

US EPA ARCHIVE DOCUMENT

Technical Factsheet on: POLYCHLORINATED BIPHENYLS (PCBs)

[List of Contaminants](#)

As part of the Drinking Water and Health pages, this fact sheet is part of a larger publication:
National Primary Drinking Water Regulations

Drinking Water Standards

MCLG: zero mg/L
MCL: 0.0005 mg/L
HAL(child): none

Health Effects Summary

Acute: EPA has found PCBs to potentially cause the following health effects from short-term exposures at levels above the MCL: acne-like eruptions and pigmentation of the skin; hearing and vision problems; spasms.

Chronic: PCBs have the potential to cause the following health effects from long-term exposure at levels above the MCL: effects similar to acute poisonings; irritation of nose, throat and gastrointestinal tracts; changes in liver function.

Cancer: There is some evidence that PCBs may have the potential to cause cancer from a lifetime exposure at levels above the MCL.

Usage Patterns

Production of PCBs has decreased drastically: from over 86 million lbs. in 1970 to 35 million lbs in 1977. EPA banned most uses of PCBs in 1979. In 1975 it was estimated that industries consumed PCBs as follows: Capacitors, 70%; Transformers, 30% PCBs were formerly used in the USA as hydraulic fluids, plasticizers, adhesives, fire retardants, way extenders, dedusting agents, pesticide extenders, inks, lubricants, cutting oils, in heat transfer systems, carbonless reproducing paper.

Release Patterns

Current evidence suggests that the major source of PCB release to the environment is an environmental cycling process of PCBs previously introduced into the environment; this cycling process involves volatilization from ground surfaces (water, soil) into the atmosphere with subsequent removal from the atmosphere via wet/dry deposition and then revolatilization. PCBs are also currently released to the environment from landfills containing PCB waste materials and products, incineration of municipal refuse and sewage sludge, and improper (or illegal) disposal of PCB materials, such as waste transformer fluid, to open areas.

From 1987 to 1993, according to EPA's Toxic Chemical Release Inventory, PCB releases to land and water totalled over 74,000 lbs., of which about 99 percent was to land. The bulk of these releases occurred in 1990 and were primarily from non-ferrous wire drawing and insulating industries. The largest releases (10% or more of the total) occurred in California.

Environmental Fate

PCBs are mixtures of different congeners of chlorobiphenyl and the relative importance of the environmental fate mechanisms generally depends on the degree of chlorination. In general, the persistence of PCBs increases with an increase in the degree of chlorination. Mono-, di- and trichlorinated biphenyls biodegrade relatively rapidly, tetrachlorinated biphenyls biodegrade slowly, and higher chlorinated biphenyls are resistant to biodegradation. Although biodegradation of higher chlorinated congeners may occur very slowly on an environmental basis, no other degradation mechanisms have been shown to be important in natural water and soil systems; therefore, biodegradation may be the ultimate degradation process in water and soil.

If released to soil, PCBs experience tight adsorption with adsorption generally increasing with the degree of chlorination of the PCB. PCBs will generally not leach significantly in aqueous soil systems; the higher chlorinated congeners will have a lower tendency to leach than the lower chlorinated congeners. In the presence of organic solvents PCBs may leach quite rapidly through soil. Vapor loss of PCBs from soil surfaces appears to be an important fate mechanism with the rate of volatilization decreasing with increasing chlorination. Although the volatilization rate may be low, the total loss by volatilization over time may be significant because of the persistence and stability of PCBs. Enrichment of the low-Cl PCBs occurs in the vapor phase relative to the original Aroclor; the residue will be enriched in the PCBs containing high Cl content.

If released to water, adsorption to sediment and suspended matter will be an important fate process; PCB concentrations in sediment and suspended matter have been shown to be greater than in the associated water column. Although adsorption can immobilize PCBs (especially the higher chlorinated congeners) for relatively long periods of time, eventual resolution into the water column has been shown to occur. The PCB composition in the water will be enriched in the lower chlorinated PCBs because of their greater water solubility, and the least water soluble PCBs (highest Cl content) will remain adsorbed. In the absence of adsorption, PCBs volatilize relatively rapidly from water. However, strong PCB adsorption to sediment significantly competes with volatilization, with the higher chlorinated PCBs having longer half-lives than the lower chlorinated PCBs. Although the resulting volatilization rate may be low, the total loss by volatilization over time may be significant because of the persistence and stability of the PCBs.

If released to the atmosphere, PCBs will primarily exist in the vapor-phase; the tendency to become associated with the particulate-phase will increase as the degree of chlorination of the PCB increases. The dominant atmospheric transformation process is probably the vapor-phase reaction with hydroxyl radicals which has estimated half-lives ranging from 12.9 days for monochlorobiphenyl to 1.31 years for heptachlorobiphenyl. Physical removal of PCBs from the atmosphere, which is very important environmentally, is accomplished by wet and dry deposition.

PCBs have been shown to bioconcentrate significantly in aquatic organisms. Average log BCFs of 3.26 to 5.27, reported for various congeners in aquatic organisms, show increasing accumulation with the more highly chlorinated congeners. The major PCB exposure routes to humans are through food and drinking water, and by inhalation of contaminated air.

Chemical/ Physical Properties

CAS Number: 1336-36-3

Color/ Form/Odor: PCB is generic term for group of organic chemicals which can be odorless or mildly aromatic solids or oily liquids; available in mixtures containing several PCBs and other organics as well.

M.P.: 340 to 375 C B.P.: N/A

Octanol/Water Partition (Kow): N/A

Vapor Pressure: N/A; moderately volatile from water and soil

Density/Spec. Grav.: 1.44 at 30 C

Solubility: N/A; insoluble in water

Soil sorption coefficient: Koc generally above 5000; low mobility in soil, but may leach with mobile organic solvents.

Odor/Taste Thresholds: N/A

Bioconcentration Factor: Log BCF - 3.26 to 5.27 in aquatic organisms; expected to bioconcentrate in aquatic organisms.

Henry's Law Coefficient: 3.3×10^{-4} to 5×10^{-5} atm-cu m/mole at 20 deg C

Trade Names/Synonyms: PCB, Chlorinated diphenyl, Clophen, Kanechlor, Aroclor, Fenclor, Chlorextol, Dykanol, Inerteen, Monter, Pyralene, Santotherm, sovol, Therminol, Noflamol

Other Regulatory Information

Monitoring For Ground/Surface Water Sources:

Initial Frequency- 4 quarterly samples every 3 years
 Repeat Frequency- If no detections during initial round:
 2 quarterly per year if serving >3300 persons;
 1 sample per 3 years for smaller systems

Triggers - Return to Initial Freq. if detect at congener-specific limits
 Analysis:

Reference Source Method Numbers

EPA 600/4-88-039 505; 508; 508A

Treatment- Best Available Technologies:
 Granular Activated Charcoal

Toxic Release Inventory - Releases to Water and Land, 1987 to 1993 (in pounds):

	Water		Land	
TOTALS	784		73,632	
Top Five States				
CA	0	58,178		
NJ	0	13,188		
KY	250	750		
WA	0	998		
TN	255	251		
Major Industries				
Non-ferrous wire			0	58,178
Steel pipe/tubing			0	13,183
Pulp mills			0	998

For Additional Information:

EPA can provide further regulatory and other general information:
 EPA Safe Drinking Water Hotline - 800/426-4791

Other sources of toxicological and environmental fate data include:
Toxic Substance Control Act Information Line - 202/554-1404
Toxics Release Inventory, National Library of Medicine - 301/496-6531
Agency for Toxic Substances and Disease Registry - 404/639-6000