A NEW MEASUREMENT TECHNIQUE TO CHECK THE IMPACT OF DIFFUSIVE EMISSION SOURCES TO LOCAL ENVIRONMENT

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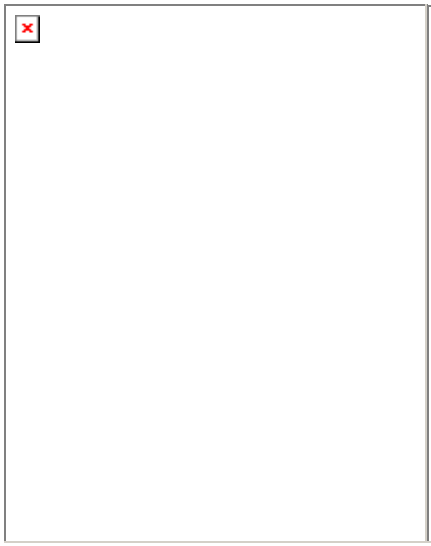
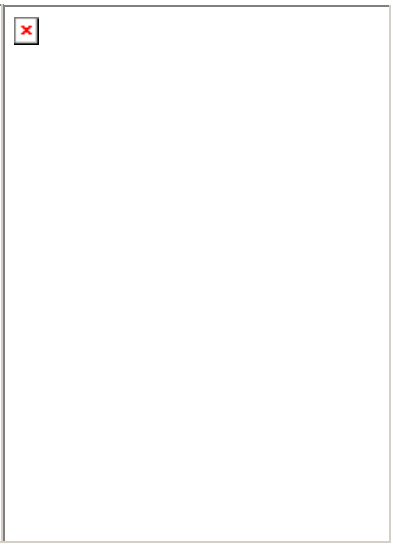
Introduction

Since publication of EN 1948[1] and its revision in 2005 the measurement of emission sources has been developed to a high standard. Although this European standard is primarily been developed for gaseous streams of waste incinerators, the practical experience shows that it can be used for a wide concentration ranges and various emission sources.

Because of the isokinetic sampling EN 1948 part 1 is suitable to measure the dioxin concentrations emitted by stacks. Diffusive sources can only be estimated by ambient air measurements. Due to increasing importance of the impact of diffusive sources there is a need to develop additional measurement techniques to quantify the impact and the importance of diffusive emission sources.

This article describes a new developed ambient air sampling system, which is able to sample ambient air , dependent on the wind direction.





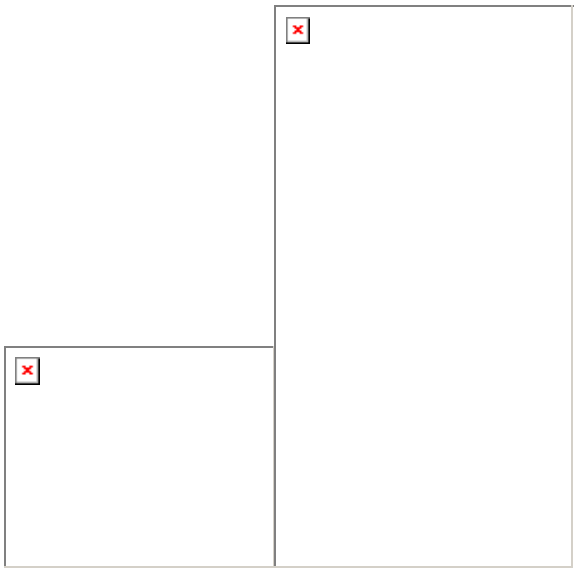
Methods and Materials

The new developed sampling system has two cartridges. Picture 1 shows the configuration to check the impact of stacks to the local environment. If the wind direction is within Sector 1, the air is sucked through cartridge 1, the sampled volume is counted to the "sector 1 volume". If the wind comes from the sector 2 side, the ambient air is sucked through cartridge 2, the sampled volume is counted to the "sector 2 volume". In the laboratory the dioxin concentrations sampled by cartridge 1 and 2 are determined.

Picture 1 Picture 2

Picture 2 shows the configuration for the so called "tunnel measurements". The tunnel can be:

- a real tunnel
- a street in a city, surrounded by high buildings
- a valley in the mountains, which causes two main wind directions



The sampler consists of a sucking system, a switchboard, an ultrasonic windsensor and two cartridges

Picture 3 Picture 4

The wind direction is calculated as vector, which represents the actual 2 minutes mean value. Dependent on the wind direction and the configured wind sectors the switchboard switches automatically the ambient air flow between the two cartridges.

Additionally to the wind direction, the wind speed is measured. Wind speed below 0,5 m/sec causes automatic stand by of the measurement.

Each of the two cartridges, has a 120 mm planar dust filter, and up to 3 PUF filters with 105 mm diameter, suitable to sample PCDD/F, PCB´s and PAH´s.


Picture 5

Planar filter and the PUF foam fullfils the requirements of the EN1948 standard part 1. The sucking unit, samples 5 m3 of air per hour., so a sampling time of 2 weeks, enables the measurement of I-TEQ values, dependent on the wind direction. Both volumes are measured by a temperature compensated gas meter.

Before starting of the sampling, sampling standards are added to the dust filter. Because of long term sampling the amount of the sampling standard is adjusted with formula 1:

Using this formula in with $c_{expected}$ = 0,0001 ng/m3, V_{sample} = 500 m3 the amount of sampling standard is described in table 1, the amount of added extraction standard is described in table 2.

Table 1: Added sampling standard

Solution	Sampling standard
Congeners added	
$^{13}C_{12}$-1,2,3,7,8-PeCDF	20 pg
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	20 pg
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	40 pg

The dry cartridge is transported to the laboratory. There the dust filter is pretreated with hydrochloric acid. Extraction standard is added.

Table 2: Added extraction standard

Solution	Extraction standard
Congeners added	
$^{13}C_{12}$-2,3,7,8-TCDF	40 pg
$^{13}C_{12}$-2,3,7,8-TCDD	40 pg
$^{13}C_{12}$-2,3,4,7,8-PeCDF	40 pg
$^{13}C_{12}$-1,2,3,7,8-PeCDD	40 pg
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	40 pg
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	40 pg
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	40 pg
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	40 pg
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	40 pg
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	80 pg
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	80 pg
$^{13}C_{12}$-OCDF	80 pg
$^{13}C_{12}$-OCDD	80 pg

The dust filter as well the PUF are extracted in the soxhlet extractor with toluene according EN 1948 part 2. After soxhlet extraction, a part of the extract (1/2) is used for clean up. The rest is stored for back up. The clean up is done by using multilayer colums acc. EN 1948 part 2. After the final concentration the syringe standard is added.

Table 3: Added syringe standard

Solution	Extraction standard
Congeners added	
$^{13}C_{12}$-1,2,3,4 TCDD	5 pg
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	5 pg

Results and Discussion

Measurements according directive 2000/76/EC, using one of the EN 1948 methods, show the dioxin emissions during a period of 6 to 8 hours normally not including the operation conditions during night and week end. Long time measurements covering the whole operation period of the waste incinerator, but are limited to emission sources like stacks.

Using this newly developed sampling system enables to measure the impact of "diffusive sources" to the local environment. One dioxin source, which can be checked with this method, is the burning of waste at dumping sites, which causes diffusive emissions. With this monitoring system, the impact of such sources can be checked.

Another important application is the measurement of the transportation behaviour. In a special construction this devive is used to measure the transportation of PCDD/PCDF and PCB´s over the alps. [4]. For this purpose this devices was installed at high mountains in Swiss, Germany and Austria. Because of low temperature at the mountains and to avoid condensation in the filter, the tube is additionally heated, to increase the sucking temperature by 10°C.

References

1. CEN/TC 264, European standard EN 1948 (1996)
2. Kahr, G Steiner T (2001) ; VDI report 1585 – Obtaining Representative Dioxin Emission Values by the Application of a Modified Installed Sampling System
3. Tirler W Donega m Voto G Kahr G – proceeding dioxin 2003 – Quick evaluation of long term monitoring samples and the uncertainty of the results
4. Weiss P Thanner G Moche W – monarpop@umweltbundesamt.at