CURRENT METHODICAL LIMIT OF LONG TERM EMISSION SAMPLING METHODS FOR THE CONCENTRATION OF I-TEQ FROM PCDD/PCDFs

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Introduction

As the application of continuous sampling became mandatory mid 2014 also in France for incineration plants, the number of installed and operating devices as well as collected experience in device use and opportunities increased significantly. Even the industrial incinerators currently got exception from this rules and with this more or less only municipal waster incinerators keeps covered by this obligation, the interest to gain data allowing to learn about operation characteristics of each monitored plant remains. The high level of quality of all involved stages, the sampling method application, the sampling devices, the laboratory work and the collected experience of the plant operators, allowed to gain data from one plant including a monitored level from one month of probably close to perfect operation of the monitored plant, leading in the maybe lowest ever measured I-$TEQ_{PCDD/PCDF}$ emission value, where all concerned isomers - with only one exception – have been detected and quantified. Following, this result can be expected to be in the typically range of uncertainty of the method, even if the concentration level was about only 10 fg/m^3_N, so the factor of 10.000 below the legal limit.

Methods and Materials

The DioxinMonitoringSystem®, established since 1993 for the monitoring of dioxin emissions by using continuous sampling of exhaust gases, allows sampling periods from a few hours to several months. The gained results represent the average emission over the sampling period, weighed by the exhaust volume flow. The number of installed and continuously operating devices raised to more than 150.

DioxinMonitoringSystem® devices use the dilution method according EN 1948-1, with two exceptions. One exception is the traversing the sampling point, there the sampling should take place from several locations of the monitored gas, which is replaced by the opportunity to use one of two sampling points alternating, to keep a minimum representativeness of 80% also in stack of a diameter of more than 2.5 meters. The other exception is the extended sampling time, which is usually 2 weeks or one month, tested up to 9 months, compared to the time of 6 to 8 hours mentioned in the standard. The dilution method allows this long term application without further changes. The TS 1948-5 also includes the dilution method, the mentioned limitations of EN1948-1 are eliminated in this document, and however, those changes are expected not to influence the devices' performance in any way as the methodical and device tests of already existing certifications (MCerts, ETV, etc.) lead in perfect performance proofs.

DioxinMonitoringSystem® devices are available in two different basic versions. The standard version allows the use of up to two sampling locations to improve sampling representativeness also for larger stacks. The compact version is available for a single sampling location of a stack only, which is sufficient to follow TS 1948-5, but also available to sample from one of two stack alternating, which allows especially to application for redundancy devices.

Pictures 1 and 2: standard control and sampling unit

Pictures 3 and 4: compact control and sampling unit

One of those standard devices started operation in April 2015 at an incineration plant in Germany, close to Berlin. This plant operates since 2009 and generates up to 35 MW electrical energy from incinerated municipal waste and biomass, thermal power is up to 118 MW.

Picture/Graph 5: Waste and biomass to energy plant IKW Rüdersdorf

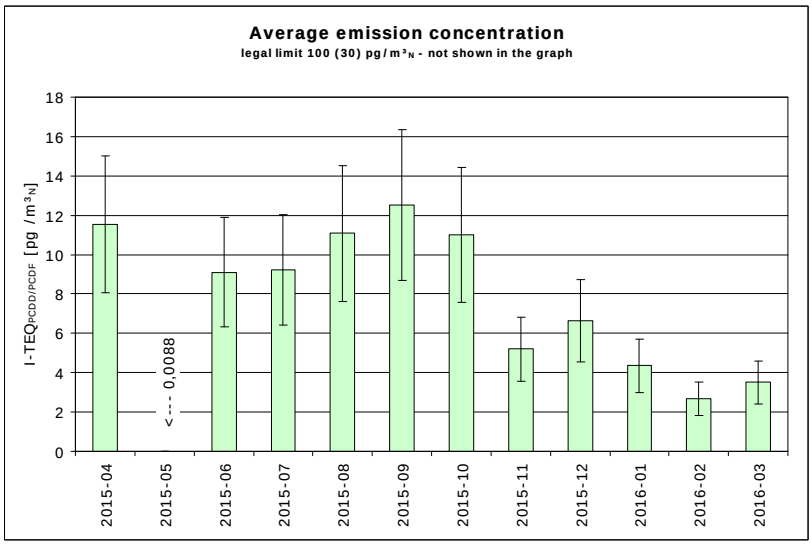
As the operators have been able to gain a lot experience over several years, the details of process control are well known and used for an optimum of high energy output at the same time as low emission values.

Emissions have been collected in periods of one month. The cartridges where the PCDDs/PCDFs have been collected in these periods have been shipped to an accredited laboratory in Bolzano for analysis in accordance to EN 1948-2 and -3.

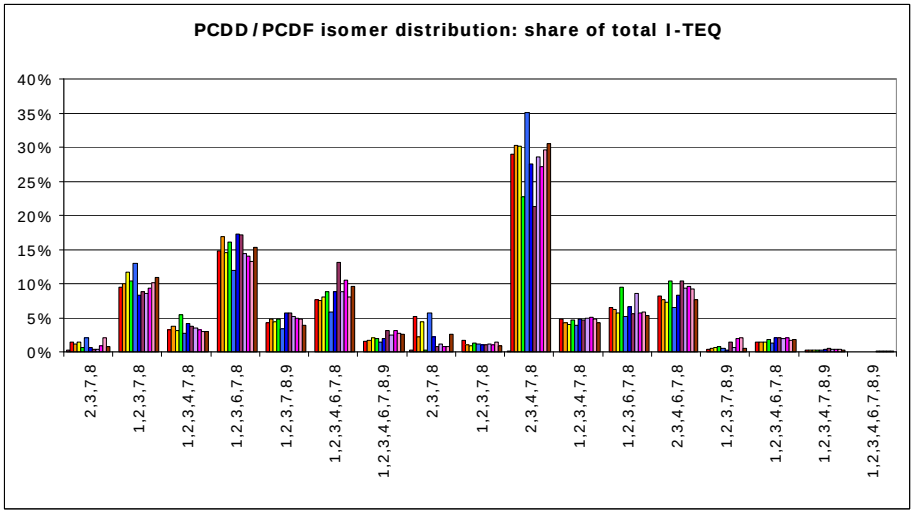
Results and discussion

Even the samples contained a comparable high amount of salts condensed from the gas phase while the PCDD/PCDF precipitation, the laboratory was able to clean up and analyse the samples quantifying all 17 concerned isomers. Each isomer is mentioned in the related reports quantified and including its uncertainty.

From the operational data of the plant, the very static and totally interruption free operation in one of the monitoring periods – a whole month – was able to be discovered. All other monitoring periods included at least one interruption and restart of the incineration process. The related results reflect this circumstance very impressively.



The result from this one month is 0.0088 ± 0,0027 pg/m³$_N$, where only one isomer – 1,2,3,7,8,9-HxCDF– was not able to be detected and not included to the calculation of the result (rated to be zero). As this isomer carries only about 0,5 to 1 % of the total I-TEQ in the samples of the other monitoring periods, the expected additional error from this circumstance was not included in further calculations.



Picture/Graph 6: Results from one year

The presented results reflect the monitoring opportunities and the current limits which have to be expected. Emission values at the level of the factor of 10.000 below the legal limit can be measured. The calculated mass flow from respective plants, at a usual emission level of already factor 10 below the limit can be expected at 5 to 10 mg I-TEQ per year.

The comparison to other presented results, where emission levels in the range of 40 ng I-TEQ per m^3_N and a volume flow of 1 million m^3/h have been presented, leading in a calculated mass flow of several g per year, allows to consider to re-focusing emission control to additional and further industrial processes.

Acknowledgements

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References

1. Tirler W., Reports of PCDD/PCDF analysis of cartridges (unpublished)