

## LONG TERM MONITORING IN THE FRAME OF THE NEW EUROPEAN GUIDLINE EN1948-1

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### Introduction

Since the European standard for the measurement of dioxins in emissions was established 1996<sup>1</sup>, long time monitoring techniques have been developed additional for this application. The review of the standard resulted now in several changes where two frames for main changes are recognised. One of them is a kind of harmonisation to the respective US standards, the other is the principle to remove restrictions from the standard and move the responsibility to a method validation. This also includes the removing of the limitation of the sampling time which allows also continuous monitoring known as long term sampling completely within the frame of the standard.

### Methods and Materials

The CEN/TC 264 workgroup 01 is preparing a new version of the European standard EN 1948. The process is close to be finished, the status when writing this document is that the standard was submitted to the CEN enquiry.

When setting up the 1996 version the main focus was set to the selection of accurate methods due to a huge number of these that time. The three selected methods were well accepted after being included in the standard and other used methods were replaced by them.

The main changes of this Revision of the part 1: "sampling" includes in general the removing of restrictions that were included in the 1996 version because of a far lower knowledge about the sampling processes. Restrictions were focused on the use of materials, sampling processes and sampling conditions. By removing restrictions the focus is set to a validation process of a specific method and specific material and equipment used. This opens the standard for a wide range application and especially by removing upper sampling time limits the long time sampling is supported, similar to the respective US standard.

Further steps to be closer to the US standard was to include the PCBs according the WHO list to the standard which finally will allow to compare results from US and Europe more closely and directly as well as including the data of the validation measurements in part 3: "Identification and quantification". Due to a principal similarity of the US standard to one of the methods provided by the European standard, the "filter-cooler-method", and by including the information of the successful validation of the three methods one against the other a principal conformity of results gained by one of the European methods and the US method can be assumed.

The long term application according the standard is mainly depending on the collection of the different phases of the sampling. In general, in case of liquid phases have to be collected, a logical limitation for the long term sampling is given by the collected volumes of this liquid phases. In case of taking samples for several weeks volumes of this liquid phases of more than 50 dm<sup>3</sup> have to be expected which makes the adequate handling of a respective sample impossible. Techniques to collect the dioxins from this fraction in a continuous process have been tested, however, the prescribed use of very high efficient and very fine filters makes the application according this standard impossible.

Further the accurate sampling is handicapped additionally by the rule that the recovery standards for these condensing methods shall be applied to the collection flasks for exactly this liquid phases.

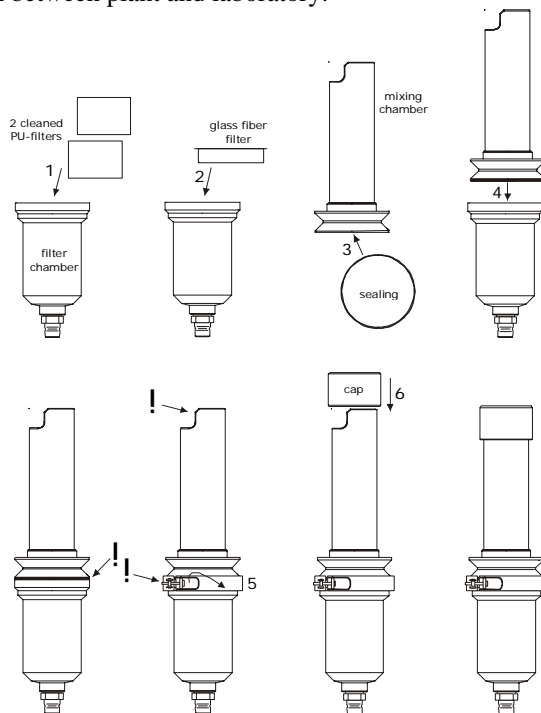
The strategy to follow this standard for long term sampling can be followed by the use of the "dry sampling method" provided by this standard. The dilution method prevents condensation by adding a dried and preconditioned gas, usually air, to the sampled gas. The temperature is decreased and the same time the humidity is reduced in a way that it stays above 100 % relative humidity in the whole process. This gas mixture can be filtered in a complete dry process through the different filter stages. The filter efficiency of defined to be better than 99.5 % for 0,3 µm particles or 99.9 % for 0,6 µm particles. The following adsorbent is more or less free to be selected, again an efficiency is the criteria for the use which is defined by 90 % minimum and the main focus is to be set to the gas velocity in this filter material. Flow velocity of 50 cm/s in the particle filter and 30 cm/s in the adsorbent in case of the use of polyurethane foam (PUF) respectively 34 cm/s in case of the use of XAD-2 is defined. Another focus has to be set to the volume measurement of the dilution method due to using a difference of two volumes. By a special inter-calibration procedure the accuracy of this volume measurement can be enhanced easily to have the same quality like a single volume measurement and - statistically - the final measurement represents better accuracy than a single measurement.

The more complex control procedure for keeping isokinetic conditions, stay inside the provided temperature and humidity limits can easily be controlled by a device which works completely independent like the device known as DioxinMonitoringSystem<sup>®</sup>.

## Results and Discussion

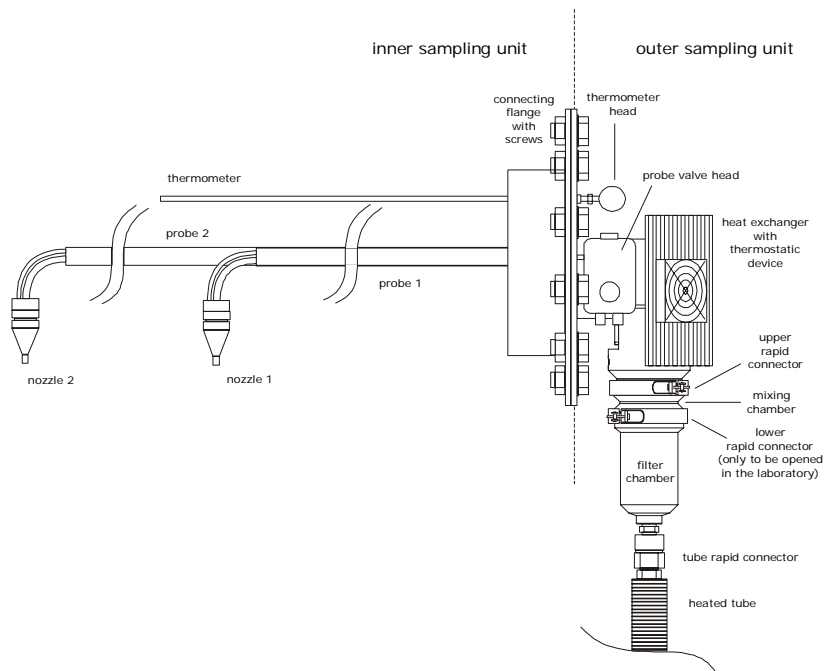
For the last step of the development of the continuous monitoring device DioxinMonitoringSystem<sup>®</sup> the inclusion of the changes of the new release of the EN1948-1 was an important base. The complete construction was checked against this new standard to ensure that all the requirements are met. The result was to let the sampling materials unchanged due to the already former compliance, so the use of a 0,04 m<sup>2</sup> glass fibre particle filter followed by a special PUF stack ensured perfect precipitation of both, particle bound dioxins as well as filter passing dioxins. A main advantage of this construction can be kept due to the opportunity to do the analysis of these two fractions separately. Very important information from plant optimisation can be gained by this procedure.

This filter cartridge was optimised to simplify handling and to reduce weight for the case of courier transportation between plant and laboratory.



The advantage of the use of PUF compared to all other filter materials is the simpler cleaning procedure using less solvents and especially the easier handling of solid parts compared to grained materials.

An other important rule of the standard is to carry out the sampling at representative positions. The standard for "Determination of low range mass concentration of dust"<sup>2</sup> include the rules of the sampling locations inside the duct. A minimum of two sampling points is to be used in any case and this minimum is allowed to be used in all cases if mentioned in the respective report. A larger number of location is usually done by manual sampling, however, the automatic and long term sampling can follow this minimum by including a special sampling device construction.



Latest measurement results confirm the highly improved reproducibility of results by the high quality of the sampling process very good recovery rates which are higher the 95 % also for sampling over several weeks.

### Conclusions

The latest release of the European standard for dioxin measurement in stationary source emissions includes changes which enables closer comparability to the respective US methods than before. Especially the included validation data are a good base for statistically evaluation from results gained by the use of different methods.

Further changes enables long term sampling knows as “continuous monitoring” (but not continuous measurement) in the exact frame of the standard. The continuous sampling device DioxinMonitoringSystem<sup>®</sup> followed the strategy of compliance to this standard from the beginning and was improved now to continue with this compliance to give the user the highest certainty for accurate results.

### References

- 1 EN 1948: Stationary source emissions – Determination of the mass concentration of PCDDs/PCDFs – Part 1: Sampling (1996)
- 2 EN 13284-1:2001, Stationary source emissions - Determination of low range mass concentration of dust – Part 1 Manual gravimetric method