

Soil Contamination with PCDD/PCDF and other organohalogen compounds in Bitterfeld/Wolfen (former GDR)

Wilken, M.^A, Cornelsen, B.^A, Fabarius, G.^A, Zeschmar-Lahl, B.^B, Jager, J.^A

^A ITU GmbH, Ansbacher Str. 5, D - 1000 Berlin 30

^B ITU-Forschung GmbH, Kolonnenstr. 26, D - 1000 Berlin 62

The area of Bitterfeld/Wolfen, a former chemical production center, is generally regarded as heavily contaminated. Due to a commission of the Landratsamt Bitterfeld, in 1991 ITU performed a screening of this area. Within the first step, 112 soil samples were collected, 103 from the upper soil layer (0 - 30 cm), and analyzed to their content of PCDD/PCDF [TE due to BGA; BGA = Federal Bureau of Health, FRG], PCB, chlorophenols, chlorobenzenes, HCH_{SUM} and DDT and metabolites (DDX). In a second step, for some contamination centers further analyses have been performed. First results of this screening and of additional samples have already been published at "Dioxin '91"¹. Further results² of this screening program are presented in the following.

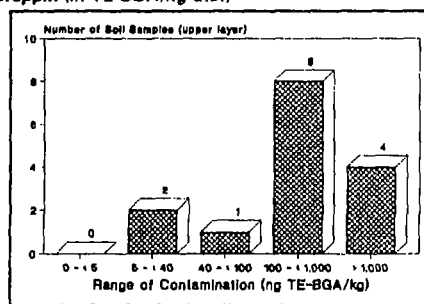
62 % of the 103 upper soil layer samples showed PCDD/PCDF contamination in the range of 5 - 40 ng TE (BGA)/kg d.s. 37 % of these samples exceeded this level, only 2 samples (\cong 1 %) showed contamination below 5 ng TE/kg. Eight of nine samples from the lower layer (depth > 30 cm) lay below 40 ng TE/kg, the exceptional one with 113 ng TE/kg was derived from the area directly beneath the producing area of present Chemie AG, where in the past 2,4-D pesticides had been produced. Soil contamination with PCDD/PCDF is on average to be regarded as distinctly enlarged in this area compared to other industrialized areas. This is not restricted to single point samples. Indeed, there seem to be several areas of concern, where the average contamination with PCDD/PCDF is still much higher. These areas of concern will be discussed below.

Contamination with PCDD/PCDF in the screening area can be regarded as referingly low. Only 2 of all 112 examined soil samples showed PCB-contamination above 1 mg/kg d.s.. Chlorobenzenes, chlorophenols and chlorinated pesticides (HCH_{SUM} and DDX) exceeded in only less than 10 % of all samples threshold limits given by Berlin resp. Brandenburg authority.

One center of concern is **Greppin**, a community in the northwestern part of Bitterfeld, direction Wolfen. Here, ITU analyzed soil samples from the area itself (including kindergartens) and its edges. All samples contained more than 40 ng TE/kg of PCDD/PCDF, the southeast even showed several samples with > 100 ng TE/kg. Figure 2 shows the distribution of PCDD/PCDF in Greppin soil samples.

The top value of 5,590 ng TE/kg occurred in an area westward the community of Greppin, localized on a fallow land. From this area, ITU examined additional nine samples, six of them showing contamination > 100 ng TE/kg, two even 1,630 and 1,190 ng TE/kg.

Fig. 2: Distribution of PCDD/PCDF in the upper soil layer of the center of concern **Greppin** (in TE BGA/kg d.s.)



Because of these and other further informations, one can draw conclusions concerning the source of this contamination. In all probability the Hormit-production plant is one of or is the major source for this contamination. ITU's analyses of pesticides having been produced here showed that 2,4-D-based pesticide "Spritz-Hormit" was highly contaminated with PCDD/PCDF (3,840 ng TE/kg). Even without damages and disturbances within production, non-point emissions of raw material, intermediates and finished product can have lead to PCDD/PCDF emission into the vicinity¹. Further analyzes are necessary to clear the question whether other areas of Greppin lying in lee of this plant have been contaminated, too.

Another center of concern is the **production plant area of the present Chemie AG**. Here, derivatives of chlorophenols, especially 2,4-D, have been produced. In consequence, soil samples of this area showed distinct higher contaminations with chlorophenols, dioxins and further organohalogen compounds. At one site on the production plant area, ITU analyzed in addition the lower soil layer. Here, the upper soil layer contained > 2 mg/kg chlorophenols and 248 ng TE/kg dioxins, while down to 50 cm depth, dioxin contamination exceeded 100 ng TE/kg. One can therefore assume a considerable vertical distribution of organohalogen pollutants, too.

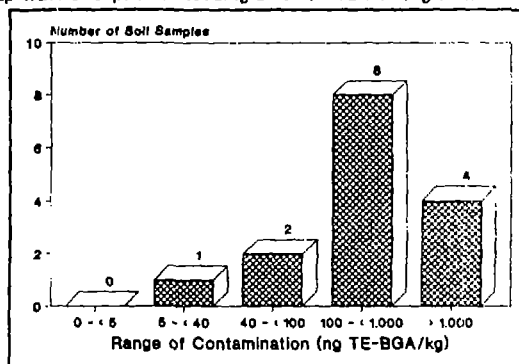
Further centers of concern are **the former waste disposal "Kniegrube", flooding area and sediments of rivers at Bitterfeld and the town of Bitterfeld itself**.

At the "Kniegrube", ITU only analyzed one soil sample, and the result was 107 ng TE/kg. This site is not secured, but is used as park and is opened for children, too. The question, whether this is a hazardous site or not, should be clarified by further investigations, especially by soil profile analyses.

Flooding areas and sediments of industrially polluted rivers often show a high degree of contamination with e.g. organohalogen compounds. This seems to be a problem, too, for the sewage system (waste water channels) and the areas of former industrial discharge (e.g. Schlangengraben).

First analyses of the river "Spittelwasser" and its sediments resulted in PCDD/PCDF contamination of 3,750, 2,180, 523 and 203 ng TE/kg d.s. and with other organohalogen compounds of > 1 mg/kg d.s.. This magnitude was confirmed by further four sediment analyses. Such high contaminations may pose a risk to agriculture.

Fig. 3: Distribution of PCDD/PCDF in sediment and soil samples of Bitterfeld tap waters resp. their flooding areas (in TE BGA/kg d.s.)



One sample from an area agriculturally used even in 1991 showed a contamination with PCDD/PCDF of 523 ng TE/kg. Due to BGA, agricultural use of this area has to be forbidden.

In the flooding area downstream of the "Schachtgraben", broad and up to 1 m thick deposits of ion exchanger resins can be found with PCDD/PCDF contamination far above 1,000 ng TE/kg. One sediment sample in the vicinity showed 3,750 ng TE/kg, another soil sample from ashore contained 2,180 ng TE/kg. Immission analyses above these resins showed a 20 to 30-fold higher contamination with PCDD/PCDF compared to immission analyses from Greppin and Wolfen. In addition, the isomer distribution pattern of these immission samples are similar to those of the resins. So one can assume a considerable transfer of PCDD/PCDF from solid to gaseous phase.

The last center of concern is the area of Bitterfeld itself. Starting from the former 2,4-D-production, in east-southeast direction down to the northern parts of Bitterfeld there can be observed a distinct enlarged soil contamination of PCDD/PCDF. As this is the far reaching lee area of the former pesticide plant, one can assume an airborne spreading of organohalogen compounds. Further investigations seem to be necessary in order to clarify extent and gravity of this expected contamination.

1. Wilken M, Neugebauer F, Fabarius G, Zeschmar-Lahl B, Jager J. PCDD/PCDF contamination of different pesticides produced in former GDR. Poster, presented at "Dioxin '91", Chapel Hill, N.C., 24.-28.9.1991

2. Wilken M, Cornelsen B, Fabarius G, Jager J. Bodenbelastung mit halogenorganischen Schadstoffen im Raum Bitterfeld/Wolfen. Vortrag und Poster, 1. Bitterfelder Umweltkonferenz, Bitterfeld, 26.-29.2.1992