

Measurements of the Emissionconcentrations of PCCD/PCDF
in a Digestergas-Torch of a municipal Sewage-Plant

Schreiner M., Reifenhäuser W., Vierle O., et.al.

Bayer. Landesamt für Umweltschutz, 8000 München 81, Germany

Sampling

After some pre-inspections of the only occassionally used Digestergas Torch of the Sewage Plant and one trial run, a square scaffold with a height of ca. 6 m and two working floors was constructed around the Torch by the Sewage Plant Office, according to the proportion of the LfU. For fixing and adjusting the sampling sond, a steelern galow was installed on the scaffold, the galow was movable in vertical and horizontal direction.

To protect the sampling units and the workers against the strong heat action, special ceramic plates had to been ordered and fixed on the scaffold.

Because of the visibility of the torch, the sampling has to be done on 3 evenings in 3 plains of the flame (s. pic.):

- plain 1: Top of the flame
- plain 2: Middle area of the flame
- plain 3: Down area of the flame

The specially developed sampling nozzle, built of fused silica with three nozzle openings (spider), was moved in just one plain through the whole cross-section of the flame in periodical time intervalls of about 15 min., whereat also the cooling zones of the flame were sampled.

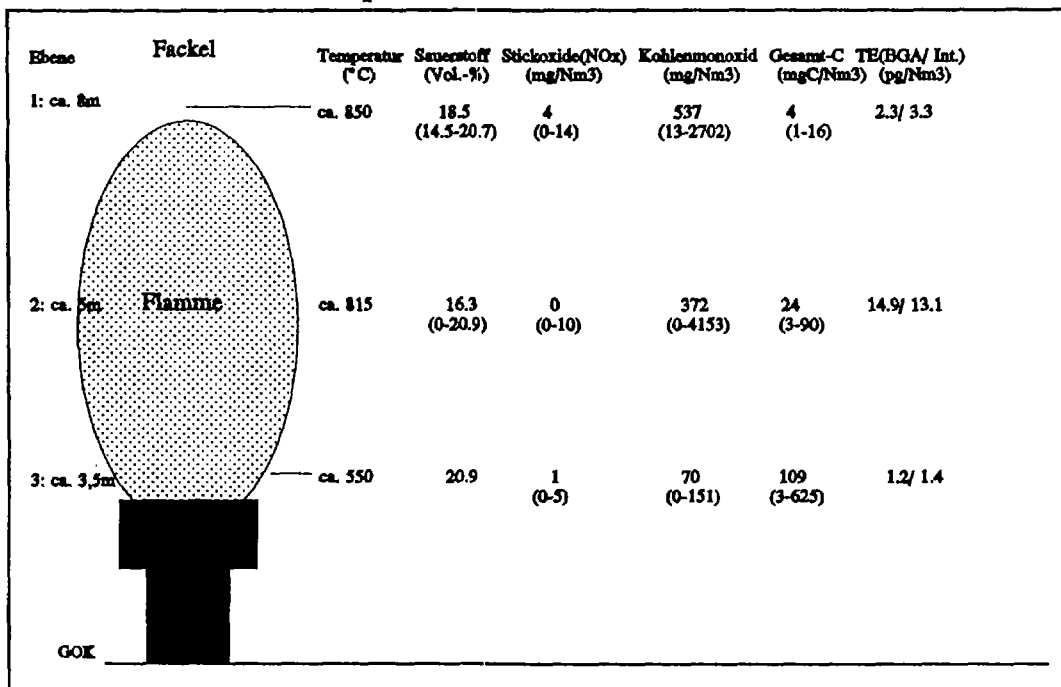
The so sampled Fluegas was conducted through a 2 m fused silica-tube and a heated Teflon tube to the special sampling unit, which was constructed by TÜV Bayern e.V. for the sampling of PCCD and PCDF appropriate to the condensation-methode¹ (silica-wool filter, ca. 120°C; coil condensor, ca. 5°C; special Impinger with Ethylenglycole; glasfiber-planefilter). A part of

¹ VDI-Richtlinie 3499 Bl.2, Teil B "Messen von PCDD und PCDF an industriellen Anlagen - Kondensationsmethode, VDI-Handbuch Reinhaltung der Luft, Band 5 (in Vorbereitung)

the Fluegasstream was used for the simultaneous determination of Carbonmonoxide (CO), Nitrogenoxides (NO, NO₂, NO_x), Oxygen (O₂) and also for Total Carbon (Gesamt-C).

Results and discussion¹

In the following picture, the most important emission-parameters are shown schematically in addition to the measured flame areas.



According to the information of the sewage plant administration, 620,000 m³ digester gas were burned by the digester gas torch between 1966 and 1990. If we suppose an average content of 75 % Vol Methanegas of the digester gas (heat content H_u = 33480 kJ/Nm³, according to the sewage plant, most of the rest (Carbondioxide), an average digester gas temperature of 35°C and an average airpressure of 950 hPa, a Methanegas volume of ca. 390,000 Nm³ can be calculated², which was burned between 1966

² Fa. Ökometric, Bayreuth, Vornahme der PCDD/PCDF-Analysen in den vom LfU gezogenen Proben,

³Nm³ = volume reduced to normal conditions (0°C, 1013 hPa)

and 1990. On the base of the theoretical calculated fluegas volume⁴ of 17.8 Nm³ per Nm³ digester gas, which could be determined by the measured average Oxygen concentration (Luftüberschußzahl $\lambda = 8,5$) the theoretical fluegas volume results by multiplication of the digester gas volume with the faktor 78.6, adequate to ca. 30.8 Mio Nm³.

If the maximal determined PCDD/F-equivalentsum of about 15 pg/Nm³ is based for a raw calculation in the worst case, a maximal Emission of ca. 460 μg TE would be calculated during the time period from 1966 to 1990.

If we consider the contamination per Nm³ torch fluegas, it is to establish, that even in the worst case TE-values are clear below the limit of 0.1 ng/Nm³, which is valid for waste incinerators in Germany.

The analysis of the digester gas to organ.-chem. components has given various concentrations on numerous Alkylated Aromates (C7-C11), PCDD/F, PCB, Trichloroethylen, Tetrachloroethylen und Dichlorbenzenes in trace concentrations, whereat under the Dichlorobenzenes the 1,4-Dichlorobenzene (desinfektant) was dominant. Fluorochlorohydrocarbons (Freons) and Vinylchloride could not be detected with the used analytical methods. As inorganic chlorine compound, Hydrogenchloride is contained in the digester gas.

The significant higher concentrations of PCDD/F indicates, that the sewage sludge contains these compounds probably in higher concentrations and only a part of them is transferred to the digester gas.

The relativ low PCDD/F-concentrations in the digester gas torch indicates, that only a small part of the chlorous compounds detected in the digester gas has been converted to PCDD/PCDF during the burning process. The although relativ low, raw estimated PCDD/F-amounts makes it unreal, that the run of the digester gas torch has contributed seriously to the partly high PCDD/F-concentrations in the soils around the sewage plant.

These results confirms also with the investigations of the Institut für Technischen Umweltschutz⁵, Techn. Universität Berlin, that in torches of waste disposal gases PCDD- und PCDF-congeneres are formed only in an amount of a few ng/m³.

⁴ Baum F. *Luftreinhaltung in der Praxis*, Oldenburg Verlag, 1988:473, ISBN-3-486-26256-4

⁵ Kluwe M., Kaimann B., Lorber K.E., Meier zu Köcker H., *Chlorkohlenwasserstoffemissionen bei der Verbrennung von Deponiegasen in Fackeln*, Poster GDCh 23. Hauptversammlung, München, Tagungsband 1991:223, ISBN 3-527-28248-3

