TOTAL TEQ EMISSIONS (PCDD/F *AND* PCB) FROM INDUSTRIAL SOURCES

Peter Luthardt, Johannes Mayer, Joachim Fuchs

GfA Gesellschaft für Arbeitsplatz- und Umweltanalytik mbH,
P.O. Box 410128, 48065 Münster, Germany

Introduction

Since the latest evaluation of the toxicity of organochlorine compounds by the WHO, emissions from industrial sources are more and more rated with respect to Total TEQ values considering both, polychlorinated dibenzodioxins and furans (PCDD/Fs) as well as polychlorinated biphenyls (PCBs)[1]. Meanwhile it was repeatedly reported about Total TEQ emissions from industrial sources, however there are only few data available which are based on the latest WHO toxicity equivalent factors for PCDD/Fs and PCBs considering all 12 WHO-PCBs[2,3].
In the present work some selected results from emission measurements carried out in the years 1998 – 2000 at different industrial plants and crematories are given. This work is aiming to show which part of the Total TEQ value is caused by the dioxin/furan emission and which part can be assigned to the PCB emission. Furthermore it was investigated which congeners from both substance classes are substantially responsible for the Total TEQ value.

Material and Methods

Flue gas samplings reported in this work were carried out at eight different plants given in Table 01. At five plants 6-h-samplings according to European standard EN 1948 were performed[4]. At three plants the long-term sampling system AMESA was used for 14- and 30-day-samplings respectively[5,6]. PCDD/Fs and PCBs were collected together within the same sample.

Tab. 1: Industrial emission sources

Plant	Description	APC[a] technology	Sampling	Year of sampling
MWI 1	municipal waste incinerator	elder technology (ESP, WS)	AMESA	1998
MWI 2	municipal waste incinerator	BAT (BF, 2 stage WS, ACR, SCR)	AMESA	2000
HWI	hazardous waste incinerator	BAT (ESP, 2 stage WS, ACR, SCR)	AMESA	1999
SINT 1	sintering plant	(ESP, primary measures)	EN 1948	2000
SINT 2	sintering plant	(ESP, primary measures)	EN 1948	1999
CEM	cement kiln	updated technology (ESP)	EN 1948	1999
CREM 1	crematory	elder technology (ESP)	EN 1948	1998
CREM 2	crematory	elder technology (Cyclone, BF)	EN 1948	1998

a APC: Air Pollution Control (ESP = Electrostatic Precipitator; WS = Wet Scrubber; ; BF = Bag Filter; ACR = Activated Coke Reactor; SCR = Selective Catalytic Reactor; BAT = Best Available Technology)

Extraction of the samples was carried out with toluene in a separation funnel (condensate) and in a soxhlet extractor (particle filter and XAD resin) respectively. The clean-up was carried out via liquid chromatography using silica and aluminia columns. All analyses were performed by HRGC/HRMS on HP 5890A / VG AutoSpec systems.

Results and Discussion

Total TEQ emissions of the eight plants are shown in Figure 01. The highest TEQ values were found at crematory 2, the sintering plants and at the municipal waste incinerator with elder technology. TEQ emissions below the 0.1 ng/m^3 limit were found at the modern municipal waste incinerator, the hazardous waste incinerator and at the cement kiln. Proportional and absolute amounts of TEQ values related to PCDD/Fs and PCBs are given in Figure 02. Parts of PCB-TEQs were found between 0 and 16 %

Fig. 01: Total TEQ emissions of industrial sources

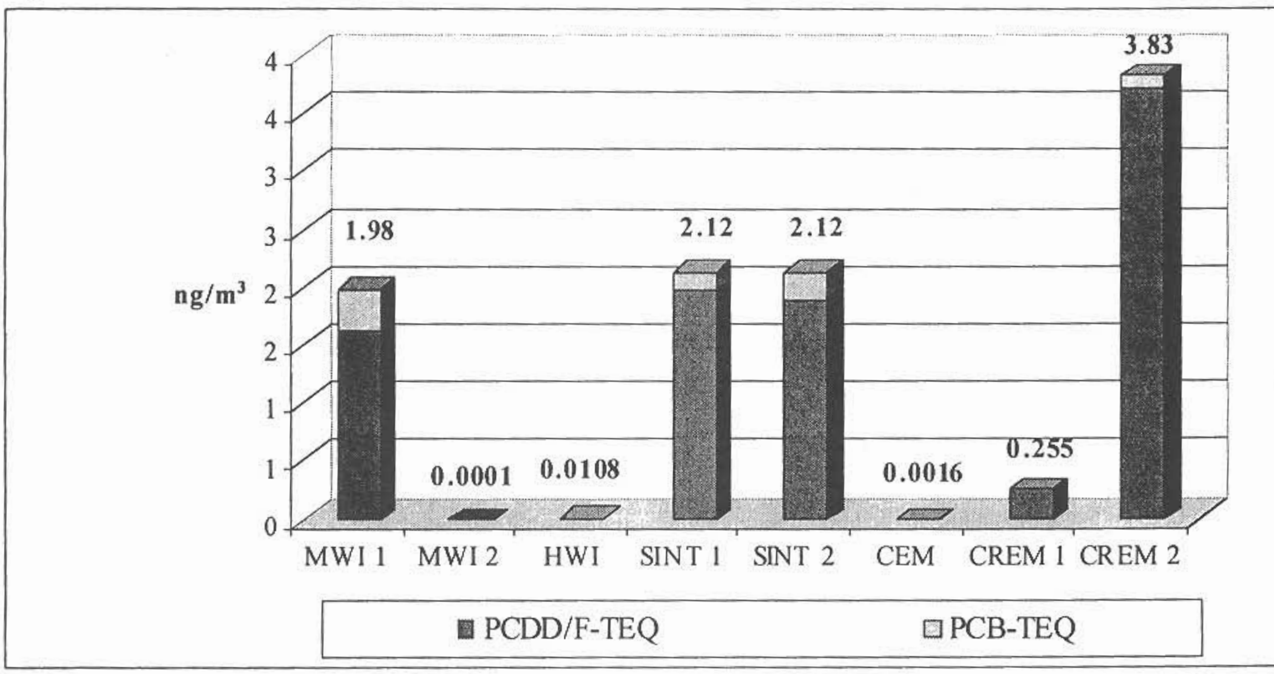
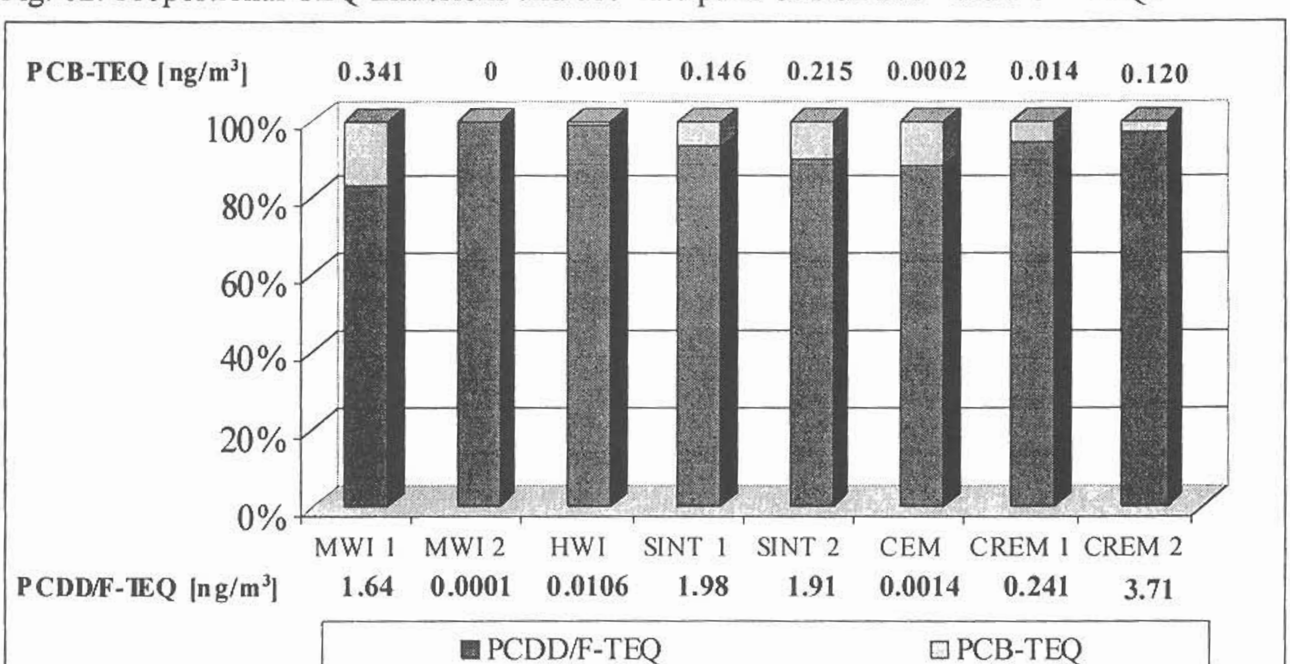
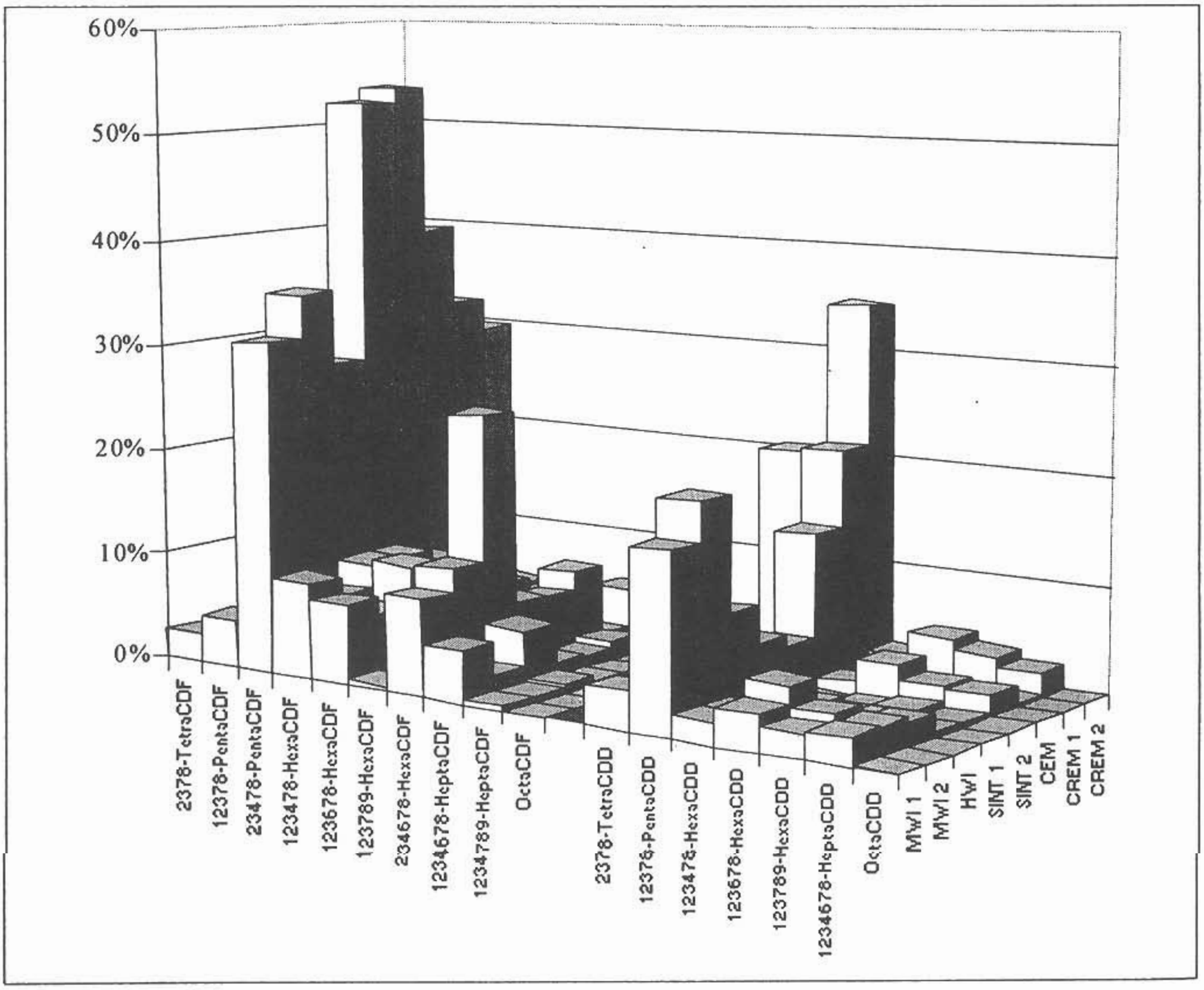


Fig. 02: Proportional TEQ Emissions and absolute parts of PCDD/F- and PCB-TEQs



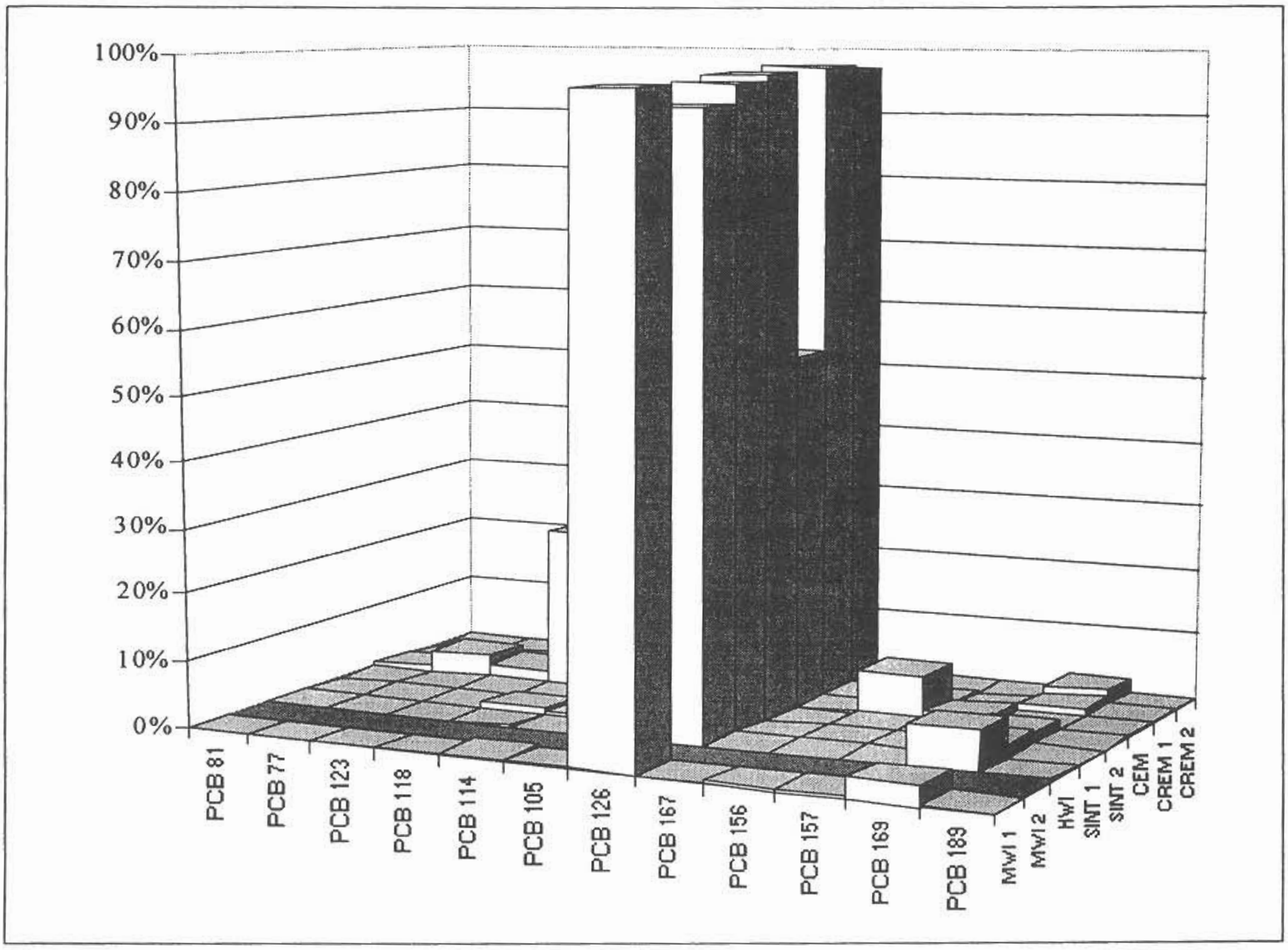
In Figure 03 the proportional contribution of the 17 individual PCDD/Fs to the PCDD/F-TEQ are shown. As can be seen from this figure the highest parts are contributed by 23478-PentaCDF and 12378-PentaCDD in most of the samples. The two samples from the sintering plants are characterized by lower parts of PentaCDD but higher parts of PentaCDF. Other tetra- through heptachlorinated compounds are relevant as well in the range up to 20 %. Contributions of OctaCDF and OctaCDD to the PCDD/F-TEQ are neglectable.

Fig. 03: Proportional contribution of individual PCDD/Fs to the PCDD/F-TEQ



On the other hand, as can be seen from Figure 04, the PCB-TEQ in the eight emission samples investigated is mostly influenced by the part of PCB-126. With exception of the cement kiln the part of PCB-126 is more than 90 % of the PCB-TEQ. The cement kiln is the only source which shows significant TEQ contribution from PCB-118 and PCB-156. PCB-169 is present in most samples and contributes up to 6 % of the PCB-TEQ. In the emissions from the municipal waste incinerator 2 with BAT and a very low Total TEQ value of 0.0001 ng/m^3 PCBs could not be detected at detection limits of 0.0001 to 0.0009 ng/m^3.

Fig. 04: Proportional contribution of individual PCBs to the PCB-TEQ



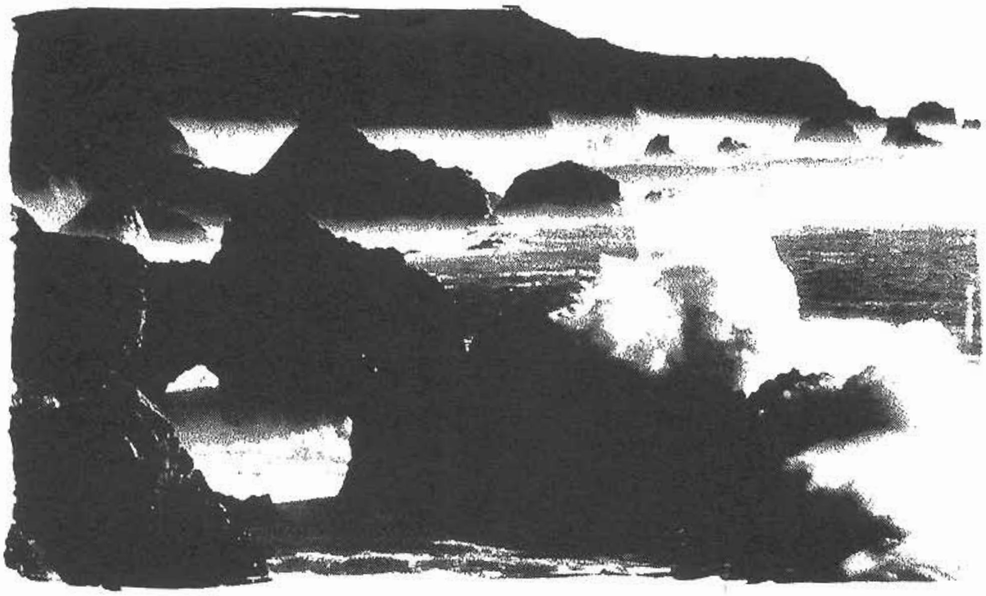
Conclusions

Within this work it was found that the contribution of PCBs to the Total TEQ of different industrial sources does not exceed 16 %. PCB-TEQ in emission samples is mainly set by the part of PCB-126. Other PCB congeners are mostly insignificant with respect to Total TEQ emissions.

References

1. van den Bergh M., Birnbaum L., Bosveld A.T.C., Brunström B., Cook P., Feeley M., Giesy J., Hanberg A., Hasegawa R., Kennedy S.W., Kubiak T., Larsen J.C. van Leeuwen F.X.R., Liem A.K.D., Nolt C., Peterson R.E., Poellinger L., Safe S., Schrenk D., Tillitt D., Tysklind M., Younes M., Waern F. and Zacharewski T. (1998) Env. Health Perspectives 106, 775
2. Alcock R.E., Behnisch P.A., Jones K.C., Hagenmaier H. (1998) Chemosphere 37 (8), 1457-1472
3. Pernin H., Ménard T., Ferrières C. (1998) Organohalogen Compounds 36, 253-255
4. CEN (European Committee for Standardization), EN 1948: Stationary source emissions – Determination of the mass concentration of PCDDs/PCDFs parts 1 – 3 (1996)
5. Funcke W., Linnemann H., Philipp C. (1993) Organohalogen Compounds 11, 345-350
6. Mayer J., Linnemann H., Becker E., Rentschler W., Jockel W., Wilbring P., Gerchel B. (2000) Chemosphere 40, 1025-1027

20th International Symposium on Halogenated Environmental Organic Pollutants & POPS



Monterey, California, USA
August 13 - 17, 2000

Analysis

Bioanalytical Approaches for POP Detection

Environmental Fate and Transport

PCDDs/PCDFs in the Atmosphere - Measurement, Trends, Sources, Fate and Transport

Emission Control and Abatement Technologies & Remediation

ORGANOHALOGEN COMPOUNDS

DIOXIN2000

Volume 45, 2000