Polychlorinated Biphenyls (PCBs) Phasing-Out Regulation in Indonesia

Final Report

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Foreword

The authors would like to thank The Indonesian Ministry of Environment and Forestry (MoEF), the United Nations Industrial Development Organization, the Global Environmental Fund and other parties involved in the drafting of this final report.

This final report consists of the main report and 6 (six) annexes:

- Annex 1 Recommendation for Regulatory Reform
- Annex 2 Existing Regulatory Framework
- Annex 3 PCB Official Guidance
- Annex 4 PCB Code of Practice (by Dr. Carlo Lupi)
- Annex 5 Analysis of Task, Role and Function of MoEF Units in PCB Phasing Out
- Annex 6 Recommendation for the Regulation of Economic Incentives

Annex 3, PCB Official Guidance, is drafted as *version 1.0*. as at the time of writing several legislations are in the process of drafting. Future versions of the PCB Official Guidance can accommodate these draft legislations, should they be enacted. Annex should be read in conjunction with Annex 4, PCB Technical Code of Practice (drafted by Dr. Carlo Lupi). The main report contains more detail than the PCB Official Guidance. The Government may choose to include materials from the main report into the PCB Official Guidance if considered relevant.

Other deliverables such as Chapter 6 (institutional arrangements, further elaborated in Annex 5) and the legal analysis for thermal versus non-thermal PCB Disposal Technologies (discussed briefly in section 4.11 – but the analysis document is not included here and delivered separately to the MoEF) is not required by our Terms of Reference but nevertheless essential to support the PCB phasing out program in general.

Bogor, 16th of September, 2016

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1. International Conventions on PCB and its implementation in Indonesia

1.1. Basel Convention

Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal (1989) ("Basel Convention") aims to reduce the movement of hazardous wastes, minimize the hazardous wastes production, ensure the environmentally sound manner of waste disposal as close to the possible source as possible and assists developing country in the environmentally sound of hazardous waste management that they generate1. The Convention covers toxic, poisonous, explosive, corrosive, flammable, ecotoxic and infectious wastes that are being moved from one country to another (transboundary movements). In 1995, the Ban Amendment was introduced in order to strengthen the Convention. It prohibits the export of hazardous waste, for any reason, from an OECD member state to non-OECD countries. In addition, in 1999, a protocol on liability and compensation was adopted.

In terms of PCBs, the Annex of the Convention specifically regulates the PCBs as follows:

Basel Convention Annexes Related to PCBs

Annex I: Categories of Waste to Be Controlled (Waste Streams)	Y10	Waste substance and articles containing or contaminated with PCBs and/or Polychlorinated terphenyls (PCTs) and/or Polybrominated biphenyls (PBBs).
Annex VIII, List A A1. Metal and Metal-Bearing Waste	A1180	Electrical waste and electronic assemblies or scarp (e-waste) containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCBs capacitors, or contaminated with Annex I constituents (e.g. cadmium, mercury lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III (note the related entry on list B B1110)[2]
	A1190	Waste metal cables coated or insulated with plastics containing or contaminated with col tar, PCB [3], lead, cadmium, other organohalogen compounds or other Annex I constituents to an extent that they exhibit Annex III characteristics.
Annex VIII, List A	A3180	**Waste substances and articles containing, consisting of or contaminated with polychlorinated biphenyl (PCB),**

[1] Chemical Convention Handbook, http://www.ntn.org.au/cchandbook/basel/desc_sc3.html
[2] PCBs are at a concentration level of 50 mg/kg or more
[3] Ibid

A3. Waste Containing Principally Organic Constituents, Which May Contain Metals and Inorganic Materials		polychlorinated terphenyl (PCT), polychlorinated naphthalene (PCN) or polybrominated biphenyl (PBB), or any other polybrominated analogues of these compounds, at a concentration level of 50 mg/kg or more[4].

The Basel Convention defines PCBs as any material or substance containing a PCB concentration more than 50 ppm. Furthermore, unidentified appliances must be alleged to be PCB-containing while awaiting their identification by screening or laboratory analysis[5]. This definition is important as it includes[6]:

- Transformers insulated with PCBs;
- Mineral oil transformers containing PCBs with a concentration of above 50 mg/kg;
- Capacitors;
- Power switches;
- Power distribution units;
- Insulators in very high voltage distribution stations;
- Used oils containing PCBs with a concentration of above 50 mg/kg;
- Magnetic circuit cleaning solvents;
- Contaminated solids such as rags, gloves, boots. A specific attention should be given to mineral oil transformers.

Indonesia has ratified the Convention through Presidential Decree No. 61/1993 on Basel Convention Ratification and the Presidential Regulation No. 47/2005 on the Ratification of the Amendment of Basel Convention.

1.2. Stockholm Convention

The Convention on Persistent Organic Pollutants (POPs), known as Stockholm Convention, was adopted in 2001 and entered into force in 2004. The purpose of the convention is to restrict and eventually prohibit the production, use, emission, import and export of persistent organic pollutants (POPs)[7]. Twelve initial chemicals, known as the 'poison without passport' or dirty dozen were initially identified by the convention for eventual elimination. Different catrgories of POPs listed in the convention is as follows:

[4] The 50 mg/kg level is considered to be an internationally practical level for all wastes. However, many individual countries have established lower regulatory levels (e.g. 20 mg/kg) for specific wastes.
[5] Preparation of a National Environmentally Sound Management Plan for PCBs and PCB-Contaminated Equipment, UNEP, B.C, 2003
[6] Ibid
[7] http://cchandbook.ntn.org.au/pops/obli_sc2.html#go

Categories of POPs Based on Stockholm Convention

Annex A Chemicals for Elimination	Annex B Chemicals for Restricted Use	Annex C Chemicals which are Unintentionally Produced[8]
Aldrin	Dichloro Diphenyl Trichloroethane (DDT)	Polychlorinated dibenzo-p-dioxins (PCDD)
Dieldrin	-	Dibenzofurans (PCDF)
Chlordane	-	Hexachlorbenzene
Toxaphene	-	Polychlorinated Biphenyls (PCBs)
Mirex	-	-
Endrin	-	-
Hexachlorobenzene	-	-
Heptachlor	-	-
Polychlorinated Biphenyls/PCB)	-	-

There are other twelve chemicals that are being assessed by the POP Review Committee after being nominated by a Party. These include; Pentabromodiphenyl ether (Penta BDE), Chlordecone, Hexabromobiphenyl, Lindane, Perfluorooctane sulfonate (PFOS), Alpha & Beta hexachlorocyclohexane (Lindane isomers), Octabromodiphenyl ether (OctaBDE), Pentachlorobenzene. Short-chained chlorinated paraffins (SCCPs), Endosulfan, Trifluralin. In terms of PCBs the Convention mandates the parties to take action as follows:

Annex A, Part II

The parties shall take action by 2015, with priorities:

- make determined efforts to identify, label and remove from use equipment containing greater than 10 % polychlorinated biphenyls and volumes greater than 5 litres
- make determined efforts to identify, label and remove from use equipment containing greater than 0.05% polychlorinated and volumes greater than 5 litres;
- ***endeavour*** to identify and remove from use equipment containing greater than 0.005 per cent polychlorinated biphenyls and volumes greater than 0.05 litres;
- promote the following measures to reduce exposures and risk to control the use of PCBs by using only intact, non-leaking equipment, not use around food or feed areas,

[8] Actions should be taken to reduce and eventually eliminate releases the chemicals under this Annex

and when it is used in populated areas, all reasonable measures to protect from electrical failure which could result in a fire and regular inspection of equipment for leaks[9];

- Equipment containing PCBs shall not be exported or imported except for the purpose of environmentally sound waste management[10];
- Except for maintenance and servicing operations, not allow recovery for the purpose of reuse in other equipment of liquids with polychlorinated biphenyls content above 0.005 per cent[11];
- make determined efforts designated to lead environmentally sound waste management of liquids containing PCBs and equipment contaminated with PCBs having a PCBs content above 0.005%, in accordance with paragraph 1 Article 6 as soon as possible but no later than 2028[12];
- endeavor to identify other articles containing more than 0.005 per cent polychlorinated biphenyls (e.g. cable-sheaths, cured caulk and painted objects) and manage them in accordance with paragraph 1 of Article 6[13];
- provide reports every five years on efforts to eliminate PCB use to the Conference of Parties (COP)[14]

Article 5: Measure to reduce/eliminate releases from unintentional production and Annex C: Unintentional Production:

Each Party shall take measures to reduce the release of chemicals listed in Annex C (unintentionally produced) and where action should be taken to reduce and eventually eliminate releases, which includes: Polychlorinated dibenzo-p-dioxins (PCDD), Dibenzofurans (PCDF), hexachlorbenzene, ***Polychlorinated Biphenyls (PCBs)***

Indonesia has ratified the Convention through Law No. 19 of 2009.

1.3. Rotterdam Convention

The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (1998), known as the Rotterdam or PIC Convention. The convention entered into force on the 25 February 2004.

The convention aims to promote shared responsibility and cooperation in the international trade in certain hazardous chemicals. The convention facilitates the information sharing and prior informed consent (PIC) among Parties and contributes to the environmental sound management of specific hazardous chemicals.

Prior Informed Procedure applies to the chemicals that are listed in the Annex III of the convention. It means that before they are being exported, the exporting country must ensure

[9] Annex A, Part II (b)
[10] Annex A, Part II (c)
[11] Annex A, Part II (d)
[12] Annex A, Part II (e)
[13] Annex A, Part II (f)
[14] Annex A, Part II (g)

that the importing country has consented to its import. A table below shows several examples of chemical subject to PIC procedures, including PCB.[15]

Several Chemicals Subject to the Prior Informed Consent Procedure

Category	Chemical	Relevant CAS number
PESTICIDES	Aldrin	309-00-2
	Chlordane	57-74-9
	Dieldrin	60-57-1
	DDT	50-29-3
	Endosulfan	115-29-7
	Heptachlor	76-44-8
	Hexachlorobenzene	118-74-1
	Lindane	58-89-9
	Mercury compounds, including inorganic mercury compounds, alkyl mercury compounds and alkyloxyalkyl and aryl mercury compounds	-
	Toxaphene	80001-35-2
Severely hazardous pesticide formulation	Methyl-parathion (emulsifiable concentrates (EC) at or above 19.5% active ingredient and dusts at or above 1.5% active ingredient)	298-00-0
Industrial	Polychlorinated biphenyls (PCB)	1336-36-3
	Polybrominated biphenyls (PBB)	36355-01-8 (hexa-) 27858-07-7 (octa-) 13654-09-6 (deca-
	Polychlorinated terphenyls (PCT)	61788-33-8
	Tetraethyl lead	78-00-2

Obligations of the parties are as follows:

- Designating a national authority and notify the secretariat[16];
- Banning or severely restricting chemicals and notify the secretariat[17];
- Developing country Party may propose to the Secretariat a listing of a severely hazardous pesticide for inclusion in Annex III[18];

[15] Annex III, Chemicals Subject to the Prior Informed Consent Procedure, As amended by the COP by its decision,http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/language/en-US/Default.aspx

[16] Article 4

[17] Article 5

[18] Article 6

- Implementing appropriate legislative or administrative measures to ensure timely decisions with respect to the import of chemicals listed in Annex III[19];
- Ensuring that the chemicals listed in Annex III are not exported from its territory to an importing Party contrary to the import decision notified by the Party[20];
- Provide an export notification to the importing Party unless the chemical is already listed on Annex III and acknowledging receipt of the export notification received[21];
- Requiring chemicals listed in Annex III and chemicals banned or severely restricted in its territory are subject to labeling requirements that ensure adequate availability of information with regard to risks and/or hazards to human health or the environment [22];
- Exchanging scientific technical, economic and legal information concerning the chemicals within the scope of this Convention including toxicology, ecotoxicology and safety information[23];
- Providing information to other Parties on domestic regulatory actions they have taken that substantially restricts one or more uses of chemicals[24];
- Conducting measures to establish and strengthen its national infrastructures and institutions for the effective implementation of this Convention[25];
- Ensuring that the public has appropriate access to information on chemical handling and accident management and on alternatives that are safer for human health or the environment.[26]

1.4. Ratification of the Basel, Rotterdam and Stockholm Conventions

The Basel Convention was ratified through a Presidential Decree in 1993.[27] Its amendment was ratified in 2005.[28] The Basel Convention Regional Centre in Indonesia was formalised by a Presidential Regulation in 2005.[29] Meanwhile, the Rotterdam Convention was ratified through

[19] Article 10
[20] Article 11
[21] Article 12
[22] Article 13
[23] Article 14
[24] Article 14
[25] Article 15
[26] Article 15
[27] Keputusan Presiden Republik Indonesia Nomor 61 Tahun 1993 Tentang Pengesahan Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.
[28] Peraturan Presiden Republik Indonesia Nomor 47 Tahun 2005 Tentang Pengesahan Amendment to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Amendemen Atas Konvensi Basel Tentang Pengawasan Perpindahan Lintas Batas Limbah Berbahaya Dan Pembuangannya).
[29] Peraturan Presiden Republik Indonesia Nomor 60 Tahun 2005 Tentang Pengesahan Framework Agreement Between the Government of the Republic of Indonesia and the Secretariat of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal on the Establishment of a Basel Convention Regional Centre for Training and Technology Transfer for Southeast Asia (persetujuan Kerangka Kerja Antara Pemerintah Republik Indonesia Dan Sekretariat Konvensi Basel Mengenai Pengawasan Perpindahan Lintas Batas Limbah Bahan Berbahaya Dan Beracun Serta Pembuangannya Tentang Pembentukan Pusat Regional Konvensi Basel Untuk Pelatihan Dan Alih Teknologi Bagi Asia Tenggara).

Law No. 10/2013.[30] Several measures taken by Indonesia in order to implement the mandate of the convention were:

- Formulating Final Regulatory Action (FRA) document to be submitted to the international secretariat. FRA contains information regarding the decision of the parties to ban and/or restrict certain chemicals in order to protect human and environment[31];
- Formulating Import Response (IR) document. IR contains information pertaining to the decision of the party related to the future import possibilities of chemicals listed in Annex III[32];
- Developing information system related to B3 (hazardous and toxic substances) and POPs at the http://sib3pop.menlhk.go.id

The Stockholm Convention was signed in 2001 and ratified through Law 19 Year 2009.[33] Elucidation of Law 19/2009 outlines that one of the purpose of the ratification is to develop national regulation and technical guidance for managing persistent organic pollutants. However, to date, Law 19 has not been enumerated into implementing regulations.

1.5. Existing Regulations Relevant to Persistent Organic Pollutants

Indonesian regulatory framework distinguishes between "hazardous and toxic substances" (*bahan berbahaya dan beracun or "B3")* and *the waste* of hazardous and toxic substances (*limbah bahan berbahaya dan beracun or "Limbah B3"*). This distinction is also reflected in the division of units (and its regulatory competences) at the Ministry of Environment and Forestry. The B3 leading legislation is Government Regulation 74 Year 2001 on Hazardous and Toxic Substance Management ("GR 74") and the leading legislation for Limbah B3 is the Government Regulation No. 101 of 2014 on the Management of Hazardous and Toxic Waste ("GR 101"). Both Government Regulations directly implements the primary environmental legislation, the Law Number 32 Year 2009 on Environmental Protection and Management ("Law 32/2009").

1.5.1. Regulation on hazardous and toxic substances (B3)

GR No. 74 defines B3 as substances that, due to their characteristic, concentration and/or amount, either directly or indirectly, can pollute and/or damage the environment, and/or harm the environment, health and the life of humans and other living beings[34]. Government Regulation No. 74 of 2001 regulates *several* pollutants addressed in the Stockholm Convention. The pollutants listed in the attachment of the GR No. 74 are as follows:

[30] Undang-Undang Republik Indonesia Nomor 10 Tahun 2013 Tentang Pengesahan Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (konvensi Rotterdam Tentang Prosedur Persetujuan Atas Dasar Informasi Awal Untuk Bahan Kimia Dan Pestisida Berbahaya Tertentu Dalam Perdagangan Internasional).

[31] Annual Report 2015, p. 44, Direktorat Jenderal Pengelolaan Sampah, Limbah dan Bahan Beracun Berbahaya, KLHK

[32] Ibid

[33] Undang-Undang Republik Indonesia Nomor 19 Tahun 2009 Tentang Pengesahan Stockholm Convention on Persistent Organic Pollutants (konvensi Stockholm Tentang Bahan Pencemar Organik Yang Persisten).

[34] Article 1 No. 1 GR No. 74/2001

List of POPs Based on GR No. 74/2001

Substances	Category Under GR No. 74/2001	Category Under Stockholm Convention
Aldrin	B3 that is forbidden to be used Chemical Abstract Service (CAS)[35]: 309-00-2 Synonym: HHDN Molecule formula: $C_{12}H_8Cl_6$	Annex A
Chlordane	B3 that is forbidden to be used CAS: 57-74-9 Synonym: CD68; Velsicol 1068; Toxichlor; Niran; Octachlor; Orthoclor; Synclor; Belt; Corodane. Molecule formula: C10H6Cl8	Annex A
Dieldrin	B3 that is forbidden to be used CAS: 60-57-1 Synonym: Compound 497; ENT 16225; HEOD; Insectiside No.497; Octalox	Annex A
DDT	B3 that is forbidden to be used CAS: 50-29-3 Synonym: Dichlorodiphenyltrichloroethane; D-58; Chlorophenothane; Clofenotane; Dicophane; pentachlorin; p,p-DDT; Agritan; Gesapon; Gesarex; Gesarol; Guesapon; Neocid. Molecule formula: C14H9Cl5	Annex B
Endrin	B3 that is forbidden to be used	Annex A
Mirex	B3 that is forbidden to be used	Annex A
Heptachlor	B3 that is forbidden to be used	Annex A
PCBs	B3 that is forbidden to be used CAS: 1336-36-3 Synonym: Polychlorinated Biphenyls; Chlorobiphenyls; Aroclor; Clophen; Fenclor; Kenachlor; Phenochlor; Pyralene; Santotherm. Molecule formula: C12X X=H or C	Annex A and C
Hexaclorbenzene	B3 that is forbidden to be used	-
Toxaphene	B3 that is forbidden to be used	-
Lindane	B3 that is restricted to be used	-

From the previous table in section 1.5.1 , it is shown that GR No. 74/2001 does not include chemicals under Annex C of the Stockholm Convention (chemicals which are unintentionally

[35] Chemical Abstract Service Registry Number, it is universally used to provide a unique, unmistakable identifier for chemical substances. A CAS Registry Number itself has no inherent chemical significance but provides an unambiguous way to identify a chemical substance or molecular structure when there are many possible systematic, generic, proprietary or trivial names. CAS Registry Numbers are used in many other public and private databases as well as chemical inventory listings and, of course, are included in all CAS-produced databases. https://www.cas.org/faqs

produced). This is because GR No. 74/2001 focuses on the chemicals as a raw material for activities rather than chemicals which is resulted (unintentionally) from certain activities.

In addition, as explained above, currently, there are another twelve chemicals being assessed by the POP Review Committee. In the future, the list of POPs to be eliminated and restricted might grow. This is a very crucial issue for Indonesia, especially on the technicalities of how GR 74 can cope with the evolving list of POPs. Should the attachment be amended whenever there is a new list of POPs or should the Ministry of Environment formulate specific regulation regarding new POPs list?

1.5.2. Regulation on *the waste* of hazardous and toxic substances (*Limbah B3*)

The Leading regulation on Limbah B3, GR 101, is relatively new. GR 101 was enacted in 2014. The GR reflects the Basel Convention as it not only regulates the management of Limbah B3 but also the transboundary movement of Limbah B3. PCBs is categorized as hazardous and toxic waste. It is listed under the attachment of the GR, Table 1 (Limbah B3 from an unspecific source), coded as A101d and classified as hazard category 1. However, the GR still have not comprehensively adopt several Annexes of the Convention which classify articles containing or contaminated with PCBs, and categorise them as hazardous and toxic waste.

2. PCB Regulation in Other Countries

2.1. United States of America

In the United States and Europe, beginning from 1929, the beginning of commercial use of PCBs until the beginning of the 1970s, PCBs was used both in open and closed systems (Commission, 2001). Nevertheless, in the United States (US), the use of PCB has been banned since 1979 under Toxic Substances Control Act (TSCA). It prohibits the manufacture, processing, use and distribution of PCBs.[36]

In June 1998, US EPA amended the PCBs and PCBs contaminated equipment regulations. The amended regulation, 40 CFR (Code of Federal Registration) Parts 750 and 761 is known as the PCB Mega Rule. The Mega Rule has detailed specification regarding PCBs (concentration) and PCBs contaminated equipment. The examples are as follows[37]:

- Contaminated transformers is a transformer that contains more than 50 ppm of PCB but less than 500 ppm of PCB (50 ppm > PCB < 500 ppm)
- Electrical equipment manufactured after July 2, 1979, is non-PCB (i.e., < 50 ppm PCBs).
- If the electrical equipment manufacture is unknown, it should be assumed that it is PCB-contaminated equipment;
- Mineral oil-filled electrical equipment that was manufactured before July 2, 1979, and whose PCB concentration is not established is categorized as PCB-Contaminated Electrical Equipment (i.e., contains ≥50 ppm PCB, but < 500 ppm PCB).

[37] PCB Mega Rule Sec.761.2
[37] PCB Mega Rule Sec.761.2
[38] PCB Mega Rule Sec.761.30 (vi)(A)

Retrofilling

Retrofilling of transformer is allowed in the US.

Registration

All owners of PCB transformers including transformers in the storage for reuse purpose are obliged to register to the Environmental Protection Agency (EPA) no later than 28 December 1998[38]. The registration includes the submission of information regarding: company name and address, contact name, telephone number, address where the transformers are located (if it is a mobile source such as ship, the owner should provide the name of the ship), number of PCB transformers and total weight (in kg) of PCBs contained in the transformers and whether the transformers contains flammable dielectric or not.

In addition, by 1 December 1985 the PCB Mega Rule also imposed the registration of PCB transformer used in commercial building (located in or near the building) to the building owners/ all building owners that are located within 30 meters of PCB transformers[39]. The information should be provided by the building owners are: location of the PCB transformer(s), type of dielectric fluid in the transformer(s) e.g. PCBs, mineral oil, silicone oil etc, type of transformer installation e.g 208/120 volt network, 208/120 volt radial, etc[40].

2.2. Philippines

The Philippines has several regulations regarding PCBs as follows:

- Department of Environment and Natural Resources (DENR) Administrative Order (DAO) 2004-01 regarding Chemical Control Order (CCO) for Polychlorinated Biphenyls.
- Environment Management Bureau (EMB) Circular No. 2015-004 regarding Clarifications to the CCO for Polychlorinated Biphenyls
- Environment Management Bureau (EMB) Circular No. 2015-007 on Technical Guideline Document on PCBs Management

One of the aims of CCO 2004-01 is to reduce and eventually eliminate the importation, production/manufacture, sale, transfer, distribution and use of PCBs, PCB equipment, PCB-contaminated equipment, non-PCB equipment, PCB articles and PCB packaging. The EMB Circular No. 2015-007 defines PCB wastes as "*any equipment or materials containing PCBs or have been in contact with PCBs* ***that are without any safe commercial, industrial, agricultural, or economic usage*** *as defined in the implementing rules and regulations for hazardous waste management (DAO 2013-22)".* This definition also includes liquid PCB waste, porous PCB wastes, and non-porous PCB wastes with specific conditions. The EMB defines that in the case of dielectric oil or porous materials contains less than 2 ppm of PCB, it is categorized as PCBs-

[38] PCB Mega Rule Sec.761.30 (vi)(A)
[39] PCB Mega Rule Sec.761.30 (vii)
[40] PCB Mega Rule Sec.761.30 (vii)

free. Furthermore, a non-porous materials are classified as PCB-free if based on a wipe test, the level of PCB is less than or equal to 10 μ_g/100cm^2.

The Philippines Government may amend the chemical control order into the following (whether this is finalized is not yet confirmed):

Phase Out Time Line

Activities	PCB Oil	PCB Contami-nated Oil	PCB Equip-ment	PCB Contami-nated Equip-ment	PCB Contami-nated Porous Materials	PCB Contami-nated Non-Porous Materials	PCB Wastes	Non PCBs Equipment
Importation	BANNED							
Distribution								
Reuse								
Use	BANNED By March 19, 2014							Banned by December 30, 2018
Storage	BANNED By March 19, 2016							Banned by October 30, 2019
Disposal	Allowed within one (1) year of its generation but no longer than December 31, 2020							

Source: **Draft** Revised Chemical Control Order for Polychlorinated Biphenyls as of February 10, 2014

The classification of PCBs based on the EMB Circular No. 2015-007 is as follows:

PCB Classification

Type of PCBs	Description	PCB Concentration
PCB Oil	Oil with PCB concentration greater than or equal to 500 ppm	PCB $\geq$ 500 ppm
PCB-Contaminated Oil	Oil with PCB concentration from 2 to less than 500 ppm	2 ppm $\leq$ PCB < 500 ppm
PCB Equipment	Any equipment containing dielectric oil with PCB concentration equal to or greater than 500 ppm	PCB $\geq$500 ppm
PCB -Contaminated Equipment	Any equipment containing dielecteric oil with PCB concentration from 50 ppm and higher but less than 500 ppm PCB	50 ppm $\leq$ PCB < 500 ppm
Non-PCB Equipment	Any equipment containing dielectric oil with PCB concentration from 2 to less than 2 ppm (PCB < 50 ppm)	2 ppm $\leq$PCB < 50 ppm

PCB –Contaminated Porous Material	Any porous material with PCB concentration greater than or equal to 2 ppm	PCB $\geq$ 2 ppm
PCB-Contaminated Non-Porous Material	Any non-porous material withPCB concentration greater than 10 micrograms per 100 square centimeter (μ_g/100 cm^2) based on a wipe test of the non-porous surface (10 x 10 cm^2)that have been in direct contact with PCBs	PCB>10 μ_g/100cm^2

Source: EMB Circular No. 2015-007

The public is guaranteed to have access to records or information obtained by the DENR. In the event a person(s) contravene with the CCO's requirement, applicable administrative and criminal sanctions based on RA 6969 will be imposed.

Retrofilling

Based on CCO 2004-01, retroifilling means "*the replacement or substitution of PCB fluids in transformers with mineral oils or any other suitable dielectric fluid*"[41]. It is considered as re-use of the decontaminated equipment. Retrofilling of the PCB equipment and PCB contaminated equipment is prohibited[42].

Registration of PCBs

Registration is an obligation of PCBs Owners[43] that have materials and equipment as follows: transformers (oil filled), capacitors (oil filled), voltage regulators (oil filled), oil circuit breakers, hydraulic fluids, and heat transfer fluids[44].The Department of Environment and Natural Resources, Environmental Management Bureau (DENR EMB) has launched the online system to register the PCBs[45]. The registration mechanism is as follows:

[41] CCO 2004-01 Section II number 19

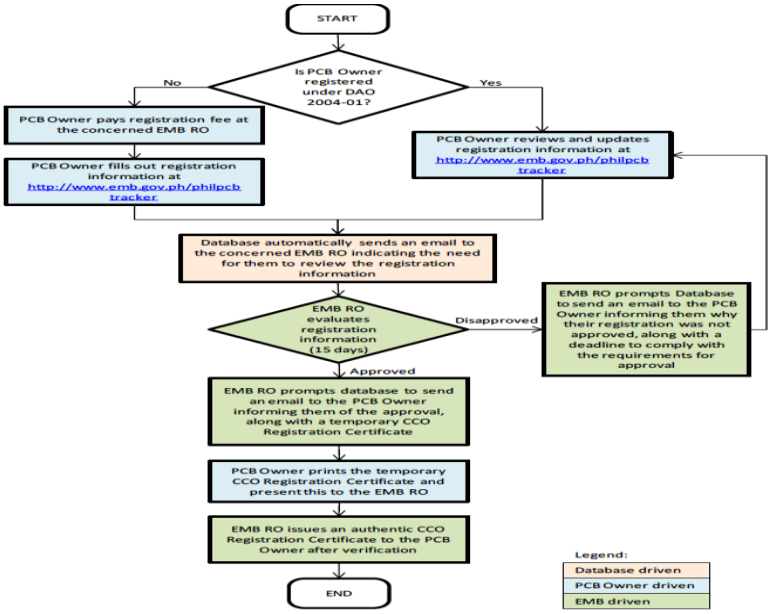
[42] EMB 2015-004 Section 10.2

[43] Based on the EMB Circular No. 2015-007, PCB Owner is defined as a person, organization, or establishment that owns, distributes, uses, operates, recycles, reprocess, stores, treats, or disposes any equipment, materials, or wastes that are contaminated with, in direct contact with, or containing PCB oil, PCB-contaminated oil, PCB equipment, PCB-contaminated equipment, non-PCB equipment, PCB-contaminated porous materials, PCB-contaminated non-porous materials, and PCB wastes.

[44] Environment Management Bureau (EMB) Circular No. 2015-007, Section 2.2 Qualification of Registration

[45] The system can be accessed at http://philpcbtracker.com/v3/index.php

Figure 1 Online Registration Process of PCBs Owners



Source: EMB Circular No. 2015-007

2.3. South Africa

The South Africa enacted a regulation under the National Environmental Management Act to phase out the use of PCBs Materials and PCBs Contaminated Material. The regulation aims to regulates phasing out stages and the use of PCB materials and PCB contaminated materials and sets a timeline regarding the process.[46]

Phase Out Time Line

Activities	PCB Materials	PCB Contaminated Materials	PCB Waste
Import and Export	Banned by 2014		
Produce	Banned by 2014		
Process			
Use	Prohibited in 2014 and should follow phase out requirements. Total Ban by 2023		
Sell	Banned by 2014		

[46] Chapter 1, 2(a) (b) National Environmental Management Act (107/1998) Notice 849 of 2013: Regulations to phase-out the use of Polychlorinated Biphenyls (PCBs) materials and Polychlorinated Biphenyl (PCB) contaminated materials.

Posses	Prohibited in 2014 should follow phase out requirements. Total Ban by 2026
Disposal	N/A

Source: National Environmental Management Act (107/1998) Notice 849 of 2013

Classification of PCB

Type of PCBs	Description	PCB Concentration
PCB contaminated material	Articles or oil with PCB concentration greater than 51 mg/kg but less than 500 mg/kg	500 mg/kg <PCB >51 mg/kg
PCB material	Articles or oils with PCBs concentration less than 500 mg/kg.	PCB > 500 mg/kg
Non-PCB material	Articles or oils with PCBs concentration less than 50 mg/kg	PCB < 50 mg/kg
PCB free material	Article or oils with PCB concentration < 1 mg/kg	PCB < 1 mg/kg
PCB waste	Waste as defined in the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), which contains PCB materials or PCB contaminated materials; and "SANS 290" means the latest edition of the South African National Standards for Mineral insulating oils Management of polychlorinated biphenyls (PCBs).	

A person is guilty of an offence in the event that the person contravenes with the provision regarding the prohibition of the use, process, produce, import, export and sell PCB materials of PCN contaminated materials; phase out time frames; registration; notification; phase out plan submission and implementation; testing and labelling; classification, retro filling and reclassification of equipment; reporting. The penalties for the offence is a fine not more than R10 million or imprisonment for a period not more than 10 years or both.

Retrofilling

Retrofilling is allowed in South Africa. However, it has to be tested by an accredited laboratory before the transformer can be put back to service/operation. The concentration of PCBs in the tested equipment must not exceed 50 mg/kg. The result from the laboratory research must be submitted to the Director General[47].

[47]National Environmental Management Act (107/1998) Notice 849 of 2013, Chapter 3, Section 7 (1), (3), (4)

Registration of PCBs

The process of the registration is as follows[48]:

- Obligation to register is imposed to anyone who uses, dispose, treat, process or produce PCB materials or contaminated materials.
- The PCB registration form is provided and its covers information regarding the applicant's details and description of activities involving the use of PCB;
- The registration is submitted to the Director General in which issue a receipt and registration number to the registrant;
- Any changes regarding the PCB material details must be notified to the Director General within 30 days of the changes occurred.

2.4. European Union

In the European Union, the use of PCB in open applications (e.g. printing inks, adhesives) has been banned since 1976, based on Directive 76/403/EEC. In addition, the use of PCBs as a chemical intermediate or as a raw material has been banned since 1985, under the Directive 85/467/EEC 6th amendment to Directive 76/769/EEC. The EU has long history in regulating PCBs as follows (Enno Christian, 2005):

- Directive 76/769/EEC, July 1976 restricts the marketing and use of certain dangerous substances and preparations (including PCBs). This Directive was amended several times (e.g. Directive 85/467/EEC, October 1985 regarding the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations e.g. PCBs/PCTs). The use of the PCBs and PCTs is prohibited in closed system;
- Directive 89/677/EEC, December 1989 is the 8th amendment of the Directive 76/769/EEC. The use and re-use of PCBs and PCTs and any mixture containing both chemicals in more than 0.005% by weight (=50ppm) are prohibited based on the Directive 89/677/EEC;
- Directive 96/59/EC, September 1996 on the disposal of PCBs and PCTs replaces Directive 76/403/EEC (ban of use of PCBs in open applications, 1976). Directive 96/59/EC aims to approximate the laws of the member states on the controlled disposal of PCBs, the decontamination or disposal of equipment containing PCBs and/or the disposal of used PCBs in order to completely eliminate them. The year of 2010 was a deadline for complete disposal or decontamination of equipment containing PCBs).

Almost all of EU member states use the EU Directive limit (50ppm) to determine whether a material is contaminated with PCB or not in which this limit is relevant to the Stockholm Convention. However, some countries have more stricter limit such as the Netherland (0,5 ppm per 7 congeners), Austria (30 ppm) and Norway (zero limit but in practice 50 ppm limit is acceptable) (Enno Christian, 2005).

Since the Stockholm Convention has been in force since 2004, most of the Member States have initiated necessary measures to implement the convention and promote

[48] Section 5 National Environmental Management Act (107/1998), Notice 849 of 2013

environmentally sound management of PCBs. With regards to EU, it was stated that although the EU community has already had legal instruments that is relevant to the Stockholm Convention, it is responsible to perform obligations imposed by the convention[49].

Retrofilling

Transformer can be retrofilled to the level that us is allowed by the Directive 96/59/EC. For transformers in service with less than 5000 ppm (less than 500 KVA), retrofilling is considered as cost effective[50]. In addition, in service transformers with less than 50 ppm can be left in service and left alone[51].

2.5. England and Wales

The Environmental Protection (Disposal of Polychlorinated Biphenyls and other Dangerous Substances)(England and Wales) Regulation 2000, defines PCBs as any mixture containing any of the substances below totaling more than 0.005% by weight:

- Polychlorinated biphenyls (PCBs)
- Polychlorinared terphenyls (PCT)
- Monomethyl-dibromo-diphenyl methane
- Monomethyl-dichloro-diphenyl methane
- Monomethyl-tetrachlorodiphenyl methane

Registration

PCBs holders is required to register based on the following conditions[52]:

The existing of containers containing residual stocks which contains PCBs or having contained PCBs that has not been decontaminated in which the total PCBs content is more than 5 litres (dm^3);

Items of equipment contaminated (including any transformer, capacitor, with PCBs where the total PCBs content is more than 5 litres (dm^3).

The registration form is provided and covers information regarding the applicant's details, description of the contaminated equipment and the location/intended location, description of PCB in the equipment, and the date regarding replacement or treatment/disposal.

The PCB regulation is effective since 4 May 2000. Thus, all PCBs-contaminated equipment holders have to complete the registration process by 31 July 2000. It is a criminal offence to keep unregistered PCBs or contaminated equipment after 31 July 2000.

[49] Stockholm Convention on Persistent Organic Pollutant (POPs) http://www.pops.int/documents/signature/signstatus.htm
[50] http://www.basel.int/Portals/4/Basel%20Convention/docs/meetings/sbc/workdoc/TM-A.pdf, p. 23
[51] http://www.basel.int/Portals/4/Basel%20Convention/docs/meetings/sbc/workdoc/TM-A.pdf, p. 23
[52] Annual Registration of PCBs Holders, Guidance Notes, https://www.aber.ac.uk/en/media/departmental/healthsafetyenvironment/pcb_env_agency_guidance.pdf

3. Definitions and concepts in the management of hazardous chemicals

3.1. Chemicals vs Articles

In EU, there is a distinction in the rules between chemicals and articles. Based on the Swedish Environmental Code[53] and EU REACH (Registration Evaluation, Authorization and Restriction of Chemicals) regulation[54], an article is defined as "*an object which during production is given a special shape, surface or design which determines its function to a greater degree than does its chemical composition"(*KEMI, 2014). The manufactured goods such as electronic chips, toys, and kitchen equipment are sample of article. In this case, a plastic glanular material that is used as a raw material in the manufacturing industry is a chemical. However, if the glanular is made into an object made of plastic (e.g a plastic toy), the object is an article, thus the rules of chemicals are no longer applicable for the article (KEMI, 2014). A certain article such as an ink cartridge is considered to be a packaging of a chemical. In other cases, a chemical is not considered as part of the article/packaging but as a separate chemical product in which the rules of chemicals apply (KEMI, 2014).

3.2. Chemical Substances vs Chemical Mixture

There are also different definitions regarding chemical substances and chemical mixtures.

A chemical mixture means a mixture or solution composed of two or more substances. A chemical mixture consists of substances that do not chemically react with each other. An example is the substances contained in a can of paint which comprises of different substances, such as pigments, solvents, preservatives, etc.[55] Some examples of the mixture under REACH among others are paints, varnishes and inks[56].

Substance is defined as "a chemical element and its compounds"[57]. The term substance includes "*substance obtained by a manufacturing process (e.g. formaldhyde or methanol) and substance in their natural state*". The term substance is also incorporate its additives and impurities where these are part of manufacturing process but it excludes any solvent that can be separated without affecting the substance's stability or changing its composition.[58]

The EU Regulation on Classification, Labeling and Packaging of Substance defines the term substance as a "chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition"[59]. In this regard, the definition of substance refers to the chemicals that are used in practice and occur in the

[53] Chapter 14 Section 2 (3)
[54] Article 3 (3)
[55] 'Rules on Chemicals in the Life-Cycle of Articles – a Legal Analysis' (KEMI (Swedish Chemicals Agency) 2014) Report 314 <https://www.kemi.se/global/rapporter/2014/rapport-3-14.pdf>.
[56] p. 13 http://echa.europa.eu/documents/10162/13632/registration_en.pdf
[57] p. 13 http://echa.europa.eu/documents/10162/13632/registration_en.pdf
[58] 'Rules on Chemicals in the Life-Cycle of Articles – a Legal Analysis' (n 38).
[59] Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures, Amending and Repealing Directives 67/548/EEC and 1999/45/EC, and Amending Regulation (EC) No 1907/2006 (OJ L 353, 31.12.2008, p. 1).

market.[60] These may include synthesized chemicals, substances of natural origin (e.g crude oil, minerals or plant material), and pure metals. Basically, the starting point is an element or chemical compound. Nevertheless, the substance may contain various additives that are necessary for the substance to remain stable. According to the Swedish Chemicals Agency (KEMI) impurities are not considered as separate substances within the meaning of chemical legislation but form part of the chemical substance.[61] KEMI notes that since the definition is relatively open, it may cause problems in their applications, especially when the rules are formulated so that it is necessary to determine whether two chemicals are – under the legal definition – "identical", i.e. considered as the same substance in the legislation.

3.3. Hazardous Substances and Substances of Very High Concern

In the EU, the term "hazardous substances" refers to substances that can be characterized as hazardous based on the criteria under the CLP (Classification, Labeling and Packaging of substances and mixtures) Regulation.[62] The hazard may include a health hazard, an environmental hazard, or a hazard due to physic-chemical properties e.g. flammability, etc.[63]

On the other hand, substances of very high concern are a smaller group of substances that have been defined in various ways and contexts. For example, based on REACH (Article 57), the term "substances of very high concern" refers to substances that are CMR (carcinogenic and mutagenic or toxic to reproduction), or is environmentally hazardous PBT substances (persistent, bio accumulative and toxic), or vPvB (very persistent and very bio accumulative).[64] According to REACH, in certain individual cases, substances can be considered as very high concern, even if they do not entirely meet the criteria for these hazardous properties. One example is the endocrine disrupting substance. Although it has hazardous properties (i.e. CMR, PBT, etc) it is separately mentioned in REACH and has separate definitions.[65] Certain substances that is fulfilling the criteria of PBT/vPvB might be eligible to be included in the Stockholm Convention or the UNECE Protocol on POPs. Even if the criteria to identify POPs are not exactly the same as the criteria of PBT/vPvB, they do partly overlap[66].

In general, chemicals in the market are often mixtures consisting of several substances. Some of these substances may have hazardous properties, others not. In general, the toxicity of the mixture is determined through conventional methods, based on the mixture and quantities

[60] 'Rules on Chemicals in the Life-Cycle of Articles – a Legal Analysis' (n 38).
[61] ibid.
[62] Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures, Amending and Repealing Directives 67/548/EEC and 1999/45/EC, and Amending Regulation (EC) No 1907/2006 (OJ L 353, 31.12.2008, p. 1) (n 42).
[63] 'Rules on Chemicals in the Life-Cycle of Articles – a Legal Analysis' (n 38).
[64] Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals, OJ L 396, 30.12.2006, p. 1.
[65] Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures, Amending and Repealing Directives 67/548/EEC and 1999/45/EC, and Amending Regulation (EC) No 1907/2006 (OJ L 353, 31.12.2008, p. 1) (n 42).
[66] p. 11, http://echa.europa.eu/documents/10162/13632/information_requirements_r11_en.pdf

contained in the hazardous properties. The hazardous properties of the mixture can be measured and can be tested.[67]

[67] Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures, Amending and Repealing Directives 67/548/EEC and 1999/45/EC, and Amending Regulation (EC) No 1907/2006 (OJ L 353, 31.12.2008, p. 1) (n 42).

3.4. Substance, Mixture and Articles under Indonesian Regulations

The hazardous and toxic substances in Indonesia are managed under different regulations and institutions such as the Ministry of Environment and Forestry, the Ministry of Industry, the Ministry of Trade, the Ministry of Transportation, etc. However, there is no specific regulation regarding PCBs. The regulations regarding B3 can be found in the attachment I of this report.

At the basic level, the Ministry of Industry and Trade, the Ministry of Environment, and Ministry of Transportation have different terms regarding hazardous substances. In general, in the EU, the term "hazardous substance" means a substance that can be characterized as hazardous and may include a health hazard, an environmental hazard, or a hazard due to physic-chemical properties. However, in Indonesia, the ministries have different references to define the hazard.

The Ministry of Industry and Trade uses the term hazardous substance or bahan berbahaya (B2) to define "matters, chemical and biology substances, in the form of single and mixture that can be directly or indirectly harmful to the environment, and the substances have the toxicity, carcinogenic, teratogenic, mutagenic, corrocive and irritation characteristic"[68]. This definition includes chemical substances and mixtures.

With regards to hazardous and toxic substances (B3) the Ministry of Industry and Trade defines it as "substances include in one or more categories as follows: (1) toxic substances, (2) explosive substances, (3) flammable substances, (4) oxidator and redactor substances, (5) explosive and flammable substances, (6) pressured gas, (7) corrocive/irritative substancs, (8) radioactive substances, (9) other hazardous and toxic substances stipulated by the Minister of Industry[69]".

The Ministry of Transportation, under the GR No. 74/2014 on Road Transportation uses the term dangerous goods or *barang berbahaya*. Elucidation of Article 63(c) states that what is meant by "dangerous goods" includes hazardous and toxic substance (B3). However, the decree does not provide more detail information regarding this matter.

On the other hand, Ministry of Transportation Decree No. KM 69/1993 uses the term hazardous substance (bahan berbahaya) to define "any substance or material due to its characteristics and condition, harmful for the health and public order and soul or human health and other living creatures"[70]. The categories of hazardous hazardous substance based on the Decree of the Ministry of Transportation are: (1) explosives (mudah meledak), (2) compressed gas, liquefied gas, dissolved gas at a certain pressure or cooling (gas mampat, gas cair, gas

[68] Ministry of Trade Regulation No. 75/M-DAG/PER/10/2014, Article 1(1). The definition in Indonesian is "*zat, bahan kimia dan biologi, baik dalam bentuk tunggal maupun campuran yang dapat*

[69] Minister of Industry and Trade No.148/M/SK/1985 on Safety of Hazardous and Toxic Substance in Industrial Companies, Article 1 (a). The Indonesian definition is "*"bahan yang termasuk dalam salah satu golongan atau lebih dari bahan-bahan berikut: (1) Bahan beracun, (2) Bahan peledak. (3) Bahan mudah terbakar/menyala, (4) Bahan oksidator dan reduktor, (5) Bahan yang mudah meledak dan terbakar, (6) Gas bertekanan, (7) Bahan korosi/iritasi, (8) Bahan radioaktif, (9) Bahan beracun dan berbahaya lainnya yang ditetapkan oleh Menteri Perindustrian."*

[70] Minister of Transportation Decree No. KM 69/1993, Article 1 number 7. The definition in Indonesian is "*setiap bahan atau benda yang oleh karena sifat dan ciri khas serta keadaannya, merupakan bahaya terhadap keselamatan dan ketertiban umum serta terhadap jiwa atau kesehatan manusia dan makhluk hidup lainnya".*

terlarut pada tekanan atau pendingin tertentu), (3) flammable liquid (cairan mudah menyala), (4) flammable solid (padatan mudah menyala), (5) oxidator, organic peroxide (oksidator, peroksida organik), (6) toxic and infectious substances (racun dan bahan yang mudah menular), (7) radioactive (radioaktif), (8) corrocive (korosif), (9) other dangers (berbahaya lain)[71]".

The Ministry of Manpower based on the Decree No. 187/Men/1999 regarding the Management of Hazardous Chemicals in the Workplace, uses the term hazardous chemical. The term of hazardous chemicals is defined as "*chemicals in the form of single or mixtures that based on the chemical and physic characteristics and/or toxicology are harmful to manpower, equipments and environment*[72]".

GR No. 74/2001 uses the term "hazardous and toxic substance" to define substances that, due to their characteristic, concentration and/or amount, either directly or indirectly, can pollute and/or damage the environment, and/or harm the environment, health and the life of humans and other living beings[73]. Furthermore, GR No. 74/2001, classifies the B3 to 15 characteristics such as[74]: (1) explosives (*mudah meledak)*, (2) oxidizing (*pengoksidasi)* (3) extremely flammable (*sangat mudah sekali menyala)*, (4) highly flammable (*sangat mudah menyala)*, (5) flammable (*mudah menyala)*, (6) *extremely toxic* (*amat sangat beracun)*, (7) highly toxic (*sangat beracun)*, (8) moderately toxic (*beracun)*, (9) harmful (*berbahaya)*, (10) corrocive (*korosif)*, (11) irritant (*bersifat iritasi)*, (12) dangerous to the environment (*berbahaya bagi lingkungan*), (13) carcinogenic (*karsinogenik*), (14) teratogenic (*teratogenik*), (15) mutagenic (*mutagenik*). The attachment II of the GR lists numbers of B3 that are forbidden to be used. **It needs to be clarified whether the list refers to a single substance or can be interpreted as a part of mixtures.**

From the discussion above, we can conclude that Indonesian legislation does not specifically differentiate between substance, mixture and article. From several discussions with Ministry officials, sometimes the term substance (*bahan*) are in practice interpreted extensively so as to include articles and mixtures. In this respect Transformers (which is actually an article containing a mixture of dielectric oil which may contain PCB) are treated as substance by the Ministry of Environment and Forestry. Nevertheless, they may not be treated as substance in other Ministries.

Furthermore, as discussed, sectoral decrees are also different in terms of naming it as B2 (*bahan berbahaya* or hazardous substances) and B3 (*bahan berbahaya dan beracun* or hazardous and toxic materials). This follows that sectoral regulations (industry, transport and environment) has different hazard statement and hazard categories. Thus, what is considered a B2 in one sector may not necessarily a B3 in other sectors.

[71] Minister of Transportation Decree No. KM 69/1993, Article 11 (2)
[72] Decree No. 187/Men/1999, Article 1 a
[73] Article 1 No. 1 GR No. 74/2001
[74] Article 5 (1) GR No. 74/2001

3.5. Globally Harmonised System in Indonesia

Indonesia has adopted the Globally Harmonised System of Classification and Labeling of Chemicals, also known as the GHS system. It aims to globally unify the rules to classify hazards and provide same format and content for labels and safety data sheets (SDs). GHS defines and classifies the hazard of chemical products and communicates information regarding health and safety information through labels and SDs[75]. For the classification, **GHS applies to pure substance, as well as their diluted solutions and mixtures**. GHS is a non-binding rule but since it is important to unify the system, most of the countries have implemented it, including Indonesia.

The two main features of GHS are:

- Classification of the hazard of chemicals is based on the GHS rules. In this case, the GHS system provides guidance to classify pure chemicals and mixtures according to its criteria or rules.
- Communication of the hazards and precautionary information using SDs and labels.

There are three major hazard groups based on the system as follows[76]:

- Physical hazards. The classes within the physical hazards are: explosives, flammable gases, aerosols, oxidizing gases, gases under pressure, flammable liquids, flammable solids, self-reactive substances and mixtures, pyrophoric liquids, pyrophoric solids, self-heating substances and mixtures, substances and mixtures that emit flammable gasses **when in contact with water**, oxidizing liquids, oxidizing solids, organic peroxides, and metal corrosives**.**
- Health hazards. The classes within the health hazard groups are: acute toxicity, skin corrosion/irritation, serious eye damage/eye irritation, respiratory or skin sensitization, germ cell mutagenicity, carcinogenicity, reproductive toxicity, specific target organ toxicity (singe exposure), specific target organ toxicity (repeated exposure) and aspiration hazards.
- Environmental hazards. The classes within the environmental hazards are: hazardous to the aquatic environment (acute and chronic), hazardous to ozone layer.

GHS is a non-binding rule but since it is important to unify the system, most of the countries have implemented it, including Indonesia. To implement the GHS system, the Indonesian government has enacted some regulations as follows:

- Minister of Industry Regulation No. 87/M-IND/PER/9/2009 on Globally Harmonized System of Classification and Labeling of Chemicals;
- Minister of Industry Regulation No. 23/M-IND/PER/4/2013 on the amendment of Minister of Industry Regulation No. 87/M-IND/PER/9/2009;
- Director General Industry Agro and Chemical Regulation No. 21/IAK/PER/4/2010 on the Technical Guideline on the Implementation of GHS;

[75] http://www.ccohs.ca/oshanswers/chemicals/ghs.html
[76] Ibid

- Director General of Industry and Manufacture Based Regulation No. 04/BIM/PER/1/2014 on the Technical Guideline and Implementation of GHS.

3.6. Chemical Substances under the Indonesian Chemical Bill

Indonesia does not have a comprehensive chemical law. However, there is a chemical bill that aims to develop harmony in the classification system and hazard communication, to optimize the use of chemical substances, and to eliminate the risk of chemical substances.

The bill (dated 23 February 2013) provides definitions for the basic terms as follows:

- A chemical substance is "all materials in the form of elements, a single compound and/or mixtures that are solid, liquid or gas.[77]"
- A hazard is defined as "the natural ability of the chemicals that can have a negative impact.[78]"
- A package of chemical substances is defined as "containers to trammel and/or wrap the chemicals.[79]"
- Chemical substance disposal is defined as "to process and dispose of chemicals that do not met specifications, expired chemicals, and/or discarded packaging of chemicals and chemical waste generated from the production or use of chemicals as remnants of bussiness/activity, or the results of the production process that cannot be used further and/or intended to be disposed of [80]
- Chemical substance extermination is defined as "destruction attempts or decomposition/decomposition of chemicals as remnants of the production process that cannot be reused, expired chemicals, chemicals that do not meet specifications, and/or used chemical packaging, either technologically or naturally transform to a simple form. [81]"

Chemical substances that are regulated in the bill include all chemical substances in the form of raw materials (*bahan baku)*, intermediate materials (bahan antara), and/or finished goods (*bahan jadi*)[82]. The bill regulates: a) classification, hazard and risk communication and labelling of chemical substances, b) chemical substance management, c) value-added optimization, d)

[77] Chemical Bill, Article 1 number 1 The Indonesian definitions is "*semua materi berupa unsur, senyawa tunggal, dan/atau campuran yang berwujud padat, cair, atau gas."*

[78] Chemical Bill, Article 1 number 2. The Indonesian definition is "sifat kemampuan alamiah bahan kimia yang dapat memberi dampak negatif".

[79] Chemical Bill, Article 1 number 6. The Indonesian definition is "wadah untuk mengungkung dan/atau membungkus bahan kimia".

[80] "Chemical Bill, Article 1 number 12 The Indonesian definition is "memproses dan membuang bahan kimia yang tidak memenuhi spesifikasi, bahan kimia kadaluarsa, dan/atau bekas kemasan bahan kimia, dan limbah bahan kimia yang dihasilkan dari produksi atau penggunaan bahan kimia yang berupa sisa hasil usaha atau hasil proses produksi yang tidak dapat dimanfaatkan lebih lanjut dan/atau dimaksudkan untuk dibuang".

[81] Chemical Bill, Article 1 number 13. The Indonesian definition is "upaya destruksi atau dekomposisi/penguraian bahan kimia yang berupa sisa hasil proses produksi yang tidak dapat dimanfaatkan kembali, bahan kimia kadaluarsa, bahan kimia yang tidak memenuhi spesifikasi dan/atau bekas kemasan bahan kimia, baik secara teknologi atau secara alamiah menjadi bentuk lebih sederhana"

[82] Chemical Bill, Article 4 (1)

chemical safety and security, e) the authority of central government and local government, f) research and development[83].

The bill focuses on GHS system implementation rather than the establishment of a comprehensive chemical management such as the REACH regulation in the EU. The bill is more similar to CLP Regulation rather than REACH. The bill also relies on implementing regulations (e.g. government regulation) to further regulate and implement important aspects such as substance identification, reportage and chemical registration.

3.7. Waste

3.7.1. Waste under Conventions and EU Law

EU Directive

Based on Directive 2006/12/EC on Waste**,** the term "waste" is defined as a "substance or object, which the holder discards, intends to discard, or is required to discard.[84]" In this regard, 'waste' includes any substance or object in the categories in Annex I of the Directive, which the holder discards, intends to discard, or is required to discard. Contaminated materials (e.g. oil contaminated with PCBs, etc) are included in the Annex I. In addition, disposal means that the content of the waste is not utilized but that the waste is incinerated, landfilled or disposed of some other way (KEMI, 2014).

The Basel Convention

The Basel Convention defines waste as "substances or objects, which are disposed of or are intended to be disposed of or are required to be disposed of by the provision of national law". Furthermore, hazardous wastes that shall be subject to the transboundary movement for the purpose of the Basel Convention are:

- Wastes that belong to any category contained in Annex I, unless they do not possess any of the characteristics contained in Annex III[85]; and
- Wastes that are not covered under paragraph (a) but are defined as, or are considered to be, hazardous wastes by the domestic legislation of the Party of export, import, or transit[86].

The Convention does not cover the following:

- Wastes that belong to any category contained in Annex II that are subject to transboundary movement[87].
- Wastes, which, as a result of being radioactive, are subject to other international control systems, including international instruments, applying specifically to radioactive[88].

[83] Chemical Bill, Article 5
[84] Article 1 (a) Directive 2006/12/EC on Waste
[85] Article 1 a Basel Convention
[86] Article 1 b Basel Convention
[87] Article 2 Basel Convention
[88] Article 3 Basel Convention

- Wastes, which derive from the normal operations of a ship, the discharge of which is covered by another international instrument[89].

3.7.2. Waste under Indonesian Law

GR 101 – the leading regulation on B3 waste – covers the the stipulation of B3 waste, elimination of B3 waste, storage of B3 waste, collection of B3 waste, transportation of B3 waste, untilisation of B3 waste, management of B3 waste, stockpilling of B3 waste, dumping of B3 waste, exception of B3 waste, transboundary movement of B3 waste, environmental pollution control and/or environmental damage and environmental function rehabilitation, emergency response and B3 waste management, guidance, supervision, financing and administrative sanctions.

Waste is defined by GR 101 as: *remnants of business and/or activities that contain B3*[90]. A "remnant" means a quantity or a part that is left after the greater part has been used, removed or destroyed[91]. Remnant/residue is associated with leftover materials. The definition of B3 waste as a remnant of business and or activities that contain B3 reflects the end of pipe approach or proactive environmental reaction since the focus is on the remnant/residue.

Furthermore, the GR defines B3 as: "…substances, energy, and/or other components that, due to their characteristics, concentration and/or amount, either directly or indirectly, can pollute and/or damage the environment, and/or harm the environment, health and the life of humans and other living beings."[92]. Thus there is a slightly different definition regarding the term "hazardous and toxic" (B3) within GR 101 and GR 74. Based on GR No. 74/2001, B3 is "…substances that, due to their characteristics and or concentration and/or amount, either directly or indirectly, can pollute and/or damage the environment, and/or harm the environment, health and the life of humans and other living beings[93].

Stipulation of B3 Waste

Chapter II, of GR 101, especially Article 3 and 5 includes procedure regarding the stipulation of B3 waste.

Article 3(2) states that B3 waste based on its **hazard category** consists of:

a. B3 waste category 1;
b. B3 waste category 2.

Article 3(3) the B3 waste aforementioned in article (2) based on the sources are consists of:

[89] Article 4 Basel Convention
[90] Article 1 No. 3 GR No. 101/2014, Limbah Berbahaya dan Beracun adalah sisa suatu usaha dan/atau kegiatan yang mengandung B3.
[91] Definition based on *Kamus Besar Bahasa Indonesia*
[92] Article 1 No. 1 GR No. 101/2014, zat, energi, dan/atau komponen lain yang karena sifat, konsentrasi, dan/atau jumlahnya, baik secara langsung maupun tidak langsung, dapat mencemarkan dan/atau merusak lingkungan hidup, dan/atau membahayakan lingkungan hidup, kesehatan, serta kelangsungan hidup manusia dan makhluk hidup lain.
[93] GR No. 74/2001 "bahan yang karena sifat dan atau konsentrasinya dan atau jumlahnya, baik secara langsung maupun tidak langsung, dapat mencemarkan dan atau merusak lingkungan hidup, dan atau dapat membahayakan lingkungan hidup, kesehatan, kelangsungan hidup manusia serta makhluk hidup lainnya."

a. B3 waste from non-specific source.

Table 1. List of B3 waste from non-specific sources. Waste from specific sources means B3 waste that is not generated from the main process but from activities such as equipment maintenance, washing, corrosion prevention, corrosion inhibition, crust dissolution and packaging[94]. The waste includes:

- Waste code A101d: waste containing the compounds of POPs and UPOPs such as PCBs, DDT, PCDD, and PCDF. In this case the waste is categorized as B3 waste category 1.
- Waste code A108d: waste contaminated with B3. It is categorized as B3 waste category 1.

Further consultation with experts is needed to determine whether a transformer (regardless its condition) that contains PCBs or is contaminated with PCBs, can be categorized as B3 waste from the non-specific source.

b. B3 waste from expired B3, spilled B3, B3 that does not fulfill the specification regarding product that is intended to be discharged, and used B3 packaging; and
c. B3 waste from specific source

In addition, list of B3 waste from Common Specific Source – Table 3, attachment of the GR, as follows:

Industry /Activity Code	Type of Industry/Activity	Waste Source	Waste Code	Waste Description	Hazard Category
32	All types of industry that produce or use electricity	Energy distribution facility Replacement refilling, reconditioning, retrofitting process from the transformer and capacitor Gas treatment facility Oil treatment and/or storage facility Air pollution control facility	A332-1	Sludge from the oil treatment or storage facility	1
			B332-1	Sludge and filter cakes from the gas treatment	2
			B332-2	Dust from the air pollution control facility	2

The table does not specifically include a PCB contaminated transformer or a transformer containing PCBs – although PCB can still be covered under A101d as above.

The process of replacement, refilling, reconditioning, retrofitting from the transformer and capacitor is identified as a source of waste. The waste that is described as a result of this process only cover sludge and dust.

[94] Elucidation Article 3(3) GR No. 101/2014 "*Limbah B3 dari sumber tidak spesifik merupakan Limbah B3 yang pada umumnya bukan berasal dari proses utamanya, tetapi berasal dari kegiatan antara lain pemeliharaan alat, pencucian, pencegahan korosi atau inhibitor korosi, pelarutan kerak, dan pengemasan".*

Artice 5(1) states in the event that there is waste which fall outside the B3 waste listed in the Attachment I that is indicated to have B3 waste characteristics, the Minister shall conduct characteristic test[95] to identify the waste as either category 1, category 2 or non-B3 waste.

In terms of PCBs, GR No.101/2014 Article 107 (5) states the treatment must comply with the efficiency standard of at least a 99.9999% destruction and removal of the polychlorinated biphenyl compounds. The emission standards related to the treatment will be further stipulated in the Ministerial Regulation[96]. Law 32/2009 regulates that if there is an expired B3 then it should be treated as B3 waste[97]. The same is stipulated in GR No. 101 Article 3(3) b mentioned above and GR No. 74/2001 which states that the expired B3 and/or B3 that does not fulfill the specification and/or used packaging must be managed under provision regarding hazardous and toxic waste (B3) management[98]**.** In this case, expired PCBs should be treated as B3 waste. Nevertheless, there is yet a specific regulation to manage articles/equipment contaminated with PCBs. As yet, there are no technical guidelines regarding the management of equipment/products, such as transformers, capacitors and other electronic and electrical equipment containing PCBs, nor is there a technical code of practice or incentive mechanism for the extermination of PCBs.

Related regulations regarding the management of B3 waste can be found in the Attachment II of the report. Several legal issues which may arise are as follows:

- The definition of B3 "waste"
- Whether PCBs which are contained in articles and/or equipment (e.g transformer, capacitor) can be categorized as B3 waste regardless of their condition (e.g new, used) based on domestic (Indonesian) regulation.

As previously mentioned, GR No. 101/2014 defines "*limbah*" (waste) as remnants/residue. In this case, this definition cannot be applied for transformer. If the Ministry of Environment extend the term residue extensively, the application to the transformer would be as follows:

- In the case of transformer is a brand new one; it cannot be considered as a remnant/residue. If the transformer has already been used and is still in good condition, it is categorized as used rather than as a remnant/residue. The contextual definition of "remnant/residue" is not suitable to describe the aforementioned conditions of the transformers. It seems that the Miistry of Environment would use a very broad definition regarding "remnant/residue". The KLHK may interpret that the waste is not limited to the remnants/residue of the business and/or activities but also any object that it is not being used anymore.
- Nevertheless, if the "broad" definition above is used, the synthesis interpretation regarding a transformer containing PCBs as B3 waste is as follows: "A transformer is a remnant of business and/or activity that contains substances, energy, and/or other

[95] GR 101/2014, Article 8, and 9 states that the characterictic test is conducted by a B3 waste expert tim appointed by the Minister. The decision regarding the category of waste will be stipulated by The Minister.
[96] GR No. 101/2014 Article 107(8)
[97] Article 59 Law No.32/2009
[98] Article 20 GR No. 74/2001

components (in this case PCBs) due to its characteristic, concentration (the level of the concentration will refer to the Stockholm Convention, e.g 50-500 ppm) and/or amount, either directly or indirectly, that can pollute and/or damage the environment, and/or harm the environment, health and the life of humans and other living beings.

There is a gap between GR No. 101/2014 and the Basel Convention. The Basel Convention regulates PCB contaminated materials as shown in the table below, but the GR does not explicitly regulate it.

Annex – Basel Convention

Annex I: Categories of Waste to Be Controlled (Waste Streams)	Y10	Waste substance and articles containing or contaminated with PCBs and/or Polychlorinated terphenyls (PCTs) and/or Polybrominated biphenyls (PBBs).
Annex VIII, List A A1. Metal and Metal-Bearing Wastes	A1180	Electrical waste and electronic assemblies or scarp (e-waste) containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCBs capacitors, or contaminated with Annex I constituents (e.g. cadmium, mercury lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III (note the related entry on list B B1110)[99]
	A1190	Waste metal cables coated or insulated with plastics containing or contaminated with col tar, PCB[100], lead, cadmium, other organohalogen compounds or other Annex I constituents to an extent that they exhibit Annex III characteristics.
Annex VIII, List A A3. Waste Containing Principally Organic Constituents, Which May Contain Metals and Inorganic Materials	A3180	Waste substances and articles containing, consisting of or contaminated with polychlorinated biphenyl (PCB), polychlorinated terphenyl (PCT), polychlorinated naphthalene (PCN) or polybrominated biphenyl (PBB), or any other polybrominated analogues of these compounds, at a concentration level of 50 mg/kg or more[101].

The Basel Convention defines PCBs as any material or substance containing a PCB concentration more than 50 ppm.

PCB and e-wastes

Some PCBs are used chemicals in electrical products (chemical-in-products). It is therefore important to mention some regulation on e-waste, which is also listed in Annex VIII of the Basel Convention. There is yet a specific definition or specific regulation on e-waste management, however, GR 101 lists e-waste:

[99] PCBs are at a concentration level of 50 mg/kg or more
[100] Ibid
[101] The 50 mg/kg level is considered to be an internationally practical level for all wastes. However, many individual countries have established lower regulatory levels (e.g. 20 mg/kg) for specific wastes.

GR No. 101/2014 includes several types of e-waste (e.g printed circuit board, cathod ray tube, etc) as shown in the table below:

List of B3 Waste from Common Specific Source

Industry/ Activity Code	Type of Industry/ Activity	Waste Source	Waste Code	Waste Description	Hazard Category
28	The assembly of electronic components or electronic equipment	Electronic components or electronic equipment manufacture and assembly Waste water treatment facility which treats the effluent	A327-5	Sludge from waste water treatment facility	2
			A328-1	Mercury contactor/switch	1
			A328-2	Fluorescent lamp (hg)	1
			A328-3	Solution for printed circuit	1
			A328-4	Caustic strapping (photoresist)	1
			A328-5	Sludge from the assembly production process	1
			B328-1	Cathode Ray Tube (CRT)	2
			B328-2	Coated glass	2
			B328-3	Solder residue and its flux	2
			B328-4	Printed circuit board (PCB)	2
			B328-5	Metal cable waste & its insulation	2
			B328-6	Sludge from waste treatment facility	2
29	Recondition or remanufac-turing electronic goods	Electronic component and equipment remanufacture, recondition and assembly Waste water treatment facility which treats the effluent	A329-1	Mercury contactor/switch	1
			A329-2	Fluorescent lamp (hg)	1
			A329-3	Caustic strapping (photoresist)	1
			A329-4	Cathode Ray Tube (CRT)	2
			A329-5	Solution for printed circuit	1
			A329-6	Sludge from production process	1
			A329-1	Coated glass	2
			A329-2	Solder residue and its flux	2
			B329-3	Printed circuit board (PCB)	2
			B329-4	Metal cable waste & its insulation	2

Relevant Regulations Regarding to E-waste Management

No	Regulations Title	Description
1	Environmental Protection and Management Act No. 32/2009	
2	Law No. 18/2009 on the Waste Management	Introduces the concept of extended producer responsibility . In this case the e-waste producer should be responsible to manage its waste.
3	Presidential Decree No. 61/1993 on Basel Convention Ratification	
4	Presidential Regulation No. 47/2005 on the Ratification of the Amendment of Basel Convention	
5	Government Regulation No. 101/2014.	
6	Minister of Public Work Regulation No. 03/PRT/M/2013 on the Waste's infrastructure and facilities in order to handle the domestic waste and similar type of waste	
7	Minister of Trade and industry Decree No. 39/2005 regarding Imported Used Machinery and Equipment (transportation equipment)	
8	Minister of Industry and Trade Decree No. 520/MPP/Kep/8/2003 regarding the Prohibition of Hazardous and Toxic Waste Import	

E-waste is unusable and/or nonfunctioning electronic or electric appliances since it becomes obsolete and needs to be disposed of either in whole form or as parts[102]. E-waste that is categorised as toxic and hazardous waste should be any e-waste containing components or parts made of or containing toxic and hazardous substance[103]. According to one official, after the e-waste is dismantled, it is only the components containing or contaminated by hazardous and toxic substance/materials that would be categorised as hazardous and toxic waste[104].

4. Regulatory Framework for PCB Life Cycle in Indonesia

4.1. Import, Export and Production

Based on GR 74, PCBs is categorized as B3 that is forbidden to be used. GR 74 added that a B3 that is forbidden to be used means the type of B3 that is forbidden to be used, produced, distributed or imported[105]. The transition article of the GR No. 74/2001 states that at the time when the GR is enacted and the B3 that is forbidden to be used still exists in Indonesia, such B3 can be exported to the country that is in need of that B3, based on the existing export mechanism[106]. The GR does not provide sanctions for those who use and/or possess such B3.

[102] Haruki Agustiana, Indonesian Ministry of Environment, Identification of E-Waste and Secondhand e-products in Indonesia, Beijing, 28-29 March 2007
[103] Ibid
[104] Ibid
[105] Article 1 number 10 GR No. 74/2001
[106] Article 41 GR No. 74/2001

The Law on Environment (Law 32/2009) [107]prohibits everyone to "insert" (*memasukkan*) B3 that is forbidden to be used based on the law and regulation, to the Indonesian territory. The elucidation of the articles states that B3 that is forbidden to be used among other are DDT, PCBs and Dieldrin. The Act No. 32/2009 imposes criminal sanctions of imprisonment (minimum 5 years and maximum 15 years), and fines of minimum Rp. 5,000,000,000 and maximum Rp. 15,000,000,000, for those who imports/inserts the B3 that is forbidden to be used. Nevertheless, similar to GR 74, the law does not have sanctions for those who use and/or possess such B3.

Furthermore, PCB is included in the Indonesian Negative List of Investment. Presidential Decree No. 39/2014 regarding Business Fields that are Closed and Opened to the Requirement of Investment lists the type of chemical industry that is potentially damaging to the environment (e.g the pesticide industry's active substances, namely DDT, Aldrin, Endrin, Dieldrin, Chlordane, Heptachlor, Mirex, Toxaphene) as well as the industrial chemical industry's substances, namely Polychlorinated biphenyl/PCB and Hexachlorobenzene, as the business fields that are closed for investment.

4.2. PCBs Import to Indonesia

The import of PCBs in various forms to Indonesia can be found in the report of Statistic Agency (*Badan Pusat Statistik*), as follows:

Imported PCBs as Commodity to Indonesia February 2015

Import By Harmonised System Commodity, FEBRUARY 2015[108]				
Commodity Description	Net Weight (Kg)		Value C.I.F (US$)	
	Current Month	Cumulative, January to date	Current Month	Cummulative, January to date
2710910000 Waste oil, containing PCBs, PCTs or PBBs	7	654	1328	17197
3824820000 Mix and preparation containing pbbs, PCBs, PCTs	330	5121	132067	339681

From the table above, it can be seen that PCBs in the form of waste oil and mixture substances with HS Code 2710910000 and 3824820000 are imported to Indonesia. The Harmonised System (HS) code is a nomenclature for international product. It is developed by the World Customs Organisation (WCO). There are at least 200 countries using the system as a reference for their customs tariff policy and to collect information regarding the international trade statistic[109].

[107] Article 69 (1) b Environmental Protection and Management Act

[108] http://perpustakaan.bappenas.go.id/lontar/file?file=digital/155140-%5B_Konten_%5D-BULETIN_IMPOR_0215.p

[109] World Costums Organisation, What is the Harmonised System? http://www.wcoomd.org/en/topics/nomenclature/overview/what-is-the-harmonized-system.aspx

In Indonesia, the importation of commodities and tariffs is regulated by the Minister of Finance Regulation No. 213/PMK.011/2011 regarding The Stipulation of Goods Classification System and Imposition of Import Duty for Imported Goods (*Penetapan Sistem Klasifikasi Barang dan Pembebanan Tarif Bea Masuk atas Barang Impor*). The HS Code 2710910000 is regulated in the Attachment II, Chapter 27 Article 3. The Article states:

For the purpose of heading 27.10 "waste oils" means waste containing mainly petroleum oils and oils obtained from bituminous minerals, whether or not mixed with water. These include:

(a) Such oil no longer fit for use as primary products (for example, used lubricating oils, used hydrolic oils **and used transformer oils**);
(b) Sludge oils from the storage tanks of petroleum oils, mainly containing such oils and high concentration of additive (for example, chemicals) used in the manufacture of the primary products; and
(c) Such oils in the form of emulsions in water or mixture with water, such as those resulting from oil spills, storage tank washing, or from the use of cutting oils for machining operations.

The import duty for the HS Code 2710910000 is 0%, based on the Attachment III of the regulation.

In addition, HS Code with the heading 3824 is a category for prepared binders for foundry moulds or cores, chemical products and preparations of the chemical industries (including those consisting of mixture of natural products), not elsewhere specified or included. The import duty for HS code 3824820000 is 5%.

There is a need to clarify the status of the PCBs with the HS Code 2710910000 and 3824820000 whether it should be categorized as B3 waste or B3. If it is considered as B3 waste, the relevant ministries should prohibit the importation immediately and revise the existing regulation.

4.3. Distribution of POPs in Indonesia

There are at least two verdicts of the Indonesian court regarding the case on the distribution of pesticides containing endosulfan. Based on the verdict of Tegal Court No. 24/Pid.Sus/2015/PNTgl, Mr Tan Swat Hng the owner/manager of a agricultural supplies shop in Tegal City, faced 3 months imprisonment and fined Rp. 4,000,000 (four million Indonesian Rupiah) based on Article 60 (1) g and h, Article 60 (2) g and h Law No. 12/1992 regarding Plants Cultivation (*Budi Daya Tanaman*). It was proven that the shop sold unregistered pesticides namely Akodani, Indodan, and Akodan in which based on the examination of the Indonesian Police Forensic Laboratory Centre (Puslabfor) it was found that the Indondan contained endosulfan. Endosulfan is one of the types of pesticides that is prohibited to be used for rice plants based on Presidential Instruction No. 3/1986 regarding the Chocolate Planhopper Pest Control Improvement for the Plants (*Peningkatan Pengendalian Hama Wereng Coklat Pada Tanaman*). Mr Tan Swat Hng was convicted for: a) intentionally distributed unregistered pesticides or not in accordance with the label as it is stipulated in the Article 38 (1) Law No. No.12/1992, and b) intentionally do not dispose pesticides that are forbidden to be distributed, not qualified, damaged, or unregistered as it is stipulated in Article 41 Law No. No.12/1992.

A similar case happened in Malang City. Based on Malang Court verdict No. 505/Pid.Sus./2015/PN.Mlg, Mr Ivan Budianto, the owner of an agricultural supplies shop in

Malang City faced 1 month imprisonment based on Article 60 (1) g Law No.12/1992, Article 60(2) g Law No.12/1992. It was proven that the shop sold unregistered pesticides namely Akodani and Indodan, in which they contained endosulfan, based on the examination of Agrochemical Residue Substances Laboratory, Bogor Institute of Agriculture. Mr Budianto was convicted for: a) intentionally distributed unregistered pesticides or not in accordance with the label as it is stipulated in the Article 38 (1) Law No. No.12/1992 and b) intentionally do not dispose pesticides that are forbidden to be distributed, not qualified, damaged, or unregistered as it is stipulated in Article 41 Law No.12/1992.

The two cases mainly refer to the Law No. 12/1992 as the case is relevant with the regulations specific to pesticides. In this case, the Law No. 74/2001 cannot be applied as the attachment II of Law focuses on endosulfan as a substance rather than as a mixture.

4.4. Registration

B3 registration means the registering and numbering B3 that exist in Indonesia[110]. GR 74 puts a one-time obligation to register on importer or producer of B3, especially for the B3 that is imported for the first time.[111] Nevertheless, under GR 74, there is no obligation for owners of B3 to register. In addition, the import of product containing B3 (PCBs) is not under the authority of KLHK and is not regulated under GR 74/2001.

In terms of B3 registration, the MoEF issues Ministry Regulation No. 2/2010 regarding The Utilisation of Hazardous and Toxic Substance (B3) Electronic System Registration within the Framework of INSW (Indonesia National Single Window) at the Ministry of Environment and Forestry.[112]INSW is a national system that enables single submission of data and information, single and synchronous processing of data and information, and single decision-making for custom release and clearance of cargoes[113]. The B3 electronic aims to handle customs documents which relates to permitting and/or import and/or export of B3 within the framework of INSW[114]. The Deputy in the MoEF that is responsible for the B3 management implements the registration.[115]

For the purpose of comparison, the registration system for pesticide and halon is elaborated below:

[110] Registrasi B3 Online Terintegrasi INSW, Penerapan Registrasi B3 Online Dalam Mendukung Tata Kelola B3 Nasional, Direktorat Pengelolaan B3, Direktorat Pengelolaan Sampah, Limbah dan B3, KLHK, Jakarta 10 Juni 2016, http://www.menlhk.go.id/berita-106-launching-aplikasi-registrasi-b3-online-pada-pekan-lingkungan-hidup-dan-kehutanan-2016-jumat-10-juni.html

[111] Article 6(1),(2)GR No 74 Tahun 2001 Tentang Pengelolaan Bahan Berbahaya Dan Beracun

[112] The title of the regulation in Indonesian is *Penggunaan Sistem Elektronik Registrasi B3 dalam Kerangka Sistem INSW di KLHK.*

[113] Ministry of Environment and Forestry Regulation No. 2/2010, Article 1 number 6

[114] Ministry of Environment and Forestry Regulation No. 2/2010, Article 2

[115] Ministry of Environment and Forestry Regulation No. 2/2010, Article 6

Pesticide Registration

Based on the hazard, pesticides are categorized in two groups, forbidden pesticides and pesticides that can be registered. The forbidden pesticides are those which meet criteria as follows[116]:

- The formulation of the pesticide includes as class Ia (extremely dangerous) and Ib (very dangerous) based on World Health Organisation (WHO) classification;
- The active and/or additive ingredients of the pecticides have carcinogenic effect (category I and IIa based on the classification of International Agency for Researh on Cancer (IARC), mutagenic and teratogenic based on Food and Agriculture Organisation (FAO) and WHO;
- The active and/or additive ingredients of the pesticides caused drug resistantcy to human;
- The active and/or additive ingredients of the pesticides are included as POPs (Persistent Organic Pollutants) based on Stockholm Convention.

Pesticide registration is only applicable to pesticides that is not categorised as forbidden pesticides and/or does not contain prohibited substances as explained above. The pesticide should comply with the pure grade of active ingredients based on FAO and WHO specification[117]

There are two types of licenses for pesticides they are trial license and permanent license[118]. Trial license is given by the Director General to the applicant in order to prove its claim for the quality and the safety of pesticide being registered[119]. Under this license, the pesticide is forbidden to be distributed or be used commercially.[120] In terms of permanent license, it consists of three types, they are: a) pesticide permanent license, b) pesticide technical material permanent license, and c) pesticide permanent license for export. Under the permanent license, the pesticide can be produced, distributed and used.[121] As pesticides are primarily regulated under agriculture legislation, the whole system of pesticide registration is administered by the Ministry of Agriculture.

Halon Registration

With respect to the phasing-out of the ozone-depleting substances, the Indonesian government enact registration measures for Halon through the Minister of Environment Regulation No. 35/2009 regarding Halon Management**.** Halon is used in the refrigerant system/cooling systemIn terms of the registration, the regulation obliged any parties possessing Halon to:

Store the Halon based on the attachment of the regulation;

- Keep the records of the storage balance sheet (*pencatatan neraca penyimpanan*) and the use of Halon in the log book;

[116] Ministry of Agriculture Regulation No. 39/Permentan/SR.330/7/2015, Article 6(1),(2)
[117] Ministry of Agriculture Regulation No. 39/Permentan/SR.330/7/2015, Article 22 (1),(2)
[118] Ministry of Agriculture Regulation No. 39/Permentan/SR.330/7/2015, Article 11
[119] Ministry of Agriculture Regulation No. 39/Permentan/SR.330/7/2015, Article 12(1),(2)
[120] Ministry of Agriculture Regulation No. 39/Permentan/SR.330/7/2015, Article 12(3)
[121] Ministry of Agriculture Regulation No. 39/Permentan/SR.330/7/2015, Article 13(2),(4)

- Report the amount of Halon in their posession to the environmental agency in the Regency/City at minimum once in a year and submit the copy to the Ministry of Environment and Forestry and responsible agency for environmental management in the province;
- Report the plan to eliminate the use of Halon to the Ministry of Environment and Forestry and responsible agency for environmental management in the province;
- Maintain the system and/or equipment that are using Halon which are installed or in the storage in order to prevent them leakage.

As it is already mentioned previously, there is no mechanism to register equipment/article containing/contaminated with PCBs. GR 101 is also absent on the registration of PCB Waste.

With regards to PCBs phasing out, additional measures can be imposed to companies having PCBs and/or equipment/transformers containing PCBs in their facility/storage (while they are waiting to be disposed). The Halon registration procedure can be used as precedent and practices in other countries can be used as a comparison.

4.5. Packaging and Labelling of B3

The labelling for B3 is regulated in general under Ministry of Environment Regulation 03 Year 2008 (Permen LH 03/2008) on The Symbol and Labelling of B3.[122] Under the Globally Harmonized System (GHS), PCB hazard is coded as H373, H400 and H410 and the Pictogram is coded under GHS08 and GHS09. The legal basis for GHS are:

- Minister of Industry Regulation No. 87/M-IND/PER/9/2009 on Globally Harmonized System of Classification and Labelling of Chemicals as amended by Minister of Industry Regulation No. 23/M-IND/PER/4/2013;
- Director General Industry Agro and Chemical Regulation No. 21/IAK/PER/4/2010 on the Technical Guideline on the Implementation of GHS;
- Director General of Industry and Manufacture Based Regulation No. 04/BIM/PER/1/2014 on the Technical Guideline and Implementation of GHS.

GHS09 GHS08

Under GHS, PCB is coded as GHS09 and GHS08. This corresponds to Picture 8 (dangerous to the environment) and Picture 9 (carcinogenic, tetragenic and mutagenic) substances of

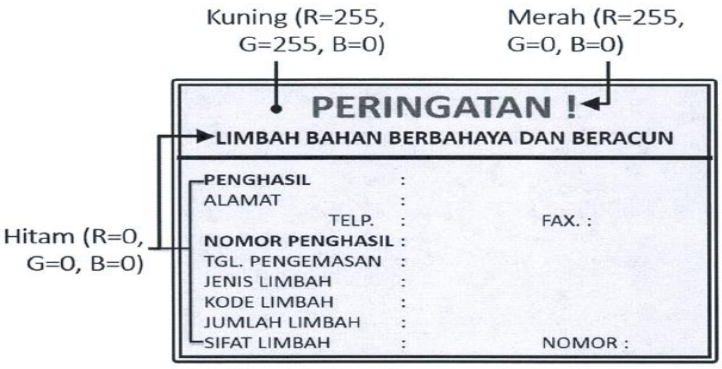
[122] Peraturan Menteri Negara Lingkungan Hidup Nomor 3 Tahun 2008 Tentang Tata Cara Pemberian Simbol Dan Label Bahan Berbahaya Dan Beracun.

Attachment of Permen LH 03/2008. Any articles/equipment, mixtures or substances containing PCBs which are in use or in the form of waste must be labelled according to the above pictograms.

4.6. Packaging and Labelling of B3 Wastes

The labelling for B3 Waste is regulated in general under Ministry of Environment Regulation No. 14/2013 (Permen LH 14/2013) on Symbol and Labelling of B3 Waste. The symbol and labelling of the B3 waste should be done for: a) containers and/or packages of the B3 waste, b) site/location for the B3 storage, c) vehicle transporting B3 waste[123].

Figure 2 Label for B3 Waste Containers/Packages[124]



The symbol and labelling of the B3 waste should be based on the B3 waste hazard characteristic which includes a) explosive (*mudah meledak*), b) flammable (*mudah menyala*), c) reactive (*reaktif*), d) toxic (*beracun*), e) infectious (*infeksius*), f) korosif (c*orrocive*), g) dangerous to the environment (*berbahaya terhadap lingkungan*)[125]. Thus, under Ministry Regulation 14/2013, in order to do the symbolling and labelling for the PCBs waste, it is important to identify the hazard characteristic of the PCBs waste.

Figure 3 B3 Waste Symbol: Dangerous to the Environment[126]

[123] Ministry of Environment Regulation No. 14/2013, Article 2 (2)
[124] Ministry of Environment Regulation No. 14/2013, Attachment
[125] Ministry of Environment Regulation No. 14/2013, Article 2 (6)
[126] Ministry of Environment Regulation No. 14/2013, Attachment

However, there are differences in terms of the pictogram and hazard characteristic between B3/GHS and Limbah B3. The characteristic of carcinogenic, tetragenic and mutagenic are not present – presumably intended to be covered by "toxic" but this is also not precise. We recommend that PCB waste hazard characteristics and pictogram refers to **GHS09 and GHS08.**

4.7. B3 Waste Storage

B3 waste treatment license for storage activities[127] lasts for 5 years and can be extended[128]. The maximum durations for the B3 waste storage are [129]:

- 90 days since the B3 waste is produced in which the volume is 50 kg per day or more (B3 waste category 1) ;
- 180 days since the B3 waste is produced in which the volume is less than 50 kg per day (B3 waste category 1) ;
- 365 days since the B3 waste is produced in which the volume is less than 50 kg per days (B3 waste category 2 from non-specific sources or from common specific sources); or
- 365 days since the B3 waste is produced in which the volume is less than 50 kg per day (B3 waste category 2 from the specific sources) .

-

In the event the storage of the B3 waste beyond the time period, the license holder of B3 waste management for B3 waste storage activities shall utilize the B3 waste, treat/process the B3 waste and/or hoarded the B3 waste, and/or transfer the B3 waste to other parties which are[130]: B3 waste collector, B3 waste utilizer, and/or B3 waste horder[131]. As explained above, PCB is considered as B3 waste category 1 from the non-specific source. It is important to note that,

[127] Izin pengelolaan limbah B3 untuk kegiatan penyimpanan limbah B3
[128] GR No.101, Article 21
[129] GR No. 101, Article 28 (1)b
[130] GR No. 101, Article 29(1)
[131] GR No. 101, Article 29(2)

the period of the storage of the B3 waste is shortened as the risk of hazard increase with the increase of amount.

Administration sanctions applied for the violation of the above provisions. The administrative sanctions consist of: a) written notice, b) government coercion (*paksaan pemerintah*), c) the freezing of the B3 waste management license for the B3 waste storage activities[132].

In one induction meeting[133], official from one region stated its concern that they do not have sufficient storage and B3 waste treatment facility available in the city. Therefore, the BLH may ask companies that have equipment (transformers) containing/contaminated with PCBs to keep/store them in their companies until the facility is available. However, the problem is that the 90-day limit for temporary storage is a regulatory limit, in which, upon the elapse of such limit all waste must be processed for disposal. Nevertheless, the absence of a PCB disposal facility in Indonesia meant that the 90-day limit would inevitably be surpassed. In addition, this may trigger administrative and legal actions towards the company if a contamination occurs. Indonesian regulation adheres to the strict liability principle in the event of B3/B3 waste contamination.

One of the option is to exercise discretion (of not enforcing) the lapse of time limit. However, such discretion, may cause complicated legal problem as explained below.

In addition, such discretion could be problematic under The Law on Government Administration (Law 30 Year 2014, hereinafter the "GovAdmin Law"). The GovAdmin law defines discretion as decision or action which are taken when dealing with concrete matters.[134] This is further detailed in Chapter VI which is dedicated to regulating discretion. Article 23 of the GovAdmin Law limits discretion into four possibilities (i) when laws and regulation provide options for decision or action, (ii) when laws and regulations are silent, (iii) laws and regulations are incomplete are unclear and (iv) the decision or action needs to be taken stagnation in government, for the greater good. In this case, possibilities of (i), (ii) and (iii) are closed, since GR 101 does not provide option, is not silent and very clear about the time limit. Only (iv) becomes a possibility, nevertheless, the GovAdmin Law elucidation clarifies that government stagnation occurs, for example, in major events such as disaster or political turmoil, which renders the government to be dysfunctional. Evidently, this condition is not applicable to the case at hand. As such, laws and regulations does not seem to provide latitude for discretion in this case.

It needs to be mentioned that discretion could be rendered void or voidable for reasons listed in Articles 30 and 31. Article 32 mentioned that a discretion could be voidable if they are, among other, (i) not in accordance with the purpose of the authority or (ii) is against the good governance principles. Indeed, during the drafting of the GR 101 presumably, the condition where wastes are stockpiling due to the absence of treatment facilities (and therefore require more time to stockpile until the facilities are in place) was not anticipated. Thus the discretion was based on a good intention to facilitate compliance. **On the other hand**, the regulation provides option to export the B3 waste in the event that the B3 waste producer cannot process the waste or the facility to utilise/treat/process the waste is not exist in Indonesia[135] It could

[132] GR No. 101, Article 243
[133] Induction Meeting, Serpong, 24 February 2016
[134] Undang Undang Republik Indonesia Nomor 30 Tahun 2014 Tentang Administrasi Pemerintahan. See Article 1 (9)
[135] GR No. 101, Article 123 (1), (4)

be argued in the Court that the strict liability principles and the polluters pays principles require the waste to be exported – at the company's cost. Thus, it can be argued, that the government should not facilitate further delays of such action – especially by extending the time limit through discretion – and as such, (it can be argued that) the discretion is considered to be against the good governance principles. This is of course a very subjective argument as it is also possible to counter-argue by suggesting that if this time limit is directly enforced, then the whole phasing-out process as required by the Stockholm Convention would not be possible – and thus a policy objective cannot be attained.

Finally, one of the most important legal risks in exercising such discretion is not administrative but liability. As previously mentioned, the treatment of B3 wastes is different given the polluters pays principles and the strict liability principle. If a contamination occurs during the period that the time limit for storage is extended through a discretion, then the government could also be held liable for issuing a policy which contradicts a regulation. The motive for giving time limit for storage is to lessen the risk. If the government extends the time limit, it means that it has wilfully and knowingly, extend the risk of contamination in direct contradiction with the regulation.

especially if formulated in a written policy, could expose the government to lawsuit, in case a contamination occurred. This is because the nature of hazardous substances which entails strict liability as previously mentioned

4.8. B3 Waste Collection

The B3 waste producer is obliged to collect its waste.[136] In the event that the B3 waste producer cannot collect its own B3 waste, it is obligated to request the B3 waste collector to do it[137]. The permit for the B3 waste management for the B3 waste storage activities lasts for 5 years and is extendable.[138] However, the duration for the B3 waste storage in the B3 waste collection facility is 90 days since the PCBs waste is transferred to the B3 waste collector. In the event the B3 waste storage exceed 90 days, the B3 waste collector is required to transfer the collected B3 waste to other parties [139] such as: B3 waste user, B3 waste treatment/processor, and B3 hoarder waste[140]. Administration sanctions applied for the violation of this provisions.

[136]GR 101 Article 31(1)
[137] GR 101, Article 32 (1)
[138] GR 101, Article 36 (1)
[139] GR 101, Article 45(1)
[140] GR 101, Article 45(2)

4.9. Transportation

Transportation of B3

Government Regulation No. 74 /2001 (GR 74) on the Management of B3 require transporters to be equipped with Materials Safety Data Sheet (MSDS).[141] Further, GR No. 74/2001 refer to prevailing transportation regulations in terms of the roadworthiness of each vehicle.

Transportation of B3 Waste

Government Regulation No.101/2014 Chapter VI contain provision regarding the transportation of B3 waste. The B3 transporter must have a recommendation letter to transport B3 waste from the Ministry of Environment and Forestry and a permit regarding B3 waste management to transport B3 waste from the Minister of Transportation.[142] In order to obtain the letter of recommendation, a written application should be submitted along with: a) the identity of the applicant, b) the deed of the establishment of the business entity, c) a proof of ownership pertaining to the environmental prevention and pollution funds and/or environmental damage and environmental rehabilitation assurance fund, d) a proof of ownership regarding the vehicle, e) B3 waste transport document[143] f) contract/agreement among the B3 waste producer and the B3 waste collector, B3 waste utilisator (*pemanfaat limbah* B3), B3 waste treator (pengolah limbah), and/or B3 waste hoarder (*penimbun limbah B3*) whose have permit[144].

4.9.1. Road Transportation

General provisions regarding road transportation of hazardous substance is regulated under GR No. 74/2014 on Road Transportation. The detailed requirements are further stipulated under the Ministry of Transportation Decree No. KM.69/1993 on Goods Transportation by Road and its amendment, Decree No. KM 30/2002.

Based on the Decree No. KM.69/1993, the transportation of hazardous substances should use vehicle that meets the technical requirements.[145] The vehicle should equipped with company's name, placard, driver's identity, first aid box, and radio communication. It is also required to be equipped by eyeglasses, mask, gloves, and safety clothes for the passengers[146]. Attachment IV of the Decree provides examples of the shape and size of the placard for the vehicle transporting hazardous substance.

[141] Article 12 GR No. 74/2001
[142] Article 48(1) GR No.101/2014
[143] The document should covers information regarding the amount and type of vehicle, source, name and characteristic of B3 waste, B3 waste emergency respond procedure, equipment to handle B3 waste, loading and unloading of B3 waste procedure.
[144] Article 48(3) GR No.101/2014
[145] Article 11(1) Decree No. 69/KM.1993
[146] Article 14(1)(2) Decree No. 69/KM.1993

Further requirements regarding the transport of hazardous substance is regulated under the Director General of Land Transportation Decree No. SK.725/AJ.302/DRJD/2004 regarding the Land Transportation of the Hazardous and Toxic Substance. Some of the provisions on the Decree regulates: a) Vehicle to transport B3; b) Driver and Driver's Helper; c) Hazardous and toxic substance trajectory; d) Operational procedure for vehicle transporting hazardous and toxic substance; e) Approval for the hazardous and toxic substance transportation; f) Obligation of the hazardous and toxic substance transporter; g) The responsibility of the owner and/or party responsible for the hazardous and toxic substance; h) Supervision; and i) Information system and management.

In addition, obtaining an approval from the Director General of Land Transportation prior to transporting B2 is a must[147]. For the purpose of the approval, the Director General of Land Transportation issued Decree No. SK.1280/AJ.302/DRJD/2004 on the Form, Color and Size of a Letter of Approval regarding the Transport of Heavy Equipment and Hazardous and Toxic Substances.

The hazardous substance transport services have specific characteristics that should be fulfilled such as: the road infrastructure traversed for transporting B2 should comply with the road classification; the availability of places, loading and unloading facilities; the hazardous substance is transported by the designated vehicle that meets criteria to transport hazardous substance; the availability of transportation document from relevant agency; the transportation should have special signs and labels as classified in the attachment III of the Decree No. 69/KM.1993[148].

There is a slight different definition regarding hazardous substance based on the Decree with other existing regulations such as Ministry of Trade Regulation and GR No. 74/2001.

The Minister of Transportation Decrees and the Director General Decree only mention transportation for hazardous substance/hazardous and toxic substance. **It does not specify the transportation for the hazardous waste and/or hazardous and toxic *waste*.**

4.9.2. Marine Transportation

Transporting B3 (Hazardous and Toxic Substances)

Minister of Transportation Decree No KM. 17/ 2000 regarding Guideline on Handling Substances/Dangerous Goods in Indonesia Navigation was issued to implement the International Maritime Dangerous Goods (IMDG) Code as a guide to handle hazardous substance/material in Indonesia's navigation. The guide consists of Book I, II, III, IV and its supplements as the attachment of the Decree.

Minister of Transportation Regulation No. KM 02/ 2010 on the amendment of Minister of Transportation Decree No. KM 17 of 2000, states that the Director General of Marine Transportation is appointed as the competent authority for the implementation of International Maritime Dangerous Goods/IMDG Code 2008 within Indonesia's water

[147] Article 12 (1) Decree No. 69/KM.1993
[148] Article 13 Decree No. 69/KM.1993

territory [149] . The authorities of the Director General are: a) organizing and stipulating requirements for hazardous substance handling training; b) stipulating the classifications of hazardous substances; c) authorize the hazardous substance packing; d) authorizing certain requirements from IMDG Code 2008; e) exempting IMDG Code 2008[150].

Based on the IMDG Code, dangerous goods mean the substances, materials and articles covered by the IMDG Code[151]. Substances (which include mixtures and solution) and articles that are regulated under the Code are assigned to one of the classes 1-9 based on the hazard or the highest threat of the hazard they present. The hazard classes can be found in the attachment.[152]Several substances from classes 1 to 9 are considered as marine pollutants. Specific marine pollutants with extreme pollution potential are identified as severe marine pollutants.

Transporting B3 Waste (Hazardous and Toxic Waste)

In terms of terms of wastes, they should be transported based on the provisions of the appropriate class, considering their hazards and criteria in the Code. IMDG Chapter 7.8 Provide Provisions regarding Transport of Wastes. Based on the Preamble of the chapter, it is states that " *wastes, which are dangerous goods, shall be transported in accordance with the relevant international recommendations and conventions and, in particular, where it concerns transport by sea, with the provisions of this code".* Wastes that are not subject to this Code but covered under the Basel Convention may be transported under Class 9[153].

In 2014, the Minister of Transportation issued Regulation No. PM 29/2014 regarding Marine Pollution Prevention. Chapter V of the regulation specifically includes provisions regarding B3 Waste Transportation. The vessel that is used to transport B3 waste has to comply with the requirement [154] . Several requirements are: manifest document, marking, labelling and stowage, loading procedure (*tata cara pemuatan),* pollution control and safety equipment[155]. The applicant/transporter has to provide: sufficient data regarding the vessel, copy of pollution prevention certificate, copy of safety certificate, data and information regarding type of B3 waste being transported, standard operational procedure for transporting the B3 waste[156]. In the event that the requirements are fulfilled, the Director General of Marine Transportation (*Direktur Jenderal Perhubungan Laut*) issues the permit letter for transporting of hazardous and toxic waste, in which the format of the letter is provided by the regulation[157].

In 2015 the Director General of Marine Transportation issued Circular Letter No.003/I/2/DK-15 regarding B3 waste Transportation for the Indonesian Flag Vessels (*Pengangkutan Limbah Bahan Berbahaya dan Beracun Bagi Kapal-Kapal Berbendera Indonesia*). The circular letter requires a reporting obligation for the ship owner to report all the B3 waste transportation

[149] Article 1A (1) Minister of Transportation Regulation No. KM 02/ 2010
[150] Article 1A (2) Minister of Transportation Regulation No. KM 02/ 2010
[151] Chapter VII Regulation 1 IMDG Code
[152] IMDG Code
[153] Section 7.8.4.6 IMDG Code
[154] Regulation No. PM 29/2014, Article 80 (1)
[155] Regulation No. PM 29/2014, Article 80 (3)
[156] Regulation No. PM 29/2014, Article 80 (1)
[157] Regulation No. PM 29/2014, Article 80 (4)

activities to the local harbormaster (*syahbandar*) and provides the copy of the report to the *Direktur Perkapalan dan Kepelautan, Ditjen Hubungan Laut (Hubla).*

4.9.3. Air Transportation

Air Transporation is regulated under Ministry of Transportation Regulation No.KM 16/2009 on Civil Aviation Safety Regulation (CASR) Part 92 on the Safe Transport of Dangerous Goods by Air. The Director General of Air Transportation is in charge to monitor the implementation of this regulation. The definition regarding dangerous goods is refer to the CASR that is "*Articles or substances which are capable of posing a risk to health, safety, property or the environment and which are shown in the list of dangerous goods in the technical instructions or which are classifies according to those instructions*[158]*."* The technical instruction refers to the document entitled Technical Instruction for the Safe Transport of Dangerous Goods by Air, issues by the International Civil Aviation Organization.

Nevertheless, the Ministry of Transportation Regulation KM 16/2009 applies only for civil aviation and it is not assigned for specific aircrafts transporting dangerous goods.

4.10. B3 Waste Utilisation

Under GR 101, B3 waste utilization is defined as the activities of re-use, recycle and and or recovery (*perolehan kembali*) which aims to transform B3 waste into usable products that can be used to substitute raw materials, factory supplies (*bahan penolong)* and/or fuels that are save to the human health and environment[159].

B3 waste can be utilized for several purposes: a) as a substitute of raw material, b) as a source of energy, c) as a raw material, d) other purpose based on the development of science and technology[160]. The B3 waste management permit for the B3 waste utilization lasts for 5 years and can be extended.[161]. Prior to the issuance of the permit, the utilisator has to obtain environmental permit and approval for the piloted B3 waste utilization.[162] The approval for the piloted B3 waste utilization lasts for maximum 1 year and cannot be extended. [163] The approval is given by the Minister of Environment in order to test the equipment, method, technologies, and/or B3 waste utilization technology. [164]

In the induction meeting[165], there was a question on the possibility of PCBs being utilized or recycled into other materials. However, based on the discussion in the induction meeting, if dielectric oils are intended to be recycled, it has to be purified.

[158]Subpart 92.010 CASR Part 92
[159] GR 101, Article 1 number 22
[160] GR 101, Article 54
[161] GR 101, Article 87(1)
[162] GR 101, Article 76(4)
[163] GR 101, Article 81
[164]GR 101, Article 76(7)
[165] Induction Meeting, Serpong, 24 Februari 2016

Raw Material Substitution/Alternative Fuel

in 2010, the Minister of Environment issued a Decree No. 140/2010 regarding Permit to Utilise B3 Waste for PT Holcim Indonesia TBK, Cibinong Plant Unit. The Decree was valid until 2015. It stipulated several requirements for the company in order to utilize and to collect B3 waste as follows:

The type of B3 waste being collected and utilized by PT Holcim Indonesia should be:

- B3 waste that can substitute main raw material, auxiliary raw material, or alternative fuel;
- The type of B3 waste were utilized as a substitute of the raw material must have a total content of SiO_2, Al_2O_3, Fe_2O_3, and $CaO \geq 50\%$;
- The type of B3 waste were utilized as a substitute of fuel must have a total content of calori equal to or more than 2500 kkal/kg and comply with the limits the total amount of organic halide (TOX) ≤ 2% wet weight and maximum content of PCBs maximal 30% of TOX;

The type of B3 waste were utilized as a substitute of main material and/or fuel must meet the limit of metal pollutants.

Under current permits, B3 waste liquid containing PCBs can be utilized to substitute fuel by PT Holcim Indonesia Tbk – Cibinong Plant Unit as long as it meets the requirement. The B3 waste liquid must be burnt in the main burner that has an interlock system[166]. The stored and collected B3 waste can be stored maximum 90 days prior to the utilization. The Decree[167] also provide requirement regarding emission monitoring and reporting, as well as general requirement pertaining to storage, symbol and transportation.

In addition to Decree No. 140/2010, the Ministry of Environment had issued other Decrees for PT Holcim Indonesia Tbk regarding the utilisation and/or management of the B3 waste. The Decrees are as follows:

- Decree No. 187/2011 regarding Permit on the B3 Waste Management Through Thermal Method in the PT Holcim Indonesia Tbk. Cibinong Plant Unit. The attachment of the decree listed the emission standard for the PCDDs/PCDFs/PCBs (DRE maximum 99,9999 %) and POHCs (DRE maximum 99,99%). **The Permit is valid until 14 September 2016.**
- Decree No. 327/2010 regarding Permit to Utilise B3 Waste for PT Holcim Indonesia Tbk.
- Decree No. 697/2008 regarding Permit for the operation of the B3 waste processing equipment (kiln as an incinerator) for PT Holcim Indonesia Tbk, Cilacap Plant Unit.
- Decree No. 391/2008 regarding Permit to Utilise B3 Waste for PT Holcim Indonesia Tbk.
- Decree No. 506/2007 regarding Permit to Utilise B3 Waste as a substitute of fuel and raw material alternative for PT Holcim Indonesia Tbk, Cilacap Plant Unit.

[166] Minister of Environment Decree No. 140/2010 regarding Permit to Utilise B3 Waste for PT Holcim Indonesia TBK, Cibinong Plant Unit.
[167] Minister of Environment Decree No. 140/2010 regarding Permit to Utilise B3 Waste for PT Holcim Indonesia TBK, Cibinong Plant Unit.

Based on the explanation above it can be argued that at the time of writing Indonesia allows the re-utilization of B3 waste. In the case of PT Holcim Tbk, PCB oils can substitute the fuel[168]. This policy needs to be reviewed—especially on whether PCBs waste (after treatment) can be reused or should be disposed. This also signifies that Indonesia still allows the practice of B3 waste (PCBs) disposal with thermal process. Also, it is important to review the thermal method to dispose B3 waste (especially POPs), as the Stockholm Convention does not recommend it.

4.11. B3 Waste Treatment/Processing (*Pengolahan Limbah B3*)

B3 waste treatment shall be treated by anyone who produces it. In the event that the person cannot treat the waste he/she has to transfer it to the party who treats the B3 waste or export the B3 waste that he/she had produced[169] Government Regulation 101 on B3 Waste outlines several treatment options of B3 wastes in general, which includes (i) Thermal Process, (ii) Solidification/Stabilisation and (iii) other means.

Thermal Process

GR No. 101 stipulates that the B3 waste treatment through thermal process has to meet several standards such as emission standard, combustion efficiency and the destruction and removal efficiency (DRE) for the principle organic hazardous constituents (POHCs) which includes PCBs, Polychlorinated dibenzofuran, and Polychlorinated dibenzo p-dioksin. The combustion efficiency minumun should be 99,99% and the DRE should be equal or more than 99,9999%[170]. The GR mandated the formulation of the emission standard through the Ministry regulation[171]. Nevertheless, this regulation is not yet issued until this report is made.

The residue and/or the combustion residue from the thermal process have to be kept[172]. Some standards that have to be meet are[173]:

- Air emission;
- Combustion efficiency at least 99,99% (however, this number does not relevant for the B3 waste treatment utilising kiln at the cement industry);
- Destruction and removal efficiency (DRE) of the POHCs (principle organic hazardous constituent) at least 99,99% (however this standard does not relevant for the B3 waste with infectious characteristic and/or polychlorinated biphenyl that is potentially releases polychlorinated dibenzofurans, and polychlorinated dibenzo-p-dioxins).
- The DRE of the PCB is 99,9999%
- The DRE of the polychlorinated dibenzofurans has to be 99,9999% as well as the DRE of polychlorinated dibenzo-p-dioxins.

Although permitted by existing regulations, B3 waste treatment especially POPs with combustion at the incinerator or kiln cement should be avoided due to the reasons below:

[168] Minsitry of Environment Decree No. 140/2010
[169] GR 101/2014, Article 123(1)
[170] GR 101/2014, Article 107 (4), (5), (6),(7)
[171] GR 101/2014, Article 107 (8)
[172] GR 101/2014 , Article 143 (1) h
[173] GR 101/2014 , Article 107 (1), (2), (3), (4), (6),(7), (8)

- The Stockholm convention, Article 6 (d) ii[174] implies that POPs (e.g. POPs waste or waste containing POPs) should be destroyed or irreversibly transformed into non-POPs and does not pose the characteristic of POPs. In this context, it is important that the destruction method/technology being used will not produce unintentional release of POPs.
- The convention, Article 6(d) iii[175] prohibits the disposal of POPs through *recovery* (perolehan kembali), *recycling* (daur ulang), *reclamation, direct use* (penggunaan secara langsung) atau *alternative uses* (penggunaan alternative) POPs.

Annex C, V. A (d) of the Stockholm Convention reads:

"*Priority should be given to the consideration of approaches to prevent the formation and release of the chemicals listed in Part I (PCDD/PCDF, HBC, PCB): Replacement of feed materials which are persistent organic pollutants of where there is a direct link between the materials and releases of persistent organic pollutants from the source*".

In terms of *unintentional production* of POPs, the Stockholm Convention prioritize the use of technology which could form **PCDD/PCDF, HBC, PCBs** as listed under list I Annex C. **Annex C, V B (b)** of the Convention reads:

"*When considering proposals to construct new facilities or significantly modify existing facilities using processes that release chemicals listed in this Annex,* ***priority consideration*** *should be given to alternative processes, techniques or practices that have similar usefulness but which avoid the formation and release of such chemicals*."

Furthermore, several literatures suggest against using thermal processes: (i) the investment to control unintentional release of dioxin or other POPs is huge[176]; incineration may result in large amount of solid wastes (fly ash and residues), Dioxin, Furan and other POPs can be released[177]; the technology is controversial and opposed by environmental groups and communities[178]; for *Cement kiln air pollution controls* (APC) there are potentials for *products of incomplete combustion*/PIC[179]; the DRE *(Destruction and Removal Efficiency)* is generally applicable for gases/air emission but does not include liquid and solid toxic contaminants (bottom ash and liquid waste).[180]

[174] The Articles states "Disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed so that they do not exhibit the characteristics of persistent organic pollutants or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option……."

[175] The Articles states "Not permitted to be subjected to disposal operations that may lead to recovery, recycling, reclamation, direct reuse or alternative uses of persistent organic pollutants"

[176] Allsop, Michelle, Costner, Pat, et.al, Incineration and Human Health, Greenpeace Research Laboratories, University of Exeter, UK, 2001, p.37, http://www.greenpeace.org/norway/Global/norway/p2/other/report/2001/incineration-and-human-health.pdf

[177] Reference Guide to Non Combustion Technologies for Remediation of Persistent Organic Pollutants in Soil, Second Edition 2010, US – EPA, p. vii, https://www.epa.gov/remedytech/reference-guide-non-combustion-technologies-remediation-persistent-organic-pollutants

[178] ibid

[179] Karstensen, K. H. (2008). Formation, release and control of dioxins in cement kilns. *Chemosphere*, *70*(4), 543-560. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.454.9778&rep=rep1&type=pdf

[180] Rahuman, Mujeebur, Pristone, Luigi, et.al, Destruction Technologies for Polychlorinated Biphenyls (PCBs), ICS-UNIDO Publications "Proceedings of Expert Group Meetings on POPs and Contamination: Remediation Technologies

(April 2000) and on Clean Technologies for the Reduction and Elimination of POPs (May 2000), p. 8, https://clu-in.org/download/remed/destruct_tech.pdf

Non Thermal Processes

Several non-thermal processes may include Dehalogenation processes: Base Catalyzed Decomposition (BCD) and metal based sodium. Similar to the above thermal processes, the by-product of such technology must become a factor for consideration. For example, BCD may produce soluble which contains Chlorin and further treatment for such materials may be required.

4.12. B3 Waste Hoarding (*Penimbunan Limbah B3*)

B3 waste hoarding may not be generally applicable to PCB. However, GR No. 101/2014 states that in the case that the B3 waste is processed through the stabilitation and solidification methods the result of the processed should be hoarded[181]**.** Thus, if PCBs if it is treated through stabilization and solidification methods, the result of the processed should be hoarded and comply with regulation.

Under GR 101, B3 waste hoarding shall be done by anyone who produce it. In the event that the person cannot hoard the waste, he/she has to transfer it to the B3 waste hoarding[182].

The hoarding can be done in the B3 waste hoarding facility such as: a) final hoarding class I, class II and class III, b) injection wells, c) reinstatement in the mined area (*penempatan kembali di area bekas tambang*),d) tailing dam and/or B3 waste hoarding facility in accordance with the development of science and technology.[183]. In the event that B3 waste is horded in the final hoarding, the location has to meet several conditions such as: free from flood, meet the land permeability standards, geologicaly safe and stable, outside of the conservation area, and is not located in the water catchment areas (*daerah resapan air*) for drinking[184]. In addition, the facility has to: meet the design criteria, be equipped with coating system, have monitoring wells, have final overburden (*lapisan penutup akhir*) and other equipment[185]. Test on the total contaminant concentrations must be conducted prior to applying for B3 waste management permit for B3 waste hoarding.[186] The permit lasts for 10 years and can be extended. [187].

4.13. Accident and Emergency Response

In terms of B3, general measures for accident and emergency responses are regulated in GR 74. Under the GR , anyone in charge of managing B3 is under obligation to (i) isolate, (ii) mitigate, (iii) report the incident to local authorities, (iv) provision information to local

[181] GR 101/2014Article 143(3)
[182] GR 101/2014Article 145 (1),(2), Article 162 (1)
[183] GR 101/2014Article 146(2), (3), Article 163(2)
[184] GR 101/2014Article 148(1)
[185] GR 101/2014Article 149(1)
[186] Article 147 (1)
[187] Article 153(1)

communities.[188] Local government must undertake all necessary steps after receiving report of such incidents[189].

In terms of B3 waste, general measures for accident and emergency responses are regulated in GR 101 in the form of (i) provision of information to local communities through both printed and electronic media that a contamination has occurred within 24 hours after the incident or after it become known, (ii) isolation of affected areas (including evacuation, control, reporting to authorities as well as identification and determination of hazardous area), (iii) cessation of contamination on the source (production process must be stopped, all activities around the area must be suspended, mitigation measures reported to authorities) and/or (iv) other measures according to science and technology. Anyone producing or handling B3 waste are also required to enact an emergency preparedness and response system.[190] The system must provide adequate (i) infrastructure (which includes facilities, equipment, coordination, organisation, procedures and training) and functions (identification, reporting, activation, mitigation, emergency protection, information dissemination and protection of local communities).

4.14. Occupational Health and Safety

Notation	The name of chemical substances and CAS number	NAB (Treshold Limit Value)		PSD /KTD		Molecular Weight	Note
		BDS	Mg/m 3	BDS	Mg/m 3		
*	DDT (50-29-3)		1; A3			354,50	Liver damage
*	Dieldrin (60-57-1)		0,25;A 4			380,93	Skin, Liver and Kidney Damage
*	Endosulfan, benzoepin 115-29-7		0,1;A4			406,95	Skin, Central nervous disorder, Headache
*	Endrin		72-20-8			380,93	Skin, Liver damage
	Heksaklorobenzen (118-74-1)		0,002			284,78	Porphyrin effect, Skin damage, damage to nervous system
	Heptaklor (76-44-8) and		0,05;A 3			373,32	Skin

[188] Article 25 GR No. 74/2001
[189] Article 26 GR No. 74/2001
[190] GR No. 101/2014, Article 220

	Heptaklorepoksida (1024-57-3)					389,40	
	Poliklorodipenil (42% chlorine) 53469-21-9		1			266.50	Liver damage, Upper respiratory tract irritation, Cloracne
	Poliklorodipenil (54% chlorine) 11097-69-1		0,5			328.40	Liver damage, Upper respiratory tract irritation, Cloracne
	Toxaphene						Skin, reproduction

General framework regarding occupational health and safety is regulated under Government Regulation No. 50/2012 on the Implementation of Work, Health and Safety System Management System. It obliges every company to implement the Work, Health and Safety System Management System or known as SMK3 (*Sistem Manajemen Keselamatan dan Kesehatan Kerja*)[191]. The obligation applies to companies that are employing minimum 100 workers or having high level of potential danger[192]. The SMK3 covers: a) Health, Safety, Environment (HSE) policy stipulation, b) HSE plan, c) HSE performance evaluation and monitor; d) HSE performance improvement and review[193].

One of the main regulations, which relates to the PCBs exposure and occupational health is the Minister of Manpower and Transmigration Regulation No. 13/MEN/X/2011 regarding Threshold Value of Physic and Chemical in the Work Place. The regulation requires the management (of the company) to control the threshold value of physic and chemical in the work place. The regulation provides detailed threshold value of the physical and chemical factors in the work place. Attachment II of the regulation covers the threshold value several POPs including PCBs as follows:

Note:

- PSD (*Paparan Singkat Diperkenankan)* means Short Term Exposure Limit. It is the level of chemicals in the air in the workplace, which should not be exceeded. Therefore, the workers are exposed to a brief period, not more than 15 minutes, can accept such exposure without having irritation, tissue damage or sedated. This exposure cannot be done more than four times in one working day.
- *Bagian Dalam Sejuta* (BDS) means Part Per Million (ppm). It is concentration of gas or steam from contaminated air
- *Kadar Tertinggi Diperkenankan* (KTD) means Maximum Allowable Concentration. It means the highest chemical concentration in the workplace that cannot that cannot be surpassed. yang selanjutnya disingkat
- *Nilai Ambang Batas* (NAB) means Treshold Limit Value. It is a standard of hazard factor in the workplace as a level/time weighted average that a worker can be exposed

[191] Article 5(1)
[192] Article 5(2)
[193] Article 6 (1) GR No. 50/2012

without health effects in a daily working day not more than 8 hours a day or 40 hours in a week.

- Chemicals that has higher Threshold Limit Value than Permissible Exposure Limit from OSHA or limit suggested by NIOSH
- Identity of chemicals from other sources or proven to be carcinogenic for human

In addition, Minister of Manpower and Transmigration, Decree No. 187/Men/1999 regulates the Management of Hazardous Chemicals in the Workplace. The management (of the company) is responsible to manage the hazardous chemicals the workplace. The control of the chemicals can be done through: the provision of MSDS and labelling, and the assignation of safety and health officer and chemical expert. The decree provides detailed information regarding information should be available in MSDS and the label. Attachment III of the Decree provides the lists of threshold limit quantity (*Nilai Ambang Kuantitas*) of the hazardous chemical. It includes one of POPs but not PCBs as follows:

Name and Threshold Limit Quantity of Hazardous Chemicals

II. Very Hazardous		
No	Name	Threshold Limit Quantity
..	…	…
92	2,3,7,8 –tetrachloro dibenzo-p-dioxin (TCDD)	1 kilogram

PCB contaminated oil are flammable. Therefore, it is relevant to identify regulations that relate to the fire prevention at the workplace and urban areas. Some of the regulations are:

- **Minister of Manpower and Transmigration Regulation No. 186/MEN/1999 on Fire Fighting Units in the Workplace.** The regulation consists of 6 chapters, 17 articles and 2 attachments. The divisions of the chapters are as follows:

  - **Chapter I: General provision.** The chapter provides explanation regarding the general term and requirements that the employer shall prevent, reduce, extinguish fire and carry out fire prevention training at the workplace[194]. The duties to prevent, reduce and extinguish fire at the workplace constitutes among other: controlling every form of energy, controlling smoke, heat and gas at the workplaces, forming the fire protection units at the workplaces, performing training and rehearsals on fire prevention periodically, having a plan book regarding fire prevention for emergency situation for a workplace with more than 50 workers and/or workplaces with medium and high fire risk potencies[195].
  - **Chapter II: Formation of fire prevention unit.** The fire prevention units in general consist of: fire role officials, fire prevention teams, coordination of fire prevention units; work safety and health experts as the technical underwriter[196]. The chapter is also classifies the fire hazard potency level which consist of: light fire hazard potency

[194] Article 2 (1) Regulation No. 186/MEN/1999
[195] Article 2 (2) Regulation No. 186/MEN/1999
[196] Article 5 Regulation No. 186/MEN/1999

level, light medium I fire hazard potency level, light medium II fire hazard potency level, light medium III fire hazard potency level and heavy fire hazard potency level[197].

- **Chapter III: Duty and the requirement for fire prevention unit.** The chapter provides detail provisions regarding duties and requirements of fire role officials, fire prevention teams, coordination of fire prevention units; work safety and health experts[198].
- **Chapter IV: Supervision.** The manpower supervisor (at the company) supervises the implementation of the regulation[199].
- **Chapter V: Transitional provision.** The existing fire prevention unit must be adjusted to the requirements under this regulation maximum one year after the stipulation of Regulation No. 186/MEN/1999 (by the year of 2000)[200].
- **Chapter VI: Closing provision.** The regulation shall take effect on the stipulation date (29 September 1999)[201].
- Minister of Public Works Regulation 20/PRT/M/2009. This document regulates fire norm in urban areas ("Fire Regulation"). The Fire Regulation require appropriate documentation in ground plan and site-map, concerning areas where Hazardous Materials are stored.[202] Furthermore, Fire Regulation require Hazardous Materials Safety Plan to be invoked by building management.[203] Chambers or rooms which should not be suppressed by water following a fire incident must be properly documented and communicated to building inspectors and fire officers.[204] The Fire Regulation contained detail standard and conditions on the treatment of flammable materials, building design and fire management ("*Manajemen Proteksi Kebakaran"* or "MPK"). Fire Regulation, to the extent applicable, may also require fire drill to be exercised.

[197] Article 4(1) Regulation No. 186/MEN/1999
[198] Article 7 to 10 Regulation No. 186/MEN/1999
[199] Article 15 Regulation No. 186/MEN/1999
[200] Article 16 Regulation No. 186/MEN/1999
[201] Article 17 Regulation No. 186/MEN/1999
[202] Peraturan Menteri Pekerjaan Umum Nomor. 20 Tahun 2009 Tentang Pedoman Teknis Manajemen Proteksi Kebakaran di Perkotaan. See Chapter III, para 1.2 also Chapter 3 Part 6b.
[203] ibid. See Chapter IV part 4.3
[204] ibid. See attachment 4

5. Environmental Standards and Product Standards

5.1. Air Quality

GR No. 41/1999 on Air Quality Control does not include PCB emission in the air quality standard. In addition, Minister of Environment Decree No. Kep-13/MENLH/3/1995 on the Emission Standard for Cement Industry does not include the PCBs parameter. The parameters used for the klins are the total particle, NO_2, and SO_2.

5.2. Water Quality

In terms of water, GR No. 82/2001 on Water Quality and Pollution Control regulates the water quality standard for POPs (*aldrin, chlordane, dieldrin, endrin, heptachlor, toxaphene*, dan DDT). However, it does not cover PCBs.

Kep-03/BAPEDAL/09/1995 regarding Technical Requirements for Hazardous and Toxic Waste Treatment and Kep-04/BAPEDAL/09/1995 regarding Procedures and Requirements for Disposal of Treated Hazardous and Toxic Waste Treatment and ex-Landfill Sites regulate waste water quality standard for the industrial B3 waste treatment which includes POPs (PCBs, PCDFs and PCDDs) as follows[205]:

Parameter	Maximum Concentration	
	Value	Unit
Physics		
Temperature	38	^oC
Etc		
Chemical		
Aox	0,5	mg/l
PCBs	0,005	mg/l
PCDFs	10	mg/l
PCDDs	10	mg/l
Etc		

In addition, based on Kep-04/BAPEDAL/09/1995, one of the requirements for the B3 waste that can be disposed in the landfill is that it must not contain PCBs.

5.3. Limit Values for PCBs in Food and Human Bodies

At present we found no regulatory standard in Indonesia.

5.4. Standards to Determine Land Contamination

GR No. 101/2014 attachment V lists the standard value regarding toxicity characteristics through TCLP and total concentration to determine the management of land contaminated with hazardous and toxic waste. The standard includes the PCBs as follows:

[205] Tabel 4 Baku Mutu Limbah Cair Kegiatan Pengolahan Limbah Industri B3 (BMLCK-PPLIB3) Kep-03/BAPEDAL/09/1995, Tabel 5 Tabel 4 Baku Mutu Limbah Cair Kegiatan Pengolahan Limbah Industri B3 (BMLCK-PPLIB3) Kep-04/BAPEDAL/09/1995

Pollutants	TCLP-A	TK-A	TCLP-B	TK-B	TCLP-C	TK-C
Unit (dry weight)	mg/L	Mg/kg	mg/L	mg/kg	mg/L	mg/kg
Polychlorinated biphenyls	N/A	50	N/A	2	N/A	0,02

5.5. Product Standardisation

Indonesian National Standard (SNI) aims to increase the quality, production efficiency and business competition as well as to protect consumers and other stakeholders in relation to their health, environment, and safety[206]. At present, there is no standardization regarding PCBs in electrical and electronic equipment and/or products based on Indonesian National Standard (SNI).

SNI can be applied on voluntary and mandatory basis. In terms of voluntary scheme, various stakeholders such as business actors, ministries and/or agencies, and/or regional government can implement it[207]. In this case, the stakeholders can apply for a certification to the accredited LPK[208] and the LPK will grant the certificate to the applicant[209]. After the certification is granted, the business actors are obliged to attach SNI or conformity sign in the product and/or package[210]. It is forbidden to attach SNI number that is different from the number written in the certificate. It is also forbidden to attach the SNI or conformity sign in the product when the certificate is no longer valid, revoked or frozen.[211]

SNIs which becomes mandatory should be stipulated by the relevant minister regulation or agency (non-ministry) in the event that there is a necessity in relation to the safety, security, health and environmental protection[212]. Several regulations which relates to the mandatory SNI are:

- Law No. 20/2014 on Standardisation and Comformity Evaluation;
- GR No. 102/2000 regarding National Standardisation;
- Minister of Trade Regulation No. 14/M-DAG/PER/3/2007 regarding Trade Standardisation on Trade and SNI Mandatory Supervision for the Traded Goods and Services, and its amendments (Minister of Trade Regulation No. Minister of Trade No. 14/M-DAG/PER/3/2007 and No. 47/M-DAG/PER/8/2014);

The formulation of SNI in planned within National Program for Standard Formulation/ PNPS (*Program Nasional Perumusan Standar*). National Standardisation Agency/*Badan*

[206] Article 3 Law No. 20/2014
[207] Article 21 (1) Law No. 20/2014
[208] Article 21(2) Law No. 20/2014
[209] Article 21(3) Law No. 20/2014
[210] Article 22 (1) Law No. 20/2014
[211] Article 22 (2) (3) Law No. 20/2014
[212] Article 24 (1) Law No. 20/2014

Standardisasi Nasional (BSN) forms a technical committee. The committee consists of national government/regional government, business actors/relevant associations, consumers/relevant associations and experts/academicians[213]. After the committee formulates SNI draft, the BSN will conduct a pooling. In the SNI draft formulation process[214], the public can participate by providing recommendations and input in the SNI formulation process, seek information for the SNI implementation, developing a standard culture and reporting any misuse/fraud of SNI certificate to the relevant institutions[215]. The draft SNI will be stipulated based on the head of BSN decree[216].

It is possible for Indonesia to formulate SNI for electrical and electronic equipment and/or products that are not containing/contaminated with PCBs. Furthermore, in the induction meeting the business sector is willing to commit to purchase and/or import PCBs free transformers.

On one meeting, participant raise several issue. What if the transformers purchased are claimed to be PCBs free but it fact they contain PCBs, and/or what if the information declared in MSDS sheet is different from the specifications? Does Indonesia have sufficient laboratory and equipment to examine if such products comply with the standard or not? The laboratory test is important besides tracking the history of transformers whether they are new or not (as a result of retrofilling). Also, what is the standard limit of PCBs oil concentration allowed in the transformer? Should it be totally free (0% of PCBs) or referred to the Basel Convention (below 50 ppm considered as PCBs free)? [217].

[213] Article 14 (3)(4) Law No. 20/2014
[214] Article 15 (1) Law No. 20/2014
[215] Article 52 Law No. 20/2014
[216] Article 17 Law No. 20/2014
[217] Induction Meeting, Serpong, 24 Febaruary 2016

6. Institutional Arrangements

6.1. Specific Institutions

In Indonesia, some institutions are formed in order to assist the relevant Ministries to manage the B3 and/or B3 waste such as: Chemical Committee, B3 Commission and Pesticide Commission

The Chemical bill (dated 26 April 2012) establishes a chemical committee[218]. Its duties are:

- establishing and developing a data center and national chemical inventory;
- identifying and analyzing benefit-risk in the chemical management;
- identifying, researching and also providing recommendation for chemical disaster, chemical accident, chemical poisoning, and or chemical pollution. It also coordinating with the Badan Nasional Penanggulangan Bencana (BNPB) and other relevant institutions;
- conducting study pertaining to the risk of potential abuse and misuse of chemicals that can harm the safety and security through cooperation with the relevant institutions or parties abroad;
- conducting consultancy to develop chemical substance and its derivatives products in order to increase added value and competition;
- preparing preparatory program on human resources development and capacity through chemical management training.

The Ministry of Trade is responsible to regulate the Chemical Committee and its role, duties, coordination mechanisms and its relation to the relevant parties. Further provisions regarding the chemical committee will be regulated under the Government Regulation.

GR 74, on the other hand, mandates the establishment of B3 Commission. The B3 Commission is an independent body. The functions of the commission are providing recommendation and consideration to the Government regarding the management of B3 in Indonesia[219]. The commission may consist of several sub commissions, one of them can be the Pesticide Commission[220]. The members of commission are representatives from relevant authorities, responsible agencies, university, environmental organisations and associations. The structure of commission's membership, responsible and its role will be stipulated further thorough a Presidential Regulation[221]. In the event that a person wants to import new type of B3, the person is required to follow notification procedures[222]. The notification is submitted by the authority of the exporting country to the responsible agency in Indonesia (in this case the Ministry of Environment and Forestry/MoEF)[223]. The responsible agency informs the

[218] Article 45 of the draft law
[219] Article 21 (1) GR No. 74/2001
[220] Article 21 (2) GR No. 74/2001
[221] Article 21 GR No. 74/2001
[222] Article 9(1) GR No. 74/2001
[223] Article 9 (2) GR No. 74/2001

committee in order to obtain consideration or recommendation [224]. Based on the recommendation or the consideration from the committee, the responsible agency proposes changes to the (current) attachment of the GR No.74/2001 and approves the agency that has authority in trade affairs to issue or reject an import permit[225]. However, such commission is not yet functional.

The responsible agency (MoEF) and relevant authorities, based on their functions are responsible to supervise activities related to B3[226]. In a specific conditions the supervision of B3 management can be given to the government at the Provincial/ Regency or City level and it is stipulated by the responsible institutions and/or authorized institutions[227].

6.2. Ministry of Environment and Forestry

In general, the duties of the Central Government regarding B3 and B3 waste management are stipulating national policy, norms, standards, procedures and criteria; stipulating and implementing policy regarding B3, waste and B3 waste[228].

The responsible and authorized agencies are responsible to supervise the B3 management based on their respective duties. [229] In a specific case, the supervisory authority can be transferred to the Province/Regency/City in the event that the Province/Regency/Cuty Government has the capacity to supervise B3 management[230].

The governance of MoEF is regulated under Minister Regulation No. P.18/MenLHK-II/2015 regarding Organisation and Governance of MoEF. The main structure of the MoEF and its relevant divisions regarding B3 and B3 waste management can be found in the Attachment IV.

6.3. Local Government

Some of the duties and authorities of the Provincial Government which relate to the B3 and B3 waste management based on Law No. 32/2009 are: stipulating policies at the provincial level, supervising and assisting the implementation and compliance of business actors and/or activities to the environmental permit provisions and environmental regulations.

In terms of B3 management, the supervision related to B3 management is conducted by relevant institution. In a specific case, the monitoring authority can be transferred to be the Provincial/Regency/City affairs[231].

With regards to regional autonomy, the Ministry of Home Affairs has released a circular letter No. 660.2/2176/SJ on 28 July 2008 ordering local governments to be in charge of hazardous and toxic waste management in their jurisdiction. Their duties include monitoring, issuing

[224] Article 9 (3) GR No. 74/2001
[225] Article 9 (5) GR No. 74/2001
[226] Article 28 (1) GR No. 74/2001
[227] Article 28 (2) GR No. 74/2001
[228] Article 63 Law No. 32/2009
[229] Article 28 GR No. 74/2001
[230] Article 28(2) and its elucidation No. 74/2001
[231] GR No.74/2001

permits and provide recommendations, etc. [232] In 2009, Law No. 32/2009 provides detailed provisions regarding the roles and responsibilities of Central and Regional governments.

We collected and analyses regional regulations in DKI Jakarta[233], Banten, East Java[234], and Yogyakarta[235] regarding B3 and B3 waste management. The regions are chosen based on the location of the inventories. Most of the regions have not yet formulate new regulation regarding B3 waste and their regional regulations still referring to the old B3 waste Government Regulation (GR No. 18/1999 jo. GR No.85/1999) which has been revoked. The anachronistic regulatory framework regarding B3 waste management at the local level is a challenge. In addition, local environmental agency (BLHD) also has issue regarding the number/qualification of human resources to handle the management of B3 waste at the regency/city level.

7. Gap Analysis and Recommendations

This chapter will summarize existing gap in the regulatory framework and provide recommendation for the government in addressing the issue. In general, the gaps identified can be grouped into five categories: (a) definition and concepts, (b) mechanism for POP listing, (c) sanctioning mechanism, (d) ESM and (e) institutional issue. **The more detailed descriptions on regulatory gaps and recommendation is described in Annex 1**.

(a) Definition and Concepts. Existing regulatory framework in lacking on specific definitions for substance, articles and mixtures. The current regime is focused on "substance" and in practice extend the term "substance" into mixture and articles. This may cause impediment in the enforcement of existing regulation. The notion of transformer or electrical equipment containing PCB as "substance" can be legally challenged. This can also hamper sectoral coordination – i.e. whether the importation of transformer should be categorized as substance under the rules of trade and import. In order to address this issue, existing regulatory framework must be amended so as to incorporate the concept of mixture and articles. This would mean some changes in Law and Government Regulation will be required. However, since the level of legislation that needs amendment is quite high, this will not be feasible in short-term. In the meantime, the practice of extending the interpretation of substance into articles and mixture can continue, but in the form of at least a ministerial regulation, with direct reference to laws which ratifies the POPs (Basel, Stockholm, Rotterdam) conventions.

(b) The list of POPs to be prohibited under international practice will continue to grow. This will require flexibility in national regulation. Unfortunately, under the existing system, adding the list of prohibited chemicals would require amending a Government Regulation.

[232] Indonesian text is available at http://b3.menlh.go.id/bulletin/article.php?article_id=82

[233] Peraturan Gubernur Provinsi Khusus Ibukota Jakarta No.76/2009 tentang Pengelolaan Limbah Bahaya dan Beracun

[234] Peraturan Walikota Surabaya No.26/2010 Tentang Tata Laksana Perizinan dan Pengelolaan Limbah Bahaya dan Beracun

[235] Peraturan Walikota Yogyakarta No. 57/2010 tentang Izin Penyimpanan Sementara dan Pengumpulan Limbah Bahan Berbahaya dan Beracun

Another alternative is through the process involving hazardous and toxic substances commission (*Komisi B3*) but the legal framework is less clear on the technicalities of amendments even after Komisi B3 approves the new list. Furthermore, the system involving Komisi B3 is currently not operational. Since Indonesia is already a party to the Stockholm and other convention, there is actually no need to involve another process in adding new POPs. We recommend that new POPs which are banned should be automatically included in the list of prohibited B3. This could be done by a Ministerial Regulation but some empowerment to do so would be required, at least in the form of legislation (Law or Government Regulation).

(c) Sanctioning mechanism is lacking, especially in terms of B3 management. At the moment, there is no sanction whatsoever for those who use and/or possesses B3 that is forbidden to be used. This could jeopardize the phasing out process since there is no (negative) incentive to comply. The only negative incentive is *ex*-post, when a contamination already occurred then strict liability will be implemented. However, this is not particularly helpful in terms of the phasing out process (registration, monitoring).

(d) ESM. The are some regulatory gaps in each stages of the ESM. In terms of registration – as mentioned earlier – there is no sanction for those refusing to register or mislead information about their PCB Ownership. For import, there is yet a specific sectoral rules prohibiting import. HS Code 2710910000 and 3824820000 (both PCB containing) are still active. We recommend that MoEF send formal letter to the Ministry of Finance and the Ministry of Trade. The latter should issue a PCB import ban in accordance with the Convention.

The other problem on ESM is with respect to waste storage. The time limit for storage is at maximum 90 days (for those above 50kg), however, since there is at present, no designated PCB treatment facility, this time limit is in practice, exceeded. It is difficult to change the time limit since GR 101 has to be amended. The government could exercise its discretion to extend the time limit, but this may trigger legal complications as elaborated above. Another option is to export the PCB waste but the procedure could be complicated.

Quality standard is another issue. At present the air quality regulation does not include PCB emission. The water quality standard regulates some POPs but not PCB. Both needs to be regulated by way of Government Regulation or Ministerial Regulation.

PCB can take the form of chemicals-in-products (such as in cables, paints). There is at present, no standard that obligates products to be PCB free. We recommend that the MoEF coordinates with the National Standardization Board (*Badan Standardisasi Nasional*) to create a mandatory national standard (SNI) number for PCB free products. This could refer to standards in the Stockholm Convention.

(e) Institutional Issue. At the national level, there is a lack of clarity on which unit does what in PCB Phasing-Out. We have conducted an analysis of MoEF units in terms of PCB phasing out and come up with recommendation on **Annex 5: Analysis of Task, Role and Function of MoEF Units in PCB Phasing Out**. Other issue includes inter-institutional coordination, especially on importation rules (with the Ministry of Trade), economic incentive (with the Ministry of Finance), Transportation (with the Ministry of Transport) and product standard (with the National Standardization Board). This needs to be immediately resolved by

amending relevant regulations at each ministries, in accordance with PCB Official Guidance and Code of Practice.

At the regional level, there is a lack of capacity for PCB ESM at BPLHD (Regional Environmental Management Unit). Most regional regulations on B3/B3 waste ESM still refers to old rules which are incomplete and can be challenged. This can be overcome through a Ministerial Regulation on PCB Phasing Out.

Follow up:

As elaborated above, some of the recommendations may require amendment of higher legislations (Law/Undang-Undang and Government Regulation/PP). This recommendation is valid, not only for PCB, but also the phasing out of Persistent Organic Pollutants in general. As such, this research can be used as the basis of future phasing out plan for other POPs.

The PCB Official Guidance and the Code of Practice (after they are adopted) needs to be disseminated. PCB Owners would need to understand the legal implications of PCB ESM practice. Trainings would be required to fully implement the Code of Practice. However, this should be commenced only after the Government accommodates our recommendations into formal policy.

Finally, the Government of Indonesia may require technical expertise to accommodate these recommendations into legal products. Since the amendment of Undang-Undang or PP will require some time, to develop and enact. We recommend a transitional regulation in the form of Ministerial Regulation/Permen for PCB Phasing out. Nevertheless, not all recommendation (especially those with respect to criminal sanctioning) can be incorporated into the Permen. The government may require technical expertise in identifying which parts that can be incorporated into a Permen; which ones are not and in conducting the legal drafting of the Permen.

8. Annexes

- **Annex 1 Recommendation for Regulatory Reform**
- **Annex 2 Existing Regulatory Framework**
- **Annex 3 PCB Official Guidance**
- **Annex 4 PCB Code of Practice (by Dr. Carlo Lupi)**
- **Annex 5 Analysis of Task, Role and Function of MoEF Units in PCB Phasing Out**
- **Annex 6 Recommendation for Regulation of Economic Incentive**

ANNEX 1: Recommendations for Regulatory Reform

Subject Matter		Existing Regulation	Recommendation	Level and format of Regulation	Reference
General Concepts	Definition regarding substance, articles, mixture	GR 74/2001, does not includes mixture and substances in the article	There needs to be more specific definitions whether it includes single substance, mixture or article	Government Regulation	Chapter 3.2, 3.3
	Definition of B2	One ministry (Ministry of Trade) has two regulation regarding B2 and B3. The definition of B2 and B3 are different but they have similar hazard categories such as flammable, corrosive, etc. The Ministry of Trade Regulation No. 75/M-DAG/PER/10/2014, the definition includes the single substance and mixture. On the other hand the Minister of Industry and Trade Regulation No.148/M/SK/1985, it is not clear. However, from the attachment of the list of substance the regulation No.148/M/SK/1985 only covers single substances.	There is a need specific information whether B2 substances are the same with B3 substances	Minister Regulation	Chapter 3.7
	Definition of B2	GR No. 74/2014. Elucidation of Article 63(c) states that what is meant by “dangerous goods” includes hazardous and toxic substance (B3)	There is a need to synchronize the same definition used in different regulations	Government Regulation Minister Regulations	Chapter 3.7

	Definition of B2	Ministry of Transportation Decree No. KM 69/1993. The definition of “bahan berbahaya” under this regulation is different from the Ministry of Trade Regulation No. 75/M-DAG/PER/10/2014. However, under both regulations the “bahan berbahaya” has similar hazard category.	There is a need to synchronize the same definition used in different regulations	Minister of Transportation Regulation Minister of Trade Regulation	Chapter 3.7
	Definition regarding substance, articles, mixture	Ministry of Transportation Decree No. KM 69/1993, the definition includes” any substance or material.” It is not clear whether it covers single substance, mixture and/or article. On the other hand, Ministry of Trade Regulation No. 75/M-DAG/PER/10/2014, clearly covers single and mixture substances.	It needs to be explained why the same name (B2) has different coverage?	Minister of Transportation Decree Minister of Trade Regulation	Chapter 3
	Definition of B3	The Minister of Industry and Trade Regulation No.148/M/SK/1985 and GR No. 74/2001, has different definition regarding B3	There is a need to synchronize the same definition used in different regulations	Minister Regulation Government Regulation	Chapter 3
	Definition regarding substance, articles, mixture	The Minister of Industry and Trade Regulation No.148/M/SK/1985 does not specifically explained B3 as single substance but it is reflected in the list of	There needs to be more specific definitions whether it covers single substance only and/or mixture.	Government Regulation Minister Regulation	Chapter 3

		substances in the attachment			
	Definition regarding hazardous chemical	Ministry of Manpower based on the Decree No. 187/Men/1999 includes the chemical in the form of single or mixture	There is a need to clarify the different of hazardous substance and hazardous chemical	Minister Regulation	Chapter3
	Definition of B3	There is a slightly different definition regarding the term "hazardous and toxic substances" (B3) within GR No. 101 and GR 74/2001	There is a need to synchronize the same definition used in different regulations	Government Regulation	Chapter 3
List of Substances	List of POPs	The list of POPs are listed in the GR No. 74/2001 and in the Minister of Agriculture's Regulation (specific to pesticides). The list of the POPs keep evolving at the international level	There is a need to update the list of the POPs regularly. Should the GR and the Minister Regulation amended all the time along the growing list?	Government Regulation Minister of Agriculture Regulation	Chapter 1.5.1,1.5.2
		GR No. 74/2001 does not includes POPs that is unintentionally released	There is a need to prohibit/prevent activities that will unintentionally release POPs to the environment	Government Regulation or Minister of Environment Regulation	Chapter 1.5.1
	Definition of B3 waste	GR No. 101/2014 defines B3 waste as: remnants of business and/or activities that contain B3[1]. A "remnant" means a quantity or a part that is left after the greater part has been used, removed or destroyed[2].	• Synchronize the definition of B3 waste with the definition under international convention (e.g Basel) • There is a need to stipulate the status	Government Regulation Minister of Environment and Forestry regulation Regarding PCB	Chapter 3.7

[1] Article 1 No. 3 GR No. 101/2014, *Limbah Berbahaya dan Beracun adalah sisa suatu usaha dan/atau kegiatan yang mengandung B3.*

[2] Definition based on *Kamus Besar Bahasa Indonesia*

		Remnant/residue is associated with something that is leftover. • The definition does not include articles/equipment contaminated with B3 waste • The definition does not include substances/article/products that is not remnant but it is intended to be disposed of • The definition does not include used product	regarding transformer containing/contaminated with PCBs		
Sanctions	Sanctions	The GR No. 74/2001, does not have sanctions for those who use and/or posses B3 that is forbidden to be used.	There is a need to give sanctions for those who use and/or posses B3 that is forbidden to be used (Provide the transition time. In this case provide timeline for phase out and the sanction for the non compliance)	Government Regulation Minister of Environment and Forestry regulation Regarding phase out PCBs	Chapter 4.4
General Legislation	The draft of Chemical Law and the Revision of GR No. 74/2001	The intersection between the draft of chemical law and the revision of GR No. 74/2001 is unclear.	There is a need to identify the intersection between the two regulations and synchronize the definitions used in both regulations	Draft of Chemical Law Revision of GR No. 74/2001	Chapter 3.6.
	Regulatory Framework at the local level	Regulatory Framework at the local level is not sufficient	There is a need to formulate the new Perda	Regional Regulation by law Guideline	Chapter 6.3

		because it is still referring the old GR	and provide technical details/guideline for the staff at the local environmental agency for technical matters that they need to handle		
ESM	Import and Distribution	There is no *specific* prohibition regarding the import, distribution and/or control of article and/or equipment that contains PCBs to Indonesia.	There is a need to prohibit the import, distribution and/or control of article and/or equipment that contains PCBs to Indonesia.	Government Regulation or Ministerial Regulation	Chapter 4.1 and 4.2
	Import and Distribution	Minister of Finance Regulation No. 213/PMK.011/2011, still allowing the import of PCBs with the HS Code 2710910000 and 3824820000 and sets the import duties.	There is a need to clarify the status of the PCBs with the HS Code 2710910000 and 3824820000 whether it should be categorized as B3 waste or B3. If it is considered as B3 waste, the relevant ministries should prohibit the importation immediately and revise the existing regulation.	Minister of Finance Regulation	Chapter 4.1. and 4.2
	B3 waste storage	GR No. 101/2014 limits temporary storage (90-days). The time limit will be surpassed due to the inexistence of PCBs waste disposal facility.	First option, the possibility of exporting the PCBs waste needs to be explored by the KLHK while the facilities of the PCBs waste treatment is not yet exist in Indonesia.	GR No.101/2014 Minister of Environment and Forestry Regulation	Chapter 4.7

			Second option, revise the GR No.101/2014 . Third option, extend time limit by way of discretion, but this has legal risks and complexities.		
	B3 Waste Utilisation	Minister of Environment issued several Decrees regarding the utilization of B3 waste (e.g. substitute fuel containing maximum content of PCBs maximal 30% of TOX)	There is a need to clarify whether PCBs can be utilized or should be totally disposed.	Minister of Environment and Forestry Decree/Regulation	Chapter 4.10
	B3 waste treatment: Thermal Process	Indonesia still allows the practice of B3 waste (PCBs) disposal with thermal process. There is a need to clarify whether PCBs can be utilized or should be totally disposed. Also, it is important to review the thermal method to dispose B3 waste (especially POPs), as the Stockholm Convention does not recommend it.	It is important to review the thermal method to dispose B3 waste (especially POPs), as the Stockholm Convention does not recommend it.	GR No.101/2014	Chapter 4.11
	B3 waste treatment: Thermal Process	GR No. 101/2014 does not prohibit the B3 waste thermal process. The thermal disposal can release POPs (unintentionally released)	• B3 waste disposal with thermal method should be prohibited • POPs disposal with thermal method should be prohibited	Revise the GR 101 or issue a specific Ministerial regulation regarding prohibition of specific B3 wastes/POPs waste that are treated with thermal method that may release POPs to the environment	Chapter 4.11
	B3 waste treatment: Disposal	Kep-04/BAPEDAL/09/1995	The Bapedal Decree can be contested.	Minister Regulation	Chapter 4.11

		regarding Procedures and Requirements for Disposal of Treated Hazardous and Toxic Waste Treatment and ex-Landfill Sites requires that B3 waste to be disposed in the landfill must not contain PCBs.			
	Retro filling	There is no policy yet regarding the retro-filling of PCB transformers	It should be discussed whether retro-filling of PCBs can be conducted or totally prohibited. If it is prohibited there should be regulation to prohibit it. If it is not, then there should be regulation to administer the process of retro-filling.	Minister of Environment and Forestry Regulation	Chapter 5.5
	Base Catalyzed Decomposition (BCD) or other Dehalogenation Process	not yet regulated	Enacting implementing regulations/Minister regulation regarding PCBs treatment through BCD/Dehalogenation method if this method is considered as environmentally sound manner	Minister of Environment and Forestry Regulation Regarding PCB	Chapter 4.11
	Registration of equipment/products containing/contaminated with PCBs	• The registration procedure regarding the import and distribution, of equipment/products containing/contaminated	Establish the registration procedure	Minister of Environment and Forestry Regulation Regarding PCB and provide guideline regarding registration	Chapter 4.4.; 5.5

		with PCBs is not yet in place • The registration procedure regarding possession or the use of equipment/products containing/contaminated with PCBs is not yet in place			
	Labeling	Regulations regarding symbol and labeling B3 and B3 waste	A guide is needed regarding symbol and labeling of the PCBs contaminated equipment, PCB waste, equipment containing PCBs as there are differences between that regulating B3 and Limbah B3	Minister of Environment and Forestry Regulation or Guideline for PCBs labeling	Chapter 4.5 and 4.6
	Transporting B3 waste	The Minister of Transportation Decrees and the Director General Decree only mention Road transportation for hazardous substance/hazardous and toxic substance. It does not include the transportation for the hazardous waste and/or hazardous and toxic *waste*.	It needs to clarify with the Minister of Transportation regarding the road transport of hazardous and toxic waste	Minister of Transportation Regulation	Chapter 4.9
	Accident and Emergency Responses	GR No. 74/2001 and GR No.101/2014 provides general measures for accident and emergency responses but it is not yet specific to the PCBs	Provide specific plan regarding accident and emergency responses on the PCBs contamination/emergency responses	Minister of Environment and Forestry Regulation Regarding PCB and a technical guideline regarding emergency responds	Chapter 4.13

	OSHA	There are general regulations regarding OSHA but not specifically about handling PCBs	Provide specific information regarding PCB management at the work place	Minister of Environment and Forestry Regulation Regarding PCB and a technical guideline	Chapter 4.14
	Quality Standard: air quality	GR No. 41/1999 on Air Quality Control does not include PCB emission in the air quality standard and air quality monitoring.	There is a need to monitor the PCBs/POP emission and maintain the air quality standard	Government Regulation Minister of Environment and Forestry Regulation	Chapter 5.1
	Quality Standard: water quality	GR No. 82/2001 on Water Quality and Pollution Control regulates the water quality standard for POPs (*aldrin, chlordane, dieldrin, endrin, heptachlor, toxaphene*, dan DDT). However, it does not cover PCBs.	There is a need to monitor the PCBs level and other POPs in the water	Government Regulation or Minister Regulation	Chapter 5.2
Product Standard	Standard limit of PCBs oil concentration allowed in the transformer/product	There is no standard yet	SNI (can refer to the standard under the Stockholm Convention)	Minister Regulation	Chapter 5.5
	The standard regarding PCB contamination in the transformer/product	There is no standard yet	SNI	Minister Regulation	Chapter 5.5.
	The standard for the PCBs free transformer/product	There is no standard yet	SNI	Minister Regulation	Chapter 5.5.
Institutions	The tasks and duties (Tupoksi) within KLHK	There is a need to clarify the tasks and duties (Tupoksi), and issue the relevant policies	The mutual understanding and identification regarding authority and duties within units KLHK should be established	Minister Regulation	Chapter 6. 2
	Inter Ministerial	There is no Inter Ministerial	Establish coordination	Minister Regulations	Chapter 6.2

	Coordination	Coordination yet to address the plan regarding PCBs phase out	with relevant ministries. Enacting relevant policies based on their authority.		
General Legal Framework for PCB Phasing Out		No official guidance nor technical code of practice on PCB Phasing Out	To the farthest extent possible, standards on PCB could be imposed through a Ministerial Regulation which supersedes (*lex specialis*) all other previous standard.	Minister Regulation	Chapter 7

ANNEX 2

Regulatory Framework Related to Hazardous and Toxic Substance, POPs, Hazardous and Toxic Waste

Laws

No	Titles	Notes
	Undang-Undang Nomor 7 Tahun 2014 tentang Perdagangan	• Kebijakan Perdagangan disusun berdasarkan asas a.l. berwawasan lingkungan (Pasal 2) • Pemerintah menetapkan larangan atau pembatasan Perdagangan Barang dan/atau Jasa untuk kepentingan nasional dengan alasan a.l. melindungi kesehatan dan keselamatan manusia, hewan, ikan, tumbuhan, dan lingkungan hidup (Pasal 35,1(d)). • Pemerintah melarang Impor atau Ekspor Barang untuk kepentingan nasional dengan alas an a.l. untuk melindungi kesehatan dan keselamatan manusia, hewan, ikan, tumbuhan, dan lingkungan hidup (Pasal 50, 2 (c)). • Pemerintah dapat membatasi Ekspor dan Impor Barang untuk kepentingan nasional dengan alas an a.l. untuk melindungi kesehatan dan keselamatan manusia, hewan, ikan, tumbuhan, dan lingkungan hidup (Pasal 54,1 (b)).
	Undang-Undang Nomor 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup	• Setiap orang yang memasukkan ke dalam wilayah Negara Kesatuan Republik Indonesia, menghasilkan, mengangkut, mengedarkan, menyimpan, memanfaatkan, membuang, mengolah, dan/atau menimbun B3 wajib melakukan pengelolaan B3 (Pasal 58). • Setiap orang yang menghasilkan limbah B3 wajib melakukan pengelolaan limbah B3 yang dihasilkannya (Pasal 59). • B3 kadaluwarsa, pengelolaannya mengikuti ketentuan pengelolaan limbah B3 (Pasal 59). • Setiap orang yang tidak mampu melakukan sendiri pengelolaan limbah B3, pengelolaannya diserahkan kepada pihak lain (Pasal 59). • Pengelolaan limbah B3 wajib mendapat izin dari menteri, gubernur, atau bupati/walikota sesuai dengan kewenangannya (Pasal 59). • Menteri, gubernur, atau bupati/walikota wajib mencantumkan persyaratan lingkungan hidup yang harus dipenuhi dan kewajiban yang harus dipatuhi pengelola limbah B3 dalam izin (Pasal 59). • Keputusan pemberian izin wajib diumumkan (Pasal 59). • Pengelolaan limbah B3 merupakan rangkaian kegiatan yang mencakup pengurangan, penyimpanan, pengumpulan, pengangkutan, pemanfaatan, dan/atau pengolahan, termasuk penimbunan limbah B3 (penjelasan Pasal 59).
	Undang-Undang Nomor 4 Tahun 2009 tentang Mineral dan Batu Bara	• Semua material yang dihasilkan dari hasil pertambangan harus memenuhi standardisasi teknis dan ramah lingkungan. • Pemberian sanksi yang tidak memenuhi standardisasi teknis dan ramah lingkungan
	Undang-Undang Nomor 22 Tahun 2009 tentang Lalu Lintas dan Angkutan Jalan	• Pengetahuan tentang jenis bahan berbahaya merupakan persyaratan khusus untuk dapat memiliki Surat Izin Mengemudi Kendaraan Bermotor Umum (Psl 83) • Penyelenggara angkutan barang yang melakukan kegiatan pengangkutan barang khusus wajib menyediakan tempat penyimpanan serta bertanggung jawab terhadap penyusunan sistem dan prosedur penanganan barang khusus dan/atau berbahaya selama barang tersebut belum dimuat ke dalam Kendaraan Bermotor Umum (Pasal 163) • Jika barang angkutan tidak diambil oleh pengirim atau penerima sesuai dengan batas waktu yang telah disepakati, Perusahaan Angkutan Umum berhak memusnahkan barang yang sifatnya berbahaya atau mengganggu dalam penyimpanannya sesuai dengan ketentuan peraturan perundang-undangan (Pasal 196). • Yang dimaksud dengan “angkutan barang khusus” adalah angkutan yang membutuhkan mobil barang yang dirancang khusus untuk mengangkut

		benda yang berbentuk curah, cair, dan gas, peti kemas, tumbuhan, hewan hidup, dan alat berat serta membawa barang berbahaya, antara lain: (1) barang yang mudah meledak; (2) gas mampat, gas cair, gas terlarut pada tekanan atau temperatur tertentu; (3) cairan mudah menyala; (4) padatan mudah menyala; (5) bahan penghasil oksidan; (6) racun dan bahan yang mudah menular; (7) barang yang bersifat radioaktif; dan (8) barang yang bersifat korosif (penjelasan Pasal 160).
	Undang-Undang Nomor 30 Tahun 2009 tentang Ketenagalistrikan	• Semua instalasi ketenagalistrikan harus memenuhi Andal, Aman dan Akrab Lingkungan • Pemberian sanksi terhadap pemilik instalasi yang tidak memenuhi Andal dan Akrab Lingkungan karena membahayakan keselamatan
	Undang-Undang Nomor 18 Tahun 2008 Pengelolaan Sampah	Tidak mengatur secara spesifik tentang POPs namun mengatur tentang pengelolaan sampah secara keseluruhan termasuk kewajiban untuk mengelola sampah rumah rumah tangga, sampah sejenis sampah rumah tangga, dan sampah spesifik; termasuk larangan membakar sampah yang tidak sesuai dengan persyaratan teknis pengelolaan sampah (yang dapat menjadi sumber lepasan POPs).
	Undang-Undang No. 22 Tahun 2002 tentang Minyak dan Gas Bumi	• Semua material yang dihasilkan dari minyak dan gas bumi harus memenuhi standardisasi teknis dan ramah lingkungan. • Pemberian sanksi yang tidak memenuhi standardisasi teknis dan ramah lingkungan
	Undang-Undang Nomor 12 Tahun 1992 tentang Sistem Budidaya Tanaman	• Pestisida yang akan diedarkan di dalam wilayah negara Republik Indonesia wajib terdaftar, memenuhi standar mutu, terjamin efektivitasnya, aman bagi manusia dan lingkungan hidup, serta diberi label (Pasal 38). • Pemerintah menetapkan standar mutu pestisida dan jenis pestisida yang boleh diimpor (Pasal 38). • Pemerintah melakukan pendaftaran dan mengawasi pengadaan, peredaran, serta penggunaan pestisida (Pasal 39). • Pemerintah dapat melarang atau membatasi peredaran dan/atau penggunaan pestisida tertentu (Pasal 40). • Setiap orang atau badan hukum yang menguasai pestisida yang dilarang peredarannya atau yang tidak memenuhi standar mutu atau rusak atau tidak terdaftar wajib memusnahkannya (Pasal 41).
	Undang-Undang Nomor 36 Tahun 1992 tentang Kesehatan	• Pemerintah, pemerintah daerah dan masyarakat menjamin ketersediaan lingkungan yang sehat dan tidak mempunyai risiko buruk bagi kesehatan (Pasal 163). • Lingkungan sehat bebas dari unsur-unsur yang menimbulkan gangguan kesehatan, antara lain: (a) limbah cair; (b) limbah padat; (c) limbah gas; (d) sampah yang tidak diproses sesuai dengan persyaratan yang ditetapkan pemerintah; (e) binatang pembawa penyakit; (f) zat kimia yang berbahaya; (g) kebisingan yang melebihi ambang batas; (h) radiasi sinar pengion dan non pengion; (i) air yang tercemar; (j) udara yang tercemar; dan (k) makanan yang terkontaminasi (Pasal 163).
	Undang-Undang Nomor 5 Tahun tentang 1984 Perindustrian	• Dalam rangka pembinaan berupa bimbingan dan penyuluhan, Pemerintah memberikan petunjuk-petunjuk pelaksanaan mengenai upaya menjamin keamanan dan keselamatan terhadap penggunaan alat, bahan baku serta hasil produksi industri termasuk pengangkutannya, dengan memperhatikan pula keselamatan kerja. Adapun yang dimaksud dengan pengangkutan adalah pengangkutan bahan baku dan hasil produksi industri yang berbahaya. Selain itu perlu diawasi pula langkah-langkah pencegahan timbulnya kerusakan dan pencemaran terhadap lingkungan hidup serta pengamanan terhadap keseimbangan dan kelestarian sumber daya alam (penjelasan Pasal 15). • Perusahaan industri wajib melaksanakan upaya keseimbangan dan kelestarian sumber daya alam serta pencegahan timbulnya kerusakan dan pencemaran terhadap lingkungan hidup akibat kegiatan industri yang dilakukannya (Pasal 21).
	Peraturan Pemerintah Nomor 1 Tahun 2014	Pelaku usaha harus memenuhi standardisasi teknis dan ramah lingkungan untuk material yang dihasilkan dari usaha pertambangan

	Peraturan Pemerintah Nomor 14 Tahun 2012 tentang Kegiatan Usaha Penyediaan Tenaga Listrik	Pelaku usaha harus memenuhi Andal, Aman dan Akrab Lingkungan

Government Regulations

No	Titles	Notes
	GR No. 82/2001 on Water Quality and Pollution Control.	Mengatur tentang baku mutu air untuk senyawa POPs: *aldrin, chlordane, dieldrin, endrin, heptachlor, toxaphene*, dan DDT (but it does not cover PCBs)
	GR No. 41/1999 on Air Quality Control	Mengatur baku mutu udara secara umum dan nasional (tidak memuat baku mutu POPs)
	Peraturan Pemerintah Nomor 38 Tahun 2007 Pembagian Urusan Pemerintahan, antara Pemerintah, Pemerintah Daerah Provinsi dan Pemerintah Daerah Kabupaten/Kota	
	Government Regulation No. 74/2014 on Road Transportation.	Article 53 regulates transportation for specific goods. Article 53 (1) Angkutan barang khusus sebagaimana dimaksud dalam Pasal 51 huruf b merupakan angkutan yang menggunakan mobil barang yang dirancang khusus sesuai dengan sifat dan bentuk barang yang diangkut. Article 53 (2) Barang khusus sebagaimana dimaksud pada ayat (1) terdiri atas: barang berbahaya; dan barang tidak berbahaya, yang memerlukan sarana khusus. Article 53 (2) Angkutan barang khusus berbahaya yang memerlukan sarana khusus sebagaimana dimaksud pada ayat (2) huruf a paling sedikit: -barang yang mudah meledak; -gas mampat, gas cair, gas terlarut pada tekanan atau temperatur tertentu; -cairan mudah menyala; - padatan mudah menyala; -bahan penghasil oksidan; -racun dan bahan yang mudah menular; barang yang bersifat radioaktif; -barang yang bersifat korosif; dan/atau -barang khusus berbahaya lainnya.

Presidential Decrees

No	Titles	Notes
	Presidential Decree No. 39/2014 on the list of businesses that are closed and opened for the investment requirement	Lampiran 1 Daftar Bidang Usaha yang tertutup untuk penanaman modal Bidang Perindustrian. Pada tabel, Bidang Perindustrian (No. 3), Industri bahan kimia yang dapat merusak lingkungan diantaranya: Industri Bahan Aktif Pestisida: Dichloro Diphenyl Trichloroethane (DDT), Aldrin, Endrin, Dieldrin, Chlordane, Heptachlor, Mirex, dan Toxaphene - Industri Bahan Kimia Industri: Polychlorinated Biphenyl (PCB), Hexachlorobenzene

Minister of Industry and Trade Decrees/Regulations
Hazardous and Toxic Substance Management/Export-Import Procedure

No	Titles	Notes
	Minister of Industry and Trade Decree No. 40/MPP/KEP/1/2003 on Importer Identification Number. This decree revokes and replaces Minister of Industry and Trade Decree No. 550/MPP/Kep/10/1999 and Minister	

	of Industry and Trade, Decree No. 253/MPP/Kep-07/2003.	
	Minister of Industry and Trade No. 254/MPP/Kep/7/2000 on The Import and Distribution Management of Certain Dangerous Substances	The Decree regulates the procedure regarding import and distribution of the certain dangerous substances, such as the obligation to obtain the recognition as dangerous substance importer and to report. Note: • Attachment I Daftar Bahan Berbahaya Yang Diatur Tata Niaga Impornya PCBs is not on the list • Psl 2(1) B2 yang diatur tata niaga impornya sebagaimana tercantum dalam Lampiran I Keputusan ini berjumlah 351 Pos Tarif yang terdiri dari bahan kimia yang membahayakan kesehatan dan merusak kelestarian lingkungan hidup dan bahan kimia daftar 2 dan 3 Konvensi Senjata Kimia (KSK). Convention On The Prohibition Of The Development, Production, Stockpiling And Use Of Chemical Weapons And On Their Destruction
	Minister of Trade Decree No.44/M-DAG/PER/9/2009 on Procurement, Distribution and Monitoring of Hazardous Substances. This decree revokes and replaces Minister of Trade Regulation No. 04/M-DAG/PER/2/2006 and its amendment (Minister of Trade Regulation No. 08/M-DAG/PER/3/2006 and Minister of Trade Decree No. 254/MPP/Kep/7/2000.	The decree specifies the types of hazardous substance that is produced domestically or imported. It also regulates the distribution of hazardous substances and provides the conditions for distribution, packaging and labeling. Distributors and retailers of hazardous substances must have permit in order to trade the hazardous substances. Further, the decree is also regulates the submission of regular reports on the acquisition and distribution of hazardous materials, sale restriction, sale, transfer, import or hazardous substances, development on, and control over, the distribution of hazardous materials, sanction,etc Note: Lampiran I Jenis Bahan Berbahaya yang Diatur Tata Niaga Impornya. → tidak memuat PCbs
	Ministry of Trade Decree No. 75/M-DAG/PER/10/2014 on the second amendment of the Ministry of Trade Decree No.44/M-DAG/PER/9/2009 on Procurement, Distribution and Monitoring of Hazardous Substances.	
	Peraturan Menteru Keuangan Regulation No. 213/PMK.011/2011 regarding The Stipulation of Goods Classification System and Imposition of Import Duty for Imported Goods (Penetapan Sistem Klasifikasi Barang dan Pembebanan Tarif Bea Masuk atas Barang Impor).	

Minister of Industry and Trade Decrees/Regulations
Hazardous and Toxic Substance Management/Handling, Supervision, Labelling

No	Titles	Notes
	Minister of Industry and Trade No.148/M/SK/1985 on Safety of Toxic and Hazardous Substance in Industrial Companies.	Note: Pada lampiran terdapat daftar bahan beracun dan berbahaya. Pada daftar tersebut tidak terdapat PCBs.
	Minister of Industry 24/M-IND/PER/5/2006 on Monitoring on Production & Utilization of Hazardous Substances (B2) for Industry	Hazardous substance (B2) are: 1. Formaldehyde (No CAS : 50-00-0) 2. Borax (No CAS : 303-96-4) 3. Metanil Yellow (No CAS : 587-98-4)

		4. Rodamin-B (No CAS : 81-88-9) 5. Paraformaldehyde (No CAS : 30525 89-4) 6. Trioksan (No CAS : 110-88-3) Hazardous Substances (B2) can only be produced by Registered Producer and utilized only by Registered Industry. Safety Data Sheet should be attached on all B2 substance packaging. The packaging of the B2 substance should follow International Maritime Dangerous Goods Code (IMDG Code/United Nation Standard) and pictogram/ hazardous symbol. Note: PCBs tidak termasuk dalam dafar. Lampiran III memuat Panduan Umum label bahan berbahaya dan kemasannya tidak memuat PCBs.
	Ministry of Trade Decree No. 23/M-DAG/PER/9/2011 on the Amendment of the Ministry of Trade Decree No.44/M-DAG/PER/9/2009 on Procurement, Distribution and Monitoring of Hazardous Substances	Hazardous and toxic substances, in which their import & distribution are regulated, are listed in the Attachment I and II of the Decree. The import of the substances needs to be verified and technical tracked by a surveyor in the port of loading country before they are being shipped Note: Explaining procedure does not include any information regarding POPs or PCBs
	Minister of Industry Regulation No. 87/M-IND/PER/9/2009 on Globally Harmonized System of Classification and Labeling of Chemicals	Note: Sasarannya adalah bahan kimia dlm bentuk cairan, padat atau gas berupa unsur atau senyawa dalam bentuk tunggal atau campuran yg mempunyai sifat khusus. Psl 4 (1) Bahan kimia diklasifikasi berdasarkan bahaya kriteria GHS yg terdiri dari: Bahaya Fisik, bahaya terhadap kesehatan dan bahaya terhadap lingkungan akuatik. Psl 5(1) Bahan kimia tersebut wajib diberi label. PCB termasuk kriteria yang mana? Pelaku usaha yg memperoduksi bahan kimia atau produknya wajib klasifikasi, label, membuat MSDS dan kaji ulang label (psl 11 ayat 1) Pelaku usaha g melakukan pengemasan ulang bahan kimia wajib: a) mencantumlan label, menyertakan MSDS Psl 11 (2). Pelaku usaha pada ayat 1 dan 2 wajib memberikan laporan kp Direktur Jenderal Pembina Industri
	Minister of Industry Regulation No. 23/M-IND/PER/4/2013 on the amendment of Minister of Industry Regulation No. 87/M-IND/PER/9/2009	• Pelaku usaha adalah setiap orang/kelompok yg melakukan usaha di bidang produksi dan distribusi. • Psl 2 (1) Memberlakukan ketentuan secara wajib pada : a) bahan kimia tunggal hasil produksi dalam negeri maupun impor sejak diberlakukan Peraturan Menteri, b) Bahan Kimia Campuran hasil produksi dlm negeri maupun impor sejak 31 Desember 2016.
	Peraturan Direktur Jenderal Basis Industri dan Manufaktur No. 04/BIM/PER/1/2014 tentang Petunjuk Teknis dan Petunjuk Pelaksanaan Sistem Harmonisasi Global dan Klasifikasi Bahan Kimia.	Lampiran memberikan petunjuk secara khusus mengenai: Lampiran I: Nilai Batas (cut off) dan batas Konsentrasi (Concentration limit) Lampiran II, Building Blocks GHS Lampiran III: Formulir Lembar Data Keselamatan (LDK), Lampiran IV: Pelabelan GHS pada kemasan, Lampiran V: Ukuran dan Tata Letak Piktogram Bahaya
	Keputusan Menteri Perindustrian Nomor 148 Tahun 1985 Juncto Peraturan Menteri Perindustrian Nomor 24 Tahun 2006 tentang Pengawasan Produksi dan Penggunaan Bahan Berbahaya untuk Industri.	• Mengatur tentang POPs pestisida (berbagai macam bahan aktif pestisida dan berbagai macam pestisida) namun tidak merinci jenis pestisida atau jenis bahan aktif pestisida tersebut. • Industri bertanggung jawab sepenuhnya terhadap pengelolaan B3 mulai dari pengadaan, penyimpanan, pengolahan, pengemasan, dan pengangkutan sampai di distributor.

Minister of Environment Regulations

No	Titles	Notes

1	**Minister of Environment Regulation No. 3/ 2008** on Procedure of Labeling and Symbolizing Hazardous Substance	Based on the regulation, every package of the hazardous and toxic substances shall be symbolized and labeled based on the type and their classifications. Those classifications among other are: explosive, oxidizing, flammable, and etc. The attachment of the regulation provides a detailed procedure for the symbolizing and labeling. Note: Psl 2 (1) Setiap kemasan B3 wajib diberikan simbol sesuai dengan klasifikasinya dan label sesuai dengan jenis dan klasifikasinya. Psl 2(2) Klasifikasi B3 bersifat a. mudah meledak (*explosive*); . pengoksidasi (*oxidizing*); . sangat mudah sekali menyala (*extremely flammable*); . sangat mudah menyala (*highly flammable*); . mudah menyala (*flammable*); . amat sangat beracun (*extremely toxic*); . sangat beracun (*highly toxic*); . beracun (*toxic*); . berbahaya (*harmful*); . iritasi (*irritant*); . korosif (*corrosive*); . berbahaya bagi lingkungan (*dangerous to environment*); . karsinogenik (*carcinogenic*); . teratogenik (*teratogenic);* • Pada lampiran terdapat Jenis symbol B3, terdiri dari 10 jenis: • Simbol B3 untuk klasifikasi explosive, pengoksidasi, mudah menyala, racun, berbahaya, iritan, korosif, berbahaya bagi lingkungan, karsinogenik, teratogenik dan mutagenic, gas bertekanan. • Terdapat ketentuan pemasangan symbol pada kemasan, kendaraan pengakut, penyimpanan kemasan • Terdapat petunjuk: bentuk, warna, ukuran, pengisian label B3, pemasangan label B3.
2	**Minister of Environment Regulation No. 2/ 2010** regarding the application of electronic system regarding hazardous and toxic substance registration in the framework of Indonesian National Single Window (INSW) at the Ministry of Environment.	The regulation requires every importer or exporter to register to the Ministry of the Environment (MoE) through INSW system. Attachment I of the regulation provide standard operation procedure of the INSW at the MoE. Attachment II provides registration form for the hazardous and toxic substances.
3	**Minister of Environment Decree No. Kep-13/MENLH/3/1995** tentang Baku Mutu Emisi untuk Industri Semen	Attachment IVA and IV B provide emission quality standard for cement industry. It doesn't include POPs parameter at all. Untuk parameter pada klins (tanur putar) yang diatur parameter opasitas, total partikel, NO_2, SO_2.

Minister of Health Decree

Hazardous and Toxic Substance Management/Handling, Supervision

No	Title	Note
1	Minister of Health Regulation No. 472/Menkes/Per/V/1996 on Preventive Measures against Chemicals Harmful to Human Health.	Regulates technical procedure on preventive measures against chemical harmful to human death. Article 1, covers the definition of hazardous substance, MSDS, General Director of Drugs, and food monitoring. Psl 1 (1) Bahan berbahaya adalah zat, bahan kimia dan biologi, baik dalam bentuk tunggal maupun campuran yang dapat membayakan kesehatan dan lingkungan hidup secara langsung atau tidak langsung. yang mempunyai sifat racun, karsinogenik, teratogenik, mutagenik. korosif dan iritasi. Article 2, the type of hazardous substance shall refer to attachment I of

		the regulation (attachment does not includes PCB but other POPs, such as endosulfan) . Article 3, the registration process. Article 4, MSDS. Article 5, packaging and labeling. Article 6, regular report on certain substance. Article 7, importer has to report the General Director regarding the hazardous substance to the General Director at least 2 weeks after they receive the substance. Importer has to make special note, and in the labeled the package with the name of the importer. Article 8, General Director for Drugs and Food Monitoring and/or province office of the Health Department. Article 9, Sanction (criminal sanction and administrative sanction).

Minister of Manpower and Transmigration Decrees
Hazardous and Toxic Substance Management/Handling, Supervision

No	Titles	Note
1	Minister of Manpower and Transmigration Decree No. 187/Men/1999 on Management of Dangerous Chemicals used in the workplace	Manage the dangerous chemicals used in the workplace, the focus in the protection of the workers/labor from the dangerous chemical. Also mention the preparation of MSDS, stipulation of installation potential hazard, obligations, and work health safety official for chemical and work health safety for chemical expert. The attachment listed the four tables describe toxic substance, highly toxic substance, highly reactive substance, and explosive substance. Note: Psl 9 membangi 7 kriteria bahan kimia berbahaya: a) beracun, b) bahan sangat beracun, c)cairan mudah terbakar, d) cairang sangat mudah terbakar, e)gas mudah terbakar, f) bahan mudah meledak, g)bahan reaktif, h) bahan oksidator. Lampiran III memuat nama dan nilai ambang batas kuantitas (NAK) bahan kimia berbahaya. PCB tidak ada dalam list.lampiran I memuat lembaran MSDS, lampiran II form daftar nama dan sifat kimia serta kuantitas bahan kimia berbahaya
2	Peraturan Menteri Tenaga Kerja dan Transmigrasi Nomor 13 Tahun 2011 Nilai Ambang Batas Faktor Fisika dan Faktor Kimia di Tempat Kerja	Mengatur nilai ambang batas kimia di tempat kerja untuk POPs: Aldrin, DDT, Dieldrin, Endosulfan, Endrin, Hexachlorobenzene, Chlordane, dan Toxaphene.

Minister of Transportation Decrees
Hazardous and Toxic Substances Management/Transporting

No	Titles	Note

1	Ministry of Transportation Decree No. 30/KM.2002 on the Amendment of Minister of Transportation Decree No. 69/KM.1993 on Goods Transportation by Road	Note: Tidak secara spesifik mengatur tentang angkutan POPs namun secara umum merinci tentang persyaratan pengangkutan bahan berbahaya (Pasal 11 sampai Pasal 16). Psl 14(1) (2) Vehicle requirements for transporting B3, such as placard, company name, driver's identity, first aid box, radio communication, for the passenger equipped by eyeglasses, mask, gloves, and safety clothes. Psl 11 (1) angkutan bahan berbahaya dilakukan dengan menggunakan kendaraan bermotor yg memenuhi persyaratan teknis dan laik jalan sesuai dengan peruntukannya. Psl 11 (2) Klasifikasi bahan berbahaya: a) mudah meledak, gas mampat, cair, gas terlarut pada tekanan atau pendinginan tertentu, cairan mudah menyala, padatan mudah menyala, e) oksidator, peroksida organic, f) racun dan bahan yang mudah menular, g) radio aktif, h) korosif, i) berbahaya lain. Psl 12 (1) pengakutan bahan berbahaya wajob mengajukan permohonan persetujuan kepada Direktur Jenderal sebelum pelaksanaan pengangkutan. Psl 13 Pelayanan angkutan bahan berbahaya mempunyai ciri-ciri pelayanan sebagai berikut: a) prasarana jalan yg dilalui memenuhi ketentuan kelas jalan, tersedianya tempat, fasilitas perlengkakapan memuat dan membongkar, dilayani dengan mobil barang akutan bahan berbahaya sesuai dengan peruntukannya, mempunyai dokumen pengakutan bahan berbahaya dari instansi yg berwenang, pelayanan lambat, memiliki tanda-tanda khusus yg klasifikasinya terdapat pada lampiran III. Lampiran III memuat klasifikasi bahan berbahaya dan labelnya yakni: kelas I eksplosif, kelas 2 gas, kelas 3 cairan mudah terbakar, kelas 4 zat padat mudah terbakar, kelas 5 zat-zat yang mengoksidasi dan peroksida organic, kelas 6 zat-zat beracun, kelas 7 bahan-bahan radioaktif, kelas 8 korosif, kelas 9 zat-zat lain. Lampiran 1V memuat ukuran dan bentuk plakat serta contohnya (untu mobil angkutan berbahaya)
	Minister of Transportation Decree No. 17 of 2000 Concerning Guideline on Handling Substances/Hazardous Substance in Indonesia Navigation	
	Minister of Transportation Regulation No. KM 02 of 2010 on the revision of Minister of Transportation Decree No. KM 17 of 2000	
	Director General of Land Transportation Decree No. SK.1280/AJ.302/DRJD/2004 on the Form, Color and Size of a Letter of Approval regarding the Transport of Heavy Equipment and Hazardous and Toxic Substances.	

	Director General of Land Transportation Decree No. SK.725/AJ.302/DRJD/2004 regarding the Land Transportation of the Hazardous and Toxic Substance	
	Director General of Land Transportation Decree No. SK.1280/AJ.302/DRJD/2004 on the Form, Color and Size of a Letter of Approval regarding the Transport of Heavy Equipment and Hazardous and Toxic Substances.	

Minister of Agriculture Decree

Hazardous and Toxic Substance Management/Handling, Supervision

No	Titles	Note
1	Minister of Agriculture Letter of Decree No. 429/Kpts/UM/9/1973 Concerning requirements on packaging and labeling pesticides.	Stipulating the requirement on packaging and labeling pesticides.
2	Peraturan Menteri Pertanian No. 847 Tahun 2011tentang Komisi Pestisida	Mengatur peran dan tugas komisi pestisida, terutama perannya dalam meberikan saran kepada Menteri Pertanian mengenai pengelolaan pestisida
3	Peraturan Menteri Pertanian Nomor 24 Tahun 2011 tentang Syarat dan Tata Cara Pendaftaran Pestisida	Mengatur tentang senyawa POPs pestisida, yang mencakup: *aldrin, chlordane, dieldrin, endrin, heptachlor, mirex, toxaphene*, DDT, *alpha hexachlorocyclohexane, beta hexachlorocyclohexane, chlordecone, lindane, pentachlorobenzene*, dan *endosulfan*
4	Peraturan Menteri Pertanian Nomor 42 Tahun 2007 tentang Pengawasan Pestisida	Mengatur secara rinci tentang pengawasan pestisida yang mencakup serangkaian kegiatan pemeriksaan terhadap produksi, peredaran, penyimpanan dan penggunaan pestisida agar terjamin mutu dan efektivitasnya, tidak mengganggu kesehatan dan keselamatan manusia serta kelestarian lingkungan hidup dan sesuai dengan peraturan perundang-undangan yang berlaku. . Mengatur tentang tugas pokok dan fungsi Pengawas Pestisida Pusat, Provinsi, dan Kabupaten/Kota.
5	Keputusan Menteri Pertanian Nomor 276 Tahun 2008 tentang Komisi Pestisida	Merinci tentang tugas Komisi Pestisida, terutama perannya dalam memberikan saran kepada Menteri Pertanian berkaitan dengan pengelolaan pestisida
	Peraturan Menteri Pertanian No. 39/Permentan/SR.330/7/2015 tentang Pendaftaran Pestisida	http://perundangan.pertanian.go.id/admin/file/Permentan%2039-2015%20Pendaftaran%20Pestisida.pdf

BPOM

No	Titles	Notes

1	Ka BPOM No 28 tentang Pengawasan Pemasukan Bahan Obat, Bahan Obat Tradisional, Bahan Suplemen Kesehatan dan Bahan Pangan ke dalam wilayah Indonesia	
2	Ka BPOM No HK.00.06.1.52. 4011 tentang Penetapan Batas Maksimum Cemaran Mikroba dan Kimia dalam Makanan	
3	Ka BPOM No HK. 03.1.23.08.11.07517 tentang Persyaratan Teknis Bahan Kosmetika.	
4	BPOM HK 03.1. 23.07.11.6664 tentang Pengawasan Kemasan Pangan.	

Decree of the Ministry of Environment related to Hazardous and Toxic waste

No	Titles	Notes
	Kep-01/BAPEDAL/09/1995, Procedures and Requirements for the Storage and Collection of Hazardous and Toxic Waste.	Requirements for packing, requirements for hazardous and toxic waste storage, requirements for hazardous and toxic waste collection. **Note:** Lampiran Keputusan ini memuat ketentuan pengemasan Limbah B3. The decree provides general guideline (pengemasan, pewadahan, penyimpanan limbah B3, persyaratan bangunan penyimpanan limbah) but not specifically for PCBs.
	Kep-02/BAPEDAL/09/1995, Hazardous and Toxic Waste Document.	Pasal 1 Dokumen limbah B3 adalah surat yang diberikan pada waktu penyerahan limbah B3 untuk diangkut dari lokasi kegiatan penghasil ke tempat penyimpanan di luar lokasi kegiatan, dan atau pengumpulan dan atau pengangkutan dan atau pengolahan limbah B3 dan atau pemanfaatan limbah B3 serta penimbunan hasil pengolahan; Pasal 2 Dokumen limbah B3 sebagaimana dimaksud dalam Pasal 1, terdiri dari: - Bagian I : yang harus diisi oleh Penghasil/pengumpul; - Bagian II : yang harus diisi oleh pengangkut; - Bagian III : yang harus diisi oleh pengumpul/pemanfaat/pengolah. Psl 3 Setiap badan usaha yang melakukan pengolahan limbah B3 wajib mengajukan permohonan kepada Kepala Badan Pengendalian Dampak Lingkungan untuk mendapatkan nomor registrasi terlebih dahulu sebelum dokumen limbah B3 dipergunakan, dengan melampirkan izin pengelolaan limbah B3.
	Kep-03/BAPEDAL/09/1995, Technical Requirements for Hazardous and Toxic Waste Treatment.	The decree regulates the B3 waste management requirements which includes: Location of the B3 waste management, facilities required for B3 waste treatment, requirements prior to treatment of hazardous and toxic waste, B3 waste

		management, and the result of the B3 waste management. Psl 7 The B3 waste management operator is also has to submit a report at least once in three months to the head of BAPEDAL copies to the related Governor and/or Regent/Mayor Note: Pasal 1 : • Pengolahan Limbah Bahan Berbahaya dan Beracun (B3) adalah proses untuk mengubah karakteristik dan komposisi limbah B3 menjadi tidak berbahaya dan/atau tidak beracun. • Mengatur konsentrasi POPs dalam uji ekstraksi limbah (TCLP) – Tabel 1. Baku Mutu TCLP: *aldrin, dieldrin, chlordane, endrin, heptachlor, hexachlorobenzene, lindane*, PCBs, dan *toxaphene*. • Mengatur tentang Baku Mutu Penghancuran dan Penghilangan atau *Destruction and Removal Efficiency* (DRE) Insinerator untuk POPs: PCBs, PCDFs dan PCDDs. Baku mutu DRE untuk ketiga POPs tersebut harus lebih besar atau sama dengan 99,9999 persen. • Mengatur tentang baku mutu limbah cair pengelolaan efluen limbah industri bahan berbahaya dan beracun (Tabel 4.) untuk senyawa POPs: PCBs, PCDFs dan PCDDs.
	Kep-04/BAPEDAL/09/1995, Procedures and Requirements for Disposal of Treated Hazardous and Toxic Waste Treatment and ex-Landfill Sites.	1. Procedures and Requirements for land filling of Hazardous and Toxic waste includes; selection of Landfill sites, requirement for hazardous and toxic waste landfill design, requirements for construction and installation of landfill components, requirement for equipment at landfill facilities, pre-treatment of toxic and hazardous waste. 2. Requirements for former waste treatment and landfill sites include; hazardous and toxic waste treatment facilities, requirements for former hazardous and toxic waste landfill sites). 3. Mengatur tentang konsentrasi total limbah bahan berbahaya dan beracun yang belum diolah dan kategori landfilnya (Tabel 2) untuk POPs: *hexachlorobenzene*. 4. Mengatur konsentrasi POPs dalam uji ekstraksi limbah (TCLP) – Tabel 3. Baku Mutu Uji TCLP: *aldrin, dieldrin, chlordane, endrin, heptachlor, hexachlorobenzene, lindane*, PCBs, dan *toxaphene*. 5. Mengatur tentang baku mutu limbah cair pengelolaan efluen limbah industri bahan berbahaya dan beracun (Tabel 5) untuk senyawa POPs: PCBs, *polychlorinated dibenzofuran* (PCDFs), dan *polychlorinated dibenzo-p-dioksin* (PCDDs). Note: Lampiran There are 3 different types of landfill, category I(Secure Lanfill double liner), category II (secure landfill single liner), category III (landfill clay liner). Pemilahan jenis dan karakteristik limbah yang dimaksud adalah: 1. Untuk limbah B3 dari sumber yang spesifik dalam Tabel 2 Lampiran Peraturan Pemerintah Nomor 19 Tahun 1994, yang tercantum pada tabel 1 keputusan ini

		tempat penimbunannya harus di landfill Kategori I. 2. Untuk limbah B3 dari sumber yang spesifik dalam Tabel 2 Lampiran Peraturan Pemerintah Nomor 19 Tahun 1994, yang tidak termasuk dan tercantum pada Tabel 1, tempat penimbunannya (landfill) mengacu pada tabel 2 keputusan ini. 3. Untuk limbah B3 dalam Tabel 1 dan Tabel 3 Lampiran Peraturan Pemerintah Nomor 19 Tahun 1994, tempat penimbunannya (landfill) mengacu pada Tabel 2 keputusan ini. 4. Tempat penimbunan yang dimaksud dalam butir (2) dan (3), yaitu : Untuk limbah B3 yang belum terolah dan yang total kadar maksimum bahan pencemarnya lebih besar dari atau sama dengan nilai pada kolom A Tabel 2 keputusan ini, maka limbah B3 tersebut tempat penimbunannya harus di landfill Kategori I. 5. Tempat penimbunan yang dimaksud dalam butir (2) dan (3), yaitu : Untuk limbah B3 yang belum terolah dan yang total kadar maksimum bahan pencemarnya lebih kecil dari nilai pada kolom A-Tabel 2 keputusan ini, maka limbah B3 tersebut tempat penimbunannya harus di landfill Kategori II. 6. Untuk limbah B3 yang belum terolah dan yang total kadar maksimum bahan pencemarnya lebih kecil dari atau sama dengan nilai pada Kolom B Tabel 2 keputusan ini, maka limbah B3 tersebut tempat penimbunannya harus di landfill Kategori III. 769 7. Apabila ada satu atau lebih parameter yang total kadar maksimum bahan pencemarnya melebihi nilai pada kolom A Tabel 2 keputusan ini, maka limbah B3 tersebut tempat penimbunannya harus di landfill Kategori I. 8. Apabila ada satu atau lebih parameter yang total kadar maksimum bahan pencemarnya melebihi nilai pada kolom B Tabel 2 keputusan ini, maka limbah B3 tersebut tempat penimbunannya harus di landfill kategori II.
	Kep-02/BAPEDAL/01/1998 on Procedures Monitoring Management of a Hazardous and Toxic Waste at the Regional Level	Procedures Monitoring Management of a Hazardous and Toxic Waste at the Regional Level Note: The decree provides the obligation of the Provincial and the Regency/City government to supervise the B3 waste management.
	Kep-03/BAPEDAL/01/1998 Partnership Program on Management of Toxic and Hazardous Material.	Partnership program establishment to manage the hazardous and toxic material management. Note: Program ini dapat membantu mengumpulkan informasi kiranya industry apa saja yang menghasilkan PCBs.
	Minister of Environment Regulation No. 5 of 2009 on Seaport Waste Management. This regulation revokes and replaces Minister of Environment Regulation No. 03/2007	Ship owners or operators are prohibited to dispose waste to the environment and they shall be responsible for their waste until it is handed or received by parties that will treat such waste. The regulation has 2 attachments consist of: 1) Template of certificate of waste discharge, 2) Template of waste balance form. Note: It may be relevant in the event the sea port activities produced PCBs waste. Psl 5(1)Pengelola dapat menerima dan/atau mengelola limbah yang berasal dari kegiatan rutin operasional kapal dan/atau kegiatan penunjang pelabuhan.Psl 5 (2) Limbah sebagaimana dimaksud pada ayat (1) meliputi: a. minyak; b. material cair dan/atau padat berbahaya dalam bentuk curah; c. kemasan bekas bahan berbahaya;d. limbah cair domestik;e. sampah; f. emisi;g. limbah elektronik; dan/atau h. limbah

		bekas kapal.
	Minister of Environment Regulation No. 2 of 2008 on Hazardous & Toxic Waste Utilization	The regulation includes requirement, method and procedure for the B3 waste utilisation. Note: can PCBs be utilised? If not, this regulaton is not relevant, PCBs must not be utilsed (re-use, recycle, recovery) but to be disposed. Note: there should be a prohibition regarding the utilisation of PCBs waste.
	Minister of Environment Regulation No. 30 of 2009 on Hazardous & Toxic Waste Licensing & Monitoring Procedure and Restoration Control by the Regional Government	The scopes of the regulation are: Article 2 (1) a.perizinan yang meliputi:1. izin penyimpanan sementara limbah B3; dan2. izin pengumpulan limbah B3 skala provinsi dan kabupaten/kota; b.rekomendasi izin pengumpulan limbah B3 skala nasional; c. pengawasan pengelolaan limbah B3;d.pengawasan pemulihan akibat pencemaran limbah B3; dan e. pembinaan. Izin sebagaimana dimaksud pada ayat (1) huruf a angka 2 tidak termasuk minyak pelumas/oli bekas. Pasal 3 Gubernur berwenang menerbitkan: a. izin pengumpulan limbah B3 skala provinsi; dan b. rekomendasi izin pengumpulan limbah B3 skala nasional. Bupati/walikota berwenang menerbitkan izin penyimpanan sementara limbah B3 dan pengumpulan limbah B3 skala kabupaten/kota. The regulation can be relevant if the PCBs waste management involved regional government.
	Minister of Environment Regulation No. 33 of 2009 on Method for Restoration of Land Contaminated by Hazardous & Toxic Waste	• Guideline for land restoration and its stages. There are at least four stages in the land restoration phases such as: planning, implemention, evaluation and monitoring. • Pasal 2 Peraturan Menteri ini bertujuan untuk memberikan pedoman bagi penanggungjawab usaha dan/atau kegiatan dalam melaksanakan penanganan pemulihan lahan terkontaminasi limbah B3. Note: This is relevant if there is a potential PCBs waste contamination in the land or if the land is aleady contaminated.
	Minister of Environment Regulation No. 18/2009 on Licensing Procedure for Hazardous & Toxic Waste Management. This regulation revokes and replaces the Decree of the Head of Bapedal No. Kep-68/BAPEDAL/05/1994	Psl 2 (1) The regulation covers different types of activities related to the the management of hazardous & toxic waste management which required to have permit are: transportation, temporary deposit, collection, utilization, treatment, and stockpilling. Psl 2(2) The producers of hazardous & toxic waste are not allowed to collect the hazardous & toxic waste. Psl 2(3) Such collection is allowed if only the B3 waste producers have B3 waste utilisation technology and/or has a contract of work with a party that treats or stockpile the waste. Further, the regulation describes the requirements related the hazardous and waste treatment and different government authorities responsibilities. Note: PCbs waste treatment which relates to transportation, temporary deposit, collection, utilization, treatment, and stockpilling must have a permit. (Questions, is PCBs can be utilised or have to be dispose?)

	Minister of Environment Regulation No. 14/2013 on Symbol and Label of Hazardous & Toxic Waste. This regulation revokes and replaces the Head of Bapedal Decree No. Kep-05/BAPEDAL/09/1995, Symbols and Labels for Hazardous Waste.	Everybody that manages the hazardous and toxic waste is required to provide symbol and label in the containers or packaging of the hazardous & toxic waste, storage, and transportation modes of the hazardous & toxic waste. Furthermore, the regulation provides detailed procedure of labelling and symbolizing. Bentuk dasar simbol limbah B3 (i.e. berbentuk bujur sangkar diputar 45 derajat sehinnga membentuk belah ketupat, etc) • Jenis simbol limbah B3 (terdapat 9 jenis simbol limbah B3 untuk penandaan karakteristik limbah, yaitu untuk: limbah B3 mudah meledak, mudah menyala, padatan mudah menyala, limbah B3 reaktif, limbah B3 beracun, limbah B3 korosif, limbah B3 infeksius, limbah B3 berbahaya terhadap perairan. • Label limbah: terbagi atas 3 jenis, yakni: label limbah untuk wadah/kemasan, label limbah untuk kemasan kosong, label limbah untuk penunjuk penutup wadah. • Pelekatan simbol tebagi atas: a) pelekatan simbol pada wadah/kemasan, simbol pada kendaraan pengangkut limbah B3, simbol pada tempat penyimpanan. • Pelekatan label limbah terbagi atas: yakni: label limbah untuk wadah/kemasan, label limbah untuk kemasan kosong, label limbah untuk penunjuk penutup wadah. • pelekatan simbol pada wadah/kemasan, terbagi atas 6 keadaan (korosif, reaktif, mudah menyala & reaktif, korosif & reaktif, korosif, mudah menyala dan reaktif; korosif, mudah menyala & reaktif), pelekatan simbo pada tempat penyimpanan, pelekatan simbol pada alat angkut. Note: tidak spesifik PCBs masuk kriteria apa gambar dan pelekatan simbolnya.

ANNEX 3: PCB Official Guidance

DRAFT

May 05th, 2016

Polychlorinated Biphenyls (PCB) Official Guidance

Version 1.0

DRAFT

May 05th, 2016

Contents

DRAFT

May 05th, 2016

1. Introduction

a. About PCB

Polychlorinated Biphenyl (PCBs) is a type of Persistent Organic Pollutants (POPs). Exposure to PCB is associated with certain type of cancers, heart disease, endocrine disruptions, reproductive problems and many other adverse health effects. Very high exposure to PCB will lead to liver damage and damage to the nervous system.

As POP, PCBs can accumulate in human body and the ecosystem throughout the years. They can be passed on through the food chain, with concentration levels increases as passes the next level of the food chain. PCB can be passed from mother to children through breastfeed.

PCBs are usually marketed in mixtures. As they have good insulating properties, they are often utilized in electrical equipments. In the past, there have been other uses which do not correspond to electrical equipments.

b. Purpose

The Government of Indonesia ("GoI") has ratified the three conventions on Persistent Organic Pollutants: the Stockholm, Basel and Rotterdam Conventions and thus have international obligation to ensure that such conventions are implemented.

Through the Indonesian National Action Plan on Persistent Organic Pollutants, the GoI have committed to initiate the phasing-out and elimination of PCBs as will be outlined below. The 2014 POPs Action Plan specifically outlined GoI's commitment to strengthen institutional capacity, harmonize the regulation of B3 and B3 wastes in relation to PoPs and conduct effective law enforcement with regards to POPs.

This OG is intended to facilitate those objectives by clarifying the procedures and mechanism for the phasing-out and elimination of PCBs to affected parties.

c. Version

This OG is subject to amendment from time to time. The OG's version incorporates law and legislations at the issue date. **Any regulatory changes beyond the issue date are not incorporated in the OG**. Readers must consult with prevailing laws and legislations.

Version: 1.0

Issue Date: May 05th, 2016

2. Definitions

a. "Polychlorinated Biphenyl" or "PCB" is a chemical substance as referred in Annex A, Part I of the Stockholm Convention on Persistent Organic Pollutants (POPs); Government Regulation 74 Year 2001 on the Management of Dangerous and Toxic Substances (B3) Annex II, Table 1 and Government Regulation 101 Year 2014 on the Management of Dangerous and Toxic Substances (B3) Article 107 and its Attachments.

b. "Articles" means dielectric fluid containers, electrical equipments, machineries or other equipments;

c. "Substance" means any organic or inorganic substance of a particular molecular identity, including any combination of such substances occurring in whole or in part as a result of a chemical reaction or occurring in nature;

d. "Mixture" means a combination of two or more substances

e. "PCB Object" is any Article, Substance or Mixture **with a Polychlorinated Biphenyl concentration of 50 ppm (parts per million) or more**

f. "Phasing Out" means stages towards the removal of PCB Object from use and the termination of PCB Substance and Mixture

3. Scope of Application

This Official Guidance covers PCB Object as defined in Part 2.e. above

4. Regulatory Background

Polychlorinated Biphenyls is regulated under international and nationals laws of several jurisdictions, including Indonesia. The three main conventions regulating PCBs are the Rotterdam, Basel and Stockhom Conventions on Persistent Organic Pollutants, all of which [have been ratified] by Indonesia. In the United States, PCB is regulated under [TSCA] while in the European Union, it is regulated under [CFR]. Several ASEAN countries have regulated PCBs in their respective territories.

a. Conventions and Treaties

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal ("Basel Convention")

Annex I: Categories of Waste to Be Controlled (Waste Streams)	Y10	Waste substance and articles containing or contaminated with PCBs and/or Polychlorinated terphenyls (PCTs) and/or Polybrominated biphenyls (PBBs).
Annex VIII, List A A1. Metal and Metal-Bearing Waste	A1180	Electrical waste and electronic assemblies or scarp (e-waste) containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCBs capacitors, or contaminated with Annex I constituents (e.g. cadmium, mercury lead, polychlorinated biphenyl) to an extent that they possess any of the

		characteristics contained in Annex III (note the related entry on list B B1110)[1]
	A1190	Waste metal cables coated or insulated with plastics containing or contaminated with col tar, PCB[2], lead, cadmium, other organohalogen compounds or other Annex I constituents to an extent that they exhibit Annex III characteristics.
Annex VIII, List A A3. Waste Containing Principally Organic Constituents, Which May Contain Metals and Inorganic Materials	A3180	Waste substances and articles containing, consisting of or contaminated with polychlorinated biphenyl (PCB), polychlorinated terphenyl (PCT), polychlorinated naphthalene (PCN) or polybrominated biphenyl (PBB), or any other polybrominated analogues of these compounds, at a concentration level of 50 mg/kg or more[3].

Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade ("Rotterdam Convention")

The Stockholm Convention on Persistent Organic Pollutants ("Stockholm Convention")

Substances	Category Under GR No. 74/2001	Category Under

[1] PCBs are at a concentration level of 50 mg/kg or more

[2] Ibid

[3] The 50 mg/kg level is considered to be an internationally practical level for all wastes. However, many individual countries have established lower regulatory levels (e.g. 20 mg/kg) for specific wastes.

		Stockholm Convention
PCBs	B3 that is forbidden to be used CAS: 1336-36-3 Synonym: Polychlorinated Biphenyls; Chlorobiphenyls; Aroclor; Clophen; Fenclor; Kenachlor; Phenochlor; Pyralene; Santotherm. Molecule formula: C12X X=H or C	Annex A and C

b. International Regulations

In the United States (US), the use of PCB has been banned since 1979 under Toxic Substances Control Act (TSCA). The TSCA prohibits the manufacture, processing, use and distribution of PCBs.[4] In June 1998, US EPA amended the PCBs and PCBs contaminated equipment regulations into the PCB Mega Rule. The Mega Rule has detailed specification regarding PCBs (concentration) and PCBs contaminated equipment. The examples are as follows5:

A transformer is considered contaminated if it contains more than 50 ppm of PCBs but less than 500 ppm of PCBs;

Electrical equipment manufactured after July 2, 1979, is non-PCB (i.e., < 50 ppm PCBs). If the date of manufacture of mineral oil-filled electrical equipment is unknown, any person must assume it to be PCB-Contaminated;

Mineral oil-filled electrical equipment that was manufactured before July 2, 1979, and whose PCB concentration is not established is PCB-Contaminated Electrical Equipment (i.e., contains ≥50 ppm PCB, but < 500 ppm PCB).

[4] EPA Bans PCB Manufacture; Phases Out Uses, Press Release, April 19, 1979
[5] PCB Mega Rule Sec.761.2

In the European Union, the use of PCB in open applications (e.g. printing inks, adhesives) has been banned since 1976, based on Directive 76/403/EEC). In addition, the use of PCBs as a chemical intermediate or as a raw material has been banned since 1985, under Directive 85/467/EEC 6th amendment to Directive 76/769/EEC. Almost all of EU member states use the EU Directive limit (50ppm) to determine whether a material is contaminated with PCB or not in which this limit is relevant to the Stockholm Convention. However, some countries have more stricter limit such as the Netherland (0,5 ppm per 7 congeners), Austria (30 ppm) and Norway (zero limit but in practice 50 ppm limit is acceptable) (Enno Christian, 2005).

Since the Stockholm Convention has been in force since 2004, most of the Member States have initiated necessary measures to implement the convention and promote environmentally sound management of PCBs. With regards of EU, it was stated that although the EU community has already had legal instruments that is relevant to the Stockholm Convention, it is responsible to perform obligations imposed by the convention[6].

c. Lex Specialis

The management and disposal of hazardous materials in Indonesia is regulated by various implementing regulations. This Official Guidance and the accompanying Code of Practice adopt a lex specialis principle, which means that any pre-existing norms on the management and treatment of hazardous substances and materials are to be superseded by this Guidance, insofar as it pertains Polychlorinated Biphenyls. The non-exhaustive list of regulations that are being superseded are listed in Annex of this Guidance.

[6]Stockholm Convention on Persistent Organic Pollutant (POPs) http://www.pops.int/documents/signature/signstatus.htm

5. Phasing Out

This Guidance impose four deadlines for the phasing out of PCB in Indonesia, as follows:

a. Deadline for 500 ppm (Use of equipment)

Equipments containing PCB with concentration of 500 ppm or more should no longer be used after **January 1, 2018**

b. Deadline for 50 ppm (Use of equipment)

Equipments containing PCB with concentration of 50 ppm or more should no longer be used after **January 1, 2028**

c. Deadline for storage

Pursuant to Government Regulation 101 Year 2014 on the Treatment of Hazardous Wastes, PCBs are listed as Category 1 waste. Storage are permitted for, at maximum, 180 days for waste which are produced with a quantity of less than 50 kg/day or at maximum, 90 days, for waste which are produced at or more than 50kg/day.[7]

Production	Maximum Storage Period
< 50 kg/day	180 days
≥ 50 kg/day	90 days

d. Deadline for disposal

P.C.B should have been fully treated before [*]

[7] Peraturan Pemerintah Republik Indonesia Nomor 101 Tahun 2014 Tentang Pengelolaan Limbah Bahan Berbahaya Dan Beracun. Article 28 (1) (b)

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6. Management and Disposal

a. Restrictions of Use

PCB containing transformers [**low call: transformers containing pure PCB oil**] shall not be kept in operation in densely-populated areas, public areas (parks, schools), sensitive areas such as hospital or areas used for the production of food and beverages.

b. Maintenance

Maintenance of PCB containing transformers shall not cause cross-contamination of PCBs between transformers. Anyone in charge with the maintenance of PCB containing transformers must exercise due-dilligence to ensure that such cross-contamination does not occur. [**See: Code of Practice Cahpter II part 1.8.]**

c. Storage

The storage of PCB waste must fulfil prerequisites with respect to (i) maximum storage period, (ii) technical requirements, (iii) emergency planning, (iv) monitoring and site inspection and (v) 1.5. Design considerations for a centralized PCB storage facility, pursuant to PCB Code of Practice [**See Code of Practice, Chapter II especially part 1.2-1.5**].

i. Maximum Storage Period

As the risk of contamination increases with the quantity of materials being stored, the maximum period allowed for storage are reduced along with the increase of quantity. As previously

mentioned, the maximum period of PCB storage according to GR 101 are as follows:[8]

Production	Maximum Storage Period
< 50 kg/day	180 days
≥ 50 kg/day	90 days

ii. Fire Norms

Ministry of Public Works Regulation 20/PRT/M/2009 regulates fire norm in urban areas ("Fire Regulation"). The Fire Regulation require appropriate documentation in ground plan and site-map, concerning areas where Hazardous Materials are stored.[9] Furthermore, Fire Regulation require Hazardous Materials Safety Plan to be invoked by building management.[10]

Chambers or rooms which should not be suppressed by water following a fire incident must be properly documented and communicated to building inspectors and fire officers.[11]

PCB contaminated oil are flammable. The Fire Regulation contained detail standard and conditions on the treatment of flammable materials, building design and fire management ("*Manajemen Proteksi Kebakaran"* or "MPK"). Fire Regulation, to the extent applicable, may also require fire drill to be exercised.

The Indonesian National Standard (SNI) contain several standards on fire protection. In addition, each regions/city/regency (daerah/kabupaten/kota) may regulate fore norms in further details. Anyone in charge with the storage of PCB must consult these regulations and standard and be kept

[8] ibid. Article 28 (1) (b)
[9] Peraturan Menteri Pekerjaan Umum Nomor. 20 Tahun 2009 Tentang Pedoman Teknis Manajemen Proteksi Kebakaran di Perkotaan. See Chapter III, para 1.2 also Chapter 3 Part 6b.
[10] ibid. See Chapter IV part 4.3
[11] ibid. See attachment 4

informed of any amendments or revision of such regulations and standard.

Specific prerequisites on fire accident prevention and management are outlined in Code of Practice [**See Chapter II para 1.3**]

d. Packaging

PCB Object, both those which are still in use and have been classified as waste are subject to packaging and labelling rules.

i. In use

PCB-containing equipments which are still in use (for example, transformers) must comply with packaging rules under Government Regulation No 74 Year 2001 ("GR 74"). This requirement is also applicable to transformers.

For the purpose of this OG, Transformers containing PCB oils which are *being used* (installed and operating) are regarded as its package. This comes with a monitoring obligation. Anyone still using PCB containing transformers pursuant to Para 5 regulating phasing-out above are required to regularly monitor the condition of each transformers. This is not required by GR 74 but is required by this guideline under the lex specialis principles.

GR 74 require B3 to be properly labelled and supplied with Material Safety Data Sheet (MSDS). Anyone using PCB Object are required to furnish the container with appropriate label. This is not required by GR 74 but is required by this guideline under the lex specialis principles.

ii. Waste

PCB Object which already expires or no longer in use are subjected to waste packaging rules under Government Regulation 101 Year 2014 ("GR 101"). Article 19 of GR 101

contain general prerequistes on packaging and labelling of B3 wastes.

iii. Liquid and Solid PCBs

The Code of Practice does not differentiate the packaging between waste and PCBs which are still in use. Nevertheless, it differentiates between liquid and "solid" PCBs. Transformers are regarded as "solid" PCBs. When the packaging of transformers are not feasible for transportation, the Code of Practice prescribes that the transporter shall be fitted with a leakprof metal tray with certain specifications.

The packaging for PCB containing transformers which are in storage or being transported shall refer to **Code of Practice, Chapter II.**

e. Transportation

i. In use

Government Regulation 74 Year 2001 (GR 74) on the Management of B3 require transporters to be equipped with Materials Safety Data Sheet (MSDS).[12] Further, GR 74 refer to prevailing transportation regulations in terms of the roadworthiness of each vehicle.

ii. Waste

[12] Peraturan Pemerintah Republik Indonesia Nomor 74 Tahun 2001 Tentang Pengelolaan Bahan Berbahaya Dan Beracun.Article 12

GR 101 require that all category 1 wastes, including PCBs, to be transported only using closed container.[13] The GR further require recommendation and B3 waste management license (Izin Pengelolaan Limbah B3) for transporters.[14] The recommendation is a prerequisite for obtaining license and must be obtained from the Minister of Environment.

In order to obtain recommendation, a series of prerequisites must be fulfilled by the applicant, as stipulated in detail in GR 101 Article 48. This includes, among other, legal corporate documents, evidence of vehicle ownership and one of the most important prerequisite, evidence of participation at an environmental guaranytee fund.

After recommendation is obtained, applicant shall propose to obtain B3 waste management license from the Ministry. Only after the license is granted can transportation operation commences. Transporters must deliver manifest to the ministry and report some details pertaining its transport, such as the name (of waste), quantity, the vehicle used to transport, the destination and evidence of waste transfer.

f. Accident and Emergency Response

i. In use

General measures for accident and emergency response is regulated in GR 74. Under GR 74, anyone in charge with managing B3 is under obligation to (i) isolate, (ii) mitigate, (iii) report the incident to local authorities, (iv) provision information to local communities.[15] Local government must undertake all necessary steps after receiving report of such incidents.

[13] Peraturan Pemerintah Republik Indonesia Nomor 101 Tahun 2014 Tentang Pengelolaan Limbah Bahan Berbahaya Dan Beracun (n 7). Article 47
[14] ibid. Article 48
[15] Peraturan Pemerintah Republik Indonesia Nomor 74 Tahun 2001 Tentang Pengelolaan Bahan Berbahaya Dan Beracun (n 12). Article 25

ii. Waste

General measures for accident and emergency response is regulated in GR 101 in the form of (i) provision of information to local communities through both printed and electronic media that a contamination has occurred within 24 hours after the incident or after it become known, (ii) isolation of affected areas (including evacuation, control, reporting to authorities as well as identification and determination of hazardous area), (iii) cessation of contamination on the source (production process must be stopped, all activities around the area must be suspended, mitigation measures reported to authorities) and/or (iv) other measures according to science and technology.

Anyone producing or handling B3 waste are also required to enact an emergency preparedness and response system.[16] The system must provide adequate (i) infrastructure (which includes facilities, equipment, coordination, organisation, procedures and training) and functions (identification, reporting, activation, mitigation, emergency protection, information dissemination and protection of local communities).

g. Decontamination and Recovery

GR 101 contain lengthy provision on the recovery of environmental functions, which consist of, in general: (i) cessation of contamination at the source and identification measures, (ii) remediation, (iii) rehabilitation, (iv) rehabilitation, (v) restoration and/or other measures.[17] Each of these must be formulated in an environmental recovery plan and must be approved by the Minister of Environment

[16] Peraturan Pemerintah Republik Indonesia Nomor 101 Tahun 2014 Tentang Pengelolaan Limbah Bahan Berbahaya Dan Beracun (n 7). Article 220
[17] ibid. Article 203

before being implemented.[18] The process of recovery are deemed to have been completed only when approved by the Minister.[19]

h. Disposal

GR 101 provide options for both thermal and non-thermal treatment of B3 wastes.[20] However, the GR also stipulate that any treatment options must take into account environmental standard and environmental quality standard. Thermal treatment of PCB may cause the unintentional release of dioxin-furan (DF). The Stockholm Convention requires parties to prevent the unintentional release of DF. To that extent, the Indonesian Government will only allow for non-thermal treatment of PCBs.

All details pertaining waste treatment is regulated under Chapter 2 of GR 101. Specifically for PCBs, the GR stipulates that the DE/DRE rate must be at least 99,9999%.

7. Liabilities

COMPLIANCE WITH THE OFFICIAL GUIDANCE AND THE CODE OF PRACTICE CANNOT, IN ANY CIRCUMSTANCES, BE CONSTRUED AS A MEASURE TO PREVENT, REDUCE OR AVOID LIABILITY IN THE EVENT OF CONTAMINATION OR EXPOSURE.

Indonesian Environmental Law at Article 88 stipulates that:

"Anyone, whose action, business or activities utilize B3, produces and/or manage B3, and/or cause serious threat to the environment **is strictly liable for any losses, without the need to prove the element of 'fault'."**

[18] ibid. Article 208
[19] ibid. Article 210
[20] ibid. Article 100

In other words, when a contamination or exposure occur, any previous effort to prevent contamination, including strict compliance with this guideline and the accompanying code of practice will not in any circumtances lessen or avoid the burden of liability. Ths strict liability principle is further detailed under Article 39 (1) of GR 74.

8. Tracking, Monitoring and Evaluation

a. Labelling

The labelling for B3 is regulated in general under Ministry of Environment Regulation 03 Year 2008 (Permen LH 03/2008) on The Symbol and Labelling of B3.[21] Under the Globally Harmonized System (GHS), PCB hazard is coded as H373, H400 and H410 and the Pictogram is coded under GHS08 and GHS09. The legal basis for GHS is Minister of Industry Regulation No. 87/M-IND/PER/9/2009 on Globally Harmonized System of Classification and Labeling of Chemicals as amended by Minister of Industry Regulation No. 23/M-IND/PER/4/2013.

GHS09 GHS08

As mentioned earlier, under GHS PCB is coded as GHS09 and GHS08. This corresponds to Picture 8 (dangerous to the environment) and Picture 9 (carcinogenic, tetragenic and mutagenic) substances of Attachement of Permen LH 03/2008.

[21] Peraturan Menteri Negara Lingkungan Hidup Nomor 3 Tahun 2008 Tentang Tata Cara Pemberian Simbol Dan Label Bahan Berbahaya Dan Beracun.

Any articles/equipment, mixtures or susbtances containing PCBs which are in use or in the form of waste must be labelled according to the above pictograms. The detail labelling procedure must refer to **Code of Practice Chapter IV section 1.6.**

b. Registration

GR 74 puts a one-time obligation to register on importer or producer of B3.[22] In the event that such B3 has been circulated but has not been registered on import or production, GR 74 Article 41 impose mandatory registration to B3 owners (users, distributors or keepers). This provision is applicable to PCB owners.

Any articles/equipments, substance or mixture containing PCBs which are in use or classified as waste must be registered to the government. Anyone using PCB or producing PCB waste must fill in PCB questionnaire survey as stipulated under **Chapter IV section 1 of the Code of Practice**. Form A is mandatory for both "in use" and "waste". Form B is mandatory for "in use" PCBs and form C is mandatory for "waste" PCBs.

c. Monitoring

PCB owners are required to (i) allow and facilitate supervisors to enter location where PCB equipment/articles, substance or mixture is placed, (ii) allow and facilitate supervisors to take samples, (iii) provide accurate information, both written and verbal, (iv) allow and facilitate supervisors to take photograph on-site.[23]

[22] Peraturan Pemerintah Republik Indonesia Nomor 74 Tahun 2001 Tentang Pengelolaan Bahan Berbahaya Dan Beracun (n 12).
[23] ibid. Article 30

d. Reporting

GR 74 impose reporting obligation to B3 owners every 6 months to the Ministry.[24]

9. Enforcement and Sanctions

The Indonesian Environmental Law 32 Year 2009 contain various criminal, administrative and civil penalties for violation of its provisions. GR 74 contain administrative sever al sanctions while GR 101 contain detail administrative penalties. The following is a non-exhaustive list of relevant provisions under the above regulations:

- Pollution and environmental destruction (Article 69.1.a of Law 32)
- Importation of prohibited B3 (Article 69.1.b of Law 32)
- Importation of B3 wastes (Article 69.1.d of Law 32)
- Dumping of B3 and B3 waste to the environment (Article 69.1.f of Law 32)

In terms of pollution, there are criminal sanctions associated with violation of environmental standards: ambient air/water quality, sea water quality and standard criteria for environmental destructions. When the standards are surpassed, the law impose imprisonment and financial penalties, depending on the severity of conduct. This is regulated in Law 32 under Articles 98 (in case of deliberate conduct) and 99 (for omission). Similarly, importation of B3 waste (Article 106 of Law 32) and importation of *prohibited* B3 waste (Article 107 of Law 32) entails imprisonment and financial penalties.

10. Annex: Code of Practice

11. List of Relevant Regulations

[24] ibid. Article 31

ANNEX 4: PCB Code of Practice

Chapter I: National and International Regulation

1. Indonesian Legislation related to PCB

1.1. See PCB Official Guidance

2. International regulation on PCBs storage, transportation and disposal

2.1. The USA CFR 761

Of particular interest for the storage of PCBs is the USA Code of Federal Regulation 761, firstly promulgated on February 17, 1978 and, amended on June, 1998 [63 *Federal Register* (*FR*) 35384].

The TSCA regulations in 40 *CFR* Part 761 distinguishes between two different types of storage: storage for use or reuse and storage for disposal. Storage for reuse is of concern for PCBs containing equipment awaiting installation, servicing, repair, refilling, use as a spare or replacement, or emergency use. Storage for disposal concerns PCBs waste and PCBs containing equipment that is unfit for service, unauthorized for servicing or use, considered or declared a waste, or destined for disposal. The regulations for storage for use or reuse are generally less stringent than those for storage for disposal.

Liquids containing more than 50 ppm of PCBs (i.e., dielectric fluid) must be stored in PCB storage units meeting the requirements of 40 *CFR* Part 761.65(b)(1) or (b)(2). PCB Articles that are stored for use or reuse for a storage period of five or more years must be stored in a PCB storage unit meeting the requirements of 40 *CFR* Part 761.65(b)(1) or (b)(2). All PCBs and PCB Items stored for disposal for a storage period over 30 days must be in a PCB storage unit meeting the requirements of 40 *CFR* Part 761.65(b)(1) or (b)(2) also. All PCB bulk product waste or PCB remediation waste not in a 30-day temporary storage or 180-day, on-site storage unit must be stored in a PCB storage unit also meeting the requirements of 40 *CFR* Part 761.65(b)(1)or (b)(2).

PCB Large High Voltage Capacitors containing PCBs (i.e., capacitors with more than 3 lbs. of dielectric fluid and designed for 2000 volts, AC or DC) and undrained PCB contaminated electrical equipment may be stored outside adjacent to a PCB storage unit meeting the requirements of 40 *CFR* Part 761.65(b)(1) or (b)(2), if they are (1) structurally undamaged and non-leaking, (2) palletized, (3) inspected weekly, and (4) stored outside only when the remaining space inside the PCB storage unit is limited.

A temporary storage unit is a storage unit in which PCB waste may be stored for 30 days or less from the date of removal from service and that does not have to meet the requirements of 40 *CFR* Part 761(b)(1) or (b)(2). However, a temporary storage unit must meet the following conditions: (1) only non-leaking PCB articles and PCB equipment may be stored, (2) leaking PCB articles or PCB equipment must be placed into a non-leaking container with sufficient sorbent material, (3) a Spill Prevention Control and Countermeasures (SPCC) Plan is in effect for any stored liquid with 50 ppm of PCBs or more concentration (see last question), (4) the unit is marked, and (5) any item of movable equipment that has come into contact with PCBs must be decontaminated before removal from the unit.

Any PCB waste must be disposed of within one year from the date it was determined to be a PCB waste and the decision was made to dispose it.

Under 40 *CFR* Part 761.65(b)(1), the facilities for PCBs storage shall meet the following criteria:

I. “Adequate roof and walls to prevent rain water from reaching the stored PCBs and PCB Items;
II. An adequate floor that has continuous curbing with a minimum 6 inch high curb. The floor and curbing must provide a containment volume equal to at least two times the internal volume of the largest PCB Article or PCB Container or 25 percent of the total internal volume of all PCB Articles or PCB Containers stored there, whichever is greater. PCB/radioactive wastes are not required to be stored in an area with a minimum 6 inch high curbing. However, the floor and curbing must still provide a containment volume equal to at least two times the internal volume of the largest PCB Container or 25 percent of the total internal volume of all PCB Containers stored there, whichever is greater.
III. No drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from the curbed area;
IV. Floors and curbing constructed of Portland cement, concrete, or a continuous, smooth, non-porous surface as defined at §761.3, which prevents or minimizes penetration of PCBs.
V. Not located at a site that is below the 100-year flood water elevation.”

2.2. UE directive on PCBs

The UE directive on PCBs (Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls) does not contain any specific provision on the safe storage of PCBs. The directive requires that Member States shall individually or jointly take the necessary measures to develop installations for the disposal, decontamination and safe storage of PCBs, used PCBs and/or equipment containing PCBs.

Therefore, the safe storage of PCBs equipment is regulated under each Member State’s legislation, whilst at EU level the storage of PCBs is regulated under the legislation on hazardous waste. The EU legislation (directive 2008/98 on waste) identifies as storage the disposal operation D15 (Storage pending a disposal operation, excluding temporary storage, pending collection, on the site where the waste is produced) and R15 (Storage of waste pending any recovery operation excluding temporary storage, pending collection, on the site where the waste is produced)

2.3. European Union BAT / BEP.

The European Commission, after a 2 year review process, adopted a proposal for a Directive on Industrial Emissions (Integrated Prevention and Pollution Control), and a Communication “Towards an improved policy and industrial emissions”. The proposed directive recast seven existing directives, including the the IPPC Directive, the Large Combustion Plants Directive, the Waste Incineration Directive, the Solvents Emissions Directive and 3 Directives on Titanium Dioxide.

The main technical pillar of the EU IPPC is the guidance provided by BREFs documents (the BAT and BEP Reference documents). These documents (available at http://eippcb.jrc.ec.europa.eu/reference/ analyse the technologies which have to be considered at EU level as reference BAT, and cover several sectors, of which the ones which are most interesting from the point of view of PCBs disposal are:

- Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector;
- Waste Incineration;
- Waste Treatment Industries.
- General principle of Monitoring

Although these documents have been drafted having as target the European Member States, the information they contain is mainly technical and is used as BAT technical reference in many countries, even though some of the BAT technologies or some of the capability needed to operate these technologies may be not readily

available in all countries. Extensive reference has been made to the European BREF documents in drafting the Stockholm Convention Guidelines on Waste Incineration and Waste Treatment .

3. International Treaties and Conventions related to PCB

3.1. Stockholm Convention

Definition of PCBs. The Stockholm Convention sets the following definition of PCBs under annex C (Unintentional Production):

(a) "Polychlorinated biphenyls" means aromatic compounds formed in such a manner that the hydrogen atoms on the biphenyl molecule (two benzene rings bonded together by a single carbon-carbon bond) may be replaced by up to ten chlorine atoms;

No specific requirements on packaging and transportation of PCBs equipment and PCBs waste have been set by the Stockholm Convention.

3.2. Stockholm Convention BAT / BEP

The definition of disposal in compliance of Article 6.1(d)(ii) of the Stockholm Convention on Persistent Organic Chemicals is that Stockpiles of POPs and waste contaminated by POPs must be

- *Disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed so that they do not exhibit the characteristics of persistent organic pollutants*
- *or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option or the persistent organic pollutant content is low,*
- *taking into account international rules, standards, and guidelines,…. and relevant global and regional regimes governing the management of hazardous wastes"*

Article 5 and Annex of the Stockholm Convention establishes that measures shall be established to reduce or eliminate releases from unintentional production.

More specifically, Annex V establishes that the use of best available techniques for new sources must be promoted and required; and that in any case, *"the requirement to use best available techniques for new sources in the categories listed in Part II of that Annex shall be phased in as soon as practicable but no later than four years after the entry into force of the Convention for that Party. For the identified categories, Parties shall promote the use of best environmental practices. When applying best available techniques and best environmental practices, Parties should take into consideration the general guidance on prevention and release reduction measures in that Annex and guidelines on best available techniques and best environmental practices to be adopted by decision of the Conference of the Parties;"*

The same annex provides also a definition for BAT and BEP, techniques and sources as following:

(i) "Best available techniques" means the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for release limitations designed to prevent and, where that is not practicable, generally to reduce releases of chemicals listed in Part I of Annex C and their impact on the environment as a whole. In this regard:

(ii) "Techniques" includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;

(iii) "Available" techniques means those techniques that are accessible to the operator and that are developed on a scale that allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages; and

(iv) "Best" means most effective in achieving a high general level of protection of the environment as a whole;

(v) "Best environmental practices" means the application of the most appropriate combination of environmental control measures and strategies;

(vi) "New source" means any source of which the construction or substantial modification is commenced at least one year after the date of:

a. Entry into force of this Convention for the Party concerned; or

b. Entry into force for the Party concerned of an amendment to Annex C where the source becomes subject to the provisions of this Convention only by virtue of that amendment."

Guidance on BAT and BEP for disposal of PCBs is provided under the *"Guidelines on best available techniques and provisional guidance on best environmental practices European Union BAT / BEP"*

Of particular relevance are:

- Section V, Part II Source Category (a): waste incinerators
- Section V, Part II Part II Source category (b): Cement kilns firing hazardous waste

It should be noted that the BAT/BEP guidelines do not differentiate among "combustion" or "non-combustion" technologies. The presence or absence of a combustion process is not considered a relevant criterion for selecting or discarding a technology. However, the whole Section II of the Guideline discusses how alternatives should be evaluated in selecting a technology. The Stockholm Convention requires that a sound assessment of the alternatives should be carried out, including in the assessment also the technologies that, due to their specific and intrinsic features, ensure that the emission of UP-POPs is kept at a minimum or even completely avoided. This concept is well described in the following sentence extracted from section II of the BAT/BEP guidelines:

"When a Party requires the application of best available techniques for a proposed new source of chemicals listed in Annex C, decision makers are encouraged to assure that consideration is also given to alternatives that avoid the formation and release of such chemicals. In doing this, they should undertake a comparison of the proposed process, the available alternatives and the applicable legislation using what might be termed a "checklist approach", keeping in mind the overall sustainable development context and taking fully into account environmental, health, safety and socio-economic factors."

"A proposed alternative should be given priority consideration over other options, including the originally proposed facility, if, based on the comparative evaluation described in subsection 3 above, and using relevant considerations and criteria from Convention Annex F and Annex C, an identified, available alternative is determined to:

- *Avoid the formation and release of chemicals listed in Annex C;*
- *Have similar usefulness;*
- *Fit comparatively well within a country's sustainable development plans, taking into account effective integration of social, economic, environmental, health and safety factors."*

On the selection of alternatives, a recent advisory document drafted by STAP[1] remarks that the *"policy of GEF is currently not to impose more restrictive requirements on developing countries and Countries with Economy in Transition than are being applied in developed countries."*

In the selection of alternatives it is also crucial to recognize that disposal is only part of the POPs management process, and that the comparison of alternative technologies must take into account, by means of formal evaluation instruments like EIA, the site features where the disposal facility has to be established.

3.3. Basel Convention

Indonesia has ratified the Convention through the Presidential Decree No. 61/1993 on Basel Convention Ratification and the Presidential Regulation No. 47/2005 on the Ratification of the Amendment of Basel Convention. Hazardous and Toxic waste in Indonesia are classified as B3 waste. In general, GR No. 101 of 2014 covers the following: identification, elimination, storage, collection, transportation, utilisation, management, stockpilling, dumping, transboundary movement, environmental pollution control and environmental damage and environmental rehabilitation, emergency response.
Based on the GR, a waste containing persistent organic pollutants compounds such as PCBs is categorized as hazardous and toxic waste. It is listed under the attachment of the GR, Table 1, (category of B3 from unspecific source, coded with A101d) and IS classified as hazard category 1.

The Government Regulation No. 101 of 2014 on the Management of Hazardous and Toxic Waste reflects the implementation of the Basel Convention as it not only regulates the management of B3 but also the transboundary movement of B3. Nevertheless, it does not comprehensively adopt several Annexes of the Convention which classify article containing or contaminated with PCBs and categorised as hazardous and toxic waste.

The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as "hazardous wastes" based on their origin and/or composition and their characteristics, as well as two types of wastes defined as "other wastes" (household waste and incinerator ash; article 1 and annex II).

The provisions of the Convention center around the following principal aims: (i) the reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal; (ii) the restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management; and (iii) a regulatory system applying to cases where transboundary movements are permissible.

Article 1 of the convention ("Scope of Convention") outlines the waste types subject to the Basel Convention. Subparagraph 1 (a) of that Article sets forth a two-step process for determining whether a "waste" is a "hazardous waste" subject to the Convention: first, the waste must belong to any category contained in Annex I to the Convention ("Categories of Wastes to be Controlled"), and second, the waste must possess at least one of the characteristics listed in Annex III to the Convention ("List of Hazardous Characteristics").

Annex I of the convention lists the waste to be controlled, of which the following are PCBs containing waste:

- **Y10**. Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs)

[1] Selection of Persistent Organic Pollutant Disposal Technology for the Global Environment Facility A STAP advisory document, November 2011

- **Y45**. Organohalogen compounds other than substances referred to in this Annex (e.g., Y39, Y41, Y42, Y43, Y44)

Some other waste listed in Annex I may contain PCBs under certain circumstances:

- Y6 Wastes from the production, formulation and use of organic solvents
- Y8 Waste mineral oils unfit for their originally intended use
- Y9 Waste oils/water, hydrocarbons/water mixtures, emulsions
- Y11 Waste tarry residues arising from refining, distillation and any pyrolytic treatment
- Y12 Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish
- Y13 Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives
- Y14 Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known
- Y18 Residues arising from industrial waste disposal operations
- Y39 Phenols; phenol compounds including chlorophenol
- Y41 Halogenated organic solvents
- Y42 Organic solvents excluding halogenated solvents
- Y45 Organohalogen compounds other than substances referred to in this Annex (e.g., Y39, Y41, Y42, Y43, Y44)

List A of Annex VIII describes wastes that are "*characterized as hazardous under Article 1 paragraph 1(a) of this Convention*" although "*designation of a waste on Annex VIII does not preclude the use of Annex III (hazard characteristics) to demonstrate that a waste is not hazardous*" (Annex I, paragraph (b)). List B of Annex IX lists wastes which "*will not be wastes covered by Article 1, paragraph 1 (a), of this Convention unless they contain Annex I material to an extent causing them to exhibit an Annex III characteristic*". The following Annex VIII waste categories in particular are applicable to PCBs, PCTs or PBBs:

- A1180 Waste electrical and electronic assemblies or scrap [2] containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III;
- A3180 Wastes, substances and articles containing, consisting of or contaminated with polychlorinated biphenyl (PCB), polychlorinated terphenyl (PCT), polychlorinated naphthalene (PCN) or polybrominated biphenyl (PBB), or any other polybrominated analogues of these compounds, at a concentration level of 50 mg/kg or more.

Guidance on storage of PCBs is provided under the Technical Guidelines and Guidance Documents issued under the Basel Convention. The "Updated general technical guidelines for the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants (POPs)" establish under section B 3 (Specifications for containers, equipment, bulk containers and storage sites containing POPs) that :

"To meet the requirements of ESM and specific clauses in the Basel and Stockholm conventions (for example, Basel Convention Article 4, paragraph 7, and Stockholm Convention article 6, paragraph 1), Parties may need to enact specific legislation that describes the types of containers and storage areas that are acceptable for

[2] This entry does not include scrap assemblies from electric power generation.

particular POPs. Parties should ensure that containers that may be transported to another country meet international standards such as those established by the International Air Transport Association (IATA), the International Maritime Organization (IMO) and the International Organization for Standardization (ISO)."

Technical specification on the safe storage of POPs containing waste is provided under section F (Handling, collection, packaging, labelling, transportation and storage) of the same guidance document, reported in Annex I. It is important to remark that the guidelines issued under the Basel convention concern only PCBs containing waste. Specific guidance for PCBs containing or contaminated equipment which is not waste (for instance, online equipment or equipment store pending installation or maintenance) is not covered by the Basel Convention.

The Basel Guidelines, as periodically amended and adopted by the Convention constitute basic guidance and minimum standards applied to POPs stockpiles and waste disposal technology used in GEF funded projects. Of particular relevance to the disposal of PCBs are the following guidelines documents, available under the Basel Convention website [3]

- Technical guidelines for the environmentally sound management of wastes consisting of, containing or contaminated with polychlorinated d biphenyls (PCBs), polychlorinated terphenyls (PCTs) or polybrominated biphenyls (PBBs);
- Updated general technical guidelines for the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants (POPs).
- Technical guidelines on the environmentally sound co-processing of hazardous wastes in cement kilns (adopted at COP10)
- Technical guidelines on the environmentally sound management of wastes containing or contaminated with unintentionally produced PCDDs, PCDFs, HCB or PCBs

3.4. UN ADR

The "Agreement concerning the International Carriage of Dangerous Goods by Road " (ADR Rules) . (established by the United Nations Economic Commission for Europe), commonly known as ADR rules, represents the standard international reference for packaging, transportation and consignment of hazardous goods.

ADR is an Agreement between States, and there is no overall enforcing authority. In practice, checks are carried out by Contracting Parties, and non compliance may then result in legal action by national authorities against offenders in accordance with their domestic legislation.

ADR applies to transport operations performed on the territory of at least two Contracting Parties. However, Annexes A and B (the technical part) of ADR have also been adopted by some Contracting Parties (all the EU Member States) as the basis for regulation of the carriage of dangerous goods by road within and between their territories (Directive 2008/68/EC on the inland transport of dangerous goods). A number of non-EU countries have also adopted Annexes A and B of ADR as the basis for their national legislation.

Whenever detailed standards on the transportation of PCBs are not established by local regulation, annexes A and B of the ADR rules may represent a suitable technical reference..

ADR rules establish standards, requirements and technical specification on:

- classification of goods, including classification criteria and relevant test methods;
- use of packagings (including mixed packing);

[3] http://www.basel.int/TheConvention/Publications/TechnicalGuidelines/tabid/2362/Default.aspx

- use of tanks (including filling);
- consignment procedures (including marking and labeling of packages and placarding and marking of means of transport as well as documentation and information required);
- use of means of transport (including loading, mixed loading and unloading).
- emergency procedures;
- checking of the transported goods;
- training.

Under the ADR rules, hazardous goods are classified in 9 classes and several subclasses. PCBs are classified in Class 9 (Miscellaneous dangerous substance and articles). The following subclasses also apply to PCBs:

- M2: substance and apparatus which, in the event of fire, may form dioxins;
- M6: Pollutant to the aquatic environment, liquid

The ADR rules specify the maximum total quantity per transport unit which can be transported adopting simplified provisions. However, for PCBs these simplified provisions do not apply. The ADR rules also specify procedures for loading and unloading, as well as the requirement for the transporter and the transportation vehicles.

As far as the consignment procedures are concerned, the ADR set rules for the participants involved in the transportation of hazardous goods: the loader, the packer, the filler (in case of tanks), the unloader. These rules ensure that the hazardous goods are loaded, transported and unloaded without significant risk, and that no alterations of the transported materials occur in the course of transportation.

The ADR rules also set procedures to be followed in case of accidents, including the type of information which has to be passed to the relevant authorities.

3.5. Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

The Globally Harmonized System was initiated at the UN Conference on the Environment and Development in Rio de Janeiro in 1992. The "Globally Harmonized System of Classification and Labeling of Chemicals (GHS)", addresses classification of chemicals by types of hazard and proposes harmonized hazard communication elements, including labels and safety data sheets. It aims at ensuring that information on physical hazards and toxicity from chemicals be available in order to enhance the protection of human health and the environment during the handling, transport and use of these chemicals. The GHS also provides a basis for harmonization of rules and regulations on chemicals at national, regional and worldwide level, an important factor also for trade facilitation. In Table 1, GHS classification and hazard phrases for PCBs are reported.

4. Hazard classification for PCBs

The hazard properties of PCBs are summarized below.

Chemical identification. Poly Chlorinated Biphenyls are a class of chlorine substituted biphenyls, with 209 possible isomers. Usually, PCBs are found in commercial mixtures made by several PCBs isomers differing from their level of chlorine substitution. For instance, the Aroclor mixtures may contain PCBs with an average chlorine content (as weight percentage) ranging from 10% (for the Aroclor 1210) to 68% (for the Aroclor 1268).

Chemical and physical properties. Depending on the level of chlorination, the molecular weight of PCBs ranges from 188.72 (for the Chloro-Biphenyl) to 498.72 for the fully chlorine-substituted Decachloro Biphenyl. Several physical and chemical properties of PCBs vary with the level of chlorination.

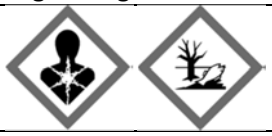
- **Water solubility:** PCBs are non-polar compounds. Their non-polar nature makes them only slightly soluble in water. In general the water solubility of PCBs is very low and decreases with the increase of chlorine substitution. It ranges from an order of magnitude of 1 mg/L for dichloro biphenyls, to an order of magnitude of around 0.01 mg/L for the pentachloro biphenyls.
- **Vapor pressure:** the vapor pressure of PCBs is very low and decreases with the increase of chlorine substitution. It ranges from around $1.5x10^{-6}$ - $4.2x10^{-6}$ for dichlorinated biphenyls to $2.9x10^{-11}$ – $6.9x10^{-8}$ for hexachlorinated biphenyls.
- **Lipophilicity.** PCBs adsorb readily to organic compound. The Octanol / Water partition coefficient (KOW) is very high and increase with the increase of chlorine substitution. Experimental values ranges from a log KOW of 5.55 for PCB 40 (tetra-chlorinated biphenyl) to a log KOW of 7.52 for PCB 207 (Nonachloro Biphenyl).
- **Flammability.** PCBs are known for their very low flammability and chemical stability to high temperatures.
- **Electrical conductivity.** PCBs are known for being excellent dielectric compound, due to the almost null value of electrical conductivity.
- **Toxicity.** Evidence of PCB toxicity was found in experimental animals: the toxic effects include skin disorders, weight loss, endocrine and reproductive disorders, carcinogenesis (liver carcinoma), etc.

Based on a recent review by the International Agency for the Research on Cancer (IARC) “sufficient” evidence exist for the carcinogenicity of PCBs in humans (with epidemiological studies associating exposure with melanoma) and laboratory animals (with exposure-related tumours seen in the lung, liver and oral mucosa). As a result, PCBs have been classified as “carcinogenic to humans” (Group 1).

PCB mixtures show a wide range of toxic effect. Coplanar PCBs, also called “dioxin-like” PCBs, have toxic effect which are similar to those caused by 2,3,7,8-tetrachlorodibenzo-p-dioxin. For this category of PCBs, relative toxicities of dioxin-like compounds in relation to the reference compound (2,3,7,8-tetrachlorodibenzo-p-dioxin, 2,3,7,8-Cl4DD) were determined on the basis of experimental studies.

PCBs classification and hazard phrases under the GHS are reported in table Table 1

Table 1. GHS classification and hazard phrases for PCBs

Substance Identification:	Name: polychlorobiphenyls; PCB	CE Number: 215-648-1 CAS Number: 1336-36-3
Hazard classification and category codes:	STOT RE 2* Aquatic Acute Aquatic Chronic	May cause damage to respiratory system through prolonged or repeated exposure. Hazardous to the aquatic environment, chronic and acute
Hazard statement (code)	H373** H400 H410	H373: May cause damage to respiratory system through prolonged or repeated exposure. H400: Very toxic to aquatic life H410: Very toxic to aquatic life with long lasting effect
Pictogram and sign warning codes	GHS08 GHS09 Wng	

Hazard statement (code)	H373 ** H410	H373: May cause damage to respiratory system through prolonged or repeated exposure.
Supp. Hazard Statement		
Specific Concentration Limit	STOT RE 2 H 373: C ≥ 0,005%	
Note	C	The supplier must state on the label whether the substance is a specific isomer or a mixture of isomers.

See section 8.a. of PCB Official Guidance for discussion on Indonesian Regulation

Chapter II: Maintenance and Storage of PCB equipment and waste.

1. Forewords

Storage of PCBs contaminated waste must be in compliance with the country legislation on the storage of hazardous waste. In Indonesia, the reference regulation is the GR No. 101/2014. See PCB Official Guidance section 6.c. for the regulation in Indonesia.

However, the storage of PCBs equipment which is still in use (either online, under maintenance os kept aside as backup equipment) is obviously not in the scope of the legislation on waste. Specification on the storage in use equipment containing PCBs must be therefore established under the country's legislation on PCB, if any, or by the general requirements for the storage of hazardous materials and equipment. In Indonesia, as a national regulation on the above is not available, specification for the storage of PCBs containing equipment should be established on a voluntary basis by the owners of PCB containing equipment (like the electric power industry in some countries). Pending the enactment of country legislation, these voluntary specification should follow the key international agreements, namely the Stockholm Convention on POPs and the ADR agreement on the transportation of hazardous materials.

It is worthwhile noticing that all the PCBs regulated by the Stockholm convention, after the deadline of the year 2025 established under Annex A, part II of the Convention, shall be removed from use. Legally, these equipment cannot be considered as equipment anymore, but – after 2025 - should instead be considered waste. Therefore, all the PCBs equipment covered by the Stockholm convention at that deadline shall have to be stored in compliance with the countries' legislation on hazardous waste pending the final disposal deadline of year 2028. It may be therefore envisaged that a significant need of upgrading of storage sites for PCBs would arise in the next few years, not only for obvious substantial reasons, but also because of the change of legal status of PCBs equipment from equipment to waste. Hopefully, this process would be completed well before the established 2025 and 2028 deadlines.

This guideline document is based on the available standards for the safe storage of hazardous waste and material (with specific reference to the standards established by the Basel Convention technical guidance and by the USA CFR 761 on PCBs), and moves from the international experience achieved on other projects on PCBs. It has been drafted with the aim to provide information and technical indication on the environmentally sound storage of waste and equipment containing or contaminated by PCBs.

One of the aim of this document is to constitute a practical reference in defining the correct technical specification for procurement of facilities and services related to the storage of PCBs waste, to be considered under GEF funded projects on PCBs.

This guideline also introduce different requirements for small storage sites, intended for the temporary storage of PCBs equipment and waste prior to their shipment to the disposal facility, and centralized storage site, which is usually have to be established nearby a PCBs disposal facility.

1.1. Site Selection

The selection of the site for the establishment of PCB storage facility should be based on logistic, infrastructural, environmental and permitting considerations.

Logistic aspects. In the selection of the site, proper consideration must be given to the distance of the storage facility from the site where PCBs waste are generated. Transportation cost, and measures aimed at preventing risks associated to transportation, are important components of the overall handling and disposal costs of PCBs; moreover , transportation of PCBs should rely as much as possible on well maintained transport infrastructures. The establishment of a storage facility should therefore always include a transportation plan and an assessment of transportation infrastructures, including specially surveyed parking lots for the temporary stop of trucks transporting PCBs.

Infrastructure and utilities. Depending on the size of the storage facility, the availability of utilities and infrastructures must be ensured. Availability of utilities like industrial and potable water, electricity, communication, must be assessed.

Environmental aspects. Environmental constraints must be considered from both the side of the impact of the storage facility on the environment, and on the risk associated to extreme meteorological or natural events (floods, storm, lightning, earthquakes, atmospheric precipitation, etc.). Typically, both aspects are covered under an Environmental Impact Assessment. Considering the hazard associated with the storage, handling and disposal of PCBs, the carrying out of an Environmental Impact Assessment based on UN or national standards is considered mandatory.

Permitting considerations. Rules concerning the minimum distance from water bodies, populated areas, protected areas must be obviously considered when selecting the site for establishing a storage facility. If no such rules are established under the national legislation on the management of hazardous waste, then the following is recommended:

PCBs storage sites should be

- at least 200m far from the nearest surface water body;
- built on surfaces where groundwater depth is at least 3m, preferring clay impermeable soil over fracturated rocks;
- never placed close to populated or sensitive areas;
- never placed in facilities subjected to risk of fire (fuel deposit, high temperature processes, etc.);
- never placed in protected areas like natural parks.

Public consultation and public perception. The involvement of the public by means of formal public consultation and proper awareness raising campaign since the early stage of the project is recommended.

1.2. Technical Requirements for PCBs storage facilities

1.2.1. Size / Capacity

As mentioned in section 6.c. of the PCB Official Guidance, the maximum storage period under Indonesian legislation are as follows:

Production	Maximum Storage Period
< 50 kg/day	180 days
≥ 50 kg/day	90 days

In general, larger the amount of PCB containing material stored at one site, , larger the associated risk. Therefore, it is important to limit to as much as possible the amount of PCBs stored at each site. .

As for the management of storage of commercial goods, the golden rule is that storage has to be minimized. Whilst stored goods represent an immobilized capital, stored PCBs represent at the same time an immobilized capital (for the provider of the disposal services), a cost (for the owner of the PCBs storage) and a source of risk.

The objective of reducing storage size may be pursued by an adequate management of the whole PCBs cycle. Reducing the storage time of PCBs, by ensuring that PCBs are mobilized from their original site to the storage site just before final disposal, will ensure reduction of the storage capacity needs.

In most cases, multiple temporary storage sites close to the site of origin of PCBs contaminated equipment, provided they are well maintained and regularly inspected, have to be preferred over centralized storage sites. The storage of PCBs (and in general of hazardous waste) is therefore not only matter of designing a facility, but also of developing a logistic system. The size of centralized storage (close to the disposal plant) and distributed storage (close to the PCBs sources) should be therefore properly balanced.

The overall storage capacity should be established by the demand / offer rule:

- From the side of PCBs generation, the storage demand is driven by the amount of PCBs which is already available for disposing and by the amount of PCBs which will be disposed over a certain period;
- From the side of PCBs disposal, the storage offer is driven by the storage capacity and by the average storage time..

Centralized storage / storage in the vicinity of treatment plant:: the size of a centralized storage to be established within or near the disposal plant should be assessed taking into consideration the capacity of the disposal plant, and the need for ensuring continuous running of the facility for minimizing disposal costs. For instance, for a dehalogenation plant with a capacity of 2t PCB oil/day, the storage could be designed assuming 2 month of continuous operation (120 tons of PCB oil, or up to 360 tons of PCB transformers).

Distributed storage close to PCB source: storages close to the PCBs owner facilities should accommodate all the PCBs which are ready for disposal and envisage an additional capacity for PCBs equipment which are planned to be disposed over a certain period of time.

The distributed storage has the key function to reduce the risk associated to the local improper storage of PCBs, by accommodating in an environmentally sound way PCBs containing equipment which need temporary storage, or PCBs waste which are already read for disposal. Temporary storage may therefore be established in sites where PCB equipment is already stored, after upgrading of necessary countermeasures to prevent release of PCBs in the environment and human exposure

1.2.2. Mitigation of Environmental Impacts

- The storage facility must be built over a layer of impermeable soil (permeability coefficient smaller than $1x10^{-9}$ ms-1, with a thickness of at least 1m.
- The groundwater surface should always be below a depth higher than 3m from the ground surface.
- The floor of the storage facility shall be constructed of continuous smooth and impervious materials, such as Portland cement, concrete or steel, to prevent or minimize infiltration of of PCBs.
- Each area where PCBs containing equipment is stored should be surrounded by impermeable curbs. The volume of the curbed area from the floor to the top of the curbs shall be equal to at least 2 times the volume of the liquid PCBs contained in the biggest equipment, or 25% of the total internal volume of the stored equipment, whichever is the bigger. In each storage area, absorption material (sawdust bags or similar) capable to absorb at least the amount of PCBs contained in the biggest equipment should be available at any time.
- Areas for the storage of equipment, barrels or tanks containing liquid PCBs should be compartmentalized to avoid the spreading of PCBs over the whole storage area in case of leakage or spilling.
- Equipment or barrels containing liquid PCBs should never be stored at a height higher than those of the curbs.
- Barrels or tanks containing liquid PCBs or oil contaminated by PCBs should be in good shape and without any presence of rust or damage.
- Any equipment which is in a bad shape, rusty or possible leaking should be drained before being stored; drained oil shall be placed in barrels.
- No draining, pipes, ditches of any type should be present within the curbed areas of storage facility, to prevent PCBs to enter the environment in case of spilling or leakage.
- Barrels should not be stacked for more than two layers.
- The storage should be at least covered by a roof for preventing rainwater hitting stored material. Usually, long term storage sites should be closed buildings, whilst small, short term storage sites to be built near the PCBs sources (in example, within a transformer substation) can be roofed open buildings.

1.2.3. Indoor air quality:

Closed PCBs Storage facilities should be maintained under negative pressure to prevent built up of dust contaminated by PCBs, especially in case of storage of PCBs contaminated soil.

- Negative pressure should be ensured by draft fan which should allow an air turnover of at least one turnover of the internal volume each 2 hours, when workers are inside the storage facility.
- The air drafted by the draft fan shall be treated before being released in the environment by means of fabric filters and activited carbon filters. To save energy in cold climate, the air can be recirculated in the building after purification.
- As in case of fire the negative pressure system described above could represent a source of air which would further sustain fire, resulting in even more dangerous conditions, this system should be automatically shut off in case of fire, and all the air inlets hermetically closed.

1.2.4. Occupational Safety and PPEs

When performing operation in PCBs storage sites, like packaging or handling of contaminated equipment or waste, the following PPE or equivalent shall be used.

- Chemical protective suits providing protection to the full body against airborne solid particulates (Level C protective clothing compliant with EN ISO 13982-1 Dry particle suit) and antidust masks (i.e. EN 149 or EN 143 FFp2 or FFp3) when moving or packaging PCBs contaminated soil;

- Chemical protective disposable suits (Level B protective clothing i.e. compliant with EN14605 Liquid tight suit, EN14605 Spray tight suit, EN ISO 13982-1 Dry particle suit) providing additional protection to the full body against liquid chemicals / aerosols and mask equipped with antidust filters and filters against gas / vapors (i.e. EN 149 with FFp2 and A-1 class filter) when draining / packaging PCBs capacitors and transformers or filling barrels with PCBs
- Safety goggles
- Heavy duty rubber gloves (neoprene or butyl)
- Reinforced safety shoes
- Overshoes
- Helmet

The personnel should always wear proper PPE when working inside the PCBs storage facility. PPE should be always removed before leaving the storage facility and entering the general environment or public buildings. Therefore, storage facilities should always include an area dedicated to the wearing and putting off PPEs.

Workers in charge of operations in the storage facility should pass a health check before starting their assignment at the PCBs storage sites, and subsequently at least once per year. These tests should include: hepatic functionality; functionality of the endocrine system; functionality of the immune system; checking for epidermis irritation or anomalies. Protection of the worker privacy with reference to the medical check results and the adoption of severe countermeasure to avoid misuse of medical data by shall be established.

1.3. Emergency planning and Prevention

1.3.1. Fire

See the discussion under section 6.c.2 of the PCB Official Guidance for fire norms in Indonesia.

PCBs exposed to fire may generate smoke and fumes highly contaminated by PCDD/F and PCBs. In addition, whilst pure PCBs are usually not flammable, PCBs contaminated oil is flammable and dangerous for its content in PCBs.

Fire prevention system must then be established at any PCBs storage site. Fire prevention should be both passive and active. Passive prevention includes avoiding PCBs being exposed to any source of fire or heat; compartmentalize the storage to ensure that in case of fire each compartment is insulated and air is not available to sustain fire; ensure that all the rooms where PCBs waste is stored can be completely insulated by switching off any air circulation system and closing air inlets.

Active prevention system includes the availability of fire extinguisher at the proper places within the storage facility, and in any case in the close vicinity of all flammable material. Fire extinguisher of the proper class and size, like for instance ABC dry powder extinguishers, 35 kg type, should be used. Fire extinguisher must be properly signaled.

The fire protection system shall also include safe evacuation rules and paths, fire protection signs, fire protection safety warning system, fire-retardant covering for the walls and the roof of the main building, and eligible fire-retardant coating for the steel structure.

1.3.2. Floods

Indonesia is prone to floods and landslide risks. A map of tsunami prone areas, as well as the map of flood and landslide has been prepared by the Ministry of Energy and Mineral Resources in 2006. Reference to this map should be made to understand the risk associated to occurrence of natural disaster and adopt the

necessary countermeasures. In general, Large PCBs storage facilities should not be located within areas subject to flood. A safe rule should be to establish storage sites outside (above) the areas of centennial recurrence of a flood. This rule may be not applicable in case of small PCB storage sites located near the PCBs source. Where small PCBs storage site are located in areas subjected to floods, the following countermeasures should be adopted:

- Make sure that drums and other containers of PCBs are closed, sturdy and leakproof.
- Secure containers to floor or walls by proper retaining systems.
- Place containers in an appropriate storage location not placed in lower areas such as basements.
- Make sure that all the containers and PCBs containing equipment are clearly labelled with indestructible labels.

1.3.3. Earthquakes

Indonesia experiences frequent seismic activity. They also frequently occurred at sea which may add to the danger of tsunamis. During the period from 1600-2006 there were 110 incidents of tsunami waves where 90% were caused by tectonic earthquakes. Around 5% of Indonesia's population is directly exposed to earthquakes, which is about 11 million people and makes it one of the most hazardous countries regarding earthquake. The risk of earthquake and tsunami should be therefore properly considered when selecting sites for storage of PCB, based not only on the Indonesian Building Code, but also on recent seismic research aimed at classifying seismic areas in the country.

1.3.4. Leakage

If spill, leakage, or similar emergency accident occurs, emergency measures must be carried out to control pollution. Spill or leakage must be enclosed, blocked, and contained immediately, and the spilled or leaked wastewater will be absorbed by soils, sawdust, or other dry materials. All the wastewater ran out of the container shall not be allowed to run out the storage building or discharge into environment, the wastewater will be collected for proper treatment. These measures prevent ambient surface water and ground water from PCBs pollution during emergency accidents.

1.4. Monitoring and Site Inspection

1.4.1. Site Inspection

Site inspection should be performed regularly. The following shall be inspected monthly:

- Condition of all the stored PCBs equipment and containers, with specific reference to any damage, formation of dust, cracks, leakage;
- Functionality of all the alarm and fire suppression systems;
- General condition of the fencing and external signaling, with special reference to any evidence of vandalism or attempted intrusion.

The following should be checked at least each three months, or immediately after any emergency situation:

- Condition of the impermeable floor and curbs for cracking or damaging (deriving for instance by the operation of vehicle inside the building);
- Availability and condition of the absorbing material;
- General condition of the building, including the functionality of the electrical system;

1.4.2. *Indoor Monitoring*

- Sampling and analysis of indoor air (VOC, PCBs and chlorine) and dust (total particulate and PM10) inside the storage facility should be performed at least two times per year to ensure that PCBs are stored in the proper way without any risk for the environment.
- Indirect online monitoring of PCBs and other organics by means of VOC and chlorine sensors should be installed in large PCB storage facilities (hosting more than xxxx tons of PCBs).

1.4.3. *Environmental Monitoring*

Sampling and analysis of soil and atmosphere near the storage facility should be performed at least once per year. The following shall be measured:

- PCBs in soil in at least 4 key places near the PCB storage plant, at surface level and at a depth of 25cm from the soil surface;
- PCBs in the ambient air and at the outlet of the air purification system.
- The methodological analysis adopted should allow the measurement of the most significant PCBs isomers, including dioxin like isomers.
- Monitoring wells should be established in at least 2 sites (up stream and down stream).

1.5. Design considerations for a centralized PCB storage facility

1.5.1. *General layout*

PCB storage site should include the following areas:

- waste acceptance facility;
- loading and unloading area;
- workshop for the dismantling / draining of PCBs containing equipment;
- compartmentalized storage for equipment or tanks containing pure PCBs
- compartmentalized storage for equipment or tanks containing oil contaminated by PCBs
- storage area for solid waste contaminated by PCBs
- storage area for solid non-PCBs material which may be considered as “end of waste”, like reclaimed carcasses, metal sheets, uncontaminated electrical component dismantled from PCBs equipment, etc.
- The storage shall be a closed warehouse with doors of a sufficient size to allow trucks to enter the storage building. The entire area shall be fenced, surveyed and clearly marked with warning signs.

Large, centralized storage facilities. Large storage facilities receiving PCBs from other areas should establish a dedicated system (staff and infrastructures) for waste acceptance. This system shall carry out the following tasks:

- Inspection, weighting and analysis of PCBs waste brought to the plant;
- Filling the relevant hazardous waste manifest form to be returned to the PCBs owner; same.

Waste acceptance facility should therefore include:

- A temporary area were waste under acceptance must be temporary stored, or where trucks transporting PCBs waste may park before unloading;
- Scales for weighing trucks and for equipment;

- A computerized database of the PCBs waste and equipment entering and stored in the PCB storage facility;
- Laboratory equipment for sampling and testing PCBs in dielectric oil and in other matrixes.

Small storage facilities . Small storage facilities located inside factories or facilities, receiving and storing PCBs only from the factory or facility where they are located, do not require to carry out the procedure for hazardous waste manifest, as this procedure is intended only for the transportation of waste by public roads. However, if these facilities accept PCBs waste coming from other areas or industries, they must put in place the same waste acceptance procedure described above for large PCBs storage facilities. Storage facilities dedicated only to the temporary storage of PCBs equipment (not waste) are however not subjected to hazardous waste manifest procedure.

1.5.2. Waste record keeping

In any case, PCBs equipment stored must be properly labeled and registered. For any PCBs equipment or waste accepted for storage, the data reported in the hazardous waste manifest form should be recorded on a computerized database. In addition, data provided by the PCBs owner which is delivering the equipment or waste should be also recorded (see form "B" and "C" of the questionnaire forms, described In the Guidelines for PCBs, PCB–containing equipment and waste identification, tracking, and record keeping).

1.5.3. Loading and Unloading areas

The loading and unloading area must be equipped with moving crane which will be used to swing and carry the wastes in the storage building. As the biggest transformer could weight several tons, according to the weight and volume of the hazardous wastes, the crane will have a lifting capacity of at least 10 tons.

A fork lift truck is to unload and carry PCBs wastes in the storage building with a lifting capacity of 2 tons shall be available at the site. There should be a path of at least 4 m wide for the fork lift truck to move.

1.5.4. Equipment draining and dismantling areas

All draining or dismantling of PCBs contaminated equipment shall be carried out in a dedicated dismantling and draining area. Transformers containing PCBs contaminated oil or pure PCBs shall be drained over impermeable platform where any leakage may be intercepted and promptly recovered. The draining and dismantling area shall be equipped with tools, draining pumps, tanks. Anti-leakage countermeasure in the dismantling compartment shall be the same described in section

1.5.5. Waste pretreatment areas

Depending on the type of pre-treatment, special areas need to be arranged as following:

- Areas for shredding of PCBs containing equipment (capacitors);
- Areas for mixing PCBs containing waste with other hazardous waste (i.e. before incineration)

These areas shall be arranged to prevent the specific risk deriving from the equipment used and the material processed.

1.5.6. Waste storage areas

The storage area shall be arranged in the following sub areas:

Waste containing liquid PCBs: these waste shall be stored adopting countermeasures aimed at preventing leakage, as specified in chapter **Error! Reference source not found.**.

- PCBs contaminated oils
- PCBs pure oil.
- Clean or decontaminated dielectric oil
- Transformers
- Capacitors

Waste contaminated by PCBs, but not containing liquid PCBs: except for drained transformers, the other shall be stored on metallic container or barrels to be placed on a concrete platform.

- Drained transformers and transformer components;
- Used tools and PPEs to be wasted;
- Non metallic PCB contaminated waste, like insulating paper, wood, etc.

1.6. Training

Training for the operators of PCBs storage sites will concern the following issues

- Basics of International and national legislation on PCBs
- Basics of PCBs toxicology and ecotoxicology
- Use of PPEs: respiratory masks, protective suits, how to wear and put off PPEs.
- How to handle PCBs contaminated equipment
- Labeling and inventory of PCBs
- Packaging of PCBs equipment
- Procedures related to the hazardous waste manifest
- Emergency procedures: leakage, fire, floods, earthquake
- First aid in case of contamination by PCBs.
- Use of fast screening kits for the detection of PCBs in dielectric oil and soil

Training shall be conducted by specialized and independent staff, repeated yearly and verified by appropriate tests.

1.7. Site Closure

At the end of its operational life, the entire PCBs storage facility as to be decontaminated from PCBs prior to be reused for other purposes. Depending on the level of contamination and on the size of the storage facility, it could be convenient to proceed to the complete demolition of the site instead of its cleanup. Demolition or cleanup costs for the PCBs storage facility should be always included in the calculation of the investment and operational cost for that facility.

1.7.1. Cleanup and demolishing of PCBs storage facilities

The cleanup of the PCBs storage facility shall be based on the following steps:

A) Mapping of the PCBs storage facility compartments based on the expected level of contamination; in general, the area to be prioritized for cleanup are tentatively as following;

- Pretreatment and dismantling areas;

- Draining areas;
- Loading and unloading areas
- Storage of PCBs contaminated material
- Storage of closed tanks;
- External areas

Priorities can be adjusted on the basis of the history of the site (for instance, change of the use of certain storage compartments, leakage episodes, other accidents).

B) Sampling and analysis of each area of compartment to confirm its level of contamination, when necessary;

C) Drafting of a cleanup plan. The cleanup plans should be arranged in such way to avoid cross-contamination between low and high PCBs contaminated areas; the cleanup plan should contain:

- Arrangement of PPEs and emergency measures;
- Cleaning of equipment (for instance, shredding equipment shall be cleaned by operating it with non contaminated material, which subsequently has to be wasted, and by cleansing with non contaminated oil; tools used for dismantling transformers shall be cleaned with solvents; empty tanks shall be repeatedly rinsed / sprayed with clean oil and solvents;
- Cleaning of surfaces: dust shall be removed and collected from all surfaces; impermeable surfaces shall be cleaned with solvents or surfactants)
- Concrete which has been contaminated by PCBs shall be either washed with solvents and subsequently by absorbing material, further coated with additional impermeable layers, or scrapped.
- Collection and packaging of all the contaminated waste and of all the materials (solvents, oil, sand, sawdust) and equipment (PPES) used for cleaning up the site; all this material shall be classified and stored in one of the PCBs storage compartment, and disposed by an appropriate disposal technology as soon as possible. After removal of these waste, a final round of cleaning of this storage compartment will be carried out.

E) Conduction of the cleanup plan

F) Sampling and monitoring for final compliance check by relevant authorities with the desired level of cleanup.

1.8. Maintenance of transformers containing PCBs

1.8.1. PCBs containing transformers (Askarel, Clophen, Piranol etc.)

Old transformers containing pure PCBs mixtures (like Askarel, Clophen, Piranol) which are still in use should be prioritized for phasing out and disposal. No pure PCB transformers should be kept in operation in intensively populated areas, in areas subjected to fire, in sensitive areas (hospital, schools) or in area / factories where food is processed. If maintenance of these transformer is needed, maintenance operation should be carried out only after all the measures aimed at preventing dispersion of dielectric oil in the environment have been established. In general, is not economically feasible to decontaminate pure PCB transformers, even because transformers designed to work with PCB dielectric mixtures should be significantly de-rated after de-contamination and refilling with a non PCB oil. These transformers have therefore to be disposed of once their operational life reach the end or in case of failure.

1.8.2. Cross-contaminated transformers

Cross contaminated transformers – i.e. transformers designed to work with non-PCB dielectric oil which have been contaminated during their maintenance or manufacturing, do not need necessarily to be disposed of. The decision whether to decontaminate or phase out these transformers is usually a trade off between the decontamination cost and residual value of the transformer. In any case, PCB contaminated transformers, especially the ones with high concentration of PCBs, should not be kept in operation in the sensitive areas listed above. If maintenance of these transformer is needed, maintenance operations should be carried out only after all the measures aimed at preventing dispersion of dielectric oil in the environment have been established.

1.8.3. Measures to prevent cross contamination

Transformers designed to work with mineral oil or other PCB free dielectric oil can get cross- contaminated with PCB in the following cases:

- During manufacturing process, if in the factory the equipment for filling the transformers is contaminated, or if the quality of the oil is not properly controlled.
- During maintenance operation, if the transformers is refilled with either a PCB mixture, a PCB contaminated oil, or using a pump or temporary tanks which have been previously used to transfer PCB mixtures or PCB contaminated oil.

To prevent cross contamination of transformers is therefore necessary to:

- ensure that any equipment (pumps, valves, pipes, tanks) which is used for maintaining contaminated transformers is kept separate from the equipment used for maintain clean transformers.;
- Ensure that PCB oil and / or PCB contaminated oil are never mixed with clean dielectric oil and vice-versa
- Check the absence of contamination of all the equipment used for transferring dielectric oil.
- Check – with fast screening tests – the quality of the dielectric oil before using it for filling or re-filling the transformers.

1.8.4. Accident prevention and response

See section 6f of the PCB Official Guidance for general rules on Accident Prevention and Response

1.9. Draft Technical Specification for the Safe Storage of PCBs under the Basel Convention

1) Wastes consisting of, containing or contaminated with POPs should be stored safely, preferably in dedicated areas away from other materials and wastes. Storage areas should be designed to prevent the release of POPs to the environment by any route. Storage rooms, areas or buildings should be designed by professionals with expertise in the fields of structural design, waste management and occupational health and safety or can be purchased in prefabricated form from reputable suppliers.
2) Some basic principles of safe storage of wastes consisting of, containing or contaminated with POPs are as follows:
   a) Storage sites inside multi-purpose buildings should be in a locked dedicated room or partition that is not in an area of high use;
   b) Outdoor dedicated storage buildings or containers[4] should be stored inside a lockable fenced enclosure;

4 Shipping containers are often used for storage.

c) Separate storage areas, rooms or buildings should be used for each type of POPs waste, unless specific approval has been given for joint storage;
d) Such wastes should not be stored at or near sensitive sites such as hospitals or other medical care facilities, schools, residences, food processing facilities, animal feed storage or processing facilities, agricultural operations, or facilities located near or within environmentally sensitive sites;
e) Storage rooms, buildings and containers should be located and maintained in conditions that will minimize volatilization, including cool temperatures, reflective roofs and sidings, a shaded location, etc. When possible, particularly in warmer climates, storage rooms and buildings should be maintained under negative pressure with exhaust gases vented through carbon filters, bearing in mind the following conditions:
    i) Ventilating a site with carbon filtration of exhaust gases may be appropriate when exposure to vapours for those who work at the site and those living and working in the vicinity of the site is a concern;
    ii) Sealing and venting a site so that only well-filtered exhaust gases are released to outside air may be appropriate when environmental concerns are paramount;
f) Dedicated buildings or containers should be in good condition and made of hard plastic or metal, not wood, fibreboard, drywall, plaster or insulation;
g) The roofs of dedicated buildings or containers and the surrounding land should be sloped to provide drainage away from the site;
h) Dedicated buildings or containers should be set on asphalt, concrete or durable (e.g., 6 mm) plastic sheeting;
i) The floors of storage sites inside buildings should be concrete or durable (e.g., 6 mm plastic sheeting). Concrete should be coated with a durable epoxy polymer;
j) Storage sites should have fire alarm systems;
k) Storage sites inside buildings should have (preferably non-water) fire suppression systems. If the fire suppressant is water, then the floor of the storage room should be curbed and the floor drainage system should not lead to the sewer or storm sewer or directly to surface water but should have its own collection system, such as a sump;
l) Liquid wastes should be placed in containment trays or a curbed, leak-proof area. The liquid containment volume should be at least 125 per cent of the liquid waste volume, taking into account the space taken up by stored items in the containment area;
m) Contaminated solids should be stored in sealed containers such as barrels or pails, steel waste containers (lugger boxes) or in specially constructed trays or containers. Large volumes of material may be stored in bulk in dedicated shipping containers, buildings or vaults so long as they meet the safety and security requirements as described herein;
n) A complete inventory of such wastes in the storage site should be created and kept up to date as waste is added or disposed of;
o) The outside of the storage site should be labelled as a waste storage site;
p) The site should be subjected to routine inspection for leaks, degradation of container materials, vandalism, integrity of fire alarms and fire suppression systems and general status of the site.

Chapter II: Packaging and Transportation

1. Packaging of PCBs

1.1. Pure PCB oil and mineral oil contaminated by PCBs

Dielectric oil and other fluids containing more than 50 ppm of PCBs are to be considered hazardous waste. Therefore, their transport in Indonesia is subjected to several regulations. See Section 6.e. of the PC Official Guidance.

Under ADR, mineral oil containing polychlorinated biphenyls or terphenyls, or polyhalogenated pibphenyls or terphenyls, shall always be classified under class 9.

Technical specification established under Annex A and B ADR for packaging liquid PCBs can be considered as relevant also for the transportation within the country.

Under ADR, PCB liquid are classified with the UN number 2315. For this class of compounds, the ADR norms prescribe the following packaging requirements:

Table 2. ADR requirements for packaging of liquid PCBs

							Limited and excepted quantity		Packaging			Portable tanks and bulk containers	
Un No.	Name and Description	Class	Classification code	Packing Group	Labels	Special provisions			Packing Instructions	Special Packing Provisions	Mixed Packing Provisions	Instructions	Special provision
2315	Polychlorinated Bipnenyls, Liquid	9	M2	II	9	305	1L	E2	P906 IBC02		MP15	T4	TP1

Packing Instructions and special provisions as from the ADR rules are as following.

P906: For liquid and solids containing or contaminated with PCBs, poly-halogenated biphenyls and terphenyls: packaging in accordance to P001 (see table below):

Table 3. Technical specifications for the packaging of liquid PCBs – Single Packaging.

Single packagings	Maximum capacity for packing Group II
Drums Steel, non removable heads (1A1) Steel, removable heads (1A2) Aluminum, non removable heads (1B1) Aluminum, removable heads (1B2) Metal other than steel or aluminium, non removable heads (1N1) Metal other than steel or aluminium, removable heads (1N2) Plastic, non removable heads (1H1) Plastic, removable heads (1H2)	450 L
Jerricans Steel, non removable heads (3A1) Steel, removable heads (3A2)	60 L

Aluminum, non removable heads (3B1) Aluminum, removable heads (3B2) Plastic, non removable heads (3H1) Plastic, removable heads (3H2)	

Table 4. Technical specifications for the packaging of liquid PCBs – Composite Packaging.

Composite Packaging	Maximum capacity for packing Group II
• Plastics receptacle with outer steel or aluminium drum (6HA1, 6Hb1) • Plastics receptacle with outer fibre, plastics or plywood drum (6Hg1, 6HH1, 6HD1)	250 L
• Plastic receptacle wit outer steel or aluminium crate or box or plastics receptacle with outer wooden, plywood, fibreboard or solid plastics box (6HA2, 6HB2, 6HCm 6HD2, 6HG2 or 6HH2) • Glass receptacle with outer steel, aluminium, fibreboard, plywood, solid plastics or expanded plastics drum (6PA1, 6BP1, 6PG1, 6PD1, 6PH1 or 6PH2) or with outer steel or aluminium crate or box or with outer wooden or fibreboard box or with outer wickerwork hamper /6PA2, 6PB2, 6PC, 6PG2 or 6PD2)	60 L

Table 5. Technical specifications for the packaging of liquid PCBs – Combination Packaging.

Combination Packaging		Maximum capacity /net mass for packing Group II
Glass 10 L Plastics 30 L Metal 40 L	**Drums** Steel (1A2) Aluminum (1B2) Metal other than steel or aluminium (1N2) Plastics (1H2) Plywood (1D) Fiber (1G)	400 kg
Glass 10 L Plastics 30 L Metal 40 L	**Boxes** Steel (4A) Aluminum (4B) Natural wood (CC1, 4C2) Plywood (4D) Reconstituted wood (4F) Fibreboard (4G) Expanded plastic (4H1) Solid plastic (4H2)	400 kg except Expanded plastics (60kg)
Glass 10 L Plastics 30 L Metal 40 L	**Jerricans** Steel (3A2) Aluminum (3B2) Plastics (3H2)	120 kg

IBC02: The following Intermediate Bulk Containers (IBC) can be used:

- Metal (31A, 31B and 31N)
- Rigid plastics (31H1 and 31H2)
- Composite (31HZ1)

In addition to the above, the ADR portable tank provisions specify the applicable minimum test pressure, the minimum shell thickness (in mm reference steel), and the pressure-relief and bottom opening equipment as following:

Minimum test pressure: 1.5 bar

Minimun shell thickness: the cylindrical portions, ends (heads) and manhole covers of shells not more than 1.8 m in diameter shall be not less than 5 mm thick in the reference steel or of equivalent thickness in the metal to be used. Shells more than 1.8 m in diameter shall be not less than 6 mm thick in the reference steel or of equivalent thickness in the metal to be used, except that for powdered or granular solid substances of packing group II or III the minimum thickness requirement may be reduced to not less than 4 mm thick in the reference steel or of equivalent thickness in the metal to be used.

Pressure relief: Every portable tank with a capacity more than 1900 litres and every independent compartment of a portable tank with a similar capacity shall be provided with one or more pressure – relief devices of the spring-loaded type.

Bottom opening: Bottom discharge outlets for portable tanks carrying certain solid, crystallizable or higly viscous sunstances shall be equipped with not less than two serially fitted and mutually independent shut-off devices. The design of the equipment shall be to the satisfaction of the competent authority or its authorized body and shall include:

a) an external stop-valve, fitted as close to the shell as reasonably practicable, and so designed as to prevent any unintended opening through impact or other inadvertent act; and
b) a liquid tight closure at the end f the discharge pipe, which may be a bolted blank flange or a screw cap

1.2. Transformers, Capacitors and other PCBs containing equipment

Transformers, capacitors and other PCBs containing equipment may be considered as “solid PCBs”, and are assigned with UN Number 3432. Under the ADR norms, the following packaging instructions shall apply:

Table 6. Technical specifications for the packaging of solid PCBs – Single Packaging.

Single packagings	Maximum capacity for packing Group II
Drums Steel (1A2) Aluminum (1B2) Metal other than steel or aluminum (1N2) Plastic (1H2) Plywood (1D) Fiber (1g)	400 kg
Boxes Steel (4A) Aluminum(4B) Natural wood (4C1) Natural wood (4C2) Plywood (4D)	400 kg except Expanded plastics (60kg)

Reconstituted wood (4F) Fiberboard 4G) Expanded plastics (4H1) Solid plastics (4H2)	
Jerricans Steel (3A2) Aluminum (3B2) Plastic (3H2)	120 kg

Table 7. Technical specifications for the packaging of solid PCBs – Composite Packaging.

Combination Packaging		**Maximum capacity /net mass for packing Group II**
Glass 10 kg Plastics[a] 50 kg Metal 50 kg Paper[a,b] 50kg Fibre [a,b] 50Kg [a] These inner packaging shall be sift proof [b] These inner packagings shall not be used when the substances being carried may become liquid during carriage	**Drums** Steel (1A2) Aluminum (1B2) Metal other than steel or aluminum (1N2) Plastic (1H2) Plywood (1D) Fiber (1g)	400 kg
	Boxes Steel (4A) Aluminum (4B) Natural wood (CC1, 4C2) Plywood (4D) Reconstituted wood (4F) Fiberboard (4G) Expanded plastic (4H1) Solid plastic (4H2)	400 kg except Expanded plastics (60kg)
	Jerricans Steel (3A2) Aluminum (3B2) Plastics (3H2)	120 kg

For transformers and capacitors and other devices: leak proof packaging which are capable of containing, in addition to the devices, at least 1.25 times the volume of the liquid PCBs or polyhalogenated byphenyls or terphenyls present in them. There shall be sufficient absorbent material in the packaging to absorb at least 1.1 times the volume of liquid which is contained in the devices. In general, transformers and condensers shall be carried in leak-proof metal packaging which are capable of holding, in addition to the transformers and condensers, at least 1.25 times the volume of the liquid present in them.

Transformers and capacitors cannot always be packaged for transportation. In this case, ADR rules specify that *"Liquid and solids not packaged in accordance with P001 and P002 (drums, boxes or jerricans) and unpackaged transformers and condensers may be carried in cargo transport units fitted with a leakprof metal tray to a height of at least 800mm, containing sufficient inert material to absorb at least 1.1 time the volume of any free liquid"*. (Part 4, Packing instructions P906), with the additional requirement that *"Adequate provisions shall be taken to seal the transformers and condenser to prevent leakage during normal conditions of carriage*"

1.3. Marking and Labelling of Packages.

The words “PCBs, Polychlorinated Biphenyls”, and the UN number corresponding to the PCBs (2315 for PCB liquids or 3432 for solid PCBs, preceded by the letters “UN”, shall be clearly and durably marked on each package.

All package markings shall be readily visible and legible, and shall be able to withstand open weather exposure without a substantial reduction in effectiveness.

Intermediate bulk containers of more than 450 liter capacity and large packaging shall be marked on both sides.

Packages shall be durably marked with the UN environmentally hazardous substance mark and with, in addition, the hazard mark specific for substances .

Information concerning the specific hazard presented by the PCBs waste / goods transported shall be also contained in the label.

Emergency number to be called in case of emergency shall also be clearly marked.

1.4. Transportation of PCBs

1.4.1. Transport by Road. Vehicle and driver Requirements

The vehicle used for transporting PCBs shall comply with the relevant rules established the Indonesian legislation. See section 6e of PCB Official Guidance and its annex.

The drivers of the vehicle which is transporting the PCBs must have been passed a training course on the transportation of hazardous waste and on PCBs.

The drivers of the vehicle undertaking the transportation of PCBs should be in possess of the relevant driving license as required under the Indonesian Legislation

Vehicle for the transportation of PCBs should be equipped with GPS, mobile phone and radio transmitter, so that the driver can easily communicate the position of the truck.

Vehicle for the transportation of PCBs should be equipped with the proper firefighting equipment, as well as all the equipment necessary for containing the accidental spill of PCBs, including proper PPEs.

1.4.2. Route and driving requirements

Route for the transportation of PCBs should be planned in advance and communicated to the shipper and the addressee of the PCBs.

Route planning should include the positioning along the route of the following points of interest:

- Local public security;
- Hospitals;
- Fuel station (select the ones far from populated areas);
- Suitable parking lots and storage areas.

The planned route should be clearly described in the Hazardous Waste Manifest carried by the driver; any deviation from the planned route should be duly reported.

The driving time should be alternated by a sufficient rest time, as per relevant regulations in Indonesia

The use of GPS is highly recommended to facilitate the planning of the trip and the communication of the position.

Areas within temporary storage terminals, temporary storage sites, vehicle depots, berthing areas and marshalling yards used for the temporary storage during carriage of PCBs shall be properly secured, well lit and, where possible ad appropriate, not accessible to the general public.

1.4.3. Training

The training shall be approved by the competent authority, on the basis of the submission of a detailed training programme, inclusive of the qualification of the training personnel.

The training shall be arranged in the following way:

General awareness: the personnel shall be familiar with the general requirements of the provisions for packaging and carriage of PCBs.

Function-specific training: the personnel shall receive training commensurate with their duties and responsibilities in the chain of packaging and transportation of PCBs.

Safety training: personnel shall be trained in the hazards and dangers presented by PCBs, with specific reference to the operation of packaging, filling, draining, loading, unloading.

Training for Drivers : Drivers of vehicles carrying PCBs shall attend a specific training course structured as following: safety drive rules; hazards related to the handling and transport of PCBs; emergency response: what to do in case of accident occurred during the transportation of PCBs (first aid, road safety, use of PPEs, etc.); use of positioning and radio devices; precaution to be taken during loading and unloading of PCBs; civil liability; security awareness; the hazardous waste manifest system.

1.5. Emergency Response

In case of accidents like combustion, explosion, leakage, poisoning or stolen, loss, the driver and escorting personnel should immediately report to the local public security departments, firefighting corps if necessary, and the transport enterprises on the accident status, name of goods, harm and first-aid measures, take all possible alarming measures on site and actively cooperate with relevant departments for disposal. Transport enterprises should be immediately start emergency plans.

This means that the transportation team, before transportation, should collect the relevant contact numbers of the nearest public security departments and nearest rescue along the route, so that the intervention time in case of accident is minimized.

For the management of the emergency situation, the following practical consideration should be kept in mind.

1. PCBs are not flammable. However, if exposed to fire or high temperature, they can generate dioxins. Therefore, preventing contact of PCBs with fire represents a high priority.
2. PCBs are not flammable, however PCBs contaminated oil is flammable. The burning of highly contaminated PCBs oil represent a worst case in term of immediate danger for life coupled with long term effect danger caused by the release of Dioxins that would be generated.
3. PCBs do not have a high vapor pressure, and usually the direct exposure to PCBs vapors does not represent an immediate risk for life. However, due to their long term toxicity, in case of PCBs leakage proper respiratory mask should be wore.
4. PCBs may easily enter the body by contact with the skin. Dermal exposure to PCBs represents the most probable cause of human exposure.

5. PCBs cannot be easily removed by water due to their very low water solubility. However, PCBs can be easily removed by using adsorbent materials with high organic content, like sawdust, soil with high organic matter content, organic solvents, greases.

The following PPEs shall be always available during any transportation of PCBs (one suit for any component of the vehicle crew)

- Chemical protective disposable suits providing protection to the full body against liquid chemicals / aerosols (Level B protective clothing i.e. compliant with EN14605 Liquid tight suit, EN14605 Spray tight suit, EN ISO 13982-1 Dry particle suit)
- Mask equipped with antidust filters and filters against gas / vapours (i.e. EN 149 with FFp2 and A-1 class filter)
- Safety goggles
- Heavy duty rubber gloves (neoprene or butyl)
- Reinforced safety shoes
- Overshoes
- Helmet
- Warning vest

The following additional material should be always available during transportation of PCBs:

- Adsorbent material (like sawdust)
- A shovel
- A drain seal
- First Aid Kit, including Eye rinsing liquid
- Fire Extinguishers
- Self standing warning signs.

Chapter III: Decontamination and Disposal of PCBs equipment and waste

1. Criteria for Evaluating PCBs Disposal Efficiency

1.1. DE and DRE

Destruction Efficiency (DE) and the Destruction and Removal Efficiency (DRE) are the two key parameters to be measured for evaluating the destruction efficiency of disposal technologies.

DE take into account the overall destruction efficiency, including residues of hazardous substance in all the process streams; it is defined as the total input mass of a chemical into a process, minus the mass of the chemical in all products, by-products and environmental releases, divided by the input mass, multiplied by 100 (to be shown as a percentage). DRE is defined as the total input mass of a chemical into a process, minus the mass of the chemical into exhaust gas, divided by the input mass, multiplied by 100 (to be shown as a percentage). Calculations of DE and DRE should use half the value of the detection limit of the method employed for any tests that result in "not detected."

The Destruction and Removal Efficiency (DRE) should be reported for any substances of concern undergoing destruction, as demonstrated by multiple samples tested using internationally recognized analytical methods and measured at a frequency sufficient to ensure compliance with this criterion during disposal operation. (Note: Other "substances of concern" refer to chemicals that have the characteristics of environmental persistence, bio-accumulation, potential for long-range environmental transport, and potential for damage to human health and the environment, as described in Annex D of the Stockholm Convention.) Destruction and removal efficiency should be not less than 99.9999%.

Similarly, the destruction efficiency (DE) should be verified for any substances of concern, as demonstrated by multiple samples tested using internationally recognized analytical methods and measured at a frequency sufficient to ensure compliance with this criterion during disposal operation. Compliance with DE means that the technology not only effectively eliminates gaseous air-emissions of substances of concerns (with special reference to PCDD/F) but it also effectively eliminates releases of these pollutants in the solid wastes and liquid wastes.

DE for PCDD/F and PCB will be measured in term of the sum of PCB + PCDD/F expressed as Toxicity Equivalent (WHO TEq) mass[5]

In term of DE values, the disposal technology should ensure the following environmental performance:

- **Destruction Efficiency (DE)** for PCBs and PCDD/Fs (IN-OUT/IN)*100, calculated as TEQ in the below formula (*), should not be less than 99.99%. Measurement of the DE calculated as TEQ shall be measured during the Proof of Performance Test of the equipment

DE calculated as TEQ

[5] The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like CompoundsTOXICOLOGICAL SCIENCES 93(2), 223–241 (2006), doi:10.1093/toxsci/kfl055, Advance Access publication July 7, 2006;

$$IN = W_{PCB(TEQ)} + W_{PCDD/F(TEQ)}$$

$$OUT = \int_{t=0}^{t=end} Q_s \left(CS_{PCB+TCDD/F(TEQ)}\right) + \int_{t=0}^{t=end} Q_{BA} \left(CBA_{PCB+TCDD/F(TEQ)}\right) + \int_{t=0}^{t=end} Q_{FA} \left(CFA_{PCB+TCDD/F(T}\right.$$

$$+ \int_{t=0}^{t=end} Q_{SL} \left(CSL_{PCB+TCDD/F(TEQ)}\right) + M_{AC} \left(CAC_{PCB+TCDD/F(TEQ)}\right)$$

(*) The meaning of the variables in the formula reported above is as following: Wpcb: mass weight of the PCB input, t=0: beginning of the waste feeding; t=end: end of the trial burn test; Q_S: Volumetric flow at the stack gas, Nm^3/h; C_S: Concentration in the stack gas, ng/Nm^3; C_{BA}: Concentration in the bottom ashes, ng/g; C_{FA}: Concentration in the flying ashes, ng/g; Q_{BA}: mass flow of the bottom ashes (kg/h); Q_{FA}: mass flow of the fly ashes (kg/h); M_{AC}: overall weight of the activated carbon pack. Oxygen reference value at the stack 11%.

- **Destruction Efficiency (DE)** for specific POPs or other substance of concern, to be decided on the basis of waste features: (IN-OUT/IN)*100, as from the below formula (*), should not be less than 99.99. Measurement of the DE calculated as TEQ shall be measured during the Proof of Performance Test

DE for specific substance (X)

$$IN = W_X$$

$$OUT = \int_{t=0}^{t=end} Q_S CS_X + \int_{t=0}^{t=end} Q_{BA} CBA_X + \int_{t=0}^{t=end} Q_{FA} CFA_X + \int_{t=0}^{t=end} Q_{SL} CSL_X + \int_{t=0}^{t=end} Q_{AC} CAC_X$$

The meaning of the variables in the formula reported above is as following: Wpcb: mass weight of the PCB input, t=0: beginning of the waste feeding; t=end: end of the trial burn test; Q_S: Volumetric flow at the stack gas, Nm^3/h; C_S: Concentration in the stack gas, ng/Nm^3; C_{BA}: Concentration in the bottom ashes, ng/g; C_{FA}: Concentration in the flying ashes, ng/g; Q_{BA}: mass flow of the bottom ashes (kg/h); Q_{FA}: mass flow of the fly ashes (kg/h); M_{AC}: overall weight of the activated carbon pack. Oxygen reference value at the stack 11%.

1.2. Influence of Pretreatment on DE and DRE

The whole treatment cycle (from packaging to storage, from pretreatment to disposal) theoretically affect the destruction efficiency, although DE and DRE are specifically related to the efficiency of the destruction technology.

As an example, in the case of a disposal process based on the following steps:

- PCB equipment opening and un-assembling,
- solvent extraction;
- recovery of decontaminated metal scraps;
- incineration of pure PCBs;
- Chemical dehalogenation of the oil and of the recovered solvents,

There may be substantial loss of PCB in the first stage, if proper countermeasure to prevent direct release of PCBs in the environment or residues remaining in the porous component of the equipment are not put in place.

In addition, there could be fugitive releases which are usually disregarded, which could lead to a significant increase of PCB / PCDD in the environment like:

- Fugitive releases from the kiln inlet during loading, in case of fault or poor performance of the negative pressure system;
- Emission of POPs contaminated dust / vapors from the storage area (either as fugitive releases or as conveyed emission if the storage facility is equipped with an air pollution control system);

Proper countermeasure aimed at avoiding any release during the pre-treatment stage should be therefore adopted. This will ensure a significant increase in the actual DE and DRE, at a cost which is often a fraction of the cost required to adopt sophisticated technologies for the reduction of emission at the stack.

Moreover, when analyzing the efficiency of a plant, all the possible sources of emission (not only the emission from stack) should be identified and considered.

2. Available Disposal Technologies for PCBs

In the following sections, the main technologies used worldwide for the disposal or decontamination of PCBs containing equipment and oils are briefly described. The number of technologies listed is not exhaustive, as some technologies, which proved promising at laboratory or pilot scale, but are not yet fully available at commercial scale, are not included.

Indeed, it should be considered that only few technologies were until now demonstrated in GEF projects for the disposal of PCBs. These are:

- Metallic Sodium dehalogenation
- Continuous Dehalogenation Process (A-PEG based)
- Incineration
- Thermal Desorption
- Co-incineration in cement kilns
- Decontamination of equipment with solvent washing

In addition to the above technologies, the following, which are commercially available in at least one country, have been included:

- Plasma
- Hydrodehalogenation

The selection a technology for the destruction of PCBs requires to properly take into account technical, financial, environmental, logistic and regulatory aspects which may vary from site to site.

For instance, the following are among the most common aspect that could significantly orient the selection of a PCB disposal technology:

- the availability and cost of the necessary chemical reagents in the region;
- the availability of special equipment and spare parts in the region;
- the local capacity to operate, maintain and repair special equipments;
- monitoring capacity like sampling and analysis of PCDD/F at the stack of the plant;
- manpower cost and availability of specialized staff;
- presence at the site of the necessary utilities (water, electricity, fuel);

- transportation infrastructures;
- specific regulation on the permitting of disposal facilities;
- specific regulation restricting the import / export of technologies and chemicals

In addition to the above, it should be considered that there are a number of constraints which are very specific to the type of PCBs containing equipment which have to be treated or disposed. In Figure 1 and Figure 2 two “technology decision tools” are summarized. In brief:

1. chemical dehalogenation technologies are not suitable for the treatment of equipment or oil with very high concentration of PCB or with pure PCB (as a rule of thumb, these technologies are not suitable to treat equipment with PCB concentration in the dielectric oil higher than 10,000 ppm). Therefore, all the equipment and oil containing pure or highly concentrated PCB mixtures should be treated through thermal destruction technologies;
2. on their side, thermal destruction technologies are not recommended for the treatment of low concentration PCB oil, in all the cases where the oil can be reused as dielectric oil after the removal and destruction of PCB contained therein. This for the simple reason that, as dielectric oil is a very expensive material, the burning of low contaminated dielectric oil would results in a significant loss of money.
3. equipment with low level of PCB contamination, and of relatively recent manufacturing and in a good shape, may be kept in use after decontamination. This will require either the integration between chemical dehalogenation and refilling with clean oil, or the of other processes continuous decontamination processes which do not require the emptying and refilling of contaminated transformers.
4. The scrap metal from phased out or wasted contaminated equipment need to be decontaminated from PCB before being recycled or resold as secondary material. There are a number of technologies that can perform this task, like solvent vacuum extraction or thermal desorption.
5. Solid waste generated from the dismantling of transformers and capacitors, need also be decontaminated from PCB. If the PCB concentration is below 50 ppm, it is compliant with the Stockholm Convention and the Basel Convention to place these waste in safe landfills. Otherwise, these waste need to be treated thermally.

Figure 1: Technologies for the destruction of highly concentrated or pure PCBs

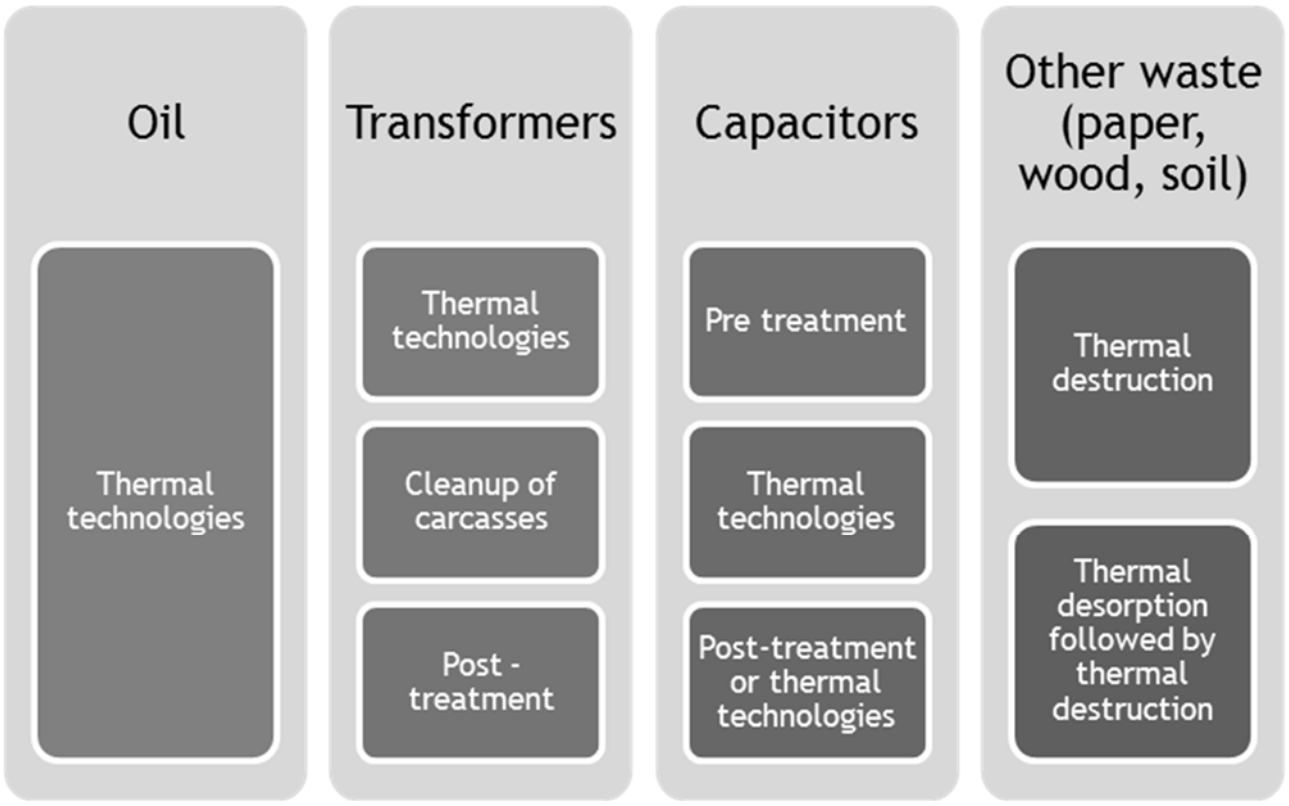
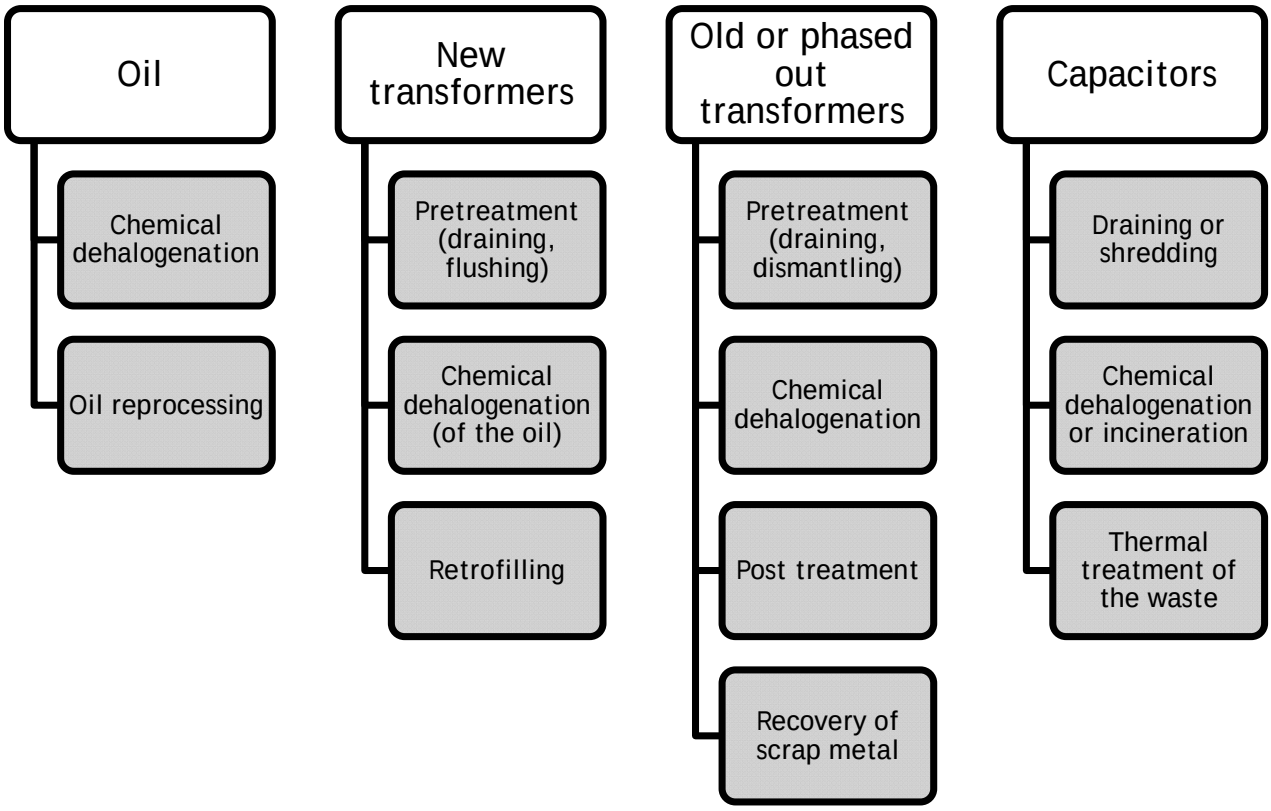

Oil
Thermal technologies
Transformers
Thermal technologies
Cleanup of carcasses
Post - treatment
Capacitors
Pre treatment
Thermal technologies
Post-treatment or thermal technologies
Other waste (paper, wood, soil)
Thermal destruction
Thermal desorption followed by thermal destruction

Figure 2: Technologies for the destruction of low concentrated or PCBs (up to 10,000 ppm)



2.1. Chemical Destruction of PCBs

2.1.1. Metallic Sodium Dehalogenation Processes

Main reactions / Description	Technologies based on the use of metallic sodium to dechlorinate the PCB molecules. The general representation of the Wurtz-Fittig reaction is: $ArX + RX + 2Na \rightarrow Ar\text{-}R + 2NaX$ The effectiveness of the destruction/reaction process is based on the formation of sodium compounds with bonding enthalpies that are higher than those between the non-sodium ions and the stripped ion.
PCB Concentration	Generally not suitable for pure PCB
Process temperature	100° -
Process pressure	Atmospheric
Reagents	Metallic sodium.
By products, outflows and waste streams	Sludge,
Applicability	Oils
Needs for post or pre treatment	The process requires the dewatering and degassing of the matrix to be treated.
Main advantage	Reaction completed in a short time; the oil decontaminated by metallic sodium dechlorination may be reused after removal of phenols.

Main limitations	The strong oxidizing power of the metallic sodium could in some cases affect negatively the dielectric properties of the oil. Risk related to the high reactivity of the metallic sodium.

Definitions. This category includes all the technologies based on the use of metallic sodium to dechlorinate the PCB molecules. These technologies may be adopted for the decontamination of transformer oil in closed loop decontamination processes, or for the decontamination of PCBs contaminated oils. The metallic sodium dehalogenation technologies usually are not suitable for the decontamination of contaminated soils and wastes; however in some cases the metallic sodium process has been used for the dehalogenation of the oily fraction of landfill leachate or to as fluorescent light ballast waste and capacitors. Due to its high reactivity, processes based on this reagent have been also proposed for the destruction of chemical warfare agents[6]

Chemistry of the process. The use of dispersed sodium for the destruction of organic compounds is based on the work of the French chemist Adolphe Wurtz who, in the mid 1850s, discovered that the reaction of an alkyl halide with metallic sodium removes the halide from the molecule to produce a sodium halide and a saturated aliphatic hydrocarbon. The general expression for the Wurtz reaction is:

$$2RX + 2Na \rightarrow R\text{-}R + 2NaX$$

where R is the alkyl radical and X is the halogen atom. In the case of a chlorinated compound, X is the chlorine atom.

The concept of the Wurtz reaction was expanded by Fittig in the mid 1860s, who discovered that, in the presence of metallic sodium, hydrocarbons could be synthesized which contained the combination of an alkyl radical and an aromatic residue. The general representation of the Wurtz-Fittig reaction is:

$$ArX + RX + 2Na \rightarrow Ar\text{-}R + 2NaX$$

The effectiveness of the destruction/reaction process is based on the formation of sodium compounds with bonding enthalpies that are higher than those between the non-sodium ions and the stripped ion. For example, the formation enthalpy of a carbon-chloride bond is 328 kJ/mol, while that of a sodium-chloride bond (which exists following destruction of a chlorinated halogen) is 411 kJ/mol. Hence, once the bond is broken and a new molecule is formed with sodium, the reaction is not reversible under the conditions that exist in the reactor. This situation eliminates the formation of toxic halogenated byproducts from the treatment process. The destruction process is also applicable to many non-halogenaheted compounds containing reactive groups that are sensitive to attack by sodium[7]. (*)*

Process details. Due to the fact that Sodium is a reactive metal which reacts violently with water to give hydrogen gas, creating a potential fire hazard, processes using metallic sodium usually require the degassing and dewatering of the media to be treated in order to avoid unwanted exothermic reactions. An inert gas (nitrogen or argon) it is also required for filling the head space of the reactors. The residues from the treatment process include sodium salts and various aromatic, non-halogenated hydrocarbons. Under pilot- and full-scale conditions, the organic byproducts are either combusted or recovered following refinement for appropriate post-treatment uses (e.g., energy recovery, reuse as dielectric fluids). The inorganic byproducts (together with the excess sodium added initially to the system) must be recovered and disposed of in an appropriate manner.

[6] Holm, 1997, Mobile alternative demilitarization technologies, proceedings of the NATO advanced research workshop on mobile technologies for remediating formerly used defense sites, Prague, Czech republic, 1-2 July 1996, NATO SCIENCE Partnership subseries 1:12, may 1997
[7] Bilger, 2004, Sodium for Destruction of Polychlorinated Biphenyls (PCB s) in transformer oil

The introduction of metallic sodium into a PCB oil leads to a reaction whose rate is dependent on the metal-oil interface. As the rate of reaction between the solid metal and the PCB-containing oils depends on the extent of this interface, the finer the metal particles, the faster will be the reaction.

Secondary reactions can occur when PCBs react with metallic sodium. During the dechlorination step, the intermediate chlorinated molecules can polymerize and lead to the formation of a solid (polymer) containing chlorine. This product can no longer be dechlorinated and settles out of the reaction as a solid.

The key research issue on which companies invest for the optimization of this technologies concern:

- The development of fine dispersed emulsions capable to increase the oil/metallic sodium interface, being at the same time stable enough to minimize the risks related to the high reactivity of the metallic sodium;
- The development of processes which can avoid the formation of polimers containing chlorine during the dehalogenation process;
- The development of processes which are non destructive to the oil dielectric properties.

In general, sodium dispersions proposed today are extremely fine and resemble emulsions, having a high metal surface area. The dispersion is used at a temperature which is above that of the melting point of the sodium, i.e., 98°C (normally in the range 110°C – 180°C), and at atmospheric pressure. Being liquid, the metal surface can be renewed continuously. In this way a reasonable reaction rate can be achieved, thus decreasing the cost of the decontamination process.

Advantages. These technologies have the great advantage to lead to a complete reaction in a short time; the oil decontaminated by metallic sodium dechlorination usually may be reused after undergoing to a regeneration process which imples the removal of also if a potential shortcoming of the technology lies in the fact that the strong oxidizing power of the metallic sodium could in some cases affect negatively the dielectric properties of the oil. Moreover, buildup of biphenyls in oil may affect negatively its technical properties. In order to overcome this shortcoming, these technologies are often associated with post-treatment technologies specifically designed for the regeneration of dielectric oils.

Other advantages are:

- Metallic Sodium dechlorination are usually performed at low temperature (110° - 180°C) and at atmospheric pressure.
- Strong enthalpies of formation preclude a reversal of the reaction once the original chemical has been degraded.
- Capital investments are relatively low.

Limitations The rate of reaction (and, hence, the rate of exothermic heat generated by the reaction) must be controlled by the rate at which the waste is added to the sodium dispersion. The process requires the dewatering and degassing of the matrix to be treated.

The cost of metallic sodium prevents the use of this technology for the treatment of very high concentration to pure PCBs oil. Usually this technology is not suitable for PCB concentration greater than 10000 ppm (1%). For this reason, Metallic Sodium Dehalogenation is a technology designed for decontaminating PCB contaminated oil rather than pure PCBs. In addition, the dehalogenation of pure PCB results in a stream mainly composed by biphenils and by of sludge made of polymerized polyphenyls and sodium chloride. The polyphenyls / sodium chloride sludge may be easily separated from the process stream: however to remove biphenyls from the oil used in the reaction batch, a specific distillation process would be required.

This problem is addressed by vendors with different approaches. One approach is based on a batch process using roughly 90% new insulating oil and 10% PCB. The new oil is reused in subsequent dehalogenation

batches. The issue of biphenyls building up in the oil being re-circulated is disregarded, as the process is intended only for cleaning PCB transformers that would be subsequently dismantled. This approach is based on the assumption that the reuse of pure PCB transformers cannot be considered economically feasible, because once filled with non PCB oil these transformers have to be de-rated. Based on this assumption, this process is oriented toward the dismantling of transformers. Transformers need to be manually dismantled and subsequently washed in a dedicate solvent washing process.

In other approaches envisaging the use of pure PCB transformers, the dilution of the oil to be processed is obtained by washing in a closed loop the carcasses of PCB pure transformers with cleaned oil. Due to the cost of new dielectric oil, this technology may be very expensive unless coupled with a second technology for refining the transformer oil.

Another key aspect is the relative efficiency of the Sodium dehalogenation reaction. Depending on the technology configuration, the amount of sodium required for destroying one ton of PCBs ranges from around 0.4 to 0.9 kg per kg of PCBs. In Table 1, comparison of the reaction efficiency among two metallic sodium technologies is reported.

2.1.2. APEG Dehalogenation processes (Glycolate/Alkaline Polyethylene Glycol)

Main reactions / Description	The process consists of mixing and heating the contaminated media with the APEG reagent. During heating, the alkali metal hydroxide reacts with the halogen from the contaminant to form a non-toxic salt; and the PEG takes the location in the PCB molecule formerly occupied by the halogen making it less hazardous. Process can be operated in batch or continuous mode.
PCB Concentration	The concentrations of PCBs that have been treated are reported to be as high as 45,000 ppm. Concentrations were reduced to less than 2 ppm per individual PCB congener. PCDDs and PCDFs have been treated to nondetectable levels at part per trillion sensitivity.
Process temperature	70° - 200°
Process pressure	From atmospheric to 3.5 bar (CDP)
Main Reagents	Alkali metal hydroxide; polyethilene glycol; (APEG) Hydroxide tetraethilene glycol (ATEG) non alkali metal, polyalkeneglycol and a alkali or alkaline earth metal hydroxide or alcoholate. (SEA Marconi CDP process)
By products, outflows and waste streams	Mainly non toxic salts, and muds; be to when the process is used for the decontamination of transformer, the oil containing de-halogenated aromatics compound is re-used into the transformer; in the case of soil decontamination, de-halogenated aromatic compounds form a non hazardous waste to be further destroyed or incinerated.
Applicability	PCBs Oils; transformers containing PCB oils; soil.
Needs for post or pre treatment	It may be necessary in the case of treatment of contaminated soil or wastes.
Main limitations	Following EPA (US EPA, 540/S-93/s 506), and regarding the soil treatment, the disadvantages of the conventional APEG processes are that it often takes numerous cycles of the process to achieve the desired results, the process only effects partial dehalogenation, and the formation of dioxin and furans often occurs when the process is implemented”
Cost	$430 to $530 per m^3 of contaminated soil (US EPA 1992b); $260 to $669 per . m^3 of contaminated soil(NFSC); in the order of 800 – 1000 for the dehalogenation and complete recovery of contaminated oil

Definitions / process description. Glycolate dehalogenation makes use of a chemical reagent called APEG. APEG consists of two parts: an alkali metal hydroxide (the “A” in APEG) and polyethylene glycol (PEG) The metal hydroxide that has been most widely used for this reagent preparation is potassium hydroxide (KOH) in conjunction with polyethylene glycol (PEG) (typically, average molecular weight of 400) to form a polymeric alkoxde referred to as KPEG; Sodium hydroxide has also been used for this process.

Process details. Generally speaking, the process consists of mixing and heating the contaminated media with the APEG reagent. In the first stage of the process, the alkali metal hydroxide, the PEG and the oxygen donor form the reagent APEG. The reagent is then heated at 80°C-120°C and atmospheric pressure; a slight excess of reagent is necessary for the Cl neutralisation.

During heating, the alkali metal hydroxide reacts with the halogen from the contaminant to form a non-toxic salt; and the PEG takes the location in the PCB molecule formerly occupied by the halogen making it less hazardous. The reaction, a nucleophilic substitution, is due to the alkoxy-derivatives of the PEG hydroxilic

terminals; among the reaction by products the hidroxilated biphenil derivatives can indeed be found. In other words, the reagent (APEG) dehalogenates the pollutant to form a glycol ether and/or a hydroxylated compound and an alkali metal salt, which are water soluble by-products.

A variation of the APEG reagent is potassium hydroxide or sodium hydroxide/tetraethylene glycol, referred to as ATEG, which is more effective on halogenated aliphatic compounds. In some KPEG reagent formulations, dimethyl sulfoxide (DMSO) is added to enhance reaction rate kinetics, presumably by improving rates of extraction of the haloaromatic compounds. Using DMSO as a solvent increases safety concerns because DMSO increases the ability of the contaminants to be absorbed through the skin.

Since 1979, the terms “APEG,” “NaPEG,” and “KPEG” have been used extensively throughout the literature in a generic sense. A patented improvement of the APEG process designed specifically for the treatment of PCB containing transformer makes use of a non alkali metal, (preferably a mixture of aluminium and titanium, but also iron, manganese, magnesium, nickel, palladium, silicon and zinc are suitable), a long chain polyalkeneglycol and a alkali or alkaline earth metal hydroxide or alcoholate.

As far as contaminated soil are concerned, the glycolate dehalogenation process consists of five steps: preparation, reaction, separation, washing, and dewatering . During the preparation step, the contaminated waste (soil, for example) is excavated and sifted to remove debris and large objects such as boulders and logs. Next, in the reaction step, the contaminated soils and the APEG reagent are blended in a large container called a reactor, mixed, and heated for four hours.

Vapors resulting from the heating process are collected. The vapor is separated into water and the gaseous contaminants by means of a condenser. The water can be used during a later step in the process and the gaseous contaminants are passed through activated carbon filters to capture the contaminant. Dehalogenation (APEG/KPEG) is generally considered a standalone technology; however, it can be used in combination with other technologies. Treatment of the wastewater generated by the process may include chemical oxidation, biodegradation, carbon adsorption, or precipitation.

2.1.3. Hydrodehalogenation

Main reactions / Description	The category includes all the reductive dehalogenation processes involving the breaking of a single bond between a carbon atom and the halogen with the subsequent formation of a single bond between hydrogen and carbon. The process may involve the use of molecular hydrogen, similarly to the hydrogenation of crude oil, or may be based on processes of catalysed transfer of hydrogen from an hydrogen donor.
PCB Concentration	Usually up to around 5000 ppm.
Process temperature	Pressure and process temperature depend greatly on the type of process adopted. The use of molecular hydrogen require temperature in the order of 350°C and high pressure. Process based on hydrogen transfer are performed at temperature ranging from 200 to 350 °C atmospheric pressure.
Process pressure	
Main Reagents	Hydrogen or a hydrogen donor; catalyst; phase transfer agent;
Applicability	Soil, PCB oils.
Needs for post or pre treatment	Pretreatment is needed if soil or contaminated devices are treated;
Main limitations	Hydrodehalogenation processes are often operated at high temperature and pressure, requiring complex plants.

Definitions / process description.

The reductive dehalogenation of halogenated organics is an important and well known reaction frequently used in organic synthesis. I may be defined as the breaking of a single bond between a carbon atom and the halogen with the subsequent formation of a single bond between hydrogen and carbon:

$$C - X + H_2 \rightarrow C - H + HX$$

$$X = Cl, F, Br, I$$

The rate at which the halogen-carbon bond may be reduced depends upon several factors:

- halogen type;
- structure of the molecule in the vicinity of the halogen atom;
- pressure, temperature

Generally speaking, giving a fixed molecular structure, the ranking order at which halogenated organics may be reduced is :

$$I > Br > Cl >> F.$$

The C-F system presents the biggest resistance to the hydrogenolysis due to its high energy of dissociation.

There are several available methods for the reductive dehalogenation of halogenated organics. Among these, the catalytic reductive dehalogenation by means of molecular hydrogen, and the catalytic reductive dehalogenation by means of the hydrogen transfer, are the most studied for the dechlorination of PCBs.

Process details.

Dehalogenation by means of molecular hydrogen. The reaction of halogenated aromatics lead to the formation of the related unsubstituted aromatics compounds and of the halogen acid:

$$Ar\text{-}X + H_2 \rightarrow Ar\text{-}H + HX$$

The reducing agent is the molecular hydrogen and the reaction proceeds only in the presence of catalyst. The catalysts most frequently used are noble metals like platinum, palladium, linked with supports of fine grained $CaCO_3$, $BaSO_4$, C and the Nickel-Raney.

The dehalogenation by means of molecular hydrogen is a widely applied process in the oil refining industry for the hydrogenation of crude oil. In some cases, oil refining companies adapted their own plant to perform the catalytic hydrogenation for the treatment of PCB wastes. The process works at high temperature and pressure (270-390°C; 14-70 atm.), as the dehalogenation is performed by means of the same plants and with the same catalysts used in the crude oil processes.

With few exceptions, this process has not yet been developed on industrial scale for the treatment of PCBs, due the high cost of the catalyst and to the low conversion rate observed.

Some new hydrodehalogenation processes using palladium as a catalyst work at atmospheric pressure. The catalyst, made by $PdCl_2$, is anchored to a N-vinyl-2-pirrolidone support; the reaction operates at atmospheric pressure and 65°C, and is strongly poisoned by the HCl formation. Due to this, it is necessary to add a stoichiometric amount of a base in order to neutralise the acid.

The reduction reaction based on the use of Nichel-Raney as catalyst, are usually slower than the palladium based ones, requiring longer reaction times and higher temperatures. The advantage lies in the lower cost of the Nickel-Raney reagent, which however may be not enough to compensate for the inefficiency of the process.

Hydrodehalogenation by means of hydrogen transfer. In the last twenty years, the possibility to reduce halogenated aromatics by means of organic molecules acting as reducing agents in presence of a catalyst has been studied. In this process, the hydrogen molecule is transferred from the organic molecule to the halogenated compound, and thus the process is usually called "hydrogen transfer dehalogenation". Compared to the catalytic reduction with molecular H2, the hydrogen transfer reaction present several improvements. First of all, as hydrogen donors are not gaseous compounds, this kind of process avoid the risk related to the use of the hydrogen gas and of pressurised reactors.

The hydrogen transfer reaction is as following:

DH_2 + Ar-X → Ar-H + D + HX DH_2 = hydrogen donor

Ar-X = halogenated aromatics

D = (hydrogen acceptors)

Hydrogen donors may be hydrazine, ipophosphites, formiates, boron, aluminium, tin, silica hydrides, alcohols, amines, hydrocarbons, used with homogeneous catalyst made of complex salts of palladium, platinum, ruthenium, iridium, iron, nickel, cobalt, or with heterogeneous catalysts made mostly of palladium.

The reaction environment is quite complex, as the simultaneous presence of a matrix contaminated by PCB, an aqueous strongly basic aqueous phase, a phase transfer agent represented usually by a quaternary ammonium salt, a solid catalyst, a gaseous phase is usually involved.

A key aspect is the selection of the proper solvent, which may play a very sensitive role in function of the type of contaminated matrix, and which may affect the effectiveness of the transfer of hydrogen between phases. The role of the phase transfer agent is to transfer reagents in one phase through the interface toward the other phase, in order to overcome the problems related to phase heterogeneity and to allow the reaction to proceed.

A lot of research work has been performed in order to discover if the role of the base in the aqueous phase is limited to the removal of the chloridic acid produced during the dehalogenation reaction, or if other phenomena are involved in the process. In the literature results concerning dehalogenation reactions using different base (KOH, NaOH, Ca(OH)2 , Na_2CO3 , Mg(OH)2) are reported, showing that the catalytic activity is directly related to the base strength. Systems using less strong base require longer reaction times to allow for a complete dealogenation.

Indeed, some reductive dehalogenation processes like the BCD (Base Catalysed Dehalogenation) process are based on the idea that the base play a central role as catalytic agent.

2.1.4. Gas Phase Chemical Reduction (GPCR)

Process Description	A process which uses hydrogen at high temperature as a reducing agent to destroy chlorinated organic compounds.
PCB Concentration	Up to pure PCB
Main Reagents	Hydrogen
By products, outflows and waste streams	
Applicability	Typical applications for GPCR include treatment of PCBs, electrical equipment, contaminated soils, petrochemical wastes, high-strength industrial chemicals, chlorofluorocarbons, carbon filter media, certain low level radioactive wastes, and municipal sludge.
Needs for post or pre treatment	A pre-treatment system is needed for feeding solid wastes into the GPCR
Main advantage	High Destruction efficiency
Main limitations	Process operating at high temperature; a pre-treatment system is required.

A gas reduction process uses high temperature hydrogen as a reducing agent to destroy chlorinated organic compounds. A process developed by originally in Canada is the Gas-Phase Chemical reduction (GPCR). The process is based on gas-phase thermo-chemical reaction of hydrogen with organic compounds. At 850^{o}C or higher, hydrogen combines with organic compounds in a reaction known as reduction to form smaller, lighter hydrocarbons, primarily methane. For chlorinated organic compounds, such as PCBs, the reduction products include methane and hydrogen chloride. This reaction is enhanced by the presence of water, which acts as a reducing agent and a hydrogen source.

Organics such as PCBs, PAHs, chlorophenols, dioxins, chlorobenzenes, pesticides, herbicides and insecticides are quantitatively converted to methane. Approximately 40% of the methane produced can be subsequently converted to hydrogen via the water shift reaction and the remaining methane converted to hydrogen in the catalytic steam reformer. Thus, the process can operate without an external supply of hydrogen.

The mixture of gases and vaporised liquids are heated as they pass electric heating elements situated around the central ceramic-coated steel tube of the reactor. Gases and any entrained fine particulates proceed up the central tube providing in excess of 2 seconds retention time at 900^{o}C.

The reactions come to completion before the gases reach the scrubber where the water, heat, acid and carbon dioxide are removed. A caustic scrubbing agent is added, if required, to maintain the scrubber water pH at between 6 and 9. The temperature of the exit gas is maintained near 35^{o}C by cooling the scrubber water using dual plate heat exchangers and cold water from an evaporative cooler.

This process is likely to be preceded by a thermal desorption unit when treating solid wastes. There is potential for the removal of organic contaminants from the solid material to be improved in the process, as the thermal desorber will operate under a reducing hydrogen atmosphere, offering simultaneous destruction. Under a reducing atmosphere the formation of dioxins is less likely to occur, although partial hydrogenation of more chlorinated molecules (eg OCDD to TCDD) may still occur and will depend on the efficiency of the overall desorption and hydrogenation process.

The technology utilizes reduction chemistry rather than oxidation reactions typical to incinerators. By reforming contaminants in a hydrogen atmosphere, the possibility of forming dioxins and furans as by-products is greatly reduced. The off gases (primarily methane and hydrochloric acid) are held and analysed prior to reuse or recycle thus ensuring that there are no uncontrolled emissions

5.1.5. BCD Dehalogenation Process

Main reactions / Description	The BCD process involves the addition of an alkali or alkaline earth metal carbonate, bicarbonate or hydroxide to the medium contaminated by PCB.
PCB Concentration	Reported values up to 100000 mg/kg
Process temperature	Up to 350°C
Process pressure	
Main Reagents	alkali or alkaline earth metal carbonate, bicarbonate or hydroxide ; an hydrogen donor (fatty acid, aliphatic alcohol or hydrocarbon, amine); carbon source.
Applicability	Mainly soil, sediment, sludges. The applications of BCD technology range from treatment of liquids to solids contaminated with a wide variety of pollutants ranging from pure PCB liquids such as Askarels and Aroclors to dielectric fluids containing PCB such as found in transformers, capacitors and other sources.
Needs for post or pre treatment	Soil may require meshing prior to entered the system. Capacitors may require a chemical pre-treatment. When applied to the decontamination of hydrocarbon fluids, either aliphatic or aromatic, air needs to be excluded in order to prevent ignition of the hydrocarbon at the elevated temperature of the BCD reaction.

Definitions / process description.

The Base Catalysed Dechlorination (BCD) process was developed from work by the USEPA RREL on earlier forms of dechlorination (in particular the "KPEG" process).

The BCD process can involve direct dehalogenation or decomposition of the waste material, or can be linked with a pretreatment step such as thermal desorption which yields a relatively small quantity of a condensed volatile phase for separate treatment by the BCD process.

Process details. The BCD process involves the addition of an alkali or alkaline earth metal carbonate, bicarbonate or hydroxide to the medium contaminated by PCB.

The BCD patent (Rogers, 1991, US Patent 5,064,526) indicates that the alkaline chemical may be added to the contaminated medium in an aqueous solution, or in a high boiling point solvent. If the chemical is added in the form of a solid dispersion or suspension in water, the water assists in distributing the metal compound homogeneously throughout the contaminated medium. If the chemical is added with a high boiling point solvent, the solvent must have a boiling point of at least 200°C, and preferably be in the range from 200°C to about 500°C. Otherwise, it will distil from the mixture during treatment.

Alkali is added to the contaminated medium in proportions ranging from 1 to about 20 percent by weight. The amount of alkali required is dependent on the concentration of the halogenated or non-halogenated organic contaminant contained in the medium.

A hydrogen donor compound is added to the mixture to provide hydrogen ions for reaction with the halogenated and non-halogenated contaminants, if these ions are not already present in the contaminated material. The hydrogen donor compound may comprise the high boiling point solvent in which the alkali or alkaline earth metal compound is added, or it may include fatty acids, aliphatic alcohols or hydrocarbons, amines or other similar compounds. In order to activate these compounds to produce hydrogen ions a source of carbon must be added, either in solution or in suspension. An inexpensive carbon source which is water soluble and suitable for use, is a carbohydrate such as sucrose.

The mixture is heated at a temperature and for a time sufficient to totally dehydrate the medium. This may be performed at atmospheric or at reduced or elevated pressure. The water which is included in the aqueous solution allows homogeneous distribution of the alkali throughout the mixture and acts as a wetting agent and penetrant. When the water is removed from the medium during the dehydration step, the alkali is concentrated to a reactive state.

After dehydration, the medium is further heated at a temperature between 200°C and 400°C for a time sufficient to ensure the reductive decomposition of the halogenated and non-halogenated organic contaminant compounds, typically 0.5 to 2 hours. At this temperature the carbon source (eg the carbohydrate) acts as a catalyst for the formation of a reactive hydrogen ion from the hydrogen donor compound, as from the following reaction:

$$R+M \rightarrow (\text{heated at } 200\ 400°C, C) \rightarrow R + H^- + M^+$$

where R is the hydrogen donor compound, M is the metal compound, C refers to a source of carbon, for example a carbohydrate, and H is the hydride ion. The reactive hydride ion then reacts with the halogenated organic compounds contained in the contaminated medium according to the following reaction:

$$H+ R\text{-}X + M^+ \rightarrow (\text{heated ad } 200 – 400°C) \rightarrow RX + R\text{-}H$$

Where R-X is the halogenated organic contaminant, X is the halogen atom and R-H is the reduced form of the contaminated compound.

Finally, the mixture is neutralised by the addition of an acid, preferably to a pH of 7 to 9. Depending on the nature of the feed material, the reagent additions and the site use, it may be possible for the treated material to be returned to the site if desired, although this may not be possible if the treated material is oily or has a high salt content.

Generally, the presence of oxygen will not adversely affect the BCD process and therefore air does not need removed. When applied to the decontamination of hydrocarbon fluids, either aliphatic or aromatic, air needs however to be removed to prevent ignition of the hydrocarbon at the elevated temperature of the BCD reaction. Nitrogen gas is usud as a blanket for this purpose.

Performance

Test results show that the BCD process canreduce PCB from 100000 mg/kg to below detectable limits in approximately 2 hours (Rogers, 1991). Test results reported by the license owner reported a decrease in concentration from up to 300000 ppm to under the detection limits in 90 minutes.

A sample of contaminated soil containing 2,200 mg/kg of Aroclor "1260", 1000 mg/kg of Aroclor "1242", 1000 mg/kg of PCP, 1000 mg/kg of dieldrin, 1000 mg/kg of lindane and 500 mg/kg ofBCD 2phenylnaphthalene, was treated by this process and the contaminants reduced to less than 1.0 mg/kg each. The 2phenylnaphthalene was also reduced to a cyclic hydrocarbon (Rogers, 1991).

The process mainly involves chlorine stripping. In treatment of chlorinated aromatic hydrocarbons the removal of chlorine atoms results in an increased concentration of lower chlorinated species (eg higher congeners are replaced by lower congeners). This is not a problem with contaminants such as PCBs. However, with constituents such as dioxins the lower congeners (eg TCDD) can have a higher toxicity than the more highly chlorinated congeners (eg OCDD). Therefore the process must be monitored to ensure that the reaction continues to completion.

In the case of treatment of PCBs and PCB contaminated oils, treatment will typically reduce the PCBs to less than detection (0.1 mg/kg total PCBs for the lower congeners, and 0.01 mg/kg for the higher congeners) if

sufficient reaction time is allowed. Given that the process is a batch operation, it is possible to allow the reaction to proceed until the required level of destruction has been confirmed.

2.2. Thermal Destruction of PCBs

2.2.1. Incineration

Process Description	Combustion in presence of an excess of oxygen
PCB Concentration	Usually less than 15% PCB in the waste fed to the plant
Main Reagents	Chemicals for the treatment of the exhaust gases;
By products, outflows and waste streams	Ashes; flue gases; secondary reagents after the flue gas treatment
Applicability	Any kind of waste may be treated
Needs for post or pre treatment	Depending on the incinerator type.
Main advantage	Highly flexible; capable to process any kind of hazardous waste; consolidated technology.
Main limitations	High energy requirement. Sophisticated air pollution control system is needed to reduce PCDD/F emissions.

In general, the objective of the incineration process is to reduce the waste volume and to simultaneously destroy the hazardous contaminant contained in the processed waste. In the case of disposal of PCB waste, the objective to destroy the toxic fraction of the contaminated waste (the PCBs themselves) is however prevailing over the objective to reduce the volume of waste;

The chlorine content of the waste being incinerated needs to be carefully controlled to ensure that the emission of PCDD/F are kept under the 0.1 ngTeq/m^3 level considered today as the minimum BAT requirement. Usually, waste with no more than 3% content of chlorine may be burnt in industrial waste incinerators, although specially designed incinerators may burn liquid waste with high concentration of PCBs, up to 15% - 20%.

If the wastes to be treated are made homogeneous in term of their physical composition (e.g., physical state, size, thermal content, moisture level, amount of non combustible fractions, etc.) the destruction efficiency of the process is higher and the management of the air pollution control system is facilitated.

As incineration is usually not economically viable below a certain capacity, incineration plants are usually large facilities requiring a significant portion of land. Thus an incinerator plant for PCB must be always thought as a part of an hazardous waste disposal platform, where a complete system for waste characterization, pre-treatment, proper mixing with other waste stream, and an up to date system for air pollution control and on line monitoring is in place. Incineration still represents in some cases the first choice treatment technology for the destruction of PCB, however some limitation should be considered when adopting this technology:

- Incineration does not allow the recovery of valuable resources (like dielectric oil), with the exception of the chemical energy which may be partially recovered as thermal or electrical energy;
- If not properly operated, incineration of PCB wastes may produce PCDD and PCDF in the exhaust gases; exhaust gases also may contain other contaminants like heavy metals, particulates, Nox, SOx. Hcl which need to be recovered or abated.
- The cost of the air pollution control and monitoring systems may represent a significant fraction of the investment cost, making incineration economically feasible only for large capacity plants.

Process details

Incineration is the chemical reaction of oxygen (oxidation) with a combustible material. A great advantage of the incineration process is their highly non specificity: all organic compound present in the combustion stream are mineralized if proper incineration conditions are ensured.

The main process stages are:

- **drying and degassing** – here, volatile content is evolved (e.g. hydrocarbons and water) at temperatures generally between 100 and 300 °C. The drying and degassing process do not require any oxidising agent and are only dependent on the supplied heat
- **pyrolysis and gasification** - pyrolysis is the further decomposition of organic substances in the absence of an oxidizing agent at approx. 400 – 700 °C. Gasification of the carbonaceous residues is the reaction of the residues with water vapor and CO_2 at higher temperature. Thus, solid organic matter is transferred to the gaseous phase. In addition to the temperature, water, steam and oxygen support this reaction
- **oxidation** - the combustible gases created in the previous stages are oxidised, depending on the selected incineration method, at flue-gas temperatures generally between 800 and 1450 °C.

To achieve good burn out of the combustion gases, a minimum gas phase combustion temperature of 850 °C and a minimum residence time of the flue-gases, above this temperature, of two seconds after the last incineration air supply have been established in legislation (Directive 2000/76/EC and earlier legislation).

For the incineration of PCB waste, the recommended values for the operational parameter are as following:

- minimum residence time of the flue-gases of 2 seconds above 1200°C at 3% O2 content, or 1.5 sec at 1600°C and 2% di O2 content;
- combustion efficiency greater than 99%;

It is also recommended to adopt technologies for the online monitoring of the waste feeding rate and for the on-line monitoring of the O2, CO2, CO, NOX, SOx, HCl, PM10 at the stack. Periodical measurement of the concentration of PCDD/PCDF, PCB, PAH and heavy metals at the stack should be also performed. Moreover, systems for the control of HCl emissions must be adopted.

The main ancillary facilities and equipment which are usually needed by large incinerators are:

- Waste reception facilities (parking, weighting, registration, archiving)
- Waste analysis laboratory
- Temporary storage for incoming wastes
- Waste pretreatment
- Energy recovery systems (steam boilers, turbines for electricity production, co-generation systems, etc.)
- Waste water control and treatment plants
- Environmental monitoring systems (air, water)
- Inertization plant for the treatment or contaminated ash
- Landfill for ash disposal and other solid waste disposal.

In the case of plants dedicated to the destruction of halogenated waste, a module for the recovering / recycling of chlorine, in the form of HCl, should be considered.

The following different plant configurations may be considered for the purpose of PCB destruction:

Rotary kiln. Rotary kiln are the most widely used incineration plants. They are able to process a wide variety of wastes, and to operate with different feeding rate. The waste is conveyed through the kiln by gravity as it rotates. Direct injection is used particularly for liquid, gaseous or pasty (pumpable) wastes – especially where they have safety risks and require particular care to minimise operator exposure. Solid materials are usually

fed through a non-rotating hopper. The residence time of the solid material in the kiln is determined by the horizontal angle of the vessel and the rotation speed.

Rotary kiln incinerators may operate at high temperature and usually allow a good mixing between solids and combustible and a continuous ash removal. The residence time of solids is easy to be managed, and the need for waste pre-treatment is very low. Disadvantages consist in the fact that rotary kiln incinerators may needs system for controlling fugitive emission, are more subjected to thermal discontinuities due to the high heterogeneity of wastes processed, and have greater emission of particulates and HCl.

For the purpose of hazardous wastes destruction, rotary or drum kilns may be equipped with post-combustion chamber and with injector for the management of pumpable wastes.

The post combustion chamber are generally designed to meet the residence time required by the regulation (EC Directive 2000/76/EC in Europe) for flue gases and for directly injected liquid wastes.

A small/medium size rotary kiln incinerator (up to 15t/day) should include the following components:

- **Storage facility**. The storage facility is a bunker maintained under negative pressure with an minimum overall area of around 2000m^2. It is divided in 3 storage areas: storage and pre-treatment (shredding, oil removal) of PCB capacitors; storage and pre-treatment of PCB contaminated soil and concrete (crushing, sieving); storage and pretreatment (washing) of PCB transformers. An insulated conveyor belt carries waste from the storage facility to the incinerator. The storage facility should include a up to date waste characterization lab, by a computerized system for waste acceptance and labeling, and an air cleaning system (activated carbon and fabric filter).
- **Rotary kiln.** The rotary kiln should ensure a maximum operating temperature of at least 1000 °C. The kiln may have a length in the order of 10-13m, and an inner diameter of 1.7 -2.5 m, with a length/diameter ratio of 6-8. The rotation and inclination must ensure an estimated waste retention time from 0.5 to 1.5 hrs. The internal wall of the kiln is usually lined with a layer of refractory material with high content of Al_2O_3 and SiO_2
- **Secondary Combustion Chamber (SCC).** The vertical furnace is usually a stainless steel cylindrical structure, connected with the rotary kiln, equipped with two two-stage light diesel burners and a maximum operating temperature of at least 1200 °C.
- **Pre cooling** The pre-cooling system is used in some plants with the purpose to decrease temperature after the post-combustion chamber down to 950°C – 1000°C to prevent damage to the Venturi quencher. This system is basically a pre-quenching operating with two high pressure nozzles injecting a water/air mixture.
- **Ventury quencher**. In this device, the temperature of the stack gas containing HCl decrease suddenly from 950°C down to 80-95°C in less than 1s. The cooling and absorption medium is water..
- **NaOH adsorbtion chamber**. The NaOH absortion tower are based on counter or co-corrent spraying of a NaOH solution, for the neutralization of Chlorine.
- **Fabric filter with lime and activated carbon injection.** The fabric filter for the removal of fly ash should be equipped with injectors of lime and activated carbon. That would ensure further removal of PCDD/F and chlorine. The flow rate of the injectors can be adjusted continuously. Fabric filter must be equipped with a closed system for the removal of fly ash, which – due to high concentration of UP-POPs and heavy metals - is usually the most dangerous residue deriving from the incineration process.
- **Activated carbon fixed bed.** The activated carbon column (ACC) is the last barrier against the release of PCDD/F and PCBs in the athmosphere. ACC may allow for a further reduction of 2-3 times of the concentration of PCDD/F and PCBs remaining in the flue gas after fabric filters. Working temperature

within ACC should not exceed 80-115°C, and the size of the ACC should be enough to ensure a proper reaction surface. Activated carbon must be incinerated once exhausted.

- **Stack.** The height and cross section of the stack must be properly designed, with the support of dispersion modeling analysis, to ensure good dispersion of the flue gas. The stack must be far from any aerodynamic obstacle that could prevent the proper dispersion of flue gases.
- **Water treatment** The process wastewater treatment system may include adjusting pond, heat exchanger and cooling tower, desalination equipment for electrodialysis, reverse osmosis and evaporation, flocculation and precipitation tank, precipitate dehydrator, etc.. After treatment, the water may be recycled for use, so that the discharge of wastewater from the whole treatment process could be avoided.

Liquid injection incinerator

Liquid injection incinerator relies on high pressure to prepare liquid wastes for incineration by breaking them up into tiny droplets to allow easier combustion. This configuration present several advantages:

- absence of mechanical components in the combustion chamber;
- limited generation of pollutants
- low maintenance and operational costs
- stability of the combustion process

These advantages are counterbalanced by several limitations:

- extensive pretreatment of wastes is required;
- suitable only for injectable wastes (liquids or fine dusts);
- risk of injector clogging in presence of incompatible wastes;
- frequent maintenance / replacement of injectors may be required in presence of corrosive wastes.

2.2.2. Plasma

Technology Scope. The Plasma technology may be used to destroy basically any type of liquid or solid waste. Theoretically there are no limits in the concentration of POPs that can be destroyed by this technology, as plasma may operate at very high temperature. However plasma is more effective for liquid waste POPs stream.

Process Description. Thermal plasma is a high temperature, partially or completely ionized gas. A thermal plasma is usually generated by an electric current (alternate at high frequency or continue) passing through the gas; the resistivity energy is dissipated by the gas which, with the increase in temperature, became conductive and able to sustain the electricity flow.

Plasma arc technology can create plasma using almost any type of gas (oxygen, nitrogen, carbon monoxide, air, etc.) and in a wide range of pressures (vacuum to 20 atmospheres). The plasma arc has a wide spectrum of temperatures ranging from 1500°C to over 7000°C.

The thermal plasma offer several advantages for the elimination of toxic wastes:

- The use of the electricity for the production of heath eliminates or greatly reduce the use of air for the combustion process; if an inert gas is used for generating the plasma, this render it actually a pirolysis process leading to the destruction of waste without oxidation.
- The high energy density and the high temperature allow for a great throughput in small size reactors.
- The switch on / switch off time for a plasma plant is usually very short, making it possible to use these

it in a discontinuous way,

- On the other side, the biggest shortcoming of plasma lies in the fact that electricity is not the most efficient way to produce thermal energy, thus plasma process are rather inefficient from the thermodynamic point of view. This shortcoming however become negligible for the treatment of waste that are inert and decompose only at very high temperature, or which for other reasons cannot be burnt directly by incinerators.

Plant components : Depending on the waste to be treated, a typical plasma plant would be composed by the following components:

1. **Electric system:** as the plasma relies on electricity as sole energy source, a suitable electricity source is the key for the proper working of the unit. Plasma usually operate at high voltage and current. A medium size plasma plant operates at a current in the order of 1000A and at a voltage of around 500V. Small plasma units, like the Plascon plasma suitable only for liquid waste, have an electricity consumption is in the order of 180KW, which can be supplied by a 300KW generator. The electrical system would then include a transformer substation to bring electricity to the desired voltage, safety switchgears, high voltage connections, control panels.
2. **System for the generation / supply of inert gases**. Plasma torches are typically supplied with a small inert gas flow rate which flows through – and actually supports – the electric arc. The gas is usually diatomic (such as Nitrogen) or monoatomic (such as Argon or Helium).The inert gas supply system is usually made of an inert gas storage and an injection system. In rare cases, the inert gas may be generated on site.
3. **System for the generation / supply of oxygen.** Oxygen is used in some plasma process as a reagent with exhaust gas generated by the thermal destruction process. In some plants, exhaust gas made of carbon and hydrogen is made reacting with a stoichiometric amount of oxygen to generate a CO and . CO and H2 are subsequently recovered or burnt in a flare, to generate CO2 and H2O.
4. **Waste feeding system.** Depending on the type of waste, waste feeding may take the form of an injection system of liquid waste, or of a batch feeding for solid or semisolid waste. The waste feeding system may include waste storage, pretreatment and mixing.
5. **Plasma torch and plasma reactor.** Plasma torches and plasma reactor are the core part of the system. There are basically two different types of plasma torches and plasma reactors:
    - **Non-transferred arch.** In a non transferred arc plasma torch, the material of the electrodes does not take part in the plasma generation. The reagents for the plasma generation may be provided directly by the waste to be treated. However, in this case the interaction of corrosive component, like chloride, with the electrodes may cause their erosion. For this reason, in the non transferred arc torches, reagents for the plasma generation are usually injected downstream to the electrodes. The plasma arc torch uses copper electrodes to create a non-transferred arc. The plasma torch and electrodes are water-cooled and the average life of the electrodes ranges between 200 to 500 hours of operation. A DC power supply unit provides the electrical requirements of the torch and commercial units are available in power levels ranging from about 100 kW to 10 MW capacity.
    - **Transferred arch.** In the transferred arch, one of the electrodes is the substance to be treated. Wastes may be introduced in the reactor as liquid or solid: the exposure to the heath generated by the arc cause the pyrolisis of the organic component of the waste an the vitrification of the inorganic components. Electric Arc furnaces in the metallurgic industry may be considered as a special kind of plasma transferred arch.
6. **Cooling system.** Cooling of electrodes is usually obtained by means of a water cooling circuit, refrigerated by evaporative or air cooling units. Usage of water for cooling the electrodes may range from

less than 2 m3/hr to tenths of m3/hr, depending on the amount of water recirculated in the system , and on the system size and design

7. **Flue gas treatment system**. The flue gas treatment system may be very specific for the type of waste disposed by the plasma plant. More specifically, for plants used for destroying chlorinated compounds, the following components are required:
    - a rapid quencher, for ensuring the instantaneous cooling of the exhaust gas and preventing the "de-novo" formation of dioxin;
    - a system for the recovery of chlorine. This is usually made by spraying the gas with an alkaline solution in the quencher.
    - Other flue gas treatment components that may be present in a plasma plant are: Post-combustor, syngas recovery system, cyclone separator, quencher, AC filters, HEPA filters, scrubbers, flares, etc.
8. **Water treatment system .** Although a water treatment system is not always necessary for treatment of the plasma wastewater effluent, depending on the features of the waste feeded, the water coming out from the quencher and the neutralizer may contain concentration of salts that may be recovered for the purpose of recirculating the water, or to have the water compliant with the regulatory limits. Water treatment system may be composed by evaporator modules or by reverse osmosis units for the removal of salts, and by filters for the removal of particulate.
9. **Waste collection system**: there is no need of a system dedicated to the collection or storage of solid waste for plasma units treating only liquid waste, with the exception of small amount of sludge or high concentrated saline solution from the wastewater treatment system. Plasma dedicated to the disposal of solid waste would generate as a solid waste inert, vitrified solid waste which are not dangerous and which can be usually be disposed in a landfill for non hazardous waste.
10. **Online monitoring.** The online monitoring system for plasma would mainly include:
    - an online monitoring system for measuring the concentration of NOx, SOx, O2, dust, HCl;
    - an online system for the monitoring of the main operational parameters, like the plasma voltage and current, reactor temperature, pressure, etc.

Key Operational Parameters.

In the following table, the key operational parameters for three types of plasma technologies commercially available are listed.

Parameter	CSM Mobile Plasma for solid waste	PACT^{TM} System for mixed waste	PLASCON liquid waste unit
Main scope of the plant	Mainly pulverized or granulated solids (asbestos); suitable for semisolid waste or liquid waste.	Solids in drums; suitable also for semisolid, pulverized or granulated waste	Only liquids and gases
Capacity (t/hr)	0.3	0.2 (based on the duration of the whole cycle)	0.135 (for pure PCBs)
Maximum power	1MW		150KW
Max current and voltage	2000A, 500V		
Type of plasma	Transferred arc, computerized design plasma torches	Multimodal torch (nonTransferred for	Non transferred arc, in flight destruction of waste.

		heating up, transferred for melting waste)	
Type of reactor	Cylindrical reaction chamber (1mx1m)	Centrifugal chamber ($1m^3$)	"In flight" tube.
Batch / continuous process	Batch (continuous for liquids)	Continuous	Continuous
Operation temperature in the destruction zone	Over 1700°C	1650°C	3100°C
Flue gas flowrate (m^3/hr)	500 Nm^3/h		0.5 Nm^3/hr
Mobile / Transportable / Fixed	Transportable	Fixed	Mobile

2.3. 8. Integration of technologies

Retrofilling, solvent washing and thermal desorption cannot be considered technologies for POPs disposal, as these technologies have as objective only the physical transfer of PCBs without destroying it.

Therefore these technologies have to be integrated with disposal technologies.

Retrofilling is very often the only chance for the treatment of large PCBs transformers with low-medium contamination of PCBs. The large PCBs amount of oil generated by the multiple-cycle retrofilling treatment of transformers calls for close integration with PCB destruction technologies. The choice between incineration of the contaminated oil and dehalogenation followed by regeneration of oil largely depends on economic constraints, like the cost of dehalogenation (which is mainly driven by the cost of metallic sodium), the cost of incineration, and the cost of new dielectric oil. There is always the risk that private or small PCBs owners find convenient to sell contaminated oil without checking it for PCB content, in order to get some revenue for compensating the cost of new oil for retrofilling transformers. If the cost of dielectric oil is high, it is likely that the options leading to its environmentally safe regeneration would be more competitive; the same could be obtained by financially supporting ESM technologies for the destruction of PCBs and the regeneration of oil.

2.4. Considerations related to the selection of the site for PCB disposal

The selection of the site for the establishment of PCBs disposal facility should be based on logistic, infrastructure, environmental, permitting considerations.

Logistic aspects: In the selection of the site, proper consideration must be given to the distance to sites where PCBs equipment is located, including areas for the intermediate storage of PCBs. Transportation cost is an important component of the overall handling and disposal of PCBs equipment; moreover , transportation of PCBs should rely as much as possible on well maintained transport infrastructures. The establishment of a disposal facility should therefore always include a transportation plan and an assessment of transportation infrastructures; the needs for establishing temporary storage areas for PCBs equipment need also to be properly assessed.

Infrastructure and utilities. Depending on the technology selected, the availability of utilities and infrastructures must be ensured. Availability of utilities like industrial and potable water, electricity, steam, must be properly assessed at the light of the needs of the technology. For instance, the establishment of a plasma facility would require a reliable and powerful connection to the electric network, capable to bear the peaks of energy required at the startup of the facility; chemical dehalogenation plants require in general the

availability of steam, that if not available as utility, must be generated on site; incinerators would require availability of large amount of water for quenching and cooling, etc.

Environmental aspects. Environmental constraints must be considered from both the side of the impact of the plant on the environment, and on the risk associated to extreme meteorological or natural events (floods, storm, lightning, earthquakes, atmospheric precipitation, etc.). Typically, both aspects are covered under a sound Environmental Impact Assessment analysis. Considering the hazard associated with the storage, handling and disposal of POPs, it the carrying out of an Environmental Impact Assessment covering the environmental criteria for selecting the site based on UN standards is considered mandatory.

Permitting considerations. Rules concerning the minimum distance from water bodies, populated areas, protected areas must be obviously considered when selecting the site for establishing a disposal facility.

Public consultation and public perception. The involvement of the public by means of formal public consultation and proper awareness raising campaign since the early stage of the project is recommended.

2.5. Conduction of No Load and Proof of Performance Tests

Before starting the operations, any technology needs to be accurately verified by means of no load tests and proof of performance test. Both no load and proof of performance tests are usually strictly related to the technical specification set by the bidding documents; therefore is extremely important, when drafting technical specification, to set for these tests only requirements and standard which are SMART, i.e. Specific, Measurable, Attainable and Relevant. This means, for instance, that some requirements which are not readily measurable should be assessed by means of reliable indicators. For instance, one common requirement is that the plant has to ensure an availability of a certain percentage over time (for instance, at least 18 hours per day for at least 230 days/year). Unfortunately, compliance with this type of requirement can be reliably verified only after some years of operations. Common specifications are also may be that “core component of the equipment must ensure a duration of certain number of years”. This second requirement, though reasonable, cannot be part of any no-load test or proof of performance test, but must be inferred only on the basis of a statistically significant data base of similar plants or materials.

Therefore, in defining criteria for requirements or standards that, though important, cannot be directly measured, it is always recommended to find out indicators that may be considered representative of the desired standard. For instance, an availability of 20 hours per day over one or two week, followed by a thorough assessment of the plant conditions after the test run, may be considered as a good indicators of an availability of 18/24 over 230 days/year.

Setting attainable target value for DE, DRE, and decontamination or cleanup target is also a key aspect in planning tests. Asking the supplier to demonstrate unreasonably low target concentrations or DE values, although attractive from the point of view of communication and public acceptance, may be dangerous as would expose the technology to a significant risk of failure; even if such low values are fulfilled, the extreme conditions under which the plant should run for attaining unreasonably low values may be not representative of the ordinary operational conditions. Target values for tests should be therefore always be based on sound scientific considerations.

2.6. No Load Test

No load test have the main purpose to check the functionality of the disposal facility from the point of view of proper working of each facility component, presence of air or liquid leakage points, correctness of the electrical layout, effectiveness of the control and monitoring system, verification of the technical and operational parameters. For technologies working at high temperature, like incinerators or thermal desorber,

necessary activities for the preparation of refractory material to high temperature by means of progressive heating under programmed temperature ramps must be completed before the no-load runs.

No load test must be carried out firstly on each separate component of the plant, and secondly on the whole system. No load test runs should be carried out with POPs free waste stream, in all the case where running the equipment in absence of any waste load can be either not representative or even dangerous for the equipment.

No load test should then include:

- The test of the remote control software and of the servomechanisms and sensors governed by the software, including the verification of the logic of the plant and of the control system;
- The complete test of the electric system (motors, switches, activators) and of its safety devices
- The complete test of hydraulic and pneumatic systems
- Complete test of fuel system and burners
- Tests of the online monitoring system,
- Test of chemical feeding system;
- Tightness of reactors, tanks, pipes;
- Separate test for any subcomponent, like water treatment system, air pollution control system, waste pretreatment and feeding system, etc.

A complete no-load test plan with procedures and acceptance standards must be included in the operational manual of the disposal facility.

2.7. Proof of Performance Test

Proof of Performance testing is intended to ensure that the technology operates in accordance with the technical specifications, is adequate to perform as warranted by the bidder, and substantiates a satisfactory level of performance reliability prior to its acceptance. The detailed Proof of Performance test protocols and acceptable parameters should be approved by the contracting parties before the testing is carried out. In general, proof of performance test should cover a set of conditions selected as the most common operational conditions, together with some “extreme” conditions which may occur during the operational life of the plants.

The purpose of the proof of performance test is twofold:

- To identify the operational conditions under which the plant may operate safely and in compliance with the required technical and environmental standards;
- To verify that the plant can effectively comply with BAT/BEP requirements and standards, and with the legislative standards on emission of pollutants in the atmosphere and in the other process streams.

The Proof of Performance Test plan must be carefully agreed among the parties, and the following details should be defined:

- Clear conditions for sharing operational costs during test;
- DE and DRE values to be attained;
- Operational, environmental and emission standards to be complied with;
- Duration of the proof of performance test;

- Amount of different waste categories to be treated during the proof of performance test, and the concentration of PCBs and other POPs in each waste;
- Methodologies for preparing waste to be treated and for measuring PCB concentration in the input waste stream;
- Number of runs to be performed for each waste category;
- Number of samples to be taken for each run;
- Location of sampling points;
- Clear conditions for the acceptance of the test results, including the arrangements for the third party verification of the compliance of the Proof of Performance Test results with the standards.
- Conditions which apply in case one or more runs or sampling result do not comply with the standard;
- Conditions which apply in case of test failure;
- Sampling methodology and standards;
- Analytical methodology and standards;
- Emergency measures
- Training on PPE and Hazop

Chapter IV. PCBs, PCB–containing equipment and waste identification, tracking, and record keeping

The following documents should be considered, among others, as fundamental literature reference documents for the guidelines on identification of PCBs:

- UNEP, Guidelines for the identification of PCBs and materials containing PCBs, 1999
- UNEP, Inventory of PCB-Containing Equipment, 2002
- James Willis, PCB Inventories: Approaches to Compiling Inventories of PCBs, PCB-Containing Equipment. Proceedings of the Subregional Workshop on Identification and Management of PCBs and Dioxins/Furans, La Habana, Cuba, April 23-26, 2001

Further reference documents used in the course of preparation of this document are listed in the "Reference" section.

1. Performing a PCBs Questionnaire Survey

1.1.1. General Description of the Questionnaire Forms

The PCB Inventory form (UNEP 2002), and more specifically, section A and B of that form, has been adopted as reference form, with some modifications, for the inventory of equipment possibly containing PCBs. Section C is the standard form for the inventory of PCBs waste and PCBs contaminated sites. These forms have been translated in an electronic worksheet for the purpose of record keeping and post elaboration. The use of a distributed electronic form would allow not only for easier record keeping, but also for a more standardized use of terms, as most of the term would be selected from a standard dropdown list. The hardcopy form can be used for data recording during field survey. All the forms contain a site univocal code which is the same for all the forms pertaining to the same site.

Below, clarifications concerning some of the fields of the proposed forms are reported.

Section A

- **Record Number:** The record number shall be a univocal numeric code for identifying the site.
- **Geographical coordinates:** In addition to the address, the geographical coordinates are added. This information is today readily available due to the low cost of GPSs and of the presence of reliable geographical maps commonly available on the internet.
- **Type of company, industry type at the specific site.** Industry is classified according to the classification of Industrial Activities in Indonesia
- **Location.** The following general location type should be adopted: Industrial zone, Urban area, Rural area, Park, or Natural Land, Others**.**

Section B

- **Record Number:** The same of Section A
- **Type of equipment:** Step Up transformer, Power Transformer, Distribution Transformer, Capacitor, Switch, Other. In the electronic form, the relevant equipment type can be selected from a drop-down list
- In addition to power rating, minimum and maximum voltages for transformers are added
- **Size (length, width and height)** Size is not considered a critical date, as it may be roughly estimated by the power rating and the weight. For this reason it is not included in the electronic form.
- **PCB concentration in dielectric oil.** This value shall be entered in ppm
- **Operational statuts of the equipment:** In use, Stand by, Under maintenance, Decommissioned. In the electronic form, the relevant operational status can be selected from a drop-down list
- **Condition of the equipment:** Good, Rusty / Overheated, Damaged but not leaking
  Leaking. In the electronic form, the relevant condition of the equipment can be selected from a drop-down list
- **Storage:** Open air; Open air / Locked; Indoor; Indoor / locked. In the electronic form, the relevant storage modality can be selected from a drop-down list.

Section C

- **Record Number:** The same of Section A
- **Type of waste:** this field will contain information for the univocal identification of the type of waste, including Basel convention classification code and the Indonesian Waste Classification code. See attachment of Government Regulation 101 on the Waste of Hazardous and Toxic Substances
- **Packaging modality:** none, plastic or steel drums, paper or plastic bags, large containers. ADR code if available.
- **Storage:** Open air; Open air / Locked; Indoor; Indoor / locked. In the electronic form, the relevant storage modality can be selected from a drop-down list.
- **Geographical coordinates**
- **Land use of the site and of the surroundings:** according to the classification of land uses and applicable zoning rules under national and regional spatial legislations.

-

1.1.2. *Form "A". Information concerning the Site and the PCB owner.*

Site Record info	Site code	(to be repeated in form "B" and "C")
	Date	
	Inspector	
Information about the company	Company name	
	Company type (NIC-2008)	*
	Public / Private	
	Headquarter address	
Site Contact and Address Information	State	*
	Site address	
	Geo ref. (°)	
	Location features	*
	Contact person name	
	Contact position	
	Phone	
	Fax	
	Email	
Site Information	Number of Staff at the site	
	Number of Transformers	
	Number of Capacitors	
	Number of other equipment	
	Electricity Consumption at site (KWh)	
	PCB Elimination plan?	

Fields marked with * will be selected from a dropdown list in the electronic format of the forms

1.1.3. Form "B". Information Concerning the Equipment.

Equipment identification	Site Code	(the same as A)
	Label Code	(univocal code for each equipment, to be placed on the label)
	Name of the Manufacturer	
	Country of origin	
	Equipment Type	*
	Serial Number	
Equipment description	Power rating	
	High Voltage (V)	
	Low Voltage (V)	
	Manufacturing date	
	Equipment weight, including dielectric oil (Kg)	
	Oil Weight (Kg)	
	Trade name of the dielectric oil or insulating oil	
	PCB content in the liquid (ppm)	
	PCB analysis performed	*
	Information source	
Equipment condition	Operational status	*
	Condition of the equipment	*
	Storage	*
	Retrofilled (Y/N)	*
	Retrofilling date	
	Retrofilling liquid	
	Maintenance company	

Fields marked with * will be selected from a dropdown list in the electronic format of the forms

1.1.4. *Form "C". Information concerning Waste and Contaminated Sites.*

	Site Code	(the same as A)
PCBs Waste identification	Type of Waste including Basel code and Indonesian Waste Classification code	
	Estimated quantity (kg)	
	Packaging modality	*
	Are containers leak proof ?	
	Storage conditions.	*
	Geographical coordinates	
PCB contaminated Site identification	Site Name	
	Land use of the site and of the surroundings	
	Monitoring report if available (attach documents)	
	Cleanup plan if available (attach documents)	
	Cleanup report if available (attach documents)	

Fields marked with * will be selected from a dropdown list in the electronic format of the forms

1.1. PCBs uses to be Considered During Identification and Inventory of PCBs.

PCBs may be found in three classes of applications: closed, partially closed and open applications. Closed applications like transformers and capacitors are the ones which typically must be included in the PCBs inventory. However, identification of PCBs should also include partially closed or open applications, especially in all the cases where these applications can be easily associated with large industries or infrastructures.

1.1.1. *Closed Applications*

Typical closed applications are transformers, capacitors, switches and lighting ballasts. A closed application is defined as "an application in which the PCBs are held completely within the equipment". In normal condition, therefore, the exposure of the environment or humans to PCBs contained in closed application is null. However, exposure may occur in circumstances like maintenance operations, and damage of the equipment due to the aging of the equipment or misuse.

Step up transformers	Power plants
Distribution transformers	Power plants, transformer substation, electricity distribution network, large industrial plants, railways, large ships, hospitals
Power capacitors	Electricity distribution network, large industrial plants
Lighting ballasts	Offices, large building, hospitals
Switches	Transformer substations, electricity distribution network, large industrial plants, railways, large ships

1.1.2. *Partially Closed Applications*

Partially closed applications are heat transfer fluids and hydraulic fluids. In partially closed applications, PCBs is not directly in contact with the environment; however emission to the environment may occur in certain circumstances during typical use, leading in some cases to significant release. A typical example is the PCBs contamination of gas pipes due to the release of PCBs contained in the compressor oil from "compressor blow-by". The two major PCBs accidents in the world (the Yusho accident in Japan in 1968, and the Yu Cheng accident in Taiwan ten years later) were caused by the contamination of rice oil due to an accidental release of PCBs after a leaking in the heater exchanger.

Heat transfer fluids	Chemical industry; petroleum refineries.
Hydraulic fluids	Any industrial process requiring hydraulic fluids. Mining equipment; ferrous and non ferrous metal industry.
Vacuum and compressors pumps	Natural gas transfer substations and pipes; any industrial facility requiring large compressors or vacuum pumps.

1.1.3. *Open Applications*

It is reported that PCBs has been used as additive in paint, flame retardant in surface coatings, plasticizers in chlorine based plastic and rubber like PVC and neoprene. PCBs has been also used as an additive to the paint of older ships.

Lubricants:	Immersion oil for microscopes; brake linings; cutting oils; lubricating oils
Casting waxes	Pattern waxes for casting
Surface coatings:	Paints (including the ones used for ship painting); surface treatment for textiles; carbonless copy paper; flame retardants;
Plasticizers;	Gasket sealers; filling materials; PVC; rubber sealers

1.1.4. *Power Capacitors*

Roughly, all the power capacitors produced before 1982 should be considered as PCB capacitors. In Table 8 below, a list of trade name and production year of power capacitors containing (or suspected to contain) PCBs is provided.

Table 8 Power capacitors containing PCB by brand and production year (Modified after ANZECC[8], 1997)

Brand name of the capacitors	Production year until capacitors contain or probably contain PCBs
AEg Hydra, Berlin	Until 1982, all the capacitors labeled with "CD", "CPA", "Clophen"
Arcotronics, Italy	All until 1977
Asea Kabel, Sweden	All until 1981, all the capacitors labeled with "Askarel"
Asea – Lepper (or Dominit or Brilon D)	All until 1980
Baugatz Ludwig, Berlin	All until 1983

[8] Identification of PCB containing capacitors. An information booklet for electricians and electrical contractors. 1997 ANZECC

Table 8 Power capacitors containing PCB by brand and production year (Modified after ANZECC[8], 1997)	
Brand name of the capacitors	Production year until capacitors contain or probably contain PCBs
Baugatz Kondensatorien, Austria	All until 1982
BICC Capacitors LTD, Helsby England (subsequently commercialized as ABB capacitors)	All capacitors until 1982, except dry capacitors
Brandt W. Gmbh, Leopoldstadt, Lippe	All capacitors
CAF Kondensatoren, Duisburg – Hamborn	All capacitors
Comar Condensatori, Italy	All until 1981
Cond. Fribourg,	All until 1983
Detron Stein	All until 1981
Dubiler, England	All until 1982
Ducati Energia SpA, Italy	All until 1982
Egra KG,	All capacitors
Elcontrol spa, Italy	All until 1984
Electronicon Gmbh	All until 1985
Elektrica (F.Kucera)	All capacitors
Elkonda Gmbh, Germany	All capacitors
Felten + Guilleaume, Energie technik, Cologne, Germany	All until 1982
Frako, Teningen	All until 1983
General Electric, Usa	All until 1980
Grunow Ernst KG, Monaco	All capacitors
Haefely SA, France and Germany	All until 1984
Hitachi, Japan	All until 1982
Hunts, England	All until 1982
I.B.M, Usa	All until 1979
ICar – Slimotor	All until 1981
Internally, USA	All until 1979
Iskra Semic, Yugoslavia	All until 1985
Isokond Gmbh, Germany	All until 1985
Italfarad Spa, Italy	All until 1981
Jensen Tobias, Denmark	All with the letter “C…” or “O…”, until 1982
Otto Junker, Gmbh, Germany	All until 1983
Kapsch & Sohne, Austria	All until 1982
KD Kondensatoren, Monaco, Germany	All until 1982
Knobel, Emenda GL	All until 1982
Konig, Vienna	All until 1982
Leclanché, SA, France	All until 1975
Liljeholmens, Kabel AB, Stockholm, Sweden	All until 1981
Leopold Vlk, Pocking Niederbayern	All capacitors
Lorenzetti, Brasileira	All until 1982
Mallory Capacitors, USA	All until 1979
Mikafil AG, Switzerland	All until 1977
NCC	All until 1982
Neuberger Gmbh	All capacitors
Neuko, Germany	All until 1982

Table 8 Power capacitors containing PCB by brand and production year (Modified after ANZECC[8], 1997)	
Brand name of the capacitors	Production year until capacitors contain or probably contain PCBs
Nokia Capacitors, Finland	All until 1982
Pressey TCC, England	All until 1982
Rectiphase SA, France	All until 1982
Richmont	All until 1982
Roederstein Gmbh	All until 1983
Ruppel & Co, Germant	All capacitors
Saarland Kondensatorenbau	All capacitors
Si Safco Colombes, France	All capacitors
Siemes AG Dynamowerk, Berlin	All until 1982
STR Standard Telephon + Radio	All capacitors
SükoHerrsching D	All until 1982
System Electric Gmbh	All until 1983
Tesla, Czechoslovakia	All until 1986
Thomson	All until 1982
Unitra Telpod, Polski	All until 1986
Varilec SA, France	All until 1984
Varo S.R.L, Italy	All until 1982
VA-RU Kondens, **Eckernförde D**	All capacitors
Vauka MPKO GmbH	All capacitors
Vlk Leopold, Pocking	All capacitors
Wegowerke, Rinkling + Winterhalter, Freiburg / Breisgau D	All until 1982
Wico, Japan	All until 1982
Xamax AG, Embrach	All until 1984
Zeh Wilhelm KG, Freiburg / Breisgau	All capacitors
Zellweger, Uster ZH	All capacitors

1.2. Industrial Sectors where PCBs Containing Capacitors Are Used.

In general, capacitors with an internal volume in the order of one or more liters are used to compensate for the inductive reactive power required by the electrical load. Very often, capacitors can be found wherever there is:

1. An intensive use of fluorescent lamps, like in the case of large buildings, hospitals, railway stations, etc.;
2. An intensive use of electrical motors, for instance in industry manufacturing plants;
3. A compensation system. Compensation systems in cabinets and electrical panels can be identified by the presence of instruments for indicating and adjusting cos (ϕ), as well as by the term "Compensation". Normally, the capacitors can be found in a primary or secondary distribution panel (cabinet) located in example in a basement or an ancillary room in a transformer station or in another secure location of the company;

Power capacitors can be therefore found in

- Buildings: Administrative buildings, Hospital, Museums, Railway Stations, Shopping Centers and in general large buildings (including the old buildings planned for demolition)
- Workshops and Industrial Manufacturing;
- Wastewater treatment plants
- Power distribution and power distribution substations;
- Refrigeration facilities;
- Research institutions.

1.3. Samplingand Analysis of Electrical Equipment

1.3.1. Sampling Dielectric oil from PCB Transformers.

Sampling of electrical equipment very often requires to temporarily shut down and fully de-energize the equipment, so that risk of electrical shock for the operators can be minimized. Transformers (except the very small ones) are usually provided with one or more dielectric oil drainage valves from which the oil can be sampled; when sampling small transformers not equipped with circulation pump, is important to drain the oil contained in the drainage valve and pipes before taking the sample. In performing this operation, all countermeasures to avoid spilling on the soil of PCBs oil must be adopted, and operators must wear proper PPE. Oil sampling should be preferentially undertaken from the transformer bottom drainage valve instead of from the expansion tank at the top. The procedure for sampling transformer is the following:

- Obtain clear, plastic tubing (Tygon).
- Attach one end of the tube to the electrical equipment sampling outlet valve and place the other end of the tube in the sample container.
- The tubing between the transformer and the container should be as short as possible to avoid leakage potential.
- Drain some oil through the sample valve and tubing into the overflow bucket or pan to ensure that no contaminants are present in the sampling line. Then close the sample valve.
- After draining some oil through the sampling line, place the tubing in the sample container.
- Open the sample valve on the transformer.
- Fill the sample container.
- When the sample container is completely full of oil, close the transformer valve.
- Secure the cap tightly.
- Label the sample bottle with the appropriate sample label. Be sure to complete the label carefully and clearly, addressing all the categories or parameters.
- Complete all chain-of-custody documents and record them in the field logbook

1.3.2. Sampling Dielectric Oil from PCB Capacitors.

PCB capacitors are normally sealed. It is therefore necessary to drill a small drainage hole for sampling oil. In doing that, it is important to operate the drill at low speed, to avoid overheating of the capacitors body with possible burning of PCBs oil. It is mandatory to put offline and completely de-energize the capacitors before starting the sampling procedure. In performing this operation, all countermeasures to avoid spilling on the soil of PCBs oil must be adopted, and operators must wear proper PPE. As PCBs capacitors are sealed, once drilled for sampling these equipment cannot be used anymore. Thus sampling of PCBs capacitors cannot be carried out for equipment still in use. Once drilling operation has been completed, the sampling procedure is performed in the same way as described for the transformers.

1.3.3. Labeling and Storing Samples.

Wide-mouth glass jars with PTFE caps must be used for storing samples. Pre-packaged kits for oil sampling can also be used if accepted by the lab. Sample volume must be enough to perform several analyses: a volume of at least 500 ml is recommended.

The sampled equipment should not be moved or underwent any further maintenance operation until analytical results are confirmed, and until the need of further sampling can be excluded. If, for unforeseeable reasons, the need to move or maintain the equipment arise before analytical results are confirmed, the analytical laboratory must be immediately informed. On its side, the analytical lab must inform without delay the equipment owner on the analytical results.

Samples must be immediately sealed and labelled. The following information should be written on the sample labels: date and time, address, equipment serial number (the same entered in Form "B", sampling serial number, operator's name and reference. Digital photo of the sampled equipment must be done using preferentially photocameras equipped with GPS. The above information, including the digital photos, should be recorded in a data base, which will also contain sampling results, for future reference. PCB are persistent substances not expected to degrade significantly, however certain isomer can degrade more quickly when directly exposed to the light, thus is recommended to store samples in a cold place at low temperature, and to perform analysis within one or two week after sampling.

1.4. Personal Protective Equipment to be used During Sampling

Before starting the sampling operation, a complete survey of the workplace to identify and assess possible hazards should be conducted. If, from this survey, no significant hazards are identified except the PCBs in the dielectric oil to be sampled, the PPE to be adopted during sampling operation can be limited to a disposable suite, goggles and proper chemical resistant gloves. Wearing respiratory mask is not necessary as the risk of inhalation exposure during sampling is limited. However, if the survey identifies possible PCBs contamination of the site, operator should also wear protective shoes, respiratory mask and a protective suite. Wearing helmet is generally mandatory in workplaces. In any case, the selection of the proper PPE equipment can only be made after the site hazard assessment; it is recommended that a certain amount of different protective equipments compliant with the OSHA standards are made available to the sampling team before starting the sampling campaign.

1.5. Preliminary Analysis by Fast Kits and Portable Equipment

There are several screening methods that can be used for preliminary analysis of PCBs oil directly on field. On selecting the proper screening methods, however, the risk of false positive and false negative outcome should be carefully considered. Colorimetric or ion specific electrode methods based on the detection of chlorine – and subsequent normalization on the basis of the expected chlorine content of the PCB mixture – may be affected by an high false positive outcome if the dielectric oil contains other chlorinated compounds (for instance chlorobenzene) instead of PCBs. In this sense, recent evaluation trials performed by US-EPA on chlorine-based determination and on immunoassay methods seem to indicate that the second is more indicate for performing screening analysis for PCBs content in oil.

1.6. Labeling

The UN Global Harmonized System for substance classification and labeling and packaging should be adopted as reference standard for labeling.

Label for PCBs contain equipment should report clearly the following information :

a. the word "Warning" followed by the sentence "This equipment contains PCBs (polychlorinated byphenils)
b. The serial number and, if feasible, the barcode of the serial number.
c. Labeling date
d. Information on the type of hazard and health effects, as from UN classification and labeling.
e. A sentence reminding that "It is severely forbidden to open this equipment. If it is necessary to open. move, replace, or maintain this equipment call the person in charge at the number xxxxxxxx"
f. A phone number to be called In case of leakage, fire or other emergencies;

2. On the basis of the above indication, a possible example for a PCB label is reported below

ANNEX 5:
Analysis of Task, Role and Function of MoEF Units in PCB Phasing Out

Identifikasi Tugas	KLHK/Ortala	Pemerintah Daerah	Perusahaan	Regulasi	Rekomendasi
PHASE OUT					
Phase Out Proses • Membuat kebijakan untuk pembatasan dan eliminasi PCBs • Bimbingan teknis dalam rangka penghapusan • -Pemantauan dalam rangka pembatasan dan penghapusan	Subdirektorat Penanganan Bahan Berbahaya dan Beracun[1]: • Seksi Pembatasan; • Seksi Penghapusan. Seksi Pembatasan bertugas melakukan pengumpulan & pengolahan bahan dalam rangka penyiapan bahan perumusan kebijakan, bimbingan teknis, melakukan pemantauan, analisis, evaluasi, dan pelaporan tentang masalah atau kegiatan terkait pembatasan peredaran dan penggunaan bahan berbahaya dan beracun[2]. Seksi Penghapusan mempunyai tugas melakukan		Setiap orang yang menghasilkan limbah B3 wajib melakukan pengurangan limbah B3. [4] Pengurangan Limbah B3 dimaksud dilakukan melalui substitusi bahan, modifikasi proses, dan/atau penggunaan teknologi ramah lingkungan[5]. Substitusi bahan dpt dilakukan melalui pemilihan bahan baku dan/atau bahan penolong yg semula mengandung B3 digantikan dgn bahan baku/bahan penolong tg tdk mengandung B3[6].		

[1]Peraturan Menteri KLHK No. P.18/MenLHK-II/2015 tentang Organisasi dan Tata Kerja Kementerian Hidup dan Kehutanan, Pasal 821
[2] Ibid, Pasal 822 (1)
[4] Pasal 10 (1) PP No. 101/2014
[5] Pasal 10(2) PP No. 101/2014
[6] Pasal 10(3) PP No. 101/2014

	pengumpulan & pengolahan bahan dalam rangka penyiapan bahan perumusan kebijakan, bimbingan teknis, melakukan pemantauan, analisis, evaluasi, dan pelaporan tentang masalah atau kegiatan terkait penghapusan peredaran dan penggunaan bahan berbahaya dan beracun[3].				
Phase out process - inventarisasi	Subdirektorat Inventarisasi Penggunaan Bahan Berbahaya Beracun. Subdirektorat ini bertugas melaksanakan penyiapan perumusan kebijakan, koordinasi dan sinkronisasi pelaksanaan kebijakan, bimbingan teknis, dan evaluasi pelaksanaan bimbingan teknis di bidang Inventarisasi penggunaan bahan berbahaya dan beracun [7] . Subdirektorat ini menyelenggarakan fungsi[8]:				

[3] Pasal 822 (2)
[7] Pasal 814

	• penyiapan bahan perumusan kebijakan di bidang inventarisasi penggunaan bahan berbahaya dan beracun; • penyiapan bahan koordinasi dan sinkronisasi pelaksanaan kebijakan di bidang inventarisasi penggunaan pengelolaan bahan berbahaya dan beracun; • penyiapan bahan penyusunan norma, standar, prosedur, dan kriteria di bidang Inventarisasi bahan berbahaya dan beracun; • pelaksanaan bimbingan teknis dan evaluasi pelaksanaan bimbingan teknis di bidang inventarisasi penggunaan bahan berbahaya dan beracun; dan • pelaksanaan supervisi atas				

[8] Pasal 815

	pelaksanaan urusan inventarisasi penggunaan bahan berbahaya dan beracun di daerah.				
Phase out process – Collecting transformers/PCBs (pengumpulan transformer atau peralatan yg mengandung PCBs yang masih di pakai)					
Phase Out - identifikasi, tracking dan recordkeeping	Subdirektorat Pengendalian Bahan Berbahaya Beracun. Subdirektorat ini bertugas melaksanakan penyiapan perumusan kebijakan, koordinasi dan sinkronisasi pelaksanaan kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang pengendalian bahan berbahaya dan beracun[9].				

[9] Pasal 810

	Subdirektorat ini menyelenggarakan fungsi: • penyiapan bahan perumusan kebijakan di bidang pengendalian bahan berbahaya dan beracun; • penyiapan bahan koordinasi dan sinkronisasi pelaksanaan kebijakan di bidang pengendalian bahan berbahaya dan beracun; • penyiapan bahan penyusunan norma, standar, prosedur, dan kriteria di bidang pengendalian bahan berbahaya dan beracun; • pelaksanaan bimbingan teknis dan evaluasi pelaksanaan bimbingan teknis di bidang pengendalian bahan berbahaya dan beracun; dan • pelaksanaan supervisi atas pelaksanaan urusan pengendalian bahan berbahaya dan beracun di daerah.				

	Subdirektorat Pengendalian Bahan Berbahaya Beracun, terdiri atas[10]: • Seksi Kategorisasi; dan • Seksi Verifikasi. Seksi Kategorisasi mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan kebijakan, bimbingan teknis, melakukan pemantauan, analisis, evaluasi, dan pelaporan tentang masalah atau kegiatan terkait kategorisasi bahan berbahaya dan beracun[11]. Seksi Verifikasi mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan kebijakan, bimbingan teknis,				

[10] Pasal 812
[11] Pasal 813 (1)

	melakukan pemantauan, analisis, evaluasi, dan pelaporan tentang masalah atau kegiatan verifikasi pengelolaan bahan berbahaya dan beracun[12]				
Phase Out - Maintenance and Penyimpanan Sementara					
Setelah PHASE OUT					
Dinyatakan sebagai Limbah B3 – Identifikasi, tracking, record keeping	Subdirektorat Penetapan Notifikasi Limbah Bahan Berbahaya dan Beracun dan Limbah Non Bahan Berbahaya Dan Beracun. Subdirektorat ini mempunyai tugas melaksanakan perumusan kebijakan, koordinasi dan sinkronisasi pelaksanaan kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang notifikasi limbah bahan				

[12] Pasal 813 (2)

	berbahaya dan beracun dan lintas batas limbah non Bahan Berbahaya Dan Beracun serta penerapan ketentuan perjanjian dan konvensi internasional[13]. Subdirektorat ini menyelenggarakan fungsi[14]: • penyiapan bahan perumusan kebijakan di bidang notifikasi limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun; • penyiapan bahan koordinasi dan sinkronisasi pelaksanaan kebijakan di bidang notifikasi limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun; • penyiapan bahan penyusunan norma,				

[13] Pasal 859
[14] Pasal 860

	standar, prosedur, dan kriteria di bidang notifikasi limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun; • pelaksanaan bimbingan teknis dan evaluasi pelaksanaan bimbingan teknis di bidang notifikasi limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun; dan • pelaksanaan supervisi atas pelaksanaan urusan notifikasi limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di daerah. Subdirektorat Penetapan Notifikasi Limbah Bahan Berbahaya Beracun Dan Non				

	Bahan Berbahaya Beracun terdiri atas[15] : • Seksi Penetapan Limbah Bahan Berbahaya Beracun dan Limbah Non Bahan Berbahaya Beracun;dan • Seksi Notifikasi Limbah Bahan Berbahaya Beracun dan Limbah Non Bahan Berbahaya Beracun. Seksi Penetapan Limbah Bahan Berbahaya Beracun dan Limbah Non Bahan Berbahaya Beracun mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang penetapan limbah bahan berbahaya dan beracun dan				

[15] Pasal 861

	limbah non bahan berbahaya dan beracun[16]. Seksi Notifikasi Limbah Bahan Berbahaya Beracun dan Limbah Non Bahan Berbahaya Beracun mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang notifikasi limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun[17].				
Limbah B3 collection	Subdirektorat Pengumpulan dan Pemanfaatan Limbah B3[18]: • Seksi Pengumpulan Limbah				

[16] Pasal 862 (1)
[17] Pasal 862 (2)
[18] Pasal 849

	B3. Seksi ini bertugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang pengumpulan limbah bahan berbahaya dan beracun[19].				
Maintenance and Storage of PCBs waste					
Packaging					
Transportation of PCBs	Subdirektorat Pengangkutan dan Pengolahan Limbah Bahan Berbahaya Beracun[20]: • Seksi Pengangkutan Limbah Bahan Berbahaya Beracun. Seksi Pengangkutan Limbah Bahan Beracun Berbahaya mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan				

[19] Pasal 850 (1)
[20] Pasal 853

	bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang pengangkutan limbah bahan berbahaya dan beracun[21].				
Site Selection					
Perizinan		Bupati/Walikota (diproses oleh BLH Kota/Propinsi)			
Izin dan Durasi (Limbah)				- Izin pengelolaan Limbah B3 untuk kegiatan penyimpanan limbah B3 berlaku 5 tahun & dpt diperpanjang[22] - Izin pengelolaan Limbah B3 untuk kegiatan pengumpulan berlaku 5 tahun & dpt diperpanjang[23] - Izin pengelolaan Limbah B3 untuk kegiatan pemanfaatan	

[21] Pasal 854 (1)
[22] Pasal 21 PP 101/2014
[23] Pasal 36 PP 101/2014

				berlaku 5 thn & dpt diperpanjang	
Durasi penyimpanan limbah			Setelah izin pengelolaan Limbah B3 untuk kegiatan penyimpanan limbah B3 terbit, pemegang izin wajib melakukan penyimpanan limbah B3 paling lama[24]: - 90 hari sejak limbah B3 dihasilkan (limbah >50 kg/hari) - 180 hari sejak limbah B3 dihasilkan (limbah <50 kg/hari) limbah B3 kategori 1 - 365 hari sejak limbah B3 dihasilkan (<50 kg/hari) limbah B3 kategori 2 dr sumber tdk spesifik & sumber spesifik umum - 365 hari sejak limbah B3 dihasilkan, utk limbah B3 kategori 2 dr sumber spesifik khusus.		Perusahaan hanya memiliki waktu yg terbatas untuk menyimpan limbah, bagaimana apabila penyimpanan melampaui batas waktu, mengingat fasilitas pengolahan belum ada?
Distance from water bodies					

[24] Pasal 28 (1) PP No. 101/2014

Persyaratan Teknis Penyimpanan Limbah	Subdirektorat Pengumpulan dan Pemanfaatan Limbah Bahan Berbahaya Beracun. Subdirektorat ini bertugas melaksanakan penyiapan perumusankebijakan, koordinasi dan sinkronisasi pelaksanaan kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang pengumpulan dan pemanfaatan limbah bahan berbahaya dan beracun serta penerapan ketentuan perjanjian dan konvensi internasional.[25] Subdirektorat ini menyelenggarakan fungsi[26]: • penyiapan bahan perumusan kebijakan di bidang pengumpulan dan pemanfaatan limbah bahan berbahaya dan beracun; • penyiapan bahan koordinasi dan sinkronisasi pelaksanaan kebijakan di bidang pengumpulan dan			Persyaratan tempat penyimpanan limbah B3 merupakan Mandat PP No. 101/2014 untuk diatur lebih lanjut melalui PerMen	

[25] Pasal 847
[26] Pasal 848

	pemanfaatan limbah bahan berbahaya dan beracun; • penyiapan bahan penyusunan norma, standar, prosedur, dan kriteria di bidang pengumpulan dan pemanfaatan limbah bahan berbahaya dan beracun; • pelaksanaan bimbingan teknis dan evaluasi pelaksanaan bimbingan teknis di bidang pengumpulan dan pemanfaatan limbah bahan berbahaya dan beracun; dan • pelaksanaan supervisi atas pelaksanaan urusan pengumpulan dan pemanfaatan limbah bahan berbahaya dan beracun di daerah. Subdirektorat Pengumpulan dan Pemanfaatan Limbah Bahan Berbahaya dan Beracun terdiri atas[27]: • Seksi Pengumpulan limbah B3; dan				

[27] Pasal 849

	• Seksi Pemanfaatan Limbah B3. Seksi Pengumpulan Limbah B3 mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang pengumpulan limbah bahan berbahaya dan beracun[28].				
Tanggap Darurat	Subdirektorat Tanggap Darurat dan Pemulihan Sektor Non Institusi.[29] • Seksi Tanggap Darurat Seksi Tanggap Darurat mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan,				

[28] Pasal 850 (1)
[29] Pasal 877

	sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis pencegahan pencemaran dan penerapan ketentuan perjanjian dan konvensi internasional di bidang sistem tanggap darurat dalam pengelolaan limbah bahan berbahaya dan beracun[30].				
Monitoring dan Inspeksi site		BLH Kota/Kab			
Desain Penyimpanan (Terpusat)					
Training					
Penutupan Site					
Disposal PCBs	Subdirektorat Penimbunan dan Dumping Limbah Bahan Berbahaya dan Beracun. • Subdirektorat ini memiliki tugas melaksanakan perumusan kebijakan, koordinasi dan sinkronisasi pelaksanaan kebijakan,		Dalam hal setiap orang yg menghasilkan limbah B3 tdk mampu melakukan pengelolaan sendiri limbah B3 yg dihasilkannya: a) pengelolaan		**Limbah PCBs di ekspor sampai Indonesia memiliki fasilitas**

[30] Pasal 878 (1)

	bimbingan teknis dan evaluasi bimbingan teknis di bidang penimbunan dan dumping llimbah bahan berbahaya dan beracun serta penerapan ketentuan perjanjian dan konvensi internasional[31]. Subdirektorat ini menyelenggarakan fungsi[32]: • penyiapan bahan perumusan kebijakan di bidangpenimbunan dan dumping limbah bahanberbahaya dan beracun; • penyiapan bahan koordinasi dan sinkronisasi pelaksanaan kebijakan di bidang penimbunan dan dumping limbah bahan berbahaya dan beracun; • penyiapan bahan penyusunan norma,		diserahkan kpd pengelola limbah B3 atau b) dapat melakukan ekspor limbah B3 yg dihasilkannya		

[31] Pasal 855
[32] Pasal 856

	standar, prosedur, dan kriteria di bidang penimbunan dan dumping limbah bahan berbahaya dan beracun; • pelaksanaan bimbingan teknis dan evaluasi pelaksanaan bimbingan teknis di bidang penimbunan dan dumping limbah bahan berbahaya dan beracun; dan • pelaksanaan supervisi atas pelaksanaan urusanpenimbunan dan dumping limbah bahan berbahaya dan beracun di daerah. Subdirektorat Penimbunan dan Dumping Limbah Bahan Berbahaya dan Beracun terdiri atas[33]: • Seksi Penimbunan Limbah Bahan Berbahaya Beracun				

[33] Pasal 857

	Seksi Penimbunan Limbah Bahan Beracun Berbahaya mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang penimbunan limbah bahan berbahaya dan beracun[34].				
Dekontaminasi (misal: memisahkan trafo dari kontaminasi PCBs)					
Rehabilitasi	Subdirektorat Tanggap Darurat dan Pemulihan Non Institusi. Subdirektorat ini bertugas melaksanakan penyiapan perumusan dan pelaksanaan kebijakan, bimbingan teknis dan evaluasi bimbingan teknis	- Kepala Badan Nasional Penanggulangan Bencana Daerah (BPBD) Kabupaten/Kota menyusun program kedaruratan			

[34] Pasal 858 (1)

	di bidang tanggap darurat dalam pengelolaan limbah bahan berbahaya dan beracun dan pemulihan kontaminasi limbah bahan berbahaya beracun sektor non institusi. [35] Subdirektorat ini menyelenggarakan fungsi[36]: • penyiapan bahan perumusan kebijakan di bidang tanggap darurat dan pemulihan kontaminasi dan sistem tanggap darurat pengelolaan limbah bahan berbahaya beracun di sektor non institusi; • penyiapan pelaksanaan kebijakan di bidang tanggap darurat pengelolaan dan pemulihan kontaminasi limbah berbahaya beracun di sektor non institusi; • penyiapan bahan	pengelolaan limbah B3 skala Kab/Kota - Kepala BPBD Provinsi menyusun program kedaruratan pengelolaan limbah B3 skala Provinsi - Kepala BPBD Nasional menyusun program kedaruratan pengelolaan limbah B3 skala Nasional			

[35] Pasal 875
[36] Pasal 876

	penyusunan norma, standar, prosedur, dan kriteria di bidang tanggap darurat pengelolaan dan pemulihan kontaminasi limbah bahan berbahaya beracun di sector non institusi; • pelaksanaan bimbingan teknis dan evaluasi pelaksanaan bimbingan teknis di bidang tanggap darurat pengelolaab dan pemulihan kontaminasi limbah bahan berbahaya beracun di sector non institusi;dan • pelaksanaan supervisi atas pelaksanaan urusan tanggap darurat pengelolaan dan pemulihan kontaminasi limbah bahan berbahaya beracun di sektor non institusi di daerah. Subdirektorat Tanggap Darurat dan Pemulihan Sektor				

	Non Institusi terdiri atas[37]: • Seksi Tanggap Darurat; dan • Seksi Pemulihan Non Institusi. Seksi Tanggap Darurat mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis pencegahan pencemaran dan penerapan ketentuan perjanjian dan konvensi internasional di bidang sistem tanggap darurat dalam pengelolaan limbah bahan berbahaya dan beracun[38]. Seksi Pemulihan Non Institusi mempunyai tugas melakukan pengumpulan dan pengolahan				

[37] Pasal 877
[38] Pasal 878 (1)

	bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis perencanaan, pemulihan, pemantauan pasca pemulihan, evaluasi, analisis dan pelaporan atas kegiatan pemulihan lahan terkontaminasi limbah bahan berbahaya dan beracun, penyiapan bahan penerapan ketentuan perjanjian dan konvensi internasional pemulihan kontaminasi limbah bahan berbahaya dan beracun untuk lahan tak bertuan[39].				
Monitoring pada industry spesifik	**Direktorat Penilaian Kinerja Pengelolaan Limbah Bahan Berbahaya dan Beracun dan**				

[39] Pasal 878 (2)

	Limbah Non Bahan Berbahaya[40], terdiri atas: **Subdirektorat Sektor Pertambangan, Energi, dan Minyak dan Gas.** Subdirektorat ini bertugas melaksanakan penyiapan perumusan kebijakan, koordinasi & sinkronisasi pelaksanaan kebijakan, bimbingan teknis dan evaluasi pelaksanaan bimbingan teknis penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang pertambangan, energi, minyak dan gas[41]. Subdirektorat ini menyelenggarakan fungsi[42]: a. penyiapan bahan perumusan kebijakan penilaian kinerja				

[40] Pasal 826
[41] Pasal 827
[42] Pasal 828

	pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang pertambangan, energi, minyak dan gas; b. penyiapan bahan koordinasi dan sinkronisasi pelaksanaan kebijakan penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang pertambangan, energi, minyak dan gas; c. penyiapan bahan penyusunan norma, standar, prosedur, dan kriteria penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang pertambangan, energi, minyak dan gas; d. pelaksanaan bimbingan teknis dan evaluasi				

	pelaksanaan bimbingan teknis penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang pertambangan, energi, minyak dan gas; dan e. pelaksanaan supervisi atas pelaksanaan urusan penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun pertambangan, energi, minyak dan gas di daerah. **Subdirektorat Sektor Manufaktur.** Sub direktorat ini mempunyai tugas melaksanakan perumusan kebijakan, koordinasi dan sinkronisasi pelaksanaan kebijakan, bimbingan teknis dan evaluasi bimbingan teknis penilaian				

	kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non-bahan berbahaya dan beracun di bidang manufaktur [43] .Subdirektorat ini menyelenggarakan fungsi[44]: • penyiapan bahan perumusan kebijakan penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang manufaktur; • penyiapan bahan koordinasi dan sinkronisasi pelaksanaan kebijakan penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang manufaktur;				

[43] Pasal 831
[44] Pasal 832

	• penyiapan bahan penyusunan norma, standar, prosedur, dan kriteria penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang manufaktur; • pelaksanaan bimbingan teknis dan evaluasi pelaksanaan bimbingan teknis penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang manufaktur;dan • pelaksanaan supervisi atas pelaksanaan urusan penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang manufaktur di daerah.				

	Subdirektorat Sektor Manufaktur terdiri atas: • Seksi Industri Hulu;dan • Seksi Industri Hilir. Seksi Industri Hulu mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di sektor industri hulu[45]. Seksi Industri Hilir mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis				

[45] Pasal 834 (1)

	dan evaluasi bimbingan teknis di bidang pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di sector industri hilir[46]. Subdirektorat Sektor Prasarana dan Jasa Subdirektorat Sektor Prasarana dan Jasa mempunyai tugas mempunyai tugas melaksanakan perumusan kebijakan, koordinasi dan sinkronisasi pelaksanaan kebijakan, bimbingan teknis dan evaluasi bimbingan teknis penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang prasarana dan jasa.				

[46] Pasal 834(2)

	Subdirektorat ini menyelenggarakan fungsi[47]: • penyiapan bahan perumusan kebijakan penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang prasarana dan jasa; • penyiapan bahan koordinasi dan sinkronisasi pelaksanaan kebijakan penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang prasarana dan jasa; • penyiapan bahan penyusunan norma, standar, prosedur, dan kriteria penilaian kinerja pengelolaan limbah				

[47] Pasal 840

	bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang prasarana dan jasa; • pelaksanaan bimbingan teknis dan evaluasi pelaksanaan bimbingan teknis penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang sektor prasarana dan jasa; • pelaksanaan supervisi atas pelaksanaan urusan penilaian kinerja pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di bidang prasarana dan jasa di daerah. Subdirektorat Sektor Prasarana dan Jasa terdiri				

	atas: • Seksi Prasarana;dan • Seksi Jasa. Seksi Prasarana mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi bimbingan teknis di bidang pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di sector prasarana[48]. Seksi Jasa mempunyai tugas melakukan pengumpulan dan pengolahan bahan dalam rangka penyiapan bahan perumusan dan pelaksanaan kebijakan, sinkronisasi dan koordinasi kebijakan, bimbingan teknis dan evaluasi				

[48] Pasal 842(1)

	bimbingan teknis di bidang pengelolaan limbah bahan berbahaya dan beracun dan limbah non bahan berbahaya dan beracun di sektor jasa[49].				
Enforcement and Sanctions	**Direktorat Jenderal Penegakan Hukum Lingkungan Hidup dan Kehutanan** Tugas dari direktorat ini adalah menyelenggarakan perumusan dan pelaksanaan kebijakan di bidang penurunan gangguan, ancaman dan pelanggaran hukum lingkungan hidup dan kehutanan [50] . Direktorat ini menyelenggarakan fungsi[51]: • perumusan kebijakan di bidang penyelenggaraan pencegahan, pengawasan, pengamanan,				

[49] Pasal 842(2)
[50] Pasal 1105
[51] Pasal 1106

	penanganan pengaduan, penyidikan, penerapan hukum administrasi, perdata, dan pidana dalam ranah lingkungan hidup dan kehutanan, serta dukungan operasi penegakan hukum lingkungan hidup dan kehutanan; • pelaksanaan kebijakan di bidang penyelenggaraan pencegahan, pengawasan, pengamanan, penanganan pengaduan, penyidikan, penerapan hokum administrasi,perdata, dan pidana dalam ranah lingkungan hidup dankehutanan, serta dukungan operasi penegakan hukumlingkungan hidup dan kehutanan; • penyusunan norma, standar, prosedur, dan				

	kriteria di bidang penyelenggaraan pencegahan, pengawasan, pengamanan, penanganan pengaduan, penyidikan, penerapan hukum administrasi, perdata, dan pidana dalam ranah lingkungan hidup dan kehutanan, serta dukungan operasi penegakan hukum lingkungan hidup dan kehutanan; • koordinasi dan sinkronisasi pelaksanaan kebijakan penyelenggaraan pencegahan, pengawasan, pengamanan, penanganan pengaduan, penyidikan, penerapan hokum administrasi, perdata dan pidana dalam ranah lingkungan hidup dan kehutanan,				

	serta dukungan operasi penegakan hukum lingkungan hidup dan kehutanan; • pelaksanaan bimbingan teknis dan supervisi atas pelaksanan urusan urusan penyelenggaraan pencegahan, pengawasan, pengamanan, penanganan pengaduan, penyidikan, penerapan hukum administrasi, perdata dan pidana dalam ranah lingkungan hidup dan kehutanan, serta dukungan operasi penegakan hukum lingkungan hidup dan kehutanan di daerah; • pelaksanaan evaluasi dan pelaporan penyelenggaraan pencegahan, pengawasan, pengamanan, penanganan pengaduan,				

	penyidikan, penerapan hukum administrasi, perdata, dan pidana dalam ranah lingkungan hidup dan kehutanan, serta dukungan operasi penegakan hukum lingkungan hidup dan kehutanan; • pelaksanaan administrasi Direktorat Jenderal Penegakan Hukum Lingkungan Hidup dan Kehutanan; dan • pelaksanaan fungsi lain yang diberikan oleh Menteri. Direktorat Jenderal Penegakan Hukum Lingkungan Hidup dan Kehutanan terdiri atas[52]: • Sekretariat Direktorat Jenderal; • Direktorat Pengaduan, Pengawasan dan Sanksi				

[52] Pasal 1107

	Administrasi; • Direktorat Penyelesaian Sengketa Lingkungan Hidup; • Direktorat Pencegahan dan Pengamanan Hutan;dan • Direktorat Penegakan Hukum Pidana.				

ANNEX 6:

Recommendations for the Regulation of Economic Incentives

Instrumen Insentif	Jenis			Dasar Hukum yang bisa diterapkan langsung untuk PCB	Preseden	Prakondisi	
Potongan Pajak	PPh				PP 18/2015 tentang Fasilitas PPh Untuk Penanaman Modal di Bidang-Bidang Usaha Tertentu dan/Atau di Daerah-Daerah Tertentu; 24/PMK.011/2010 (kegiatan pemanfatan sumber energi terbarukan)	PP 18/2015 diubah sehingga Pengelolaan limbah B3 (khususnya PCB) mendapat fasilitas	Dikeluarkan satu PMK yang mengatur fasilitas PPh, PPn dan Bea Masuk sekaligus, seperti 24/PMK.011/2010 untuk energi terbarukan
					PP 94/2010 tentang Penghitungan Penghasilan Kena Pajak dan Pelunasan Pajak Penghasilan Dalam Tahun Berjalan; 24/PMK.011/2010		
					Perda Provinsi Sumatera Utara No. 2/2015 tentang Pemberian Insentif dan Penanaman Modal. Bentuk insentif berupa: pengurangan/pembebasan pajak daerah/retribusi daerah, pemberian kemudahan teknis (e.g penyediaan sarana &prasarana, penyediaan data & informasi peluang penanaman modal, bantuan teknis, percepatan pemberian perizinan). Jenis usaha yg diprioritaskan utk mendapatkan insentif adalah:a) industri yg mengolah produk unggulan daerah/industri pemanfaatan limbah domestik, b) bidang usaha yg terbuka dgn persyaratan di bidang penanaman modal.		
					PMK 21/PMK.011/2011; 24/PMK.011/2010, PMK 21/PMK.011/2010 (mengatur fasilitas PPh utk pengembangan energi terbarukan diantaranya pengurangan sampai 30% dari investasi, tarif pajak lebih rendah utk dividen, bebas pajak penghasilan atas impor).		
	PPn				PP 81/2015 tentang Impor dan atau Penyerahan Barang Kena Pajak Tertentu Yang Bersifat Strategis Yang Dibebaskan dari Pengenaan PPN; 24/PMK.011/2010	PP 81/2015 diubah sehingga mencantumkan peralatan/bahan bahan yang digunakan untuk pengolahan PCB atau	

						pencegahan/penanggulangan pencemaran	
	Bea Masuk				PMK 176/PMK.011/2009 tentang Pembebasan Bea Masuk Atas Impor Mesin Serta Barang dan Bahan Untuk Pembangunan atau Pengembangan Industri Dalam Rangka Penanaman Modal; 24/PMK.011/2010; 97/KMK.05/2000 (kendaraan bermotor)		
				PMK 101/PMK.04/2007 tentang Pembebasan Bea Masuk atas Impor Peralatan dan Bahan Yang Digunakan Untuk Mencegah Pencemaran Lingkungan*			
	Tax allowance			PP 18/2015 tentang Fasilitas PPh Untuk Penanaman Modal di Bidang-Bidang Usaha Tertentu dan/Atau di Daerah-Daerah Tertentu	Kepala BKPM dalam siaran persnya[1]menawarkan tax allowance berdasarkan PP 18/2015 bagi industri hijau. Dasar Industri Hijau adalah PerMenPerin No. 51/M-IND/Per/6/2015. Tax allowance ini ditawarkan kepada investor diantaranya di bidang pembangkit tenaga listrik dgn energi baru/ terbarukan, pengelolaan dan pembuangan sampah, dll.		
					PMK 177/PMK.011/2007 Tentang Pembebasan Bea Masuk Atas Impor Barang Untuk Kegiatan Usaha Hulu Minyak Dan Gas Bumi Serta Panas Bumi;		
					Peraturan Direktur Jenderal Bea Dan Cukai Nomor Per- 22 /Bc/2013 Tentang Tata Cara Pemberian Fasilitas Pembebasan Bea Masuk Atas Impor Barang Modal Dalam Rangka Pembangunan Dan Pengembangan Industri Pembangkit Tenaga Listrik Untuk Kepentingan Umum		
Fund							

[1] http://www2.bkpm.go.id/images/uploads/file_siaran_pers/Siaran_Pers_BKPM_27042015_TLS_-_Kepala_BKPM.pdf

					Peraturan Pemerintah Nomor 24 Tahun 2015 tentang Penghimpunan Dana Perkebunan;Perpres 61 Tahun 2015 Tentang Penghimpunan dan Penggunaan Dana Perkebunan Kelapa Sawit	Pemusnahan limbah B3 (termasuk PCB) dicantumkan kedalam instrumen pendanaan lingkungan dalam PP Pendanaan Lingkungan dan dioperasikan oleh Badan Pengelola Dana Lingkungan Hidup (BPDLH). Pemusnahan PCB (atau limbah B3 secara umum) harus dicantumkan sebagai salah satu penyaluran dana BPDLH
Penghargaan				Pada proses assessment transformer bebas PCB dapat menjadi salah satu komponen penilaian.	Peraturan Menteri Perindustrian RI Nomor 18/M- Ind/Per/3/2016 tentang Penghargaan Industri Hijau. Program ini merupakan program pemberian penghargaan kepada perusahaan industri yang telah menerapkan prinsip industri hijau dalam proses industrinya.	
Bantuan Pendanaan	Jenis	Eliminasi			PMK 235/PMK.05/2012 tentang Tata Cara Pencairan Dana Kegiatan Capacity Building Program *Kreditanstalt fur Wiederaufbau(Kfw)-Industrial Efficiency and Pollution Control Tahap I.* Dalam hal ini, ada hibah dari *KfW* yg kemudian dipinjamkan (pinjaman lunak) oleh Pemerintah c.q. Kementerian Keuangan kepada bank pelaksana utk membiayai kegiatan investasi yang berorientasi lingkungan hidup dalam rangka pengendalian polusi dan efisiensi industri. Terdapat preseden subsidi listrik (195/PMK.08/2015) dan BBM (130/PMK.02/2015) namun pemahaman *polluters pays*	
		Transportasi				
		Pinjaman Lunak				
	Durasi	1 tahun				
		2 tahun				
	Besaran biaya	Jumlah	Besar			
			Kecil			
		Area	Indonesia timur			
			Indonesia Barat			Secara hukum administrasi dapat saja dialokasikan APBN untuk subsidi operator, namun secara politik kebijakan mungkin sulit dilakukan

					principle yang umum diterima tidak memandang limbah sebagai objek yang seharusnya disubsidi		
	Dana Alokasi Khusus Bidang Lingkungan Hidup				PerMen LHK No.P.69/Menlhk-Setjen/2015. DAK bidang LHK bersumber dari APBN dialokasikan kpd daerah utuk membantu mendanai kegiatan pemantauan dan pengawasan kualitas lingk hidup, pengendalian pencemaran lingk, pengelolaan dan perlindungan lingk, dst.	DAK ini dapat diberikan kepada Pemerintah Daerah yang serius untuk mengelola/mengatasi/memberikan bimbingan terkait limbah PCBs/trafo ber PCBs dari industri-industri yang ada di wilayahnya. Perlu ada perubahan pada petunjuk teknis PerMen yg berlaku saat ini.	
Regulator							
Operator	Mobile						
	Stationary						
Pemilik PCB	Besar						
	Kecil						