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Analysis of the Management of Hazardous and Toxic Waste (B3) in a dairy processing company

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ABSTRACT

This article discusses the analysis of hazardous and toxic waste (B3) management in a dairy processing company. The research methods used include Literature Review, Field Study, and Interviews. The research findings reveal the types of waste generated, hazardous waste management permits (B3), temporary storage facilities for B3 waste, classification of stored B3 waste, B3 waste balance, B3 waste reporting, B3 waste treatment, emergency response readiness, and B3 waste management by third parties. The company has complied with all regulations related to B3 waste management, especially Minister of Environment and Forestry Regulation Number 6 of 2021 concerning Procedures and Requirements for Hazardous and Toxic Waste Management. This document provides in-depth insights into the B3 waste management process in the dairy processing company.

KEYWORDS

Hazardous and Toxic Waste (B3)
Waste Management
Milk Processing

1. Introduction

As time progresses, industrial development worldwide is also advancing rapidly, including in Indonesia. Many companies still lack adequate social and environmental responsibility, resulting in environmental damage, as they undergo a lengthy process from raw material to finished product with the aim of maximizing company profits (Auliya, 2018). However, the production process generates various types of waste, one of which is Hazardous and Toxic Waste (B3). According to government regulation No. 101 of 2014 concerning the management of Hazardous and Toxic Waste, in addition, in Government Regulation No. 22 of 2021, B3 waste is defined as the remaining waste from a business and/or activity containing hazardous and toxic substances (B3). B3 waste consists of substances, energy, and other components which, due to their concentration and quantity, directly or indirectly endanger or even damage the environment, health, and the survival of humans and other living beings (Sandra, 2022). Consequently, B3 waste is strictly prohibited from being directly disposed of into the environment without prior treatment (Yuwati et al., 2023). B3 waste has properties and characteristics that differ from other wastes, primarily due to its unstable nature. The stability level of B3 waste is influenced by several external factors including temperature, pressure or friction, and mixing with other substances. Thus, B3 substances may trigger properties such as being easily explosive, oxidizing, flammable, moderately toxic, harmful, corrosive, irritating, environmentally hazardous, carcinogenic, teratogenic, and mutagenic. B3 Waste Management involves activities such as reduction, storage, collection, transportation, utilization, processing, and/or storage (Nguyen et al., 2023). Regulated in Articles 10 to 11 of Government Regulation No. 101 of 2015, B3 waste reduction is achieved through material substitution, process modification, and the use of environmentally friendly technologies. Meanwhile, according to Minister of Environment and Forestry Regulation No. 6 of 2021, B3 waste processing includes activities such as B3 waste reduction, storage, collection, transportation, utilization, processing, and/or storage.

One of the companies engaged in the production of baby food, particularly milk, was the focus of this study. The residual raw materials from the company's production process include both solid and liquid waste, one of which is B3 waste. The pollution impacts of these wastes on human health include headaches, nausea, dizziness, poisoning, and continuous exposure to B3 waste can lead to death, skin cancer, cataracts, and respiratory infections. Based on the above background, the researcher intends to conduct a more in-depth study regarding the management of B3 waste in milk processing companies.

2. Method

The method of data collection in research implementation is conducted using the methods of Literature Review, Field Study, and Interviews in every company activity. To explain the details of each method, among them:

2.1 Literature Review

Literature Review is the initial step that must be taken before conducting field observations. In Literature Review, there are several stages such as collecting primary and secondary literature sources. Furthermore, in Darmalaksana's research (2020), data processing or referencing is conducted to be presented as research findings, which are later abstracted to obtain comprehensive information and interpreted to derive knowledge for drawing conclusions.

2.2 Field Study

Field study or field observation is conducted in specific stages. The first stage involves designing the research and testing field equipment. Next, the research location and informants are determined. During the field research, observations, interviews, and documentation are conducted. Finally, the data obtained from the field study is presented as research findings, abstracted to obtain comprehensive information, and interpreted to produce knowledge for drawing conclusions (Darmalaksana, 2020).

2.3 Interviews

Interviews are a question-and-answer process between the interviewer and the interviewee for specific purposes. There are interview guidelines either face-to-face or using specific communication equipment (Makbul, 2021). In conducting interviews, the writer can prepare a list of questions related to the focus of the research problem needed or being investigated, specifically related to the management of Hazardous and Toxic Waste (B3 Waste) from basic understanding to the applied practices.

2.4 Data Analysis Method

Data analysis is an effort to systematically organize the data obtained through the field process, which is later presented as findings. Data analysis consists of data collection, data processing, presentation, and decision-making based on research results. The data analysis conducted by the writer is by collecting primary data obtained from observations and interviews with employees in the HSE (Health, Safety, and Environment) division regarding the management of B3 waste. Furthermore, secondary data is collected from documents and existing references, such as literature data, journals, papers, previous research reports, company profiles, explanatory data such as process flowcharts, and B3 waste balance data.

3. Results and Discussion

3.1 Types of Waste Generated

The company conducts identification and determination of the hazardous and toxic waste (B3 waste) status in accordance with Article 3 paragraph (1) and paragraph (2) of the Minister of Environment and Forestry Regulation Number 6 of 2021. There are several types of waste generated, including:

- Non-B3 Waste

Waste generated from a production process from the industry and waste generated not contaminated with hazardous and toxic substances. The Table 1 provides a breakdown of non-B3 waste generated, detailing its type, form, and characteristics. The non-B3 waste consists of various materials, including wood, paper, plastic, masks, sludge, rubber, fabric, and food waste, all of which are in solid form. These materials are classified as non-hazardous, indicating that they do not pose a risk to health or the environment. This categorization is crucial for proper waste management practices, ensuring that these materials are handled and disposed of appropriately to minimize any potential impact on human health and the environment.

Table 1. Non-B3 Waste

No	Type of Non-B3 Waste	Form	Characteristics
1	Wood	Solid	Non-Hazardous
2	Paper	Solid	Non-Hazardous
4	Plastic	Solid	Non-Hazardous
5	Masks	Solid	Non-Hazardous
6	Sludge	Solid	Non-Hazardous
7	Rubber	Solid	Non-Hazardous
8	Fabric	Solid	Non-Hazardous
9	Food Waste	Solid	Non-Hazardous

Source: Secondary Data (2023)

- Hazardous and Toxic Substance (B3) Waste

Table 2. Contaminated Waste

No	Waste Type	Waste Form	B3 Waste Code
1	Used Gauze Fabric	Solid	B110d
2	Contaminated Packaging	Solid	A108d
3	Accu Batteries	Solid	A102d
4	Oil Filters	Solid	B109d
5	Used Fluorescent Lamps	Solid	B107d
6	Used Oil	Solid	B105d
7	Chemical Residue	Liquid	A338-2
8	Used Batteries	Solid	A108d

Source: Secondary Data (2023)

Hazardous and Toxic Substance (B3) Waste is residue from an activity that contains hazardous and/or toxic substances due to their concentration and/or quantity, either directly or indirectly causing environmental damage and harm to other living organisms. The Table 2 presents a comprehensive overview of various types of B3 waste, categorizing them based on their type, form, and B3 waste code. These include used gauze fabric, contaminated packaging, accu batteries, oil filters, used fluorescent lamps, used oil, chemical residue, and used batteries. Each type of waste is identified by its specific B3 waste code, such as B110d for used gauze fabric and A108d for contaminated packaging and used batteries. These codes serve as identifiers for proper classification and management of hazardous waste, ensuring compliance with regulatory standards and facilitating effective waste disposal practices.

3.2 Management Permit for Hazardous Waste (B3 Waste)

To continue its operation, the Company generates hazardous waste (B3 waste) that requires efforts for B3 waste management based on Article 274 of Government Regulation Number 22 of 2021 concerning the implementation of environmental protection and management. There are several methods for managing B3 waste as well as non-B3 waste, including reduction, storage, collection, transportation, utilization, management, and/or disposal of B3 waste (Lestari and Djanggih, 2019). In this case, the company only conducts reduction and storage of B3 waste and collaborates with third parties for the processing of B3 waste. According to research by Pertiwi (2017), B3 waste has unstable properties, which means it cannot be directly disposed of into the environment as it would pose dangers to the environment, humans, and other living organisms. According to Haryono (2015), institutions or companies are required to conduct an Environmental Impact Assessment (AMDAL) or obtain a Mandatory Environmental Management Plan (UKL-UPL) to facilitate business activity feasibility permits. Currently, the company is in the process of obtaining an Environmental Management Plan (RINTEK) from the ministry, but the company already has a district-level RINTEK as a requirement for the temporary storage operation of B3 waste in accordance with the Minister of Environment and Forestry Regulation number 5 of 2021 concerning the Procedure for Issuing Technical Approvals and Operational Eligibility Letters in the Field of Environmental Pollution Control.

3.3 Temporary Storage Place for B3 Waste

The company is a producer of B3 waste, thus complying with Article 11 paragraph (2) of the Minister of Environment and Forestry Regulation Number 12 of 2020. There are several building requirements as a Temporary Storage Place conducted by the Company and have met the requirements as stated in the Letter of Environmental Service of the Bogor Regency Government Number 600.4/530/TL-DLH. Here is the explanation regarding the Temporary Storage Place for B3 waste:

- Construction Design of the Temporary Storage Place for B3 Waste

The Temporary Storage Place has a building size with dimensions of 9.2 meters in length, 5.0 meters in width, and 3.5 meters in height.

- Nameplate and Coordinate Point of the Temporary Storage Place for B3 Waste

The Temporary Storage Place for B3 waste is located at the coordinate point S= 06º29’53.12” E= 106º52’21.86”

- B3 Waste Symbols outside the door of the Temporary Storage Place for B3 Waste

Symbols installed on the door of the B3 TPS include toxic, corrosive, flammable, and environmentally hazardous symbols.

Figure 1. Symbols of hazardous and toxic waste outside the door of the hazardous and toxic waste temporary storage facility (TPS).

Source: Personal document (2023)

- B3 Waste protected from sunlight and rain

B3 waste is stored in a room equipped with air ventilation and protected from sunlight and rain.

- Air ventilation at the Temporary Storage Place for B3 Waste

There are two ventilations at the B3 waste TPS in the company: first, at the bottom of the entrance door of the B3 waste TPS, which functions as an inlet for air circulation. The second one is the exhaust fan, which functions as an air suction out of the B3 waste TPS.

Figure 2. Air ventilation at the bottom of the door

Figure 3. Exhaust Fan inside the B3 TPS room.

Source: Personal document (2023)

- Walls, roofs, and lighting systems at the Temporary Storage Place for B3 Waste

The walls at the B3 waste TPS are made of thick bricks with plaster. Then, the roof uses corrugated zinc and steel construction. These three materials meet the standard as non-flammable materials. As for lighting in the B3 waste TPS, there are two lamps, one in the indoor room of the B3 waste TPS and one outside the B3 waste TPS.

- Placement of B3 waste with block system using Pallets as bases

The placement of B3 waste in a block system aims to reduce contamination between waste if there is spilled B3 waste in the area of the B3 waste TPS. There are several blocks in the B3 Waste TPS including A) Used oil and oil filter, B) Contaminated packaging, Used batteries; C) Gauze cloths; D) Fluorescent lamps and electronic waste.

Figure 4. Used Oil Waste and Oil Filters

Figure 5. Contaminated Packaging Waste

Figure 6. Cotton Waste Figure 4.15.

Figure 7. Fluorescent Lamp Waste

Source: Personal Documents (2023)

3.4 Classification of Stored B3 Waste

The classification of B3 waste is carried out based on the reference in Appendix IX of Government Regulation Number 22 of 2021 concerning the implementation of environmental protection and management. The classification of B3 waste is conducted in accordance with the established procedure. The purpose of this classification is to determine the code, quantity, symbols, shelf life, and packaging of B3 waste (Purwati, 2015). The classification of B3 waste is displayed in the following table:

Table 3. Classification of B3 Waste

No	Name	Expiration date	Sources	Characteristic
1	Used Gauze Fabric	365	Production, logistics, and maintenance	Dangerous
2	Contaminated Packaging	365	Production and logistics	Dangerous
3	Accu Batteries	365	Maintenance	Dangerous
4	Oil Filters	365	Maintenance	Dangerous
5	Used Fluorescent Lamps	90	Maintenance	Dangerous
6	Used Oil	90	Maintenance	Dangerous
7	Chemical Residue	365	Production and logistics	Dangerous
8	Used Batteries	365	Maintenance	Dangerous

Source: Detailed Technical Document of B3 TPS (2023)

3.5 B3 Waste Balance for the Year 2023

Waste balance represents the performance of B3 waste management within a specific period (Nandhito, 2018). This is done to facilitate data collection and data transparency during environmental audits (Fajriah & Wardhani, 2020). The stages to conduct B3 waste data collection consist of reporting by each division generating B3 waste to the EHS (Environment, Health, and Safety) department for recording the types and volumes of B3 waste. Subsequently, packaging is done by the EHS department, providing symbols and labels according to the characteristics of B3 waste, with reference to the Regulation of the Minister of Environment of the Republic of Indonesia No. 14 of 2013 regarding Symbols and Labels for B3 Waste. After the data collection is completed, the waste is placed in the B3 waste storage facility, and another round of data recording is done in the logbook available at the B3 waste storage facility. Below is the B3 waste balance for the period from January to June 2023.

Table 4 shows that in January, the company generated the most B3 waste, mainly contaminated woven fabric and used oil. In that month, 380 kg of contaminated woven fabric and 24 kg of used oil were produced. In February, the waste generated includes 282 kg of contaminated woven fabric, 110 kg of used oil, and 13 kg of used TL lamps. In March, 161 kg of contaminated woven fabric and 47 kg of used oil were produced. In April, the B3 waste generated includes 102 kg of contaminated woven fabric and 56 kg of used oil. In May, 103 kg of contaminated woven fabric and 99 kg of used oil were produced. In June, 162 kg of contaminated woven fabric and 112 kg of used oil were generated. The total amount of contaminated woven fabric waste generated was 1,190 tons, while used oil waste amounted to 0.448 tons. On June 30, B3 waste was transported by a third party, with a total of 1651 kg of B3 waste being transported.

Table 4. B3 Waste Balance for the Year 2023

No	Name	Waste Produced (Kg)						Total
		January	Febuary	March	April	May	June	
1	Used Gauze Fabric	380	282	161	102	103	162	1190
2	Used Fluorescent Lamps	0	13	0	0	0	0	13
3	Oil Filters	0	0	0	0	0	0	0
4	Contaminated Packaging	0	0	0	0	0	0	0
5	Used Oil	24	110	47	56	99	112	448
6	Accu Batteries	0	0	0	0	0	0	0
7	Chemical Residue	0	0	0	0	0	0	0
8	Used Batteries	0	0	0	0	0	0	0

Source: Source: Secondary Data (2023)

3.6 Reporting of B3 Waste

The reporting of B3 waste involves recording the activities of storing B3 waste. In compliance with the applicable regulations, the Company has submitted reports electronically through "Siraja Limbah Online". This policy aims to facilitate and expedite access to obtain accurate and precise data or information on the types and amounts of B3 waste at each company (Kurniawan, 2019). The Company has complied with Article 80 paragraph (10) of the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 6 of 2021 concerning the procedures and requirements for the management of hazardous and toxic waste.

3.7 Management of B3 Waste Processing

In accordance with Ministerial Regulation number 6 of 2021, the Company processes B3 waste before it is handed over to third parties. According to Nandito's research (2018), B3 waste processing and storage management serve to facilitate the identification and control of B3 waste for personnel. The procedures carried out by the company in processing B3 Waste involve treating the B3 waste separately from non-B3 waste. Subsequently, waste storage is carried out. The Company temporarily stores B3 waste in enclosed places and in designated B3 waste storage areas based on the type of waste. There are three zones in the company distinguished by color, where the outside area is gray or black, the low-care area is blue, and the medium and high-care areas are stainless steel permanently fixed in the area. Additionally, when there is a pallet color outside the designated zone color, the party placing the B3 waste in the waste storage facility must provide zoning location identification. Furthermore, the responsible person for the B3 waste storage facility weighs the waste to be stored in the B3 Waste Storage Facility to be recorded in the B3 balance sheet. Then, when the B3 waste storage facility is full and/or when the waste's shelf life approaches the expiration limit, the responsible party schedules waste transport to third parties for B3 Waste transportation. In Figure 8, letter A indicates waste handed over to the sanitation department, while letter B indicates waste handed over to third parties for further management.

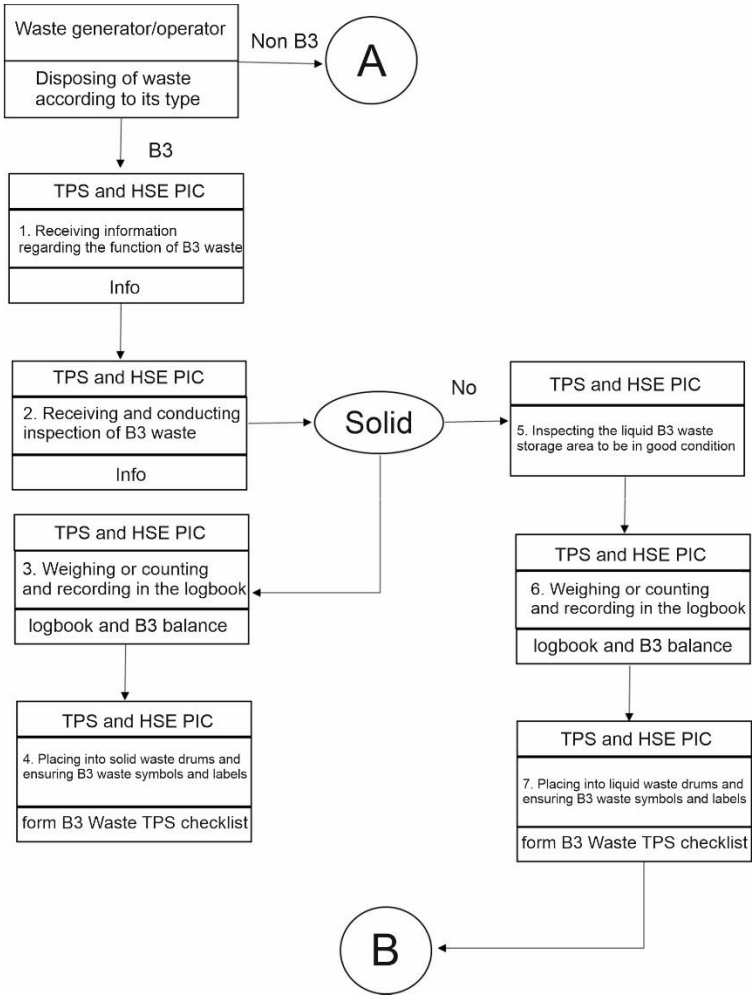

Figure 8. Hazardous Waste Management

Source: Company supporting documents (2022)

3.8 Emergency Response Preparedness

In handling B3 waste, specific emergency response guidelines are required to address and overcome emergency situations that may occur in the company's area, which could result in losses to workers, property, or the environment. According to Nandito's research (2018), the Company has emergency response preparedness. When encountering emergency conditions around the B3 waste storage facility, employees immediately inform the nearest person, shout, or call the emergency number at the Company to report the situation around the emergency location. If these three methods do not work effectively, employees inform the personnel stationed at position 1. If there are casualties around that area and employees do not have expertise in emergency response, do not move or lift the casualties. Subsequently, activation is done by the Emergency Response Team (ERT) to handle the emergency situation. Then, the ERT will provide information about the situation at the scene. Employees are prohibited from returning to the workplace until instructed by the authorized personnel.

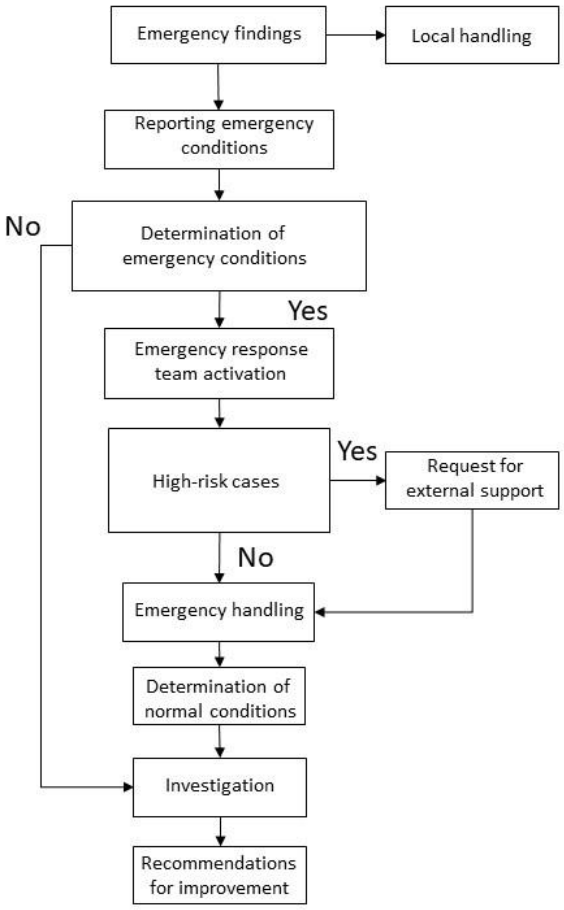

Figure 9. Emergency Handling Flowchart
Source: Company supporting data (2022)

3.9 Management of B3 Waste Towards Third Parties

After storing B3 waste at the B3 waste storage facility, the management of B3 waste is then carried out by third parties to transport the B3 waste. Transporting B3 waste cannot be done by just any party; only parties that have a business permit in the field of B3 waste transportation according to the reference of the Minister of Environment and Forestry Regulation of the Republic of Indonesia Number 6 of 2021 are allowed to do so. B3 waste management in the industry is not done through open dumping but rather through the services of third parties. This will facilitate B3 waste generators because they do not need to process B3 waste from company activities (Fitri et al., 2020).

The company has collaborated with third parties for the transportation of B3 waste. The vehicles used by the company's third party are equipped with symbols and accompanied by B3 waste manifests according to the reference of the Minister of Environment and Forestry Regulation of the Republic of Indonesia No. 56 of 2015.

4. Conclusion

Based on the research findings regarding the analysis of hazardous and toxic waste (B3) management in a dairy processing company, it is concluded that the company is a manufacturing plant operating in the food and beverage sector. B3 waste is generated from various production processes, including equipment washing, wet processing (Wet Process), boilers and utilities, and dry processing (Spray Drier). B3 waste management includes licensing, temporary storage of B3 waste, codification of stored B3 waste, B3 waste balance, and B3 waste reporting. Additionally, B3 waste treatment is carried out by third parties in accordance with Minister of Environment and Forestry Regulation No. 6 of 2021. The company has complied with all regulations, particularly Minister of

Environment and Forestry Regulation No. 6 of 2021 regarding Procedures and Requirements for the Management of Hazardous and Toxic Waste.

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