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# ANALYSIS AND MANAGEMENT OF POLYCHLORINATED BIPHENYLS (PCBS) AT TEMPORARY STORAGE OF HAZARDOUS AND TOXIC WASTE OF PLN UP3 TANJUNG KARANG

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INFO ARTIKEL	ABSTRACT
Diterima 04 November 2022 Direvisi 12 December 2022 Disetujui 25 December 2022	<i>Polychlorinated Biphenyls (PCBs) are persistent organic pollutants that harm the environment and human health. One of its uses is in the transformer at the electricity company. Efforts to prevent PCB contamination are carried out through identification and inventory, management of PCBs, and monitoring of PCBs. The methods used in this study were direct observation, questionnaires, and PCB testing using the Dexsil L2000DX/Chloride Analyzer as early detection of the presence of PCBs in offline transformer oil and sorting out samples with chloride concentrations &gt; 50 ppm. The data collected is in the form of primary data and secondary data. The purpose of this research is to implement an Environmental Safeguard, especially PCBs at PLN UP3 TPS Tanjung Karang Hazardous and Toxic Material Waste, so there will be no pollution to the surrounding environment</i>
<b>Keywords:</b> <i>Polychlorinated Biphenyls, Chloride Analyzer, Transformer oil, waste</i>	

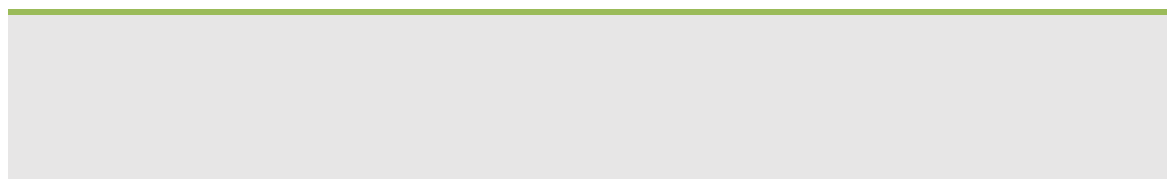
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## Introduction

Persistent Organic Pollutants (POPs) are organic compounds that are resistant to environmental degradation through chemical, biochemical and photo-oil processes (Zacharia, 2019). Therefore, POPs can survive in the environment, travel long distances, accumulate biologically in human and animal tissues, participate in the food chain, and have a significant impact on human health and the environment (Soto et al., 2013).

The government through the Ministry of Environment and Forestry has ratified international environmental agreements related to persistent organic pollutants (Yadav et al.,

2015), namely the 2001 Stockholm Convention on Persistent Organic Pollutants, especially Polychlorinated Biphenyls (PCBs), signed by 151 countries, including Indonesia. Indonesia ratified it through Law number 19 of 2009. PCBs must be managed and it is hoped that they can be phased out before 2028. The destruction of PCBs must begin with a nationally valid inventory. The inventory is the responsibility of the B3 waste owner. The Ministry of Environment and Forestry, UNIDO (United Nations Industrial Development Organization), and GEF (Global Environment Facility) 2001 has implemented the Introduction of an Environmentally-sound Management and



Disposal System for PCB-Wastes and PCB-Contaminated Equipment" project where one of the activities carried out are the PCBs Inventory (Thomas, 2017).

Management of Polychlorinated Biphenyls must comply with applicable regulations and be stored in a Temporary Storage Site (TPS) for B3 waste that already has a permit (Hossain et al., 2016). Management of hazardous and toxic waste (B3) has been regulated in regulations related to the environment in Government Regulation no. 22 of 2021 concerning the Implementation of Environmental Protection and Management, Regulation of the Minister of Environment and Forestry of the Republic of Indonesia number:

12 P.29/MENLHK/SETJEN/PLB.3/12/2020 concerning Management of Polychlorinated Biphenyls and being one of PT PLN's environmental performance programs (Persero),

PT PLN (Persero) is a state-owned enterprise that provides a reliable electricity supply for all Indonesian people (Kurniawati, 2022). In carrying out its business PT PLN (Persero) also produces waste that has a direct connection with relevant environmental sustainability issues such as environmental pollution, B3 waste, carbon emissions, use of natural resources, and others (Basuki, 2015). One of the B3 wastes produced is transformer oil waste originating from used transformers that are no longer usable and are included in the ATTB (Not Operating Fixed Assets) category. Transformer waste production year < 1997 is indicated to contain PCBs (Polychlorinated Biphenyls) which are Persistent Organic Pollutants (POPs) that are harmful to the

environment and humans.

**Research methods**

**Materials and Tools**

The equipment used in this research is the Dexsil L2000DX/Chloride Analyzer. Dexsil L2000DX/Chloride Analyzer is one of the PCBs detection equipment (Kattel & Devkota, 2015). This test kit detects the presence of chlorinated organic materials and not PCBs. The result categories are; if the result is negative it indicates the absence of PCBs, if the result is positive it indicates the presence of PCBs, and further confirmation is required using procedures with more sophisticated laboratory equipment (Rodrigues et al., 2015).

**Sampling Methods**

The samples used were 12 (twelve) offline transformer oils in the B3 Waste Temporary Storage and 32 questionnaires from K3 and Environment employees related to the important role of technology in the offline transformer inventory system.

**Research Variables**

The research analysis was carried out using descriptive qualitative methods. Primary and secondary data collection is done by (Meirinawati et al., 2018);

- a) Collecting secondary data (from the management report of the related company's temporary storage of hazardous and toxic waste materials).
- b) Conducting a literature review from published scientific journals,
- c) Make direct observations,
- d) Using questionnaire questions to employees who work in related departments.

**Table 1**

**PCBs Concentration Category**

Category	Concentration (ppm)
[PCBs] < 5 ppm	Non-PCBs
5 < [PCBs] < 50 ppm	Undefined PCBs
50 < [PCBs] < 500 ppm	Contaminated PCBs
500 ppm < [PCBs]	Pure PCBs

Not all PCBs must be destroyed. The criteria for PCBs that must be destroyed are PCBs that exceed the threshold, namely > 50 ppm. Meanwhile, if the content of PCBs is <50 ppm, Retrofit is carried out, which is emptying the oil from the transformer and replacing the oil with non-PCBs.

### Results and Discussion

Management of hazardous and toxic waste (B3) must be managed properly to prevent environmental pollution (Exposto & Sujaya, 2021). In the management of Hazardous and Toxic Materials, refer to the following regulations:

1. The 2009 Stockholm Convention concerning Persistent Organic Pollutants;
2. Law Number 11 of 2020 concerning Job Creation;
3. Regulation of the Minister of Environment and Forestry of the Republic of Indonesia number P.29/MENLHK/SETJEN/PLB.3/12/2020 concerning Management of Polychlorinated Biphenyls (PCBs);
4. Government Regulation number 22 of 2021 concerning the Implementation of Environmental Protection and Management.

### PCBs (Polychlorinated Biphenyls) Inventory System

The inventory of PCBs in Indonesia covers 11 provinces on the islands of Sumatra and Java. The Ministry of Environment and Forestry (KLHK) formed an Inventory Team in collaboration between the KLHK-UNIDO

team, Local Government, and Industry/Industry Associations and the implementation of the PCBs Management Plan. Implementation of the PCBs Management Plan includes:

1. Identify the problem
2. Priority Mapping
3. Stakeholder Mapping
4. Formulation of an Action Plan

The selection of participating units and companies is divided into two stages, namely the first is voluntary and the second is transformer priority and sector priority (Sivill et al., 2013). There are 1,100 companies from various sectors and including 4,524 transformers from 2015-2020. The implementation of PCBs testing is carried out in two stages, namely:

1. Phase I 2015-2016: 3,015 (100%) used Dexsil L2000DX
2. Phase II 2019-2020: 1,509 (10%) use GC-ECD IEC 61619

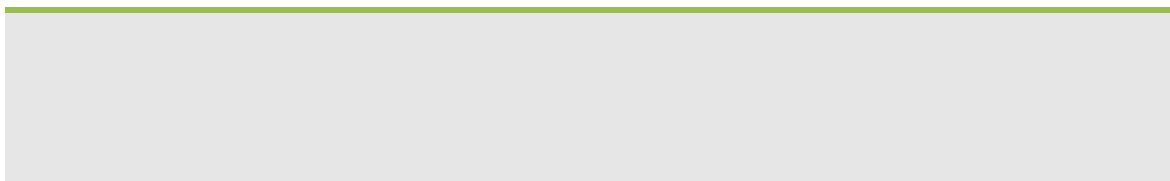
Descriptive statistics include Year of Production, Concentration of PCBs (ppm), Province, Industry Sector, and Type of Material. The results of the uni One-Way ANOVA between Dexsil and GC-ECD were Dexsil (66.6%) and GC-ECD (33.4%), the results were not significantly different ( $P < 0.05$ ).

### Management of PCBs on offline transformers

Testing of PCBs using Dexsil L2000 DX on 12 (twelve) samples of transformer oil at Temporary Storage of Hazardous and Toxic Waste Materials which was tested with the following results:

**Table 2**  
**Test Results for PCBs on Offline Transformers**

No	Category	Concentration (ppm)	Dexsil L2000 DX
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# Analysis And Management Of Polychlorinated Biphenyls (PCBs) At Temporary Storage Of Hazardous And Toxic Waste Of Pln Up3 Tanjung Karang

			Sample	%
1	Non-PCBs	[PCBs] <5	0	0
2	Undefined PCBs	5 < [PCBs] < 50	8	66,7
3	Contaminated PCBs	50 < [PCBs] < 500	4	33,3
4	Pure PCBs	500 < [PCBs]	0	0
Total			12	100%

Source: PCBs Testing Report, PLN Pusertif 2022

Testing on offline transformer oil samples resulted in 66.7% of undefined PCBs and 33.3% of offline transformer oil contaminated with PCBs. Furthermore, offline transformer oil contaminated with PCBs is stored and quarantined at Temporary Storage of Hazardous and Toxic Waste Materials (Hansen

et al., 2022). Transformer oil that is not contaminated with PCBs can be transported by transformer oil transport and management companies that already have permits from the Ministry of Environment and Forestry and the local Transportation Service (Granberg et al., 2017).

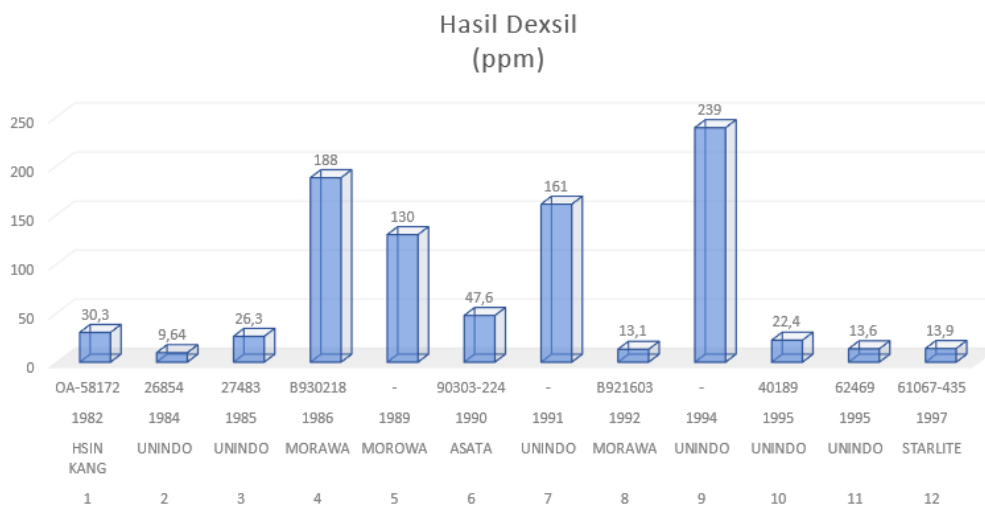


Chart 1 PCBs Test Results on Offline Transformers

### Offline Transformer Setup

In the Environmental Safeguard program, there are several programs, one of which is the placement and labeling of B3 waste (Offline Transformer Oil) following the year of transformer production, namely ≤1997, >1997 and transformer oil which has been indicated to contain Polychlorinated Biphenyls (PCBs). Transformer oil which contains

Polychlorinated Biphenyls (PCBs), is given a special label with the symbol (Dangerous for Environment and Carcinogenic, Tetragenic, Mutagenic') and PCBs labeled. For transformers < 1997, testing must be carried out first because it is indicated to contain PCBs (Polychlorinated Biphenyls). If the content is > 50 ppm, it can cause cancer, decreased

endurance, and increased risk of heart disease, hypertension, diabetes, reproductive system disorders, and nervous system disorders.

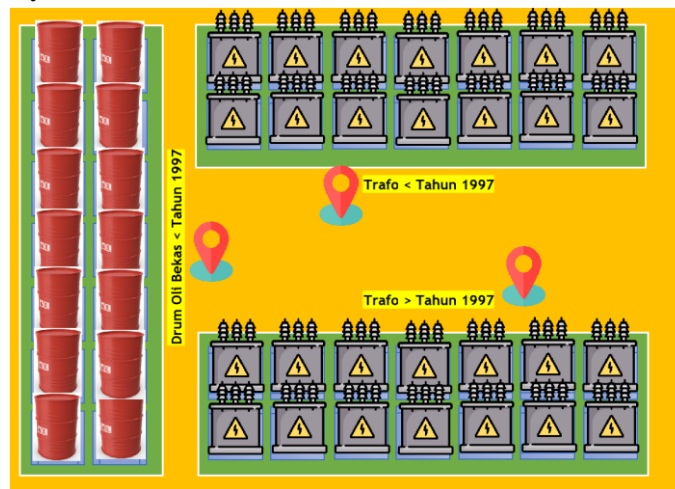


Figure 2 Arrangement of Offline Transformers in Temporary Storage of Hazardous and Toxic Waste Materials

In the Environmental Safeguard program, there are several programs, one of which is the placement and labeling of B3. In Figure 2 above is the arrangement of offline transformers at the TPS for Hazardous and Toxic Materials Waste PLN UP3 Tanjung Karang which is divided according to the category of transformer year, namely production < 1997 and > 1997. Regarding

PCBs management, it must comply with the regulations of the Minister of Environment and Forestry of the Republic of Indonesia, number P.29/MENLHK/SETJEN/PLB.3/12/2020 concerning Management of Polychlorinated Biphenyls (PCBs).

The results of environmental monitoring can be seen in the following table:

**Table 3.**  
**Environmental Monitoring Results**

Parameter	Unit	Test Result	Environmental Quality Standard	Methods *) Part Number
pH	-	6.29	6 - 9	4500-H* -B
Total Suspended Solid	mg/L	28.5	30	2540 D
BOD 5 days 20°C**	mg/L	28	30	5210 B
COD by K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	mg/L	90.4	100	5220 B
Free Ammoniac	mg/L	1.75	10	4500-NH <sub>3</sub> -F
Oil & Grease	mg/L	4	5	5520 B
Total Coliform	Colony/100 ml	1930	3000	

Standard Methods, 23th Edition 2012, APHA-AWWA-WEF. Exclude the scope of accreditation KAN

< = Less than the detection limit indicated Analyzed by Lab. Sucofindo Cibitung

### Offline Transformer Setup

From the results of environmental monitoring in the table above, the test results on

all parameters are still below the Environmental Quality Standard (Demanege et al., 2021). So it can be concluded that there is no pollution from transformer oil in the surrounding environment.

### Conclusion

Management of B3 waste (offline transformer oil) must be carried out properly so that there is no pollution to the surrounding environment and its management must be following the applicable laws and regulations. The test results on twelve samples of offline transformer oil were 66.7% undefined PCBs and 33.3% contaminated PCBs.

The results of environmental monitoring on all parameters are still below the Environmental Quality Standard, it can be concluded that there is no pollution in the surrounding environment.

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