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## Environmental Risk Analysis In Handling Medical Waste At Puskesmas Lubuk Begalung Kota Padang Using *Environmental Risk Assessment* (Era)

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### Abstrak

Puskesmas merupakan salah satu fasilitas pelayanan kesehatan yang bermanfaat untuk meningkatkan derajat kesehatan masyarakat. Kegiatan pelayanan kesehatan dilaksanakan dengan memberikan perlindungan kesehatan kepada masyarakat umum, keselamatan pasien, lingkungan fasilitas kesehatan yang baik, serta sumber daya manusia ahli fasilitas kesehatan tersebut. Agar tidak mengganggu kegiatan operasional fasilitas kesehatan dalam melayani kesehatan, maka diperlukan suatu manajemen risiko lingkungan agar dapat menghindari pencemaran lingkungan yang dapat berasal dari gangguan infeksi penyakit yang mudah ditemukan di fasilitas kesehatan tersebut. Adapun salah satu sumber pencemaran lingkungan yang dapat ditemukan dari fasilitas kesehatan yaitu limbah, terutama limbah medis masuk ke dalam golongan limbah yang dapat membahayakan lingkungan (*biohazard*) sehingga limbah tersebut pun membutuhkan penanganan khusus untuk dalam pengelolaannya.

Variabel yang digunakan dalam penelitian yaitu tindakan petugas dalam pengelolaan limbah medis, sarana prasarana dalam mengolah limbah medis, tingkat pengetahuan petugas dalam mengelola limbah medis, durasi waktu yang digunakan dalam pengelolaan limbah medis, dan volume limbah medis yang dihasilkan dalam durasi waktu tertentu.

Kata Kunci: *Limbah Medis, Manajemen Risiko Lingkungan, Pencemaran Lingkungan, Puskesmas*

### Abstract

Puskesmas is one of the health service facilities that are useful for improving the degree of public health. Health service activities are carried out by providing health protection to the general public, patient safety, a good health facility environment, and human resources experts at these health facilities. In order not to interfere with the operational activities of health facilities in serving health, an environmental risk management is needed in order to avoid environmental pollution that can come from infectious diseases that are easily found in these health facilities. One source of environmental pollution that can be found from health facilities is waste, especially medical waste, which is included in the class of waste that can harm the environment (*biohazard*) so that the waste also requires special handling for its management. The variables used in the study were the actions of officers in medical waste management, infrastructure facilities in processing medical waste, the level of knowledge of officers in managing medical waste, the duration of time used in medical waste management, and the volume of medical waste produced in a certain duration of time.

Keyword: *Environmental Pollution, Environmental Risk Management, Medical Waste, Puskesmas*

### INTRODUCTION

Puskesmas is one of the health service facilities that are useful for improving the degree of public health. Health service activities are carried out by providing health protection to the general public, patient safety, a good health facility environment, and human resources experts at these health facilities. In order not to interfere with the operational activities of health facilities in serving health, an environmental risk management is needed in order to avoid environmental pollution that can come from infectious diseases that are easily found in these health facilities. One source of environmental pollution that can be found from health facilities is waste, especially medical waste, which is included in the class of waste that can harm the environment (*biohazard*) so that the waste also requires special handling for its management.

Medical waste is hazardous waste produced by a health facility. The health risks that can be caused by medical waste can result in the risk of infection, the risk of trauma, the risk of burning or explosion, the risk of chemicals, and the risk of radioactivity. The risk hazards from medical waste can also be obtained or exposed during the process of collecting, sorting, storing, landfilling, transporting, and destroying medical waste (Sembiring et al., 2019). Because the risks posed by medical waste produced by health care facilities can produce negative impacts if not managed properly, the author wants to analyze the effectiveness of medical waste treatment produced by related health centers using the *Environmental Risk Assessment* (ERA) method.

## RESEARCH METHOD

### RESEARCH METHODS

#### Data Retrieval Methods

Practicum is carried out by collecting qualitative data, namely interviews with officers who manage Puskesmas medical waste based on working papers, risk assessment, and field observations.

#### Data Analysis Methods

Data analysis was carried out using *the Environmental Risk Assessment Method*. Risk analysis using this is a semi-quantitative method by combining elements of frequency of events, magnitude of events, and sensitivity. This method has the following stages:

1) Problem formulation

Determine the criteria for the impact of risks generated in each stage of waste treatment by officers who manage medical waste

2) Risk identification

Determine the risks that may be posed if environmental health workers who manage medical waste do not comply with applicable waste management standards and determine the relationship with the understanding and knowledge of officers with the level of compliance in following waste management procedures

3) *Exposure Assessment*

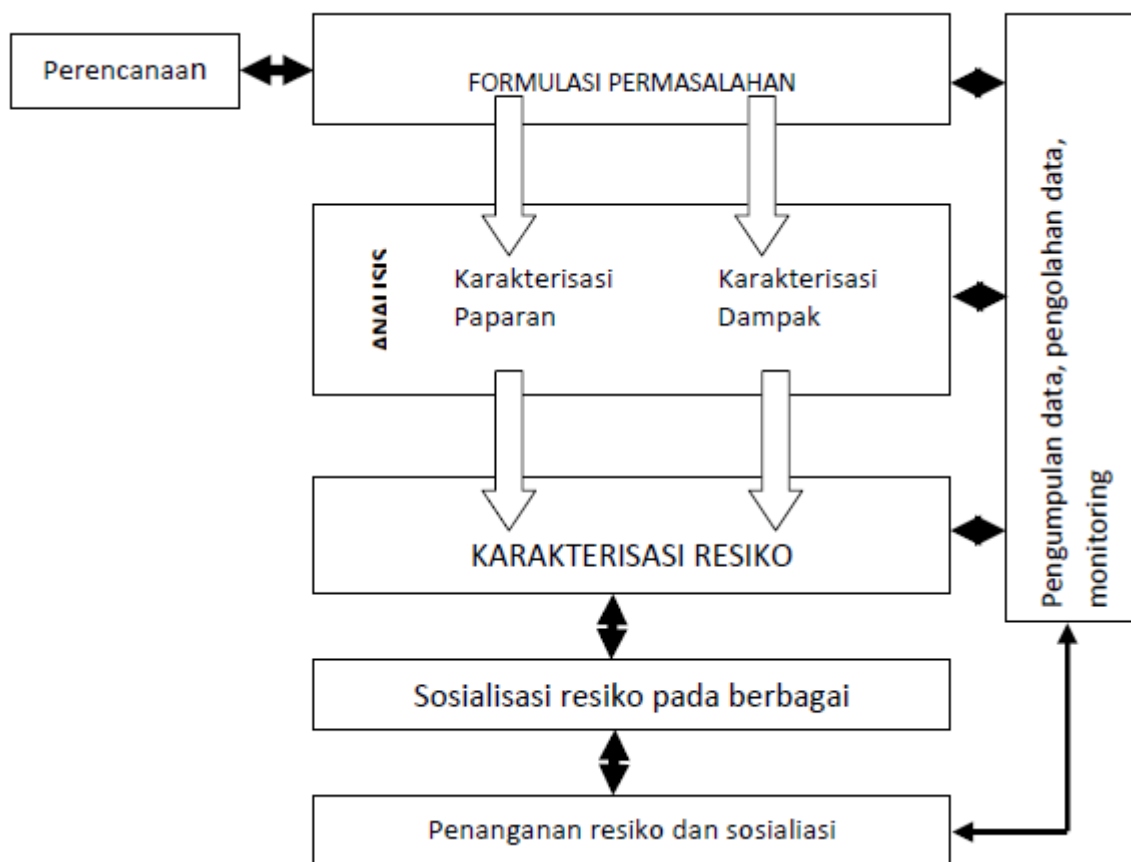
Determine the analysis and evaluation of impact criteria and possibilities that can occur when managing medical waste

4) Risk Characterization

Combining the value of likelihood and impact of risk into a measure, which is done by ranking and scaling the actions taken in managing waste and creating criteria for the duration or duration of waste management activities and waste disposal activities.

5) Risk Mitigation

Determine the treatment plan that needs to be improved from each action or treatment activity, medical waste management at the Lubuk Begalung Health Center.



Gambar 1. Kerangka Penilaian Risiko Lingkungan berdasarkan USEPA (1998)

## RESULTS AND ANALYSIS

### Conditions of the Practice Area

The object of practical study was carried out at the Lubuk Begalung Health Center in Padang City which is located at Jl. P. Air No.27 D, Parak Laweh Air Island Nan XX, Lubuk Begalung District, Padang City, West Sumatra. The location of this practice is located among fairly dense community housing, so good environmental management and management is needed from this Puskesmas, especially in its medical waste treatment system so as not to pollute and endanger the surrounding residents. This Puskesmas was chosen as the location of practice because the author wanted to know the relationship between the medical waste management and treatment system implemented by this Puskesmas and calculate and analyze the risks posed based on the way the waste was managed and treated.



### Analysis of the data used

The analysis of the data used in this practice was carried out using the ERA method. Data analysis using the ERA method is used in this practice because the author wants to know the value of the risk of medical waste produced by the Lubuk Begalung Health Center based on the score of the criteria and the amount of risk that has been determined, so that the level of danger can be assessed and an evaluation of improvements is found from the way medical waste is treated.

### Problem Formulation

The scope of practice is carried out in the Lubuk Begalung Health Center environment with the limits and context studied, namely the assessment of the stages of medical waste processing and management applied at the puskesmas.

### Risk Identification

Based on the situation and environmental conditions regarding the location of the Lubuk Begalung Health Center, Padang, risk identification can be estimated from the following environmental components:

#### A. Land Use Change

This risk of changing land use is a possible risk stemming from medical waste disposal systems that can contaminate soil, water, groundwater, and surface water. Land use change can usually occur on land that is considered uncomfortable, not strategic, or considered dangerous for people living near the land.

#### B. Air Pollution

The possible risk of air pollution can come from gases released by waste that produce unpleasant odors due to the degradation process in the waste. This situation can cause discomfort to the community or visitors to the puskesmas.

#### C. Surface Water Pollution

The possible risk of surface water contamination is a side effect of how to manage liquid waste which is directly discharged into the waterways around the puskesmas. This action can disturb the life of flora and fauna that live around the waterway, and can cause unpleasant odors that disturb the comfort of humans living around it.

#### D. Groundwater Pollution

The possible risk of groundwater contamination is a side effect of a sewage system or sewage treatment system that is not done properly. This can occur due to damage to the treatment system in liquid medical waste or the degradation process of solid medical waste that is transported too late so that it can pollute the soil and groundwater below.

#### E. Decrease in the Number of Flora and Fauna

The degradation of solid medical waste can produce methane gas which can endanger the life of terrestrial flora and fauna, and especially liquid medical waste that is not managed properly can also affect the life of flora and fauna living in the health center is threatened.

#### F. Work Accident to Janitor

This possible risk can occur due to the error of cleaners in implementing medical waste management and treatment methods, especially for officers who do not comply with medical waste management SOPs.

#### G. Accidents to Puskesmas Employees due to Medical Waste

This possible risk can also occur in puskesmas employees who are accidentally exposed to the impact of medical waste that is not treated or managed properly. If this risk is large, it can affect the performance of community services at the puskesmas.

### Risk Characterization and Analysis

After the risk identification stage is carried out, a characterization can be carried out based on risk exposure and risk impact from medical waste management and treatment activities at the Lubuk Begalung Health Center. Risk exposure characterization is carried out by creating a risk opportunity matrix in table a, and risk impact characterization will be analyzed semi-quantitatively based on tables b, c, and d using risk analysis calculations. The value given to the risk opportunity, the amount of risk, risk sensitivity, and the frequency of occurrence of the risk can then be measured by making a rating or scale of action from the risk that has been categorized. The risk characterization can be described in several matrix tables as follows:

a) Risk Opportunity/Possible Matrix

<b>RISK</b>	<b>LEVEL OF RISK OPPORTUNITY</b>	<b>DESCRIPTION</b>
Land-use change	2	The chances are small to experience changes in land use because the land used for TPS or IPAL does not disturb the surrounding community
Air pollution	2	Waste is collected once a week by the village, but the liquid waste has been processed with IPAL
Surface water pollution	2	The landfill near the puskesmas is solid waste and the soil in the puskesmas has been cast, so there is less chance of surface water pollution
Groundwater pollution	2	The landfill near the puskesmas is solid waste and the soil in the puskesmas has been cast, so there is less chance of groundwater pollution
Decrease in the number of flora and fauna	1	Until now, there has never been a dead flora and fauna around the puskesmas environment
Work accidents in janitors	1	This has never happened yet, but sometimes cleaners do not use PPE completely
Accidents to employees due to medical waste	1	Unheard of

**Skala matriks peluang risiko**

<b>1</b>	<b>Kemungkinan Sangat Kecil</b>
<b>2</b>	<b>Kemungkinan Kecil</b>
<b>3</b>	<b>Kemungkinan Sedang</b>
<b>4</b>	<b>Kemungkinan Besar</b>
<b>5</b>	<b>Kemungkinan Sangat Besar</b>

b) Risk Amount Matrix (Influence/Consequences)

<b>RISK</b>	<b>LEVEL OF RISK</b>	<b>DESCRIPTION</b>
Land-use change	2	The location of the TPS and liquid waste treatment system (IPAL) is located very close to the service location at the Puskesmas, so it

		somewhat affects the aesthetics of the puskesmas land
Air pollution	2	Solid medical waste is agreed to be only taken once a week by DLH by the village, but liquid waste has been treated with IPAL and non-medical waste is transported every day
Surface water pollution	4	Because it can affect all activities that use water in the puskesmas, humans, and the surrounding environment
Groundwater pollution	4	Because it can affect all activities that use water in the puskesmas, humans, and the surrounding environment
Decrease in the number of flora and fauna	2	Because if there is pollution in water, it can affect the flora and fauna that live near the IPAL
Work accidents in janitors	2	The possibility of work accidents in cleaners due to waste management can cause infection
Accidents to employees due to medical waste	1	The possibility of work accidents in puskesmas employees due to waste management can cause infection and affect the performance of the puskesmas

Risk scale matrix	
1	Influence is meaningless
2	Small Influence
3	The influence is being
4	The influence is great
5	Disaster

c) Risk Event Frequency Matrix

RISK	FREQUENCY OF OCCURRENCE	DESCRIPTION
Land-use change	2	The possibility exists but is small because the position of WWTP and TPS is too close to the puskesmas environment (can be dangerous if pollution occurs)
Air pollution	1	The possibility of pollution is very small because what is stored at the TPS is only domestic waste that is picked

		up every day, as well as solid medical waste that has been tightly closed and disinfected
Surface water pollution	1	The possibility of pollution is very small because what is stored at the TPS is only domestic waste that is picked up every day, as well as solid medical waste that has been tightly closed and disinfected
Groundwater pollution	1	The possibility of pollution is very small because what is stored at the TPS is only domestic waste that is picked up every day, as well as solid medical waste that has been tightly closed and disinfected
Decrease in the number of flora and fauna	1	Unheard of
Work accidents in janitors	1	Unheard of
Accidents to employees due to medical waste	1	Unheard of

Event Frequency Scale	
1	Most likely not to happen
2	Less likely to happen
3	Medium
4	Frequent occurrence
5	Very often

d) Risk Sensitivity Matrix of Medical Waste Management Measures

RISK	EVENT SENSITIVITY	DESCRIPTION
Land-use change	2	Be a group concern only
Air pollution	4	Can be of local regional concern / residents around the puskesmas
Surface water pollution	4	Can be of local regional concern / residents around the puskesmas

Groundwater pollution	4	Can be of local regional concern / residents around the puskesmas
Decrease in the number of flora and fauna	2	Be a group concern only
Work accidents in janitors	2	Be a group concern only
Accidents to employees due to medical waste	2	Be a group concern only

EVENT SENSITIVITY SCALE	
1	Not a public concern
2	Be of group concern
3	Concern certain external groups (DLH/DKK/environmental groups)
4	A local regional concern
5	Of national concern

Data analysis was carried out based on semi-quantitative analysis using several table matrices used to identify the risk value of risk management that has been applied by puskesmas in managing and processing medical waste (Kasam, 2011). The data obtained are attached to the tables of the risk matrix described in point 7.1. To analyze risk, only three variables are used to calculate the total risk value of 7 risk categories, namely the variable frequency of events (F), the variable of risk magnitude (S1), and the variable of event sensitivity (S2). The following is a description of the scale points of each of these variables:

Table 1. Risk Analysis Description

Level	Description		
	Event Frequency (F)	Event Magnitude (S1)	Event Sensitivity (S2)
1	Most likely not to happen	Influence is meaningless	Not an important concern
2	Less likely to happen	Small influence	Concern of the waste management officer group
3	Medium	The influence is being	Be the attention of employees at the place
4	Frequent occurrence	The influence is great	Concern of certain external groups (environmentalists/DKK/DLH)
5	Very often	Enormous influence/ Disaster	Become the attention of the surrounding community

The total risk value can then be assessed based on a combination of the variables of frequency of events, magnitude of events, and sensitivity with the following equation:

$$\text{Risk} = \text{Event frequency} \times (\text{Event magnitude} + \text{Sensitivity})$$

$$R = F \times (S1 + S2)$$

Then the ranking of the three variables in each risk category is listed in table 2 below:

Table 2. Risk Value Matrix

<b>RISIKO (R)</b>	<b>FREQUENCY OF OCCURRENCE (F)</b>	<b>EVENT MAGNITUDE (S1)</b>	<b>EVENT SENSITIVITY (S2)</b>	<b>Risk Value [F×(S1+S2)]</b>
Land-use change	2	2	2	8
Air pollution	1	2	4	6
Surface water pollution	1	4	4	8
Groundwater pollution	1	4	4	8
Decrease in the number of flora and fauna	1	2	2	4
Work accidents in janitors	1	2	2	4
Accidents to employees due to medical waste	1	1	2	3
<b>Total Risk</b>				<b>41</b>

Information:

R = 1 – 150 = Low risk, routine management of procedures required

R = 151 – 300 = Moderate risk, top management attention required

R = 301 – 450 = High risk, detailed research and management required

Based on the risk formula, it turns out that risk points obtained from risk management applied in puskesmas are currently in the low risk range with a total risk value of 41.

Risk Mitigation

This risk mitigation stage is the last stage to determine the improvement of the risk categorization that has been identified previously. To find out the most needed corrective actions, it is necessary to know the impact and risk rating of each risk category and this will be described in a risk assessment working paper below:

Table 3. Risk Assessment Working Paper

<b>RISK</b>	<b>RISK OPPORTUNITIES</b>	<b>RISK IMPACT</b>	<b>N</b>	<b>RISK RATING</b>	<b>PREVENTIVE CONTROL</b>	<b>CORRECTIVE CONTROL</b>
<b>Land-use</b>	2	4	8	Keep	Puskesmas Risk	Have a risk

change						
<b>Air pollution</b>	2	3	6	Keep	Management Guide	management system related to solid medical waste treatment and management
<b>Surface water pollution</b>	2	4	8	Keep	<i>Wastewater treatment plant (WWTP)</i>	Controlled use of WWTP to minimize water pollution
<b>Groundwater pollution</b>	2	4	8	Keep		
<b>Decrease in the number of flora and fauna</b>	1	4	4	Keep	Guidelines for Liquid Medical Waste Management Tools	Monitoring and control of waste management infrastructure
<b>Work accidents in janitors</b>	1	4	4	Keep	SOP on Procedures for Medical Waste Treatment and Management of Fasyankes Standard	Janitors comply with SOPs for waste treatment and management
<b>Accidents to employees due to medical waste</b>	1	3	3	Small	Puskesmas Risk Management Guide	Puskesmas employees follow risk management guidelines related to medical waste management used

Based on table 3, the resulting risk impact on medical waste treatment and management activities is in the low to moderate range. This is considered quite good because it shows that there are not many activities carried out at the Lubuk Begalung Health Center that produce

harmful risk impacts for humans and living creatures around them. Almost all activities included in the category of risky activities are in the medium risk range and only one category has a low risk, namely the possibility of accidents to employees caused by mismanaging medical waste.

Then researchers also carry out a risk mitigation that is useful for determining what corrective or preventive actions should be taken or improved by the Lubuk Begalung Health Center. These actions include preventive control or preventive actions that can be taken or improved by the puskesmas and corrective control which is a breakdown of corrective actions that can be taken by the puskesmas based on the risk categories that have been described. Preventive control measures are carried out to reduce the level of occurrence of risks described through the most feasible methods to be carried out to prevent the occurrence of such possibilities. While corrective control actions are carried out as a step that improves a risk event in order to reduce the magnitude of the consequences of the occurrence of risks described through the explanation of the preventive methods mentioned.

## CONCLUSION

Based on the risk analysis that has been carried out at the Lubuk Begalung Health Center, Padang, it can be concluded that:

a) In general, the chances of risk occurrence that have been categorized are not too great because the Puskesmas does not have an environmental impact that causes major disasters

b) Based on the risk value analysis, the value of the risk range that may be caused is low risk, where the total risk value points obtained are 41. Although the risk that may be posed is low, it still requires routine management of procedures and monitoring by DLH

## SUGGESTION

After practicing risk analysis using the ERA method, the author suggests to be able to carry out more detailed risk categories by conducting a more detailed field survey at the location. The author has not had time to do this due to limited practice time and the difficulty of meeting with puskesmas employees who are responsible for environmental risks at the puskesmas.

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