

ELBE FLOOD AUGUST 2002 PCDD/F IN SEDIMENTS FROM CZECHIA TO THE NORTH SEA

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Introduction

From August 1-10 and from 11-13, 2002 heavy rains fell in the middle and upper reaches of the Elbe River catchment causing a historic flood. Contaminated sites, landfills, chemical factories and sewage treatment plants were submerged and toxic and hazardous substances could have leaked out. To get information about the contamination of the river basin with polychlor-dibenzo-dioxins and -furans (PCDD/F) after the flood, the POP Laboratory of the Federal Environmental Agency analysed sediments from the Elbe, its Czechian part the Labe and its tributaries Vltava, Ohre, Bilina and Mulde River.

Materials and Methods

Sample Collection. Sediments from the bank (from sealed areas as cobblestone and concrete pavement or from flooded monitoring stations) and undisturbed young sediments (0-10 cm) from the bed of the Elbe River and its tributaries were collected on August 29 and from September 8-16, 2002, using a stainless steel sediment scraper or a Van Veen grab sampler. Sampling was organized by „Niedersächsischer Landesbetrieb für Wasserwirtschaft und Küstenschutz“ (2 sediments) and „Arbeitsgemeinschaft für die Reinhaltung der Elbe“ (39 sediments).

Chemical Analysis. 10 g freeze-dried sediment was extracted by ASETM (Dionex, Idstein) with toluene. The sediment was spiked with seventeen ¹³C₁₂-PCDD/F standards (1 ng Te-HpCDD/F and 2 ng OCDD/F). The extract was cleaned by a four column clean-up (Macro Al₂O₃, SiO₂-AgNO₃, H₂SO₄, NaOH, Bio-Beads S-X3, Mini Al₂O₃), spiked with the injection standard (1 ng ¹³C₆-1,2,3,4-TeCDD) and reduced to 10 µl. 1 µl was injected on-column (guard column 2 m x 0.32 mm, uncoated, deactivated) and analysed by GC-EI-LRMS (GC 8000Top-MS Voyager, ThermoQuest) using a SP-2331 (60 m x 0.25 mm, 0.2 µm). The two most intensive mass of the chlorine cluster were measured for each homologue group. The identification of PCDD/F was based on retention time and correct isotope ratio for both fragments recorded. Quantification was performed by means of the ¹³C₁₂-labelled internal standards. TEQ values were calculated using zero for non-detected congeners³.

Results and Discussion

Concentrations of PCDD/F in sediments from sealed areas collected along the bank of the Elbe River range from 1 to 45 pg I-TEQ/g d.m.: Schmilka, Monitoring Station 18, Zehren, Monitoring Station 16, Laasche, Camping 1 and Hitzacker, Old Town 45 pg I-TEQ/g d.m.. They do not exceed the action value for remediation of contaminated soil in playgrounds (100 pg I-TEQ/g d.m., Federal Soil Protection and Contaminated Sites Ordinance¹). Limitations of the agricultural (e.g. grazing) and horticultural land use might be necessary in flooding areas if increasing levels of PCDD/F are analysed in feed and foodstuff.

PCDD/F concentrations in young undisturbed sediments collected from the bed of the Elbe River and its tributaries from Czechia to the mouth of the Mulde River range from 3 to 23 pg I-TEQ/g d.m.. In and downstream the mouth of the Mulde River they are 8- to 9-fold greater than upstream (126 and 142 pg I-TEQ/g d.m.) and decrease nearly linear by dilution with less contaminated particles to 7 pg I-TEQ/g d.m. at the estuary of the Elbe River into the North Sea (Figure 1 and Table 1).

Conclusions

The PCDD/F concentration in a sediment collected near Magdeburg after the flood 2002 was comparable to one analysed in 2000 (Lostau, downstream Magdeburg 2002: 95 pg I-TEQ/g d.m.; Magdeburg 2000: 80 pg I-TEQ/g d.m.²). Leaking of highly PCDD/F contaminated soil particles from a flooded chemical factory in Neratovice, Czechia could not be proved. The main influx of PCDD/F particles into the Elbe comes from the Mulde River as can be seen by the concentration gradient to the North Sea⁶. Previous studies identified Mg-production in Bitterfeld and Staßfurt, which was closed in 1945, by multivariate statistical methods^{4,5}.

References

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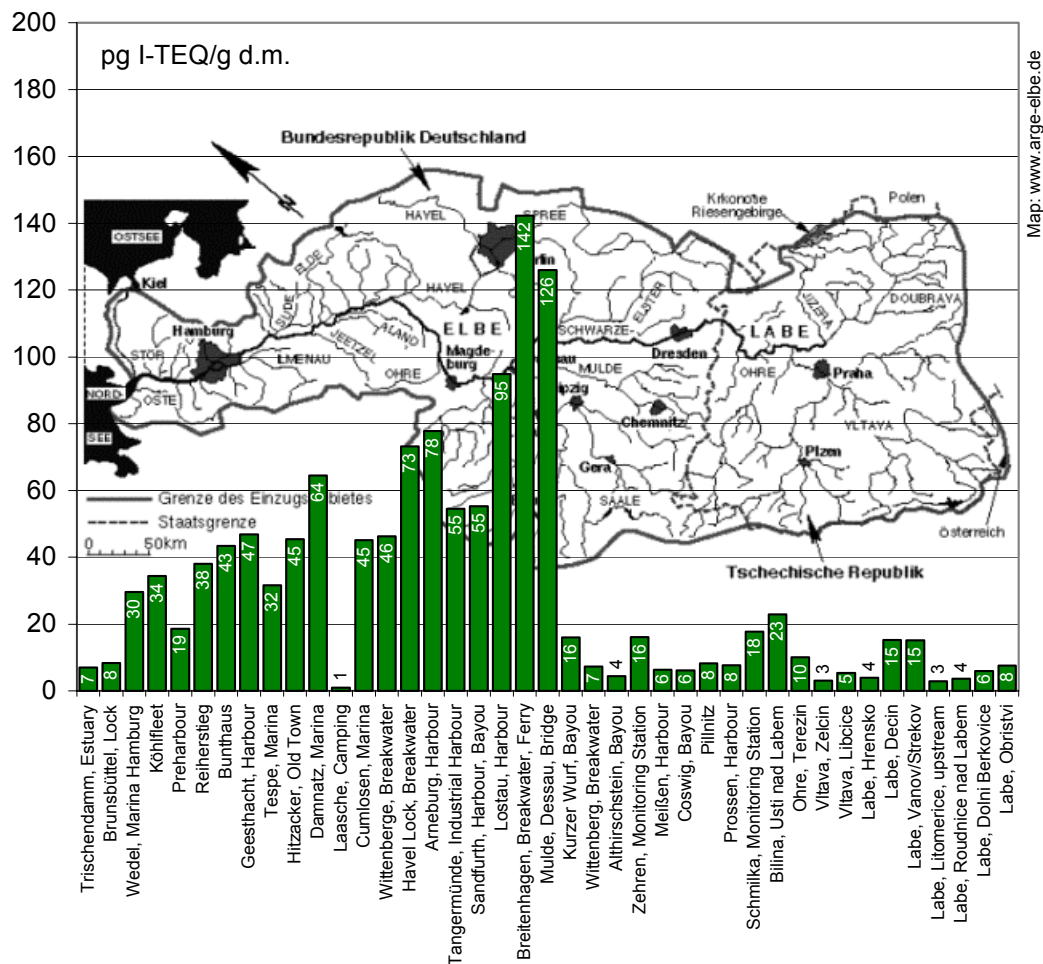


Figure 1: Elbe Flood 2002 – PCDD/F in sediments from Czechia to the North Sea – I-TEQ. Low concentrations in Czechia to the mouth of the Mulde River, the main influx of PCDD/F, nearly linear decrease by dilution with less contaminated particles to the North Sea

Table 1: Elbe Flood 2002 – PCDD/F in sediments from Czechia to the North Sea – I-TEQ

Kilometre	Sampling Site	I-TEQ [pg/g d.m.]
730	Trischendamm, Estuary	7
697	Brunsbüttel, Lock	8
643	Wedel, Marina Hamburg	30
	Köhlfleet	34
	Preharbour	19
	Reiherstieg	38
610	Bunthaus	43
583	Geesthacht, Harbour	47
579	Tespe, Marina	32
522	Hitzacker, Old Town	45
510	Damnatz, Marina	64
	Laasche, Camping	1
470	Cumlosen, Marina	45
455	Wittenberge, Breakwater	46
423	Havel Lock, Breakwater	73
409	Arneburg, Harbour	78
390	Tangermünde, Industrial Harbour	55
363	Sandfurth, Harbour, Bayou	55
336	Lostau, Harbour	95
290	Breitenhagen, Breakwater, Ferry	142
	Mulde, Dessau, Bridge	126
250	Kurzer Wurf, Bayou	16
220	Wittenberg, Breakwater	7
97	Althirschstein, Bayou	4
90	Zehren, Monitoring Station	16
83	Meißen, Harbour	6
73	Coswig, Bayou	6
43	Pillnitz	8
13	Prossen, Harbour	8
4	Schmilka, Monitoring Station	18
38	Bilina, Usti nad Labem	23
	Ohre, Terezin	10
	Vltava, Zelcin	3
	Vltava, Libcice	5
0.5	Labe, Hrensko	4
14	Labe, Decin	15
41	Labe, Vanov/Strekov	15
67	Labe, Litomerice, upstream	3
83	Labe, Roudnice nad Labem	4
104	Labe, Dolni Berkovice	6
115	Labe, Obristvi	8