Polychlorinated Biphenyls (PCBs)

Learn about Polychlorinated Biphenyls (PCBs)

On this page:

What Are PCBs?

PCBs are a group of man-made organic chemicals consisting of carbon, hydrogen and chlorine atoms. The number of chlorine atoms and their

location in a PCB molecule determine many of its physical and chemical properties. PCBs have no known taste or smell, and range in consistency from an oil to a waxy solid.

PCBs belong to a broad family of man-made organic chemicals known as chlorinated hydrocarbons. PCBs were domestically manufactured from 1929 until manufacturing was banned in 1979. They have a range of toxicity and vary in consistency from thin, light-colored liquids to yellow or black waxy solids. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including:

- Electrical, heat transfer and hydraulic equipment
- Plasticizers in paints, plastics and rubber products
- Pigments, dyes and carbonless copy paper
- Other industrial applications

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Commercial Uses for PCBs

Although no longer commercially produced in the United States, PCBs may be present in products and materials produced before the 1979 PCB ban. Products that may contain PCBs include:

- Transformers and capacitors
- Electrical equipment including voltage regulators, switches, re-closers, bushings, and electromagnets
- Oil used in motors and hydraulic systems
- Old electrical devices or appliances containing PCB capacitors
- Fluorescent light ballasts
- Cable insulation
- Thermal insulation material including fiberglass, felt, foam, and cork
- Adhesives and tapes
- Oil-based paint
- Caulking
- Plastics
- Carbonless copy paper

Floor finish

The PCBs used in these products were chemical mixtures made up of a variety of individual chlorinated biphenyl components known as congeners. Most commercial PCB mixtures are known in the United States by their industrial trade names, the most common being Arochlor.

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Release and Exposure of PCBs

Today, PCBs can still be released into the environment from:

- Poorly maintained hazardous waste sites that contain PCBs
- Illegal or improper dumping of PCB wastes
- Leaks or releases from electrical transformers containing PCBs
- Disposal of PCB-containing consumer products into municipal or other landfills not designed to handle hazardous waste
- Burning some wastes in municipal and industrial incinerators

PCBs do not readily break down once in the environment. They can remain for long periods cycling between air, water and soil. PCBs can be carried long distances and have been found in snow and sea water in areas far from where they were released into the environment. As a consequence, they are found all over the world. In general, the lighter the form of PCB, the further it can be transported from the source of contamination.

PCBs can accumulate in the leaves and above-ground parts of plants and food crops. They are also taken up into the bodies of small organisms and fish. As a result, people who ingest fish may be exposed to PCBs that have bioaccumulated in the fish they are ingesting.

The National Center for Health Statistics, a division of the Centers for Disease Control and Prevention, conducts the National Health and Nutrition Examination Surveys (NHANES). NHANES is a series of U.S. national surveys on the health and nutrition status of the noninstitutionalized civilian population, which includes data collection on

selected chemicals. Interviews and physical examinations are conducted with approximately 10,000 people in each two-year survey cycle. PCBs are one of the chemicals where data are available from the NHANES surveys.

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PCB Congeners

A PCB congener is any single, unique well-defined chemical compound in the PCB category. The name of a congener specifies the total number of chlorine substituents, and the position of each chlorine. For example: 4,4'-Dichlorobiphenyl is a congener comprising the biphenyl structure with two chlorine substituents - one on each of the #4 carbons of the two rings. In 1980, a numbering system was developed which assigned a sequential number to each of the 209 PCB congeners.

- Table of PCB Congeners

Related Information

EPA Region 3 Interim Guidelines for the Validation of Data Generated Using Method 1668 PCB Congener Data

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PCB Homologs

Homologs are subcategories of PCB congeners that have equal numbers of chlorine substituents. For example, the tetrachlorobiphenyls are all PCB congeners with exactly 4 chlorine substituents that can be in any arrangement.

- Table of PCB Homologs

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PCB Mixtures and Trade Names

With few exceptions, PCBs were manufactured as a mixture of individual PCB congeners. These mixtures were created by adding progressively more chlorine to batches of biphenyl until a certain target percentage of chlorine by weight was achieved. Commercial mixtures with higher percentages of chlorine contained higher proportions of the more heavily chlorinated congeners, but all congeners could be expected to be present at some level in all mixtures. While PCBs were manufactured and sold under many names, the most common was the Aroclor series.

- Individual PCB Congeners

Aroclor

Aroclor is a PCB mixture produced from approximately 1930 to 1979. It is one of the most commonly known trade names for PCB mixtures. There are many types of Aroclors and each has a distinguishing suffix number that indicates the degree of chlorination. The numbering standard for the different Aroclors is as follows:

- The first two digits usually refer to the number of carbon atoms in the phenyl rings (for PCBs this is 12)
- The second two numbers indicate the percentage of chlorine by mass in the mixture. For example, the name Aroclor 1254 means that the mixture contains approximately 54% chlorine by weight.
- Table of Aroclors

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PCB Trade Names

PCBs were manufactured and sold under many different names. The names in the following table have been used to refer to PCBs or to products containing PCBs. Please note:

- Some of these names may be used for substances or mixtures not containing PCBs.

Many of these names were used with distinguishing suffixes, indicating degree of chlorination, type of formulation, or other properties (e.g., Aroclor 1254; Clophen A60).

- Some of these names may be misspellings of the correct names, but are included here for completeness.

	PCB Trade Names	
Aceclor	Diaclor	PCB
Adkarel	Dicolor	PCB's
ALC	Diconal	PCBs
Apirolio	Diphenyl, chlorinated	Pheaoclor
Apirorlio	DK	Phenochlor
Arochlor	Duconal	Phenoclor
Arochlors	Dykanol	Plastivar
Aroclor	Educarel	Polychlorinated biphenyl
Aroclors	EEC-18	Polychlorinated biphenyls
Arubren	Elaol	Polychlorinated diphenyl
Asbestol	Electrophenyl	Polychlorinated diphenyls

ASK	Elemex	Polychlorobiphenyl
Askael	Elinol	Polychlorodiphenyl
Askarel	Eucarel	Prodelec
Auxol	Fenchlor	Pydrau
Bakola	Fenclor	Pyraclor
Biphenyl, chlorinated	Fenocloro	Pyralene
Chlophen	Gilotherm	Pyranol
Chloretol	Hydol	Pyroclor
Chlorextol	Hyrol	Pyronol
Chlorinated biphenyl	Hyvol	Saf-T-Kuhl
Chlorinated diphenyl	Inclor	Saf-T-Kohl
Chlorinol	Inerteen	Santosol
Chlorobiphenyl	Inertenn	Santotherm
Chlorodiphenyl	Kanechlor	Santothern
Chlorphen	Kaneclor	Santovac
Chorextol	Kennechlor	Solvol

Chorinol	Kenneclor	Sorol
Clophen	Leromoll	Soval
Clophenharz	Magvar	Sovol
Cloresil	MCS 1489	Sovtol
Clorinal	Montar	Terphenychlore
Clorphen	Nepolin	Therminal
Decachlorodiphenyl	No-Flamol	Therminol
Delor	NoFlamol	Turbinol
Delorene	Non-Flamol	
	Olex-sf-d	
	Orophene	

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Health Effects of PCBs

PCBs have been demonstrated to cause a variety of adverse health effects. They have been shown to cause cancer in animals as well as a number of serious non-cancer health effects in animals, including: effects on the immune system, reproductive system, nervous system, endocrine system and other health effects. Studies in humans support evidence for potential carcinogenic and non-carcinogenic effects of PCBs. The different health effects of PCBs may be interrelated. Alterations in one system may have significant implications for the other systems of the body. The potential health effects of PCB exposure are discussed in

greater detail below.

Cancer

Non-Cancer Effects

Immune Effects

Reproductive Effects

Neurological Effects

Endocrine Effects

Other Non-cancer Effects

Integrated Risk Information System (IRIS)

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Laws and Regulations

Statute: Toxic Substances Control Act (TSCA)

The Toxic Substances Control Act of 1976 provides EPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures, including PCBs. Some

Additional Information

In addition, the Government

substances are generally excluded from TSCA, including but not limited to, food, drugs, cosmetics and pesticides. TSCA addresses the production, importation, use and disposal of specific chemicals including polychlorinated biphenyls (PCBs), asbestos, radon and lead-based paint. For more information see EPAs Summary of the Toxic Substance Control Act page.

Printing Office maintains a searchable database of all CFR publications and Federal Register (FR) Notices.

- Code of Federal Regulations
- Federal Register Notices (FR Notices)

PCB Regulations: Part 761 in Title 40 of the Code of Federal Regulations

Current PCB regulations, published pursuant to the TSCA statute, can be found in Title 40 of the Code of Federal Regulations (CFR) in Part 761. The Government Printing Office maintains the most current version of the CFR. View PCB regulations in the electronic-CFR. For useful interpretation of the regulations as well as answers to frequently asked questions please visit EPA's Policy and Guidance for PCBs page.

Detailed List of PCB Federal Register Notices (As of September 6, 2012)

EPA publishes information about the PCB program through the Federal Register. The Federal Register Notices listed below include PCB-related rules (proposed and final), notices of public meetings, responses to official comments, etc. This is not a comprehensive list of current regulations. A searchable listing of EPA's Register Notices can be found on the Federal Digital System webpage.

View the List of Federal Register Notices that Pertain to PCBs

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Polychlorinated Biphenyls (PCBs): Revisions to Manifesting Regulations

EPA updated and clarified several sections of the PCB regulations associated with the manifesting requirements. This was done to the greatest extent possible to match the manifesting requirements for PCBs under the Toxic Substances Control Act (TSCA) to those of Resource Conservation and Recovery Act (RCRA).

- Federal Register: Proposed Rule - September 6, 2012

The docket for this rulemaking is EPA-HQ-RCRA-2011-0524 and can be accessed at Regulations.gov.

The comment period closed November 5, 2012. No adverse comments on the rule were received, so the direct final rule took effect December 5, 2012.

- Federal Register: Direct Final Rule - September 6, 2012

Frequent Questions about Revisions to Manifesting Regulations

- **Why has EPA developed these changes?**

EPA issued this direct final rule to update and clarify several sections of the PCB regulations associated with manifesting requirements. This update streamlined regulations for the safe management of PCBs making it easier for industry to understand and follow PCB manifest regulations. Specifically, this update matches the manifesting requirements for PCBs under the TSCA to those of RCRA to the greatest extent possible.

- **What new regulations are involved in this change?**

The existing PCB manifest regulations are in 40 CFR part 761. The RCRA manifest regulations are in 40 CFR parts 262, 263, and 264. Since the promulgation of the PCB manifest regulations, several updates

have been made to the RCRA manifest regulations where the corresponding changes have not been made to the PCB manifest regulations. The intent of these changes is to align the manifesting requirements for PCBs with the RCRA hazardous waste requirements. These changes are necessary because PCB wastes are manifested using the RCRA Uniform Hazardous Waste Manifest. PCB waste handlers and generators must also adhere to the more recent RCRA hazardous waste manifest regulations, while still accounting for certain unique PCB manifest regulations. Since PCBs are manifested using the same manifest as RCRA hazardous waste, all changes to part 761 are being implemented by PCB waste handlers and generators. This does not include the exemption to manifest waste transported on a right-of-way (40 CFR 262.20(f)).

- **What RCRA manifest regulatory requirements do not exist in the PCB manifest regulations?**

EPA compared the PCB manifest regulations (40 CFR part 761) to the RCRA manifest regulations (40 CFR parts 262, 263, and 264) to determine which sections from the RCRA manifest regulations do not exist in the PCB manifest regulations. Below is a table of the regulations from 40 CFR parts 262-264 EPA is adding to 40 CFR part 761 where the content of the section will be new to 40 CFR part 761. Like the other changes in this rule, explanations for the changes below are included in the subsequent sections in this direct final rule. In addition to this direct final rule, EPA will include in the docket a crosswalk between the RCRA manifest regulations and the PCB manifest regulations.

40 CFR Section	Brief Description of RCRA Regulation
262.20(c)	Designating an alternate facility on the manifest
262.20(f)	Manifesting exemption for the transport of waste on a public or private right-of-way within or along the border of contiguous property
	Generator requirements for rejected shipments

262.23(f)	returned by the receiving facility back to the generator. (Language on non-empty containers and residues is not relevant to PCB waste.)
262.40(b)	Three-year exception report retention requirement for generators
263.21(a)(2)	Alternate designated facility is listed as one of the options that the transporter must deliver the waste to
263.21(b)(2)	Partial and full load rejection requirements if the waste is rejected while the transporter is on the facility's premises
264.71(a)(1)	Facility signs and dates the manifest when the waste was received, except as noted in the discrepancy space of the manifest, or when the waste was rejected as noted in the manifest discrepancy space
264.72(a)(2)	Definition of rejected wastes as manifest discrepancies
264.72(d)	Upon rejecting waste, the facility must consult with the generator prior to forwarding the waste to another facility. The facility must send the waste to another facility or back to the generator within 60 days of the rejection. While making arrangements for the rejected waste, the facility must ensure that the transporter retains custody or the facility provides secure, temporary custody of the waste.
264.72(e)	Facility requirements for preparing a new manifest for full or partial load rejections that are to be sent off-site to an alternate facility
264.72(f)	Facility requirements for preparing a new manifest for rejected wastes that must be sent back to the generator

264.72(g)	Facility requirements for amending the manifest for rejected wastes after the facility has signed, dated, and returned the manifest to the delivering transporter or to the generator
264.76(a)(6)	Report on un-manifested waste must include the certification signed by the owner, operator, or authorized representative of the facility

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LAST UPDATED ON AUGUST 10, 2017