

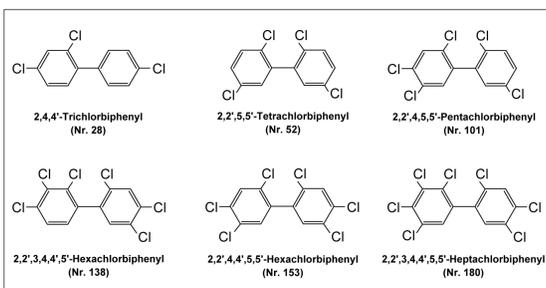


Detection of high PCB concentrations in sediments of the River Elbe: causes and effects

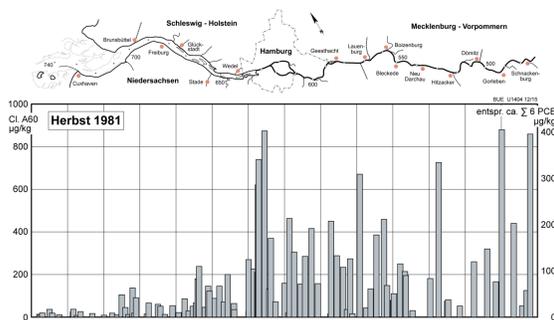
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Polychlorinated biphenyls (PCB) are persistent organic chlorine compounds. They are toxic and possibly carcinogenic to humans. PCBs belong to the so-called „dirty dozen“. Production was banned worldwide by the Stockholm Convention in 2001.

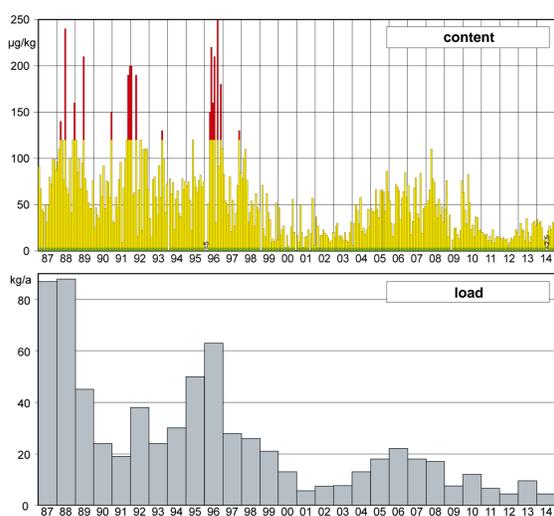
PCBs have been detected for almost four decades in the River Elbe, to some extent in significant contents. First analyses go back to the work of the ARGE Elbe where initial samples were retrieved from a profile at the former West/East-German border in Schnackenburg (german navigation km 474.5). While during the early 1980s focus was on the detection of PCBs production residues (e.g. clophenes A60), beginning with the 1990s characteristic PCB-congeners (so-called Ballschmider PCB) have been recorded and evaluated along the main stream of German and Czech Elbe as well as in the relevant tributaries.



Chemical structure of six characteristic PCB-congeners by Ballschmider and Zell (1980)

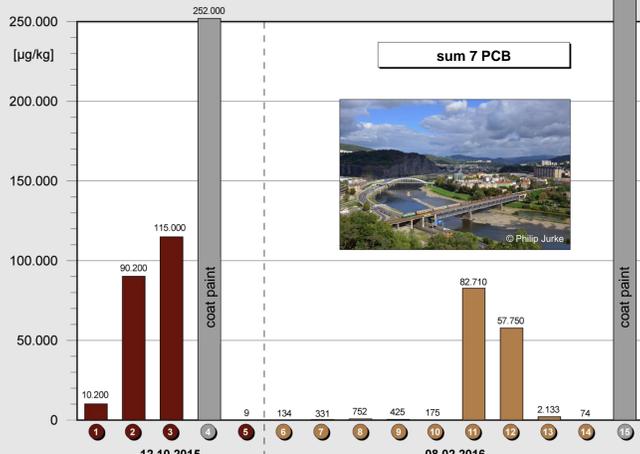


Clophenes A60 longitudinal profiles (sediments) in the section from Schnackenburg to the North Sea in 1981 (data: ARGE ELBE 1983)



Content and load development of sum 6 PCB in fresh suspended sediments of the Elbe at monitoring station Schnackenburg (german navigation km 474.5) in 1987 - 2014. Classification according ICPER sediment management concept (data: ARGE ELBE, FIS FGG Elbe)

The International Commission for the Protection of the Elbe River (ICPER) confirmed that the source of contamination can be traced back to the Czech Republic metropolitan area of Ústí nad Labem. According to the state water management of the Elbe (Povodí Labe) PCB release was caused by removal of PCB-containing paint of a railway bridge crossing the Elbe in the city of Ústí nad Labem.



Measurement results of sum 7 PCB [µg/kg] in the area of railway bridge in Ústí nad Labem (data: Povodí Labe)

Since spring of 2015 historically high PCB contents (up to 6.000 µg/kg sum 6 PCB-congeners) have been detected in the Elbe. Over a considerable distance (hundreds kilometres of river) and over a long time period (nearly one year) the PCB-environmental quality standard of 120 µg/kg for sum 6 PCB-congeners was critically exceeded. By now, significantly elevated PCB levels are detected up to the area of the lower Middle Elbe at Schnackenburg (german navigation km 474.5).



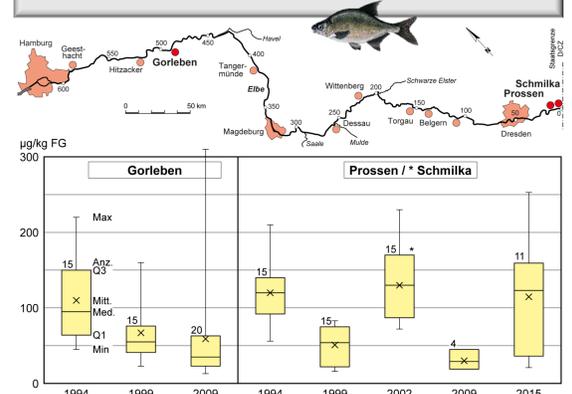
*MMP = monthly pooled sample

µg/kg MMP*	NI Schnackenburg	ST Wittenberg	SN Dommitzsch	SN Zehren	SN Schmilka	CZ Děčín
Jan.	34	51	65	112	87	178
Febr.	41	62	81	107	289	68
March	46	85	173	430	662	204
April	57	337	372	709	1.600	1.710
May	103	479	741	1.620	6.010	3.730
June	54	459	697	1.130	1.840	3.600
July	103	386	518	771	1.080	1.450
Aug.	58	322	464	497	1.090	1.440
Sept.	90	354	331	467	666	1.260
Oct.	65	453	381	525	541	1.410
Nov.	73	478	233	331	512	1.480
Dec.	118	439	344	535	1.140	1.990

Σ 6 PCB ≤ 120 µg/kg, at least one congener > 20 µg/kg
 Σ 6 PCB ≤ 1.200 µg/kg
 Σ 6 PCB > 1.200 µg/kg
 Σ 6 PCB > 6.000 µg/kg

Temporal development of sum 6 PCB contents along the river Elbe in 2015 (data: FGG Elbe, ICPER)

The PCB-pollution has arrived in the food chain. The sediment quality and the aquatic community have been permanently affected by the harmful event.



Development of PCB concentrations (sum 6 PCB) in bream (muscle wet weight) of the Elbe in 1994 - 2015; Sample Prossen 2015: White fish (bream, orfe, nase, roach) (data: ARGE ELBE, LfULG)

Due to the distinct low water levels in the middle and upper Elbe in 2015, PCB-loaded suspended solids have deposited preferentially in the adjacent still water areas. With an increased headwater discharge of about 700 m³/s in December 2015 (reference gauge: Neu Darchau, german navigation km 536.4 km) increased levels of PCB have entered the Elbe estuary for the first time.

To develop a valuable lesson from this incident the implementation of recommendations as stated in the sediment management concepts of the ICPER is required. This particularly has to include measures to sustainably reduce contaminants in the upstream area and will have to serve the fulfilment of legal environmental requirements such as the EU Water Framework Directive (WFD) and the EU Marine Strategy Framework Directive (MSFD). Permanently securing a good quality of suspended solids and sediments can only be achieved on the basis of solidarity within the ICPER via management plans and the WFD program of measures.

