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THE IMPACTS OF HAZARDOUS AND TOXIC WASTE MANAGEMENT: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Looking at the environmental and health problems caused by the irregular disposal of hazardous and toxic waste, it is important to manage B3 waste to prevent and overcome environmental pollution or damage caused by B3 waste and to restore the quality of the polluted environment so that it is following function back. In this case, every activity related to B3 must pay attention to environmental aspects and maintain environmental quality in its original condition and prevent disease.
Aim: The main objective of this review is to identify and understand the impact of hazardous and toxic waste management.
Method: This review was conducted based on sources from Google Scholar, Pubmed, Emerald Insight, DOAJ with the types of journals published such as Elsevier, IJSDGE, proceedings, ICCEM, HINDAWI, JPHE, JSTFT, JET, AJEST, JCH, WMR, BMC Health Services Research, and two reports from WHO (World Health Organization). Furthermore, screening of titles, abstracts, and content selection or content according to inclusion and exclusion was carried out which obtained 14 articles that were analyzed further.
Findings: B3 waste management that enables sorting, storage, transportation, and processing at the final waste disposal site is one of the important strategies in B3 waste management.

KEYWORDS

Management of waste, hazardous and toxic materials, systematic review

INTRODUCTION

Hazardous and Toxic Materials or often abbreviated as B3 (Dangerous and toxic substances) are substances, energy, and/or other components which due to their nature, concentration, and/or quantity either directly or indirectly can pollute and/or damage the environment, endangering the environment, health and survival. Human life and other living things. B3 (Hazardous and toxic substances) waste is the residue of a business and/or activity containing hazardous and/or toxic materials which due to their nature and/or concentration and/or amount, either directly or indirectly, can pollute and/or damage the environment, and/or can endanger the environment, health, human survival and other living things (Gupta & Babu, 1999). Hazardous waste has hazardous properties (such as toxicity, flammability, carcinogenicity, reactivity, corrosiveness which makes it one of the potential hazards for humans and the environment and thus requires strict control during handling, transportation, processing, and disposal (Yilmaz et al., 2017).

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The problem of B3 (Dangerous and toxic substances) waste that often arises in the community, health facilities, and industrial places is disposal that does not comply with the rules or Standard Operating Procedures (SOP). Disposal of waste into the environment will cause problems that are evenly distributed and spread over a wide environment. Waste gas is carried by the wind from one place to another. Liquid or solid waste that is dumped into rivers, washed away from upstream to far downstream, beyond territorial boundaries eventually ends up in the sea or lake, as if the sea or lake became a trash can. Problematic waste, among others, comes from residential, industrial, agricultural, mining, and recreational activities. Therefore, waste needs to be processed and controlled according to the requirements and with quality standards in the applicable laws and regulations (Taufan & Purwanto, 2018).

Most people think that the source of B3 (Dangerous and toxic substances) waste comes from industry only. But people do not realize that household waste also contains many types of B3 waste, of course, this household waste has an amount that is no less large than industrial waste (Fikri et al., 2017). Every day, households produce residual waste from household activities from products that contain toxic and hazardous materials, and sometimes manufacturers do not list the active ingredients used in their products. Insecticide or pesticide products, porcelain cleaners, glass, floors, and anti-plugs are some examples of household products that contain B3. This household B3 waste is easier to harm humans in the house itself, such as materials belonging to the type of B3 that are disposed of on the ground in the yard of the house that can contaminate underground water or plants that grow near the house (Florence Lansana Margai, 1999).

The disposal and management of hazardous and toxic waste (B3) is a problem throughout the country. Therefore, the legislators in each country must make regulations for the implementation of safe hazardous waste management and the regulations must appoint a B3 Waste Generator as a legal entity that must ensure that waste is managed following its regulatory standards. The objective of B3 waste management is to ensure safe, efficient, and cost-effective collection, transport, treatment, and disposal of waste.

The United Nations Environmental Program (UNEP) estimates that more than 400 million tonnes of hazardous waste is produced worldwide/year and is estimated to be around 60 kg for each individual in the world, mostly from industrialized countries. About 10% of this total hazardous and toxic waste is sent across international borders, with the majority of transfers occurring between countries. However, some unspecified portion of the total is shipped more or less (±) legally or illegally from developed countries to less developed countries (Orloff & Falk, 2003).

In Europe in 2014, identified (342,000 contaminated sites (5.7 per 10,000 population). Based on data provided by 33 countries, in 2011 the activity that contributed the most to the contamination or contamination of soil and water was the disposal of industrial waste (About 38% of sites) and industrial and commercial activities (Mining, oil extraction and production, power generation – about 34% of contaminated sites) (Fazzo et al., 2017).

In Asia, there are seven countries, 679 regions identified as contaminated by hazardous and toxic waste. 169 locations were polluted by lead which resulted in 245,949 children aged 0–4 years being exposed to lead. Estimated levels of exposure may be sufficient to produce both acute and chronic side effects, such as decreased intelligence. Chatman-Stephens and colleagues analyzed 373 hazardous waste sites in three Asian countries (India, Indonesia,

Philippines) and estimated about 9 million people at risk and an estimated 43 million others at risk from unscreened sites to the exposed population causing about 4 million people. Million people experience disability due to the impact of hazardous and toxic waste (Fazzo et al., 2017).

Hazardous waste not only poses a risk to the surrounding air, water, and soil but also poses a threat to the ecological environment and human health through various channels. Developed countries (Such as the United States and some member countries of the European Union) are the main producers of hazardous waste in the world. Hazardous waste management is very important because of the environmental, social, and economic health impacts of two decades the world has experienced a dramatic increase in the amount of hazardous waste generated. In developing countries, the management of hazardous materials is not very good due to the lack of comprehensive laws, landfills are not maintained and also those that handle waste are not by B3 waste handling standards. Bad behavior and improper disposal methods carried out during the handling and disposal of hazardous wastes increase the significant health and environmental hazards of pollution due to the hazardous nature of the waste (Mbrandi et al., 2016).

Currently, the problem of B3 waste is no longer just a regional problem for each country, but has become a global problem, a serious threat to the global environment. Anticipating this threat, a convention on B3 waste management was formed under the name Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal, namely the Basel Convention on the Control of B3 Wastes Transboundary Movements in 1989. With the international convention on B3 waste management, countries became countries, especially countries participating and ratifying the convention, have roles and responsibilities in efforts to manage B3 waste so as not to pollute the environment globally. A convention is a form of global environmental protection arrangement in addition to other global environmental protection arrangements (Dutta et al., 2006).

Looking at the environmental and health problems caused by the irregular disposal of hazardous and toxic waste, it is important to manage B3 waste to prevent and overcome environmental pollution or damage caused by B3 waste and to restore the quality of the polluted environment so that it is under its function again. In this case, every activity related to B3 (Dangerous and toxic substances) must pay attention to environmental aspects and maintain environmental quality in its original condition and prevent disease.

METHOD

The writing of this Systematic Review uses the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) method which is carried out systematically by following the stages or procedures of the Systematic Review. Article search using the keywords Impact of COVID-19, people's lives in various countries which are accessed online from websites and visits to related university or research institute pages through Google Scholar, Pubmed, Emerald Insight, and DOAJ. Article search is limited to articles in English and international publications. The total number of articles obtained is 63 and out of these 63 articles, a selection process will be carried out to meet the inclusion and exclusion criteria.

Inclusion and exclusion criteria

Based on the systematic review procedure, the reviewed articles must meet the inclusion criteria as follows:

a) Inclusion Criteria: International journal dealing with the impact of hazardous and toxic waste management, research articles published in a span of 10 years (2010-2020), research or review articles, and fully accessible research articles
b) Exclusion Criteria: International articles irrelevant to strategies for developing medical waste management interventions, research articles published more than 10 years back, and so on (Not part of the inclusion criteria)

Selection Process

The selection process or article collection is carried out in stages, namely: 1) Relevant Article Search; 2) Article submission from 2010-2020); 3) Screening according to the Inclusion and Exclusion criteria; 4) Combining review results; and 5) Determining the results, findings from the grouping that have been carried out need to be discussed to conclude the context or results of the review.

Article Evaluation

Evaluation of this article to evaluate the quality and new findings of a scientific article with an international category that is included in the Systematic Review. These criteria can be used to select articles that will not be used. The assessment was carried out in journals related to the topic of strategies for developing medical waste management interventions. It should be understood that the so-called scientific literature can be in the form of papers from scientific journals, papers from a conference (Proceedings), report from a trusted organization, and textbooks.

Data Extraction

In this Systematic Review, data extraction is carried out by looking at the entire published journal within the appropriate 10-year period, then writing down the important findings from the article and proceeding to the next stage, namely data synthesis. The process of journal tracing activities is carried out as shown in the following chart.

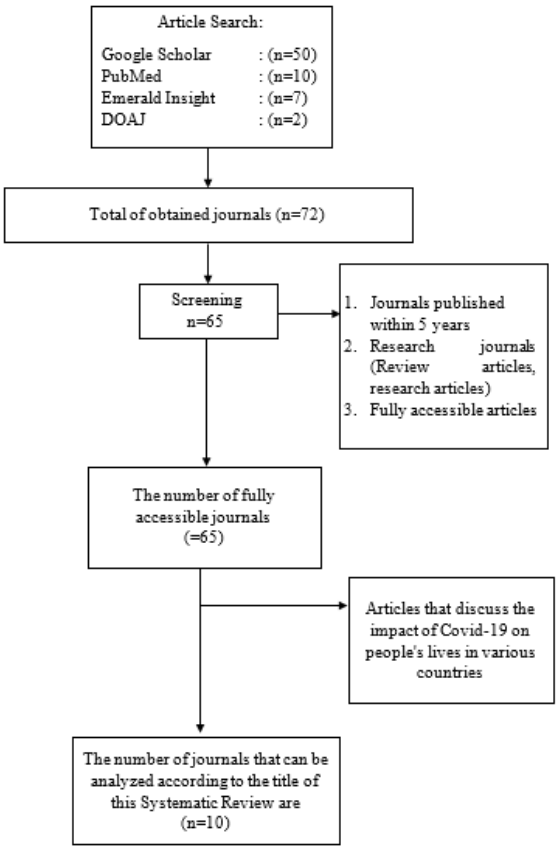


Figure 1. PRISMA Diagram: Stages of Systematic Review

Of all the articles extracted, they were taken from several sources, namely Google Scholar, PubMed, Emerald Insight, DOAJ with the types of journals published such as ELSEVIER, IJS, PROCEEDINGS, NATURERESEARCH, ORESTA, NOVEL CORONA VIRUS, GPH, BTAD, BJS, TUBITAK, CDD, JMINR, IEEE, EHP, FPH, UNTCAD, MDPI, JPP, JMII, AIM, NEJMC, OPHRP, Health Services research and six reports from WHO (World Health Organization). Furthermore, screening of titles, abstracts, and the content selection or content according to inclusion and exclusion was carried out, which obtained 10 articles that were further analyzed. This data extraction is very important in helping and tracing articles that can be analyzed and developed in the future.

Data Synthesis

Research journals that match the inclusion criteria are then collected and a journal summary is made including the name of the researcher, year of publication of the journal, country of research, research title, method, and summary of results or findings. The summary of the research journals is entered into a table sorted alphabetically and the year the journal was published and following the existing format.

RESULTS AND DISCUSSION

Based on the search results, 55 articles were found that were considered suitable for the purpose and then combined and then screened whether the titles in the articles were the same or not. After *screening, it was* found that there were 16 articles with the same title, from 55 journals, then *screened* based on eligibility according to the inclusion and exclusion criteria, 6 articles were obtained for further review. The literature search strategy can be seen in table 2 as follows:

Table 2. Literature Search Strategy

No.	Search Engine	Google Scholar	PubMed	Emerald Insight	DOAJ
1.	Search results	52	8	2	1
2.	Fulltext, pdf, 2010-2020	16	5	4	-
3.	Appropriate Title	40	10	5	-
4.	Eligible according to the inclusion and exclusion criteria	4	1	1	-
Result			**6**		

The source of this *systematic review* is taken from studies conducted in various countries. The analysis of the 6 articles showed that 1 journal with survey method, 1 journal with *mixed methods* design, 1 journal with experimental design, 1 journal with the qualitative design, and 1 journal with multiple regressions.

After assessing the quality of the study, the 6 articles can be categorized as high, then data extraction is carried out. This data extraction is done by analyzing the data based on the author's name, title, purpose, research method, and results, namely the grouping of important data in the article. The results of data extraction can be seen in the following table:

Table 3. Data Extraction

No	Author and Year	Title	Journal	Method	Analysis Technique	Result
1.	Victor E. Akpan and David O. Olukanni, (2020)	Hazardous Waste Management: An African Overview	MDPI Journal	Descriptive research with survey method	Technique percentage and cross tabulation	Studies reveal that hazardous waste management in Africa must revolve around wealth creation, economic, and environmental sustainability.

						The study provided evidence that the recycling option has high potentials in the areas of energy recovery. The data collected show South Africa to be the most advanced in the African continent in the field of hazardous waste management. For a sustainable environment, keen attention must be paid to hazardous waste management globally.
2.	Dimitrios Komilis, Anastassia Fouki, Dimitrios Papadopoulos, (2012)	Hazardous medical waste generation rates of different categories of health-care facilities	ELSEVIER	Quantitative descriptive	Non Parametric	Based on non-parametric statistics, HMWUGR were statistically similar for the birth and general hospitals, in both the public and private sector. The private birth and general hospitals generated statistically

						more wastes compared to the correspondin g public hospitals. The infectious/tox ic and toxic medical wastes appear to be 10% and 50% of the total hazardous medical wastes generated by the public cancer treatment and university hospitals, respectively.
3.	Ozge Yilmaz, Bahar Y. Kara, Ulku Yetis, (2016).	Hazardous waste management system design under population and environmenta l impact consideration s	ELSEVIE R	Mixed Methods	Explanatory sequential design	This model provides valuable insight for decision makers and facility developers. Results obtained would help authorities to set priorities and shape their action plans in terms of the missing and inadequate components that need attention.
4.	Cyril N. Nwankwo, Akuro E. Gobo, Chigozie	Effects of hazardous waste discharge from the	Central Asian Journal of Environm ental	Experiment al design method with Cross-	Parametric test	The results showed the p values of the dumpsite dot and

	Israel-Cookey, Sodienye A. Abere, (2020)	activities of oil and gas companies in Nigeria	Science and Technology Innovation (CAJESTI)	sectional approach		parameters measured are significant at 5%, while the p-value of the locations considered is significant at 10%. Hence, there is a significant difference among dumpsite dot parameters measured and the three locations considered. The least squared difference comparison tests were done to identify the significant factors. It showed that the regions where hazardous wastes are dumped are barren due to the presence of heavy metals as they render the soil unfertile to permit crops and plants to germinate and affect on agriculture.
5.	Aliyu Ahmad Aliyu, Rozilah Kasim and	Siting of hazardous waste dump facilities and their	Emerald Group Publishing Limited	Multiple regression	Univariate and multivariate techniques	The results of univariate analysis suggest a substantial

David Martin, (2010)	correlation with status of surrounding residential neighborhoods in Los Angeles County		difference between tracts with and without (or close to and far from) such hazards by race/ethnicity, income, land use, employment patterns, political participation, and population density. Multivariate analysis of the type suggested by Been (2008), and others indicates that: ➢ Even controlling for income, industrial land use, and manufacturing employment, race/ethnicity correlates with the location of TSDFs, and this holds for both African-Americans and Latinos.

	➢ Income bears a complicated relationship to the likelihood of TSDF location, with the latter first rising, then falling as income increases (see also Been, 2008); and. ➢ As suggested by other authors TSDF location and the proximity of a manufacturing labor force are significantly correlated in a multivariate analysis (and industrial land use, is even more significant

6.	Meirinawati, Eva Hany Fanida, Indah Prabawati, (2018)	Strategy Management of Hazardous and Toxic Waste Processing by PT Artama Sentosa Indonesia (Study of Transporting and Collecting Hazardous and Toxic Waste)	Advances in Social Science, Education and Humanities Research	Qualitative method	Descriptive analysis	The result showed that the strength of this company is good for communication and cooperation between superiors and subordinates, they have cooperation with almost all waste processing companies in Indonesia, they have complete license from environment minister's recommendation, ISO 14001- 2009 certified, clear, basic tasks and functions competent human resources in their field, spacious building which can accommodate vehicles of transporting and collect the hazardous and toxic waste, all of the vehicles have already equipped with GPS.

At this stage attempts to analyze and discuss the problem of B3 waste originating from articles obtained from Google Scholar, Pubmed, Emerald Insight, DOAJ with the types of journals published such as ELSEVIER, IJSDGE, PROCEEDINGS, ICCEM, HINDAWI, JPHE, JSTFT, JET, AJEST, JCH, WMR, BMC *Health Services research* and two reports from WHO (World Health Organization). Focus discussion on the problem:

1. Management of hazardous and toxic waste (B3)
2. Impact of hazardous and toxic waste on health
3. The impact of hazardous and toxic waste on the environment

Management of Hazardous Wastes and Toxic

The first step that must be considered in the process of managing B3 waste is to identify waste. The process of identifying hazardous waste is to determine the source of toxins and hazardous waste materials and is an important first step in a waste management system to determine whether the generated waste meets the definition of hazardous and toxic, as well as to determine how the waste should be managed. The waste producer has the responsibility to determine whether the waste is included in the category of B3 waste or not. The characteristics of B3 waste can be seen in the following table (Taufan & Purwanto, 2018):

Table 4. Identification of Hazardous and Toxic Waste

No.	Types of Waste	Characteristics of Waste	Codes of Waste
1.	Majun	Flammable solids	B110d
2.	Filter oil	Toxic	B340-1
3.	Spray Can, Chemical bottle, Contaminated Packaging	Toxic	B104d
4.	Ex Freon Tube	Toxic	B104d
5.	Lamp	Toxic	B107d
6.	Toner + TDI	Toxic	B339-2
7.	Chemical Waste	Toxic	A106d
8.	Oli + Used Fuel	Flammable Liquids	B105d
9.	Sawdust Waste Contamination	Flammable solids	B110d
10.	Wet and Dry Battery	Corrosive	A102d
11.	Polyclinic Waste	Toxic	B337-1
12.	Fly Ash	Toxic	B409
13.	Bottom Ash	Toxic	B410

Source: Taufan Herry Setiawan, Purwanto, (2018)

The next step in B3 (Dangerous and toxic substances) waste management is one of a series of activities that includes storage, collection, utilization, transportation, and processing of B3 waste including the landfilling of the processing results. In general, both factory and household activities are not aware that the waste produced is included in the category of B3 waste, so that waste is simply dumped in to the water system without any processing so that it can pose a potential hazard to human health and the environment (Talınlı et al., 2005).

The impact of hazardous and toxic waste on the potential for environmental pollution results in many diseases that can affect human health and the surrounding environment from the mildest to the most severe. In addition, from direct contact with hazardous and toxic waste

or breathing polluted air. From the types of hazardous and toxic wastes such as infectious waste, body part waste, medical and chemical waste, radioactive waste, which can carry a greater risk to health such as skin infections, anthrax, meningitis, AIDS, dengue fever, hepatitis A, B, C (Kumar et al., 2013).

Improper disposal of hazardous waste is an increasing problem in many developing countries. Therefore, waste materials, hazardous and toxic need to be regulated under the force of law. However, B3 (Dangerous and toxic substances) waste management is very complex and regulations must be developed in the context of a comprehensive policy covering the responsibilities of various parties, socialization to the community and business actors, establishment of facilities (with special attention to criteria for determining location), and systems to control and monitor movement and B3 waste disposal (Shapiro, 1980). So, law enforcement instruments are preventive, namely in the form of preventive measures for efforts to control pollution and environmental damage, such as the 1989 Basel Convention concerning the supervision of the cross-border movement of B3 (Dangerous and toxic substances) waste (*Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*) with the aim of for:

1. Protect human health and the environment against the dangers of B3 waste.
2. Returning to a principle that a State must be responsible for the B3 waste it produces.
3. Intensively encourage efforts to reduce the amount of B3 waste generated (Dutta et al., 2006).

In the Southeast Asia region, the country that ratified the 1989 Basel Convention was Indonesia. The Basel Convention, which consists of a preamble of 29 articles and 6 anmexes, has been ratified by Indonesia by the Decree of the President of the Republic of Indonesia Number 61 of 1993. The ratification of the Basel convention reflects the awareness of the government of the Republic of Indonesia regarding the threat of environmental pollution due to the movement or transportation of B3 waste from abroad to the country (Maulidya et al., 2019).

The main objective of any Hazardous Waste Management Plan is to ensure the safe, efficient, and economical collection, transportation, treatment, and disposal of waste (Misra & Pandey, 2005). The steps for effective B3 waste management are as shown in the following chart:

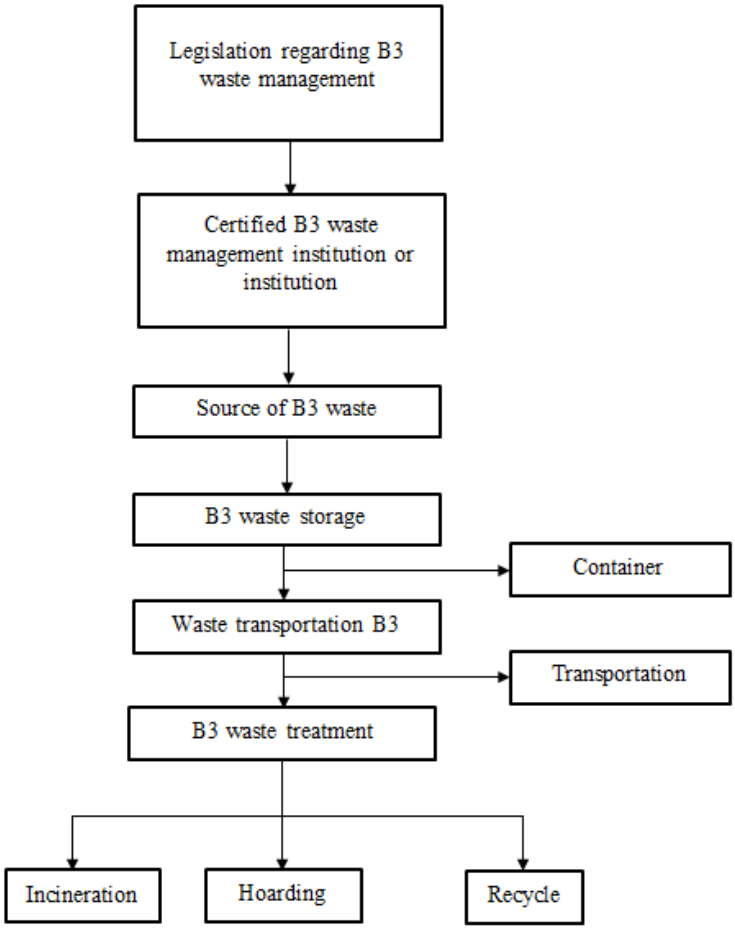


Chart 5. Hazardous Waste Management

The concept of B3 waste management is a very important aspect that needs special attention. Communities in developed countries have adopted several hazardous waste management strategies, which can be recommendations for people in developing countries (Akpan & Olukanni, 2020), such as:

1. Determination of public education about the potential for recycling B3 waste
2. Reduction of B3 waste from its source
3. Development of human resources in the effective use of B3 waste recycling technology
4. Assessment and evaluation of management schemes in the reporting platform.
5. Improvement of appropriate structure, practical awareness, and knowledge
6. Solidification and restructuring of the current regulatory structure.
7. Provision of funds for the development of modern infrastructure to reduce the dangers of B3 waste
8. B3 waste control system.

However, B3 (Dangerous and toxic substances) waste management can pose a great danger to human life, the environment, plants, and animals if not managed properly. If managed properly, B3 waste can be a source of economic benefits for the community and the state (Nwankwo et al., 2020). Therefore, environmentally friendly and sustainable B3 (Hazardous

and toxic substances) waste management always demands a well-planned management system for the collection, recycling, and final disposal of waste. Some of the household, industrial and institutional waste contains materials that can be toxic or harmful to humans and animals. In general, these materials are known as hazardous waste. At present, more attention is paid to the handling of waste and B3 (Dangerous and toxic substances) waste, both the government and society demand more in terms of protecting the environment and improving B3 waste management (Shuckrow et al., 1982).

The European Directive 2008/98/EC stipulates that the priority for B3 (Dangerous and toxic substances) waste management is prevention (Reduce), reuse, and recycling. If none of these options is feasible, the next step in the priority ranking is burning with energy recovery (Energy from waste), while the process of transporting and storing waste is also treated differently (Meirinawati et al., 2018). Management of the hazardous waste that has been generated is one of the combustion problems that require immediate attention. The main objective of any hazardous waste management plan is to ensure the safe, efficient, and economical collection, transportation, treatment, and disposal of waste. It should further ensure that the system operates satisfactorily for the current as well as for the foreseeable future scenarios. So, the B3 waste management system consists of components for the collection, transportation, treatment, and disposal of waste (Misra & Pandey, 2005).

The Impact of Hazardous and Toxic Waste on the Environment and Health

Improper waste management and illegal shipping of waste can harm both the environment and public health. Negative impacts can be caused by different handling and disposal activities that result in soil, water, and air pollution. Other disturbances caused by uncontrolled or improperly managed waste disposal can have negative impacts including impacts at the local level, such as soil damage, local air and water pollution, and indiscriminate disposal of hazardous waste. Managing waste properly and in an environmentally friendly manner is therefore important for health reasons (WHO, 2015).

Environmental pollution caused by B3 waste is a problem that has become a concern for all nations in the world since the emergence of cases of environmental pollution due to B3 waste such as in Japan's Minamata Bay, United States Love Canal, Canada's Wabigon River and India's Bophal (Maulidya et al., 2019). Hazardous and Toxic Materials are substances, energy, and/or other components due to their nature, concentration, and/or quantity, either directly or indirectly pollute and/or damage the environment, and/or damage environmental life, health, and survival. humans and other living things. Hazardous waste has a chemical composition or other properties that must be managed to prevent its release into the environment that can result in disease, death, or other harm to living organisms including humans (Meirinawati et al., 2018).

Problems regarding B3 waste management can have an impact on environmental pollution and can harm human beings, industrial players, and the environment itself. the process of pollution due to hazardous and toxic materials industrial materials can occur directly or indirectly. Directly when a pollutant has an acute effect and a direct toxic effect that interferes with human health and adversely affects the environment, animals, and plants or disrupts the ecological balance of air, water, and soil. While the indirect process is when the pollutant has an indirect and delayed effect on humans and the environment and will only be felt after a

certain period. On the other hand, improper waste management can cause carbon to explode into the atmosphere and create a domino impact on other environmental problems (Taufan & Purwanto, 2018).

The Impact of Hazardous and Toxic Waste on the Environment

Hazardous waste has the characteristics of being explosive, flammable, reactive, toxic, causing infection, and being corrosive. Assessment of the feasibility of handling B3 waste pollution requires environmental regulations for environmental safety (Li et al., 2018). The international community has tried to overcome the concern of worsening environmental conditions through various international agreements starting from the 1972 Stockholm Declaration followed by the 1989 Basel Convention which specifically highlighted the dangers of toxic waste (Hazardous waste) and the 1992 Earth Summit in Rio in Janeiro, Brazil which discusses the commitment to make the earth better and more comfortable for humans to live in. The decision to hold a "*Conference on Environment and Development*" has been made since 1989 by the United Nations General Assembly (Stone, 1992). Environmental problems have become an international issue since the 1972 Stockholm conference, even before this conference was held, developed countries had long been preoccupied with pollution problems in their respective countries (Paraschiv, 2015).

Ineffective B3 waste management techniques and inappropriate facilities, the informal sector has released large amounts of toxic heavy metals and organic pollutants into the workplace and the surrounding environment. The views and ideas of holding the Stockholm conference started from the concern of countries in the world seeing the increasingly high level of pollution and damaging the human environment as a result of industrialization. Hazardous and toxic waste materials greatly affect the community's living environment. The problem of environmental pollution is usually a concern of the government and industry players. However, sometimes the community is not involved which causes less monitoring of environmental pollution prevention (Panteghini & Sandberg, 2015).

The public in general still has little awareness and knowledge about household B3 waste which they often encounter in their daily life, ranging from types, impacts to the practice of transferring B3 waste. Therefore, socializing about the dangers of B3 waste and how to handle it to the community is a very important activity to do, in addition to protecting the environment, also for sustainability to improve the quality of the environment they live in. So from the socialization activities, it is hoped that the spirit of caring for the environment will arise by not throwing waste carelessly or without filtering. The socialization is designed to familiarize the public in managing B3 waste following the procedures so that B3 waste is not disposed of in any place (Ericson et al., 2013).

There are a series of environmental technicalities based on Multilateral Environmental Agreements relating to the management of Hazardous and Toxic Waste (HTW), such as:

1. The Stockholm Convention on Persistent Organic Pollutants (POPs) requires a irreversible transformation' of POPs and POPs waste, as well as minimization and avoidance of emissions of dioxins, furans, PCBs and hexachlorobenzene during disposal.

2. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.
3. The Rotterdam Convention on the Prior Informed Consent Procedure (PIC) for Certain Chemicals and Pesticides in International Trade.
4. The Vienna Convention on the Protection of the Ozone Layer and the Montreal Protocol on substances that deplete the Ozone layer (Convard and O'Toole, 1998) (Mbrandi et al., 2014) .

Environmental management policy is an important tool in the management of all types of waste, including material waste, hazardous and toxic, ensuring sustainable use of natural resources, application of the principle that polluters pay for non-compliance with regulations and reduce, reuse, and recycle waste (Mbrandi et al., 2014).

Impact of Hazardous and Toxic Waste on Health

Among the effects of hazardous waste on human health is due to the toxic nature of the materials contained in the waste. Various types of diseases that can occur due to hazardous waste, one of which is cancer (Fazzo et al., 2017). Diseases caused by hazardous waste can be acute and chronic. Acute effects can result in damage to the nervous system, damage to the digestive system, damage to the cardiovascular system, damage to the respiratory system, damage to the skin, and death. mutations in body cells), teratogenic effects (Driving the occurrence of congenital defects), and damage to the reproductive system. The parts of the body that are affected are kidneys (Generally caused by toxic substances Cadmium); Bones (Generally due to the toxic substance Benzene); (generally due to the toxic substance Methyl Mercury); Liver (Generally caused by toxic substances Carbon-Tetrachloride); Lungs (Generally due to the toxic substance Paraquat); Eyes (generally caused by toxic substances Chloroquine) (Fazzo et al., 2017).

Toxic substances produced by B3 waste enter the human body through:

1. Oral i.e through the mouth and then the digestive tract, difficult to reach the blood circulation.
2. Inhalation, namely through the respiratory tract, is rapidly entering the blood circulation.
3. Dermal, namely through the skin so that it easily enters the blood circulation
4. Peritonial that is through injection, directly enters the blood circulation (Steensberg, 1982).

Humans have always been exposed to the dangers of substances going back to prehistoric times when they inhaled noxious volcanic gases or succumbed to carbon monoxide from inadequately ventilated fires in caves. Toxic substances that enter the human body will be carried by the blood and distributed throughout the body and then interfere with body organs, including neurotoxic poisoning, toxic substances will be carried to the brain, or toxic substances will be stockpiled and processed in fat tissue, muscle, bone, nerves, liver, pancreas, intestines and then after going through the process the rest will be secreted out of the body (Misra & Pandey, 2005).

Given that B3 waste is a material that is hazardous to public health, the public must have an understanding of the negative impact of B3 waste on public health. This is important so that the community can be more careful and careful in using, disposing, and managing B3 waste. The health impacts of B3 waste can be seen in the following table:

Table 6. Health Impacts of Hazardous Waste

Hazardous waste	Source	Health Impact
Heavy metals Arsenic	Mining, nonanthropogenic geo-chemical formation	Carcinogenic, cardiac disorders, anemia,
Cadmium	Mining, fertilizer industry, battery waste	Carcinogenic, damage to livers and kidneys, chronic obstructive pulmonary diseases, cardiovascular and skeletal disorders.
Chromium	Mining areas, Tanneries	Kidney damage, skin disease, acute tubular damage.
Lead	Lead acid battery smelters	Lead poisoning, neurotoxic, mental impairment in children, damage to brain, kidney, and liver
Manganese	Mining areas	Respiratory disease, neuropsychiatric disorder
Mercury	Chlor-alkali industries, health care institutes	Hg poisoning affects the human brain, central nervous system, kidneys, and liver. High Hg exposure causes vision, speech and hearing. impairment. May lead to death.
Nickel	Mining, metal refining	Lung and nasal cancer, damage to the gastrointestinal system, cerebral edema, respiratory failure
Hydrocarbons Benzene	Petrochemical industries, solvents.	Headaches, nausea, leukemia, damage to bone marrow.
Vinyl chloride	Plastics	Carcinogenic (liver and lung cancer), depression of central nervous system, embryotoxic.
Pesticides	Insecticides	Cancers, genetic damage, stillbirths, immune system disturbances, embryo damage.
Organic chemicals Dioxins	Waste incineration, herbicides	Cancer, birth defects, skin disease
PCBs	Fluorescent lights, E-waste, Hydraulic fluid	Skin damage, possibly carcinogenic, gastro-intestinal damage.

Source: Shantanu K Dutta, VP Upadhyay and U Sridharan (2006)

To maintain health and prevent exposure to B3 waste as shown in the table above, in carrying out B3 waste management it is necessary to pay attention to the hierarchy of B3 waste management, among others, by seeking reductions in sources, processing materials, the substitution of materials, regulation of activity operations, and the use of clean technology. If

B3 waste is still generated, the efforts are made to utilize B3 waste, which includes recycling, recovery, and reuse.

CONCLUSION

B3 waste (Hazardous and toxic materials) is a substance that directly or indirectly pollutes, damages, or endangers the environment. This waste can also endanger the health and safety of humans and other living things. This can occur due to the nature, concentration, and the amount of hazardous substances or components in them. Therefore, every person who generates B3 waste is obliged to carry out waste management before disposing of it to a landfill, such as: reducing the production of B3 waste, storing B3 waste, collecting B3 waste, transporting B3 waste, and disposing of B3 waste.

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