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OBTAINING DIOXIN VALUES WITH LOW UNCERTAINTY USING AUTOMATIC LONG-TERM-SAMPLING EQUIPMENT AND DATA EVALUATION

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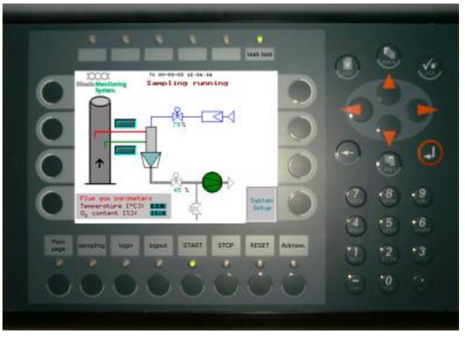
Introduction

Since publication of EN 1948[1] in 1996 long-term sampling equipment has been developed to a high standard, which enables to extend the measurement time up to 30 and more days. The operation of this equipment is controlled by a processor, the memory enables the automatic documentation of all relevant measurement parameters for further calculation of the measurement uncertainty. In 2001 the authors described relevant parameters with their impact to measurements uncertainty[3]. The parameters with highest impact to uncertainty are representative dust sampling and the volume measurement (dry, O_2 corrected). At the moment the uncertainty is estimated as a sum, without individual calculation of the impact parameters.

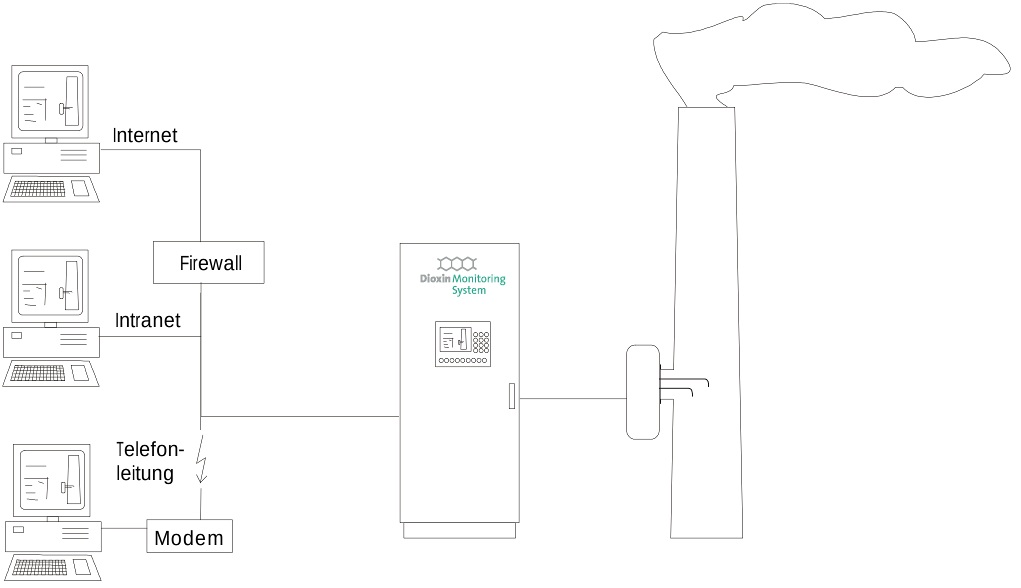
Methods and Materials

In 2001 a research project was started, which included the recording, the storage, the visualisation and evaluation of all relevant parameters, which have impact to the uncertainty of representative dust sampling. These parameters are extracted online via internet connection using and are evaluated using Excel data sheets. To improve the accuracy of the volume measurement, the periodic calibration was included as automatic process. To improve the accuracy of the correction to dry conditions a continuous calibrated humidity measurement was developed.

Picture 1: DioxinMonitoringSystem



Picture 2: Control Terminal



Picture 3: Communication and data transfer

Results and Discussion

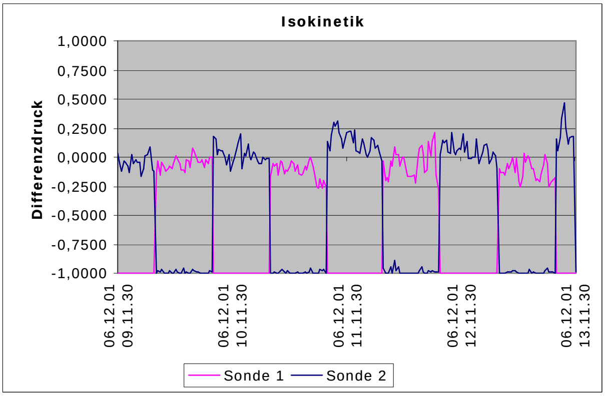
The EN 1948 requires in chapter 8.3.4.1: The following parameters are required to be periodically recorded (at least every 15 minutes) to enable the validation of the sampling: velocity in duct, temperature in duct, flow rate through sampling train, filter temperature, adsorbent temperature. The oxygen content shall be measured during sampling and recorded

Additionally chapter 8.3.4.2 and 8.3.5.1 require to store the results of the leak tests: It is recommended that the sampling train is leak checked both before and after changing sampling line. The final leak rate is recorded.

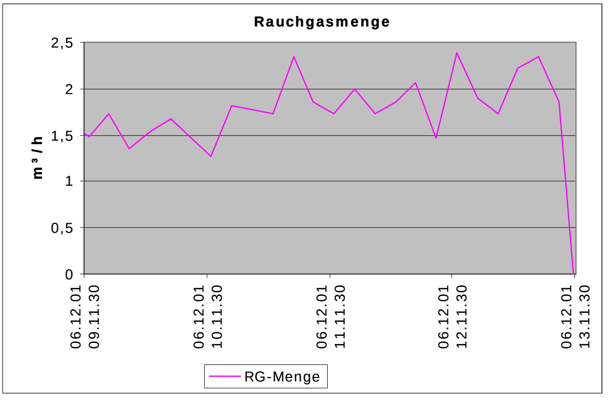
The DioxinMonitoringSystem is sampling every second all relevant measurement parameters. At begin and end of the measurement additional parameters are sampled. The complete measurement process can be described by using 9 parameters. Two of these parameters describe the representative particle sampling, which are: isokinetic sampling, amount of flue gas, six of these parameters describe the uncertainty of volume measurement (dry, O_2 corrected), which are: calibration results, amount of flue gas, amount of dilution air, oxygen and water concentration in the sampled flue gas, results of the leak test.

To enable quick data transfer and comfortable evaluation of the transmitted parameters 2 minutes and 15 minutes mean values are calculated, which are transmitted as raw values.

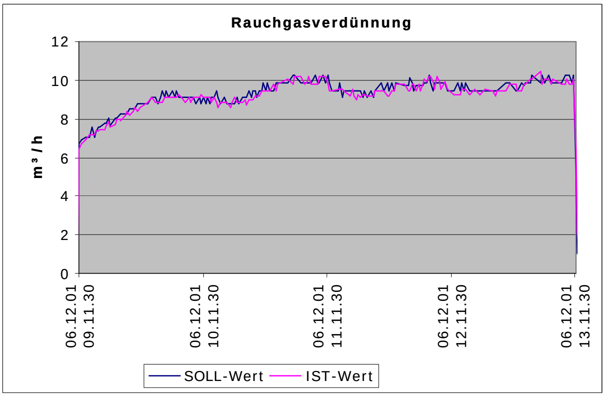
These data can be transferred to a Excel worksheet, where they are processed. Using the data sheet the uncertainties of dust sampling and volume measurement (dry, 11% O_2) are calculated for each measurement individually. Adding the laboratory data like uncertainty of analysis, recovery rate of sampling standard, blank values the uncertainty of the complete dioxin measurement can be calculated.



Picture 3: Documentation of the raw data of isokinetic sampling and flue gas velocity



Picture 4: Documentation of the raw data of the sampled flue gas



Picture 5: Documentation of used dilution air (target value and measured value)

		Probe 1 mbar	Probe 2 mbar	Position 1 m/sec	Position 2 m/sec
02-02-11	10:51:01	-0,441	-0,3045	9,69	8,05
02-02-11	10:51:06	-0,435	-0,3135	9,62	8,17
02-02-11	10:51:11	-0,4455	-0,312	9,74	8,15
02-02-11	10:51:16	-0,444	-0,3135	9,72	8,17
02-02-11	10:51:21	-0,442	-0,309	9,70	8,11
02-02-11	10:51:26	-0,4285	-0,324	9,55	8,30
02-02-11	10:51:31	-0,4155	-0,315	9,40	8,19
02-02-11	10:51:36	-0,4145	-0,3075	9,39	8,09

Picture 6: Documentation of the velocity measurement (raw data and calculated velocities)

As the example in picture 6 shows, it is necessary to measure the velocity exactly at the sampling position to obtain isokinetic sampling within the range –5% to +15%.

02-02-05	13:35:59	1474	-152,6			
02-02-05	13:36:04	864	-213,6			
02-02-05	13:36:09	662	-233,8			
02-02-05	13:36:14	675	-232,5			
02-02-05	13:36:19	682	-231,8			
02-02-05	13:36:24	687	-231,3			
02-02-05	13:36:29	692	-230,8			
02-02-05	13:36:34	697	-230,3			
02-02-05	13:36:39	702	-229,8			
02-02-05	13:36:44	707	-229,3			
02-02-05	13:36:49	711	-228,9			
02-02-05	13:36:54	716	-228,4			
02-02-05	13:36:59	721	-227,9			
02-02-05	13:37:04	726	-227,4			
02-02-05	13:37:09	730	-227			
02-02-05	13:37:14	734	-226,6			
02-02-05	13:37:19	739	-226,1	Loss	5,7	hPa/min

Picture 7: Documentation of the leak test (pressure loss per minute)

The leak test is performed according to chapter 8.2.4.2 of the draft EN 14385[2]. The pressure loss can be compared to the check value as it is described in chapter 8.2.4.2.

Acknowledgments
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References

1. CEN/TC 264, European standard EN 1948 (1996)
2. CEN/TC 264, European standard draft EN 14385 (2002)
3. Kahr, G Steiner, T (2001) : VDI report 1585 – Obtaining Representative Dioxin Emission Values by the Application of a Modified Fixed Installed Sampling System