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# Management Evaluation of Dangerous and Toxic Waste (Infectious and Covid Waste) at the Nusa Tenggara Barat Hospital

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**Abstract**

Dangerous and toxic waste from the Covid-19 pandemic increased by 30 percent. Dangerous waste management is one of the most serious problems in health facilities because a medical waste, especially infectious waste, is very potential in transmitting infectious diseases either through direct or indirect contact through environmental media. The purpose of this study was to analyze dangerous and toxic waste management based on Permenkes No. 7/2019 and Ministry of Environment and Forestry at the West Nusa Tenggara Hospital during the Covid-19 pandemic in 2020. The research design was descriptive qualitative. The data was taken by using the purposive sampling technique, the informants were selected by snowball sampling. The container stage uses yellow plastic, the transportation of covid and infectious B3 waste uses a yellow trolley and the waste transport officer is a cleaning service. Storage of dangerous and toxic waste and covid waste in temporary shelters every other day, if the weather does not support the transportation process for a maximum of one week, treatment of infectious waste and covid waste is carried out by PT PRIA as a third party. The hospital periodically controls related to the implementation of the container, transportation, and storage so that it is always following the applicable of Standard Operation Procedure.

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## INTRODUCTION

The hospital is an integral part of a social and health organization with the function of providing complete service (comprehensive), disease healing (curative), and disease prevention (preventive) to the community. The hospital is also a training center for health workers and a medical research center (WHO, 2013). Hospitals can be a source of diseases, either from sufferers or from visitors with career status. These germs can live and thrive in the hospital environment (Anies, 2006). One of the factors that can affect the health quality of the hospital environment is Dangerous and Toxic Waste (B3) (Permenkes RI, 2019).

Hospital activities produce B3 waste, especially during the Covid-19 pandemic. According to WHO, a pandemic is a new disease outbreak that has spread widely throughout the world. Meanwhile, Covid-19 is an infectious disease caused by the SARS-COV 2 virus or the coronavirus. The dangerous waste produced by the hospital can cause health protection problems or risk of pollution to the environment. During the Covid-19 pandemic, the risk of medical waste to health increased due to the increasing number of coronavirus sufferers who have been hospitalized every day and the unmanaged waste contaminated with Covid-19 sufferers. Globally, the total cases of the coronavirus were 9,353,738, in Indonesia as many as 47,896, and in West Nusa Tenggara as many as 1,102. The number of the spread of the coronavirus in West Nusa Tenggara, March 15, 2020-23 June 2020 was as many as 123-1102 (979 people) (Dinas Kesehatan Provinsi NTB, 2020). The increase in cases is in line with the increase in the amount of B3 Medical waste produced by hospitals in West Nusa Tenggara, namely the average amount of medical waste was 2 tons before the pandemic, but now it has jumped to 9.5 tons. The medical waste is in the form of disposable hazmat suits (personal protective equipment / PPE), disposable masks, and syringes and can be a source of disease from personal protective equipment contaminated with Covid-19 (Lembaga Ilmu Pengetahuan Indonesia, 2020).

In 2019, the volume of daily medical waste reached 290 tons from 2,820 hospitals and 9,884 health centers in Indonesia. This number is certain to increase during the Covid-19 pandemic about 30% (Dinas Kesehatan Provinsi NTB, 2020). However, this increase was not accompanied by the capacity for B3 waste treatment, especially in areas outside Java. As happened in West Nusa Tenggara, as much as 9.5 tonnes of medical waste was sent to Java for processing. This is according to what is stated in the Indonesian Health Profile 2019, the coverage of hospitals that carry out medical waste management according to 2019 standards in Indonesia reaches 42.64%. Provinces that have not implemented medical waste management according to standards consist of Papua, West Papua, West Sulawesi, Central Sulawesi, Southeast Sulawesi, North Sulawesi, North Kalimantan, West Kalimantan, East Nusa Tenggara, West Nusa Tenggara, and Bengkulu provinces. The coverage of hospitals that carry out medical waste management according to 2019 standards in West Nusa Tenggara is 21.88% (Kemenkes RI, 2019).

Several hospitals in West Nusa Tenggara process their medical waste because they have incinerators (Dinas Kesehatan Provinsi NTB, 2020). However, based on existing data, not all hospitals have B3 waste destruction tools. Of the 2,820 hospitals throughout Indonesia, only 110 have a licensed incinerator. Especially for referral hospitals for Covid-19 patients, only 24 have incinerators from 132 referral hospitals throughout Indonesia. Meanwhile, there are only 14 licensed companies that provide B3 waste treatment services that have incinerators (Kementerian Lingkungan Hidup dan Kehutanan, 2020).

Based on research conducted by (Zuhriyani, 2019) that the implementation of a solid medical waste management system starting from the sorting process to the solid medical waste processing process at Raden Mattaher

Jambi Hospital is good but not fully by the Minister of Environment and Forestry Regulation Number: P. 56 / MenLHK-Setjen / 2015 concerning procedures and technical requirements for the management of dangerous and toxic waste from Health Service Facilities. This research is also in line with research (Pertiwi et al., 2017) that *medical waste management in Roemani Muhammadiyah Semarang Hospital is not yet appropriate the regulation of dangerous waste management in health service according to regulation. There are some missmatch at each process of management, such as mistake in warehousing, reduction process not yet applied in medical waste management, hazardous and toxic waste disposal in the inpatient room is under standard, reduction process not yet applied in medical waste management, unoptimal policies and operating procedures, mistake in stroge and transportation*. From previous studies, it can be concluded that several hospitals in Indonesia still have not carried out medical waste management by applicable regulations.

The impact that occurs if the waste management is not following the provisions and legislation in force, can cause problems, one of which is nosocomial infection. Nosocomial infections or also known as Hospital Acquired Infections (HAIs) are hospital-acquired infections that occur in patients who are hospitalized for at least 72 hours and these patients do not show symptoms of infection when admitted to the hospital (Brooker Chris, 2009). Nosocomial infections that are often encountered are pneumonia, urinary tract infections, infection at the surgery site, and infections in the bloodstream (Tabatabaei et al., 2015). Transmission of nosocomial infections in hospitals generally occurs in five ways, namely, direct contact, common vehicle, air, vectors, and food or drink (Septiari, 2012). Meanwhile, patients, health workers, visitors, and patient watchers are a group at risk of getting nosocomial infections (Darmadi, 2008).

According to (WHO, 2013), the percentage of nosocomial infections in hospitals worldwide reaches 9% (variation 3 - 21%) or more than 1.4 million hospitalized patients in hospitals worldwide get nosocomial infections. Approximately 8.7% of 55 hospitals in 14 countries originating from Europe, the Middle East, Southeast Asia, and the Pacific showed nosocomial infections and for Southeast Asia as much as 10%. Nosocomial infections can be caused by patients, health workers, visitors, and other sources such as the hospital environment (Hidayat, & Alimul A, 2012). Besides, it is feared that the B3 medical waste generated from patients and medical personnel who are exposed to the virus during patient treatment can become a medium for spreading the virus if it is not handled properly.

Considering the large negative impact of B3 waste that is caused, the handling of B3 waste must be carried out appropriately, starting from the container stage, the transportation stage, the temporary storage stage, up to the processing stage. Dangerous waste management is one of the most serious problems in health facilities because a medical waste, especially infectious waste, is very potential in transmitting infectious diseases either through direct or indirect contact through environmental media. Therefore, medical waste should not be disposed of directly into environmental media without prior treatment.

To reduce the risk of environmental-based diseases, the government finally renewed the Minister of Health Decree 1204/2004 after 15 years to become Permenkes No.7 of 2019 concerning hospital environmental health which includes several points, one of which is waste protection. Besides, the Ministry of Environment and Forestry has issued Circular Letter No.SE.2 / MENLHK / PSLB3 / PLB.3 / 3/2020 concerning Management of Infectious Waste (B3 Waste) and Household Waste from Handling Corona Virus Disease (Covid-19). Signed on March 24, 2020, as an effort to properly and correctly remove the infectious waste of Covid-19 is very important to break the chain of transmission. This study aims to analyze B3 waste management based on Permenkes No.7 of 2019 and KLHK Circular No. 2 at the West Nusa Tenggara Provincial Hospital during the Covid-19 pandemic in 2020.

## METHODS

This research uses a qualitative approach with a qualitative descriptive design. The focus of the research was carried out at the West Nusa Tenggara Provincial Hospital, from October to November 2020 with the objects of B3 waste management in the form of the container stage, the transportation stage, a temporary storage area, and the processing stage. The data was taken by using the purposive sampling technique. The next informants were selected by snowball sampling. Primary data is in the form of B3 waste management facilities in the form of storage containers, transportation means from the source room to the garbage dump, temporary storage for B3 waste, and B3 waste treatment at the hospital or using the services of a third party outside the hospital. The data collection instrument is the researcher himself. Researchers used interview guidelines and observation sheets. Research data collection was carried out using observation, documentation, and in-depth interviews with the main informants and triangulation informants as data amplifiers. Documentation using a mobile phone. Analysis of the data in this study using the Nvivo program or application.

## RESULTS AND DISCUSSION

The results of the interview explained that the handling of covid and B3 infectious waste had differences in terms of waste packaging. Covid waste is disinfected then put in yellow plastic, tied then disinfected again then taken to the garbage dump. The waste is transported to the garbage dump using trolleys and coated with yellow plastic (for infectious) then weighed and waiting for the third party to transport, before being transported it is weighed again to confirm the amount of waste. Officers at the garbage dump have a logbook to write down the results of the waste scales that are generated every day for infectious B3 waste and covid waste.

The results of this study are in line with Ministry of Environment and Forestry of the Republic of Indonesia that sorting medical waste from its source is the simplest effort to reduce dangerous waste (Kementerian Lingkungan Hidup dan Kehutanan, 2015). Sorting medical waste based on the type, group, and characteristics of the dangerous waste. Waste sorting aims to minimize medical contamination of waste that has the potential to cause health problems and environmental pollution (Asrun & Sihombing, 2020). Besides that, sorting is also carried out on medical waste and non-medical waste from the source. The purpose of sorting medical and non-medical waste is to prevent contamination between the two. Non-medical waste has the potential to contain dangerous and toxic substances if it is contaminated with medical waste (Purwanti, 2018). The mixing of the waste will indirectly lead to the emergence of dangerous waste produced by health care facilities.

The advantages of sorting medical waste are reducing environmental pollution, saving medical waste management costs, improving the image of the hospital (Saghita & Thamrin, 2017). An example of a health service facility that implements a medical waste sorting system is PB Hospital in Riau Province (Saghita & Thamrin, 2017), dr. Saiful Anwar Hospital Malang (Pusparini & Anis, 2018), dr. Soetomo Hospital Surabaya (Purwanti, 2018).

The transportation means are a yellow trolley for infectious B3 waste and black color for non-infectious B3 waste or domestic waste prepared by a third party. Likewise, the plastic used to coat the trolley is divided into two colors, namely yellow for infectious B3 waste and black for domestic waste. The officer carrying the waste from the source room is the Cleaning Service. Each room has a waste bin which is transported by the cleaning service every day. The amount of waste generated per day is an average of 200 kg of medical waste (infectious B3 waste and covid waste).

The garbage collection system is the process of removing waste carried out by waste collection officers for further management (Kementerian Pekerjaan Umum dan Perumahan Rakyat Republik Indonesia, 2013). The waste collection process is carried out effectively and efficiently. Time to collect waste from health care facilities at least once a day (Kementerian Lingkungan Hidup dan Kehutanan, 2015) and no

later than two days after being infected with produced waste (Kementerian Lingkungan Hidup dan Kehutanan, 2020). If the amount of medical waste generated exceeds the capacity of the available container or if the capacity of the container is already filled by ¾ of the maximum volume, medical collection of waste is carried out immediately. The determination of the high capacity of medical waste generation (maximum ¾ of the maximum size) aims to make it easier for medical waste collection officers to tie up bags/plastics filled with medical waste. When collecting trash, the plastic lining in the container is removed and replaced with a new plastic cover of the same color, label, and symbol. The collection of medical waste uses waste transportation facilities such as wheeled trolleys or wheeled containers (Kementerian Pekerjaan Umum dan Perumahan Rakyat Republik Indonesia, 2013).

The medical waste collection system in several health care facilities in Indonesia does not meet applicable regulatory standards, such as cleaning services collecting medical waste by hand (Waangsir, 2018). The process of collecting medical waste should use trolleys for wheeled collectors or wheeled containers (Kementerian Lingkungan Hidup dan Kehutanan, 2015). Furthermore, officers who collect medical waste often neglect to use personal protective equipment.

The purpose of using personal protective equipment (PPE) is to maintain safety and health in the workplace. Occupational accidents that usually occur when collecting medical waste are injected with a syringe and exposed to ampoules. The timing of collection of medical waste is carried out by health care facilities according to these regulatory standards at least once a day (Kementerian Lingkungan Hidup dan Kehutanan, 2015). However, there is one health service facility that collects medical waste about twice a week. This is because of the medical waste generated by a few health care facilities (Basir et al., 2018). Therefore, using PPE is important before medical waste management activities to prevent occupational accidents.

Storage of infectious medical waste and covid waste are separated from other B3 waste. Covid waste is transported together with infectious B3 waste, while non-infectious B3 waste is processed by the central public hospital waste bank. The permit for storing waste at the garbage dump for 90 days is following the permit issued by DLH Number 071 / SK / BLH / XI / 2015, but the transporter transports the waste every 2 days. Medical action usually produces tissue, so if left too long in storage it will make the tissue heavier due to putrefaction. Transportation that is carried out more than 2 days or even once a week is caused by weather factors. But the delay from the third party will be confirmed in advance with the hospital.

Medical waste storage system based on the type, group, and characteristics of dangerous waste (Kementerian Lingkungan Hidup dan Kehutanan, 2015). Medical waste containers must be covered with plastic colors. Determination of plastic color is based on the Decree of the Minister of Health of the Republic of Indonesia Number 1204 / MENKES / SK / X / 2004 concerning Environmental Health Requirements. In the hospital, infectious waste is stored in closed yellow plastic, chemical and pharmaceutical waste is stored in brown closed plastic, radioactive waste is disposed of in a red plastic-closed container, and cytology disposal container is covered with purple plastic Sharps waste, syringes waste are stored in safety boxes (Zuhriyani, 2019). This aims to prevent leakage and maintain the security and safety of sharps waste collection officers (Amala et al., 2018).

The medical waste container must also have a dangerous waste label and symbol. The use of labels and symbols in the dangerous waste container aims to facilitate waste collection based on the type, group, and characteristics of the dangerous waste (Permenkes RI, 2019). The storage requirements for medical waste are strong, rust-resistant, not easily opened or damaged (Sirait et al., 2015), watertight, not easy to leak and mossy, and has a cover. The capacity of medical waste containers is based on the generation rate of medical waste generated by the health care facility.

The problem that occurs in medical waste storage systems in several health care facilities in Indonesia is that the color of the plastic used for medical waste container disposal is not following applicable regulations (Mirawati et al., 2019). The incompatibility of color plastics is caused by the difficulty level of obtaining plastic color with applicable laws (Waangsir, 2018). Another problem that occurs in medical waste storage is that the medical waste storage container system does not have dangerous labels and symbols (Rahno & Roebijoso, 2015). Using dangerous labels and symbols on this container aims to make it easier for health workers and patients to dispose of solid medical waste according to the type, class, and characteristics of dangerous waste (Amala., 2018). Containers for disposal of medical waste not suitable for their intended purpose are a problem in the medical waste storage system. For example, non-medical waste is disposed of into medical waste containers (Basir et al., 2018), infectious waste is stored in cupboards, and used cotton is disposed of in mineral drink boxes (Yulis & Ody, 2018), and syringe waste is stored in drinking bottles (Dewa et al., 2018), this is due to a lack of awareness in managing medical waste.

A temporary shelter is a place for storing dangerous waste for a certain time. The storage duration of medical waste such as infectious waste, sharps waste, and pathological waste is 48 hours. However, those are stored for up to 90 days from the time the waste is generated if the storage temperature is ≤ 00 C (Kementerian Lingkungan Hidup dan Kehutanan, 2015).

During the Covid-19 pandemic, infectious waste is kept in closed containers for a maximum period of 48 hours from the time the waste is produced (Kementerian Lingkungan Hidup dan Kehutanan, 2020). Determination of the maximum storage time for infectious waste during the Covid19 Pandemic aims to prevent transmission of the coronavirus (COVID-19). The storage time for chemical waste, radioactive waste, pharmaceutical waste, and cytotoxic waste is not more than 90 days since its existence is generated (if the waste produced is ≥ 50 kilograms per day) and is stored for a maximum of 180 days from the time the waste is generated (if the waste produced is <50 kilograms per day for the first dangerous waste category) (Kementerian Lingkungan Hidup dan Kehutanan, 2015).

Temporary shelter for B3 waste for building needs based on the Decree of the Head of the Environmental Impact Management Agency No. 1 of 1995 concerning Procedures and Technical Requirements for Storage and Collection of Waste Material is the outer part of the roof and the floor is specially designed so that rainwater cannot enter the building, has good air circulation and the building is protected from birds or other small animals. Another requirement for a temporary shelter for dangerous waste is that the outside of the building has a dangerous waste symbol according to the type, group, and characteristics of the dangerous waste. The use of the dangerous waste symbol aims to help officers know the type, group, and characteristics of the dangerous waste being stored. The building area is also one of the requirements for temporary shelter for B3 waste. If the waste generated is more than 1 (one) type/class/characteristic, the shelter must have a separation wall. The use of dividing wall files is intended to avoid mixing different types/groups/characteristics of waste. Besides, the floor of the temporary storage area must be sturdy, waterproof, not corrugated, not cracked, easy to clean, and equipped with a lighting system and a lightning protection system (Badan Pengendalian Dampak Lingkungan, 1995).

Supporting facilities for dangerous waste temporary shelter is space for landfills and storage equipment, tanks or containers, drainage channels, and dangerous waste places, emergency response equipment such as firefighting equipment and first aid equipment, safety fences, and generators. Other supporting facilities for temporary shelter for dangerous waste are emergency exits, smoke alarms and detectors, clean water facilities, easily accessible cleaning equipment, and easily accessible personal protective equipment (PPE) (Badan Pengendalian Dampak Lingkungan, 1995).

The temporary location requirements for dangerous waste are free from natural disasters such as floods, this area is easily accessible by officers and vehicles for collecting/transporting the dangerous waste, and the minimum distance between the location and public facilities is 50 meters (Himayati & Tri, 2018). Another requirement is that the construction of dangerous waste as a temporary shelter in a health service facility must obtain a permit from the local government. A license is required so that the location and requirements for temporary shelter dangerous waste buildings comply with Government Regulation Number 101 of 2014. Besides, other requirements for the cleanliness of temporary shelters are aimed at maintaining cleanliness and health and preventing environmental pollution.

The storage conditions for B3 waste that do not meet the applicable requirements in several health care facilities, such as temporary shelters for dangerous waste, do not yet have supporting facilities such as smoke detectors, easily accessible fire extinguishers, first aid kits, waste collection tanks and drainage (Pusparini & Anis, 2018), a temporary shelter for dangerous waste is located in the parking area of the hospital and basement adjacent to the morgue (Rachmawati & Sumiyaningsih, 2018), temporary shelter for B3 waste is difficult to reach by collection or transport vehicles (Putri & Tri, 2017), the temporary shelter for dangerous waste which is far from public facilities is <50 meters (Arindita et al., 2016), the outside of the temporary shelter for the building has not been equipped with a dangerous waste sign (Saghita & Thamrin, 2017) has no air ventilation, hygiene kits and out-of-reach personal protective equipment (PPE), storage containers dangerous waste does not have a cover, the windows and doors in the dangerous waste storage room are open, making it easier for animals such as insects, flies, birds, etc. to enter the temporary shelter for dangerous waste (Amelia & Ismayanti, 2010), duration of B3 waste storage > 48 hours (Pertiwi et al., 2017). Based on this problem, buildings and locations for dangerous waste storage must meet applicable requirements.

The NTB Provincial Hospital processes infectious medical waste and covid waste through a third party which is sent to Mojokerto (Surabaya, East Java). The NTB Provincial Hospital chose to process infectious B3 medical waste and covid waste through a third party due to permission constraints from the central Ministry of Environment and Forestry.

The schedule for transportation by a third party is not necessarily the time, sometimes night, day, or evening because the third party has to go around to the hospital that works with the PT. The transportation process is carried out by a third party, namely, the third-party contacts IKL to transport the waste, then IKL contacts CS at the TPS and then weighs it again to confirm the amount of waste to the hospital. The size of 1 truck contains approximately 3 tons. If the waste transport truck is full, then it is taken to Java by ferry.

Before the waste is transported, each hospital in collaboration with PT calculates the waste produced and confirms it to PT so that the transport trucks do not lack space. The process of destruction, entering into the plan is counted again later (there is an extermination machine) whether the weight is following the manifest or not, if it is not suitable then the cause is searched for it could be the truck driver's naughtiness who dumped the road or because it fell. If it is in balance then it is burned/destroyed.

Third-party officers are trained in the field for the transportation process, there are SOPs such as how to use PPE and how to transport the waste because transporters are very at risk of environmental-based transmission because they interact directly with infectious B3 waste and covid waste. For example, officers from third parties, transport workers have been reactive and are not allowed to cross because there is a high possibility of touching covid waste even though wearing PPE and other possibilities, namely because they meet people outside of working hours. Besides, the risk of being pricked by needles is due to carelessness. For example, officers at the hospital who wear gloves and booth shoes because they are made of rubber, there is still a possibility that they will be pierced by

needles, the officers feel that their bodies are chilled and are given a TT injection. So that with the magnitude of the impact and the risk of infectious waste and covid waste, third parties and the hospital provide counseling and explain the SOP for the use of PPE to officers transporting waste and cleaning services.

For the number of officers transporting infectious B3 waste 2 and 2 from third parties in total 4. Transportation officers from third parties hold per police vehicle number which cannot be replaced by other people because it is registered and licensed by the center. The number of PT PRIA's fleets is 70-100 and depends on the permit. Especially for those operating in NTB 4 fleets.

The dangerous waste treatment system is the process of reducing or eliminating dangerous properties in waste. Dangerous waste processing must be carried out by the waste producer or through a third party who has a processing permit (Ministry of State Secretariat of the Republic of Indonesia, 2014). The dangerous waste treatment system that is mostly implemented by health facilities is incineration. Incineration is the process of treating medical waste thermally using an incinerator.

The problem of medical waste treatment systems that use incinerators in several health care facilities in Indonesia causes air pollution, noise, produces residues (syringes and shattered glass residues) and produces ash containing heavy metals (Manila, 2017). Another problem is that officers handling medical waste have not received training on procedures for using incinerators and operational costs for treating medical waste using expensive incinerators (Romaningsih, 2017). Officers who carry out medical waste treatment do not use personal protective equipment is one of the problems that occur in some health care facilities when the medical waste treatment system uses incinerators. This condition has the potential to interfere with health (Rachmawati & Sumiyaningsih, 2018). Health care facilities must obtain permission from the government to treat dangerous waste using an incinerator. However, there are health service facilities that do not have the authority for dangerous waste management by the government. This causes health service facilities to have insufficient operational resources. Therefore, they use a third party to treat dangerous waste (Putri & Tri J, 2017).

The role of a third party in handling medical waste is to assist health care facilities that do not have an incinerator or do not have an incinerator's dangerous waste management permit. This helps health care facilities enforce the rules for handling medical waste, especially infectious waste. According to the Letter of the Ministry of Environment and Forestry of the Republic of Indonesia No. SE.02 / PSLB3 /PLB.3 / 3/2020 concerning Management of Infectious Waste (B3 Waste and Household Waste from Handling Corona Virus (Covid19), infectious waste originating from health care facilities during the Covid19 pandemic is processed using an incinerator facility with a minimum temperature burning 8000 C (Kementerian Lingkungan Hidup dan Kehutanan, 2020).

B3 solid waste processing is the process of eliminating and or reducing the dangers and toxic contaminants in dangerous waste (Pusparini & Anis, 2018), one of which is the technology for treating dangerous solid waste is incineration. Incineration is a medical organic waste treatment technology with a high-temperature thermal system. The purpose of burning medical waste is to destroy medical waste materials that are harmful to the environment, kill pathogenic bacteria, reduce the volume of medical waste to 99.95%. The products of combustion of medical waste using an incinerator are gas, unburned residue, and ash. The main components of the incinerator are the combustion chamber, blowers, combustion devices, temperature indicators and controls, wet scrubbers, chimneys (Kementerian Lingkungan Hidup dan Kehutanan, 2015).

## CONCLUSION

The management of B3 waste in the NTB Provincial Hospital during the Covid-19 pandemic has been implemented as much as possible by the Minister of Health Regulation

No.7 of 2019 and the KLHK Circular Letter No.2 of 2020.

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