artana Sentosa Indonesia and institutions.

Table 4. Results of B3 Waste Management at Mataram City Health Center

No	Health Center	volume of toxic and hazardous waste. (kg/day)	Types of toxic and hazardous waste materials.	Availability of temporary shelter for toxic and hazardous materials. (Is there (√) /not(x)	Document Technical Details of toxic and hazardous materials (Is there (√) /not(x)	Management collaboration with institutions
1	Karang Pule	563	solid and liquid waste	√	x	PT ASI

2	Karang Taliwang	>1000	Sharp, infectious and non-infectious medical	√	√	PT ASI
3	Cakranegara	50-100	-	√	x	PT ASI
4	Babakan	499	-	√	x	PT ASI
5	Tanjung Karang	-	Infectious	√	√	PT ASI
6	Mataram	440 kg	Mask, handscreen, gauze, scar tissue, syringe, vaccine bottle, infusion tube, RDT thread	√	x	PT ASI
7	Selaparang	< 50 kg	Syringe, gauze, bandage / IV tube, latex gloves, scalpel	√	√	PT ASI
8	Pejeruk	1,5 kg	Syringe, lance, gauze / cotton, gloves, medicine expired, room bottle, tissue	√	x	PT ASI
9	Perawatan Ampenan	900 kg	Solid medical waste, masks, syringes, syringes	√	√	PT ASI
10	Pagesangan	595	solid waste and liquid waste	√	x	PT ASI
11	Dasan Agung	-	Solid medical waste, masks, syringes	√	x	PT ASI

Information: PT ASI = PT. Artama Sentosa Indonesia

The weak point in waste management based on this study is the system for recording and sorting B3 solid waste as well as routine reporting of environmental management efforts and environmental monitoring efforts to the relevant agencies, which cannot be done by all existing health center agencies.

Management of B3 waste in health care facilities is necessary to minimize environmental impacts and prevent nosocomial diseases, which are carried out in the best way to minimize these impacts. Problems in hospital waste management can arise at all stages: collection, sorting, transportation, and storage [20].

Conclusion

Community health centers are health service facilities that produce waste containing microorganisms and toxic and radioactive chemicals, which are dangerous and can pose risks to health and the environment. Sources of community health center waste are dental clinic activities, laboratories, Maternal and Child Health rooms, and Emergency Unit rooms. The types of health center waste are liquid, domestic, solid medical, toxic and hazardous. All community health centers in Mataram City have adequate wastewater treatment plants, both with biofilter wastewater treatment systems and other types of wastewater treatment plants. The 11 community health centers, which have carried out sorting and have temporary shelters, namely eight health centers, have carried out management through collaboration with 3rd parties such as Mataram city environmental services, sub-districts and agencies handle solid medical waste, toxic and hazardous waste.

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