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COMPARISON OF EUROPEAN EN 1948 AND GERMAN VDI 3499/2E EMISSION SAMPLING METHODS FOR PCDD/PCDF ON A MUNICIPAL SOLID WASTE INCINERATOR

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Summary

Overall 140 PCDD/F data sets generated according to German guideline VDI 3499 part 2 are compared with 29 data sets following European EN 1948 guideline. All measurements were performed in the stacks of 2 identical combustion lines of the municipal solid waste incinerator (MSWI) MVB Borsigstr. GmbH, Hamburg, [1,2]. VDI measurements were carried out between beginning 1994 and May 1998, EN 1984 measurements started in July 1998. It can be assumed that PCDD/F-concentrations did remain fairly stable over the whole measurement period.

From comparison of the data sets (mean value, standard deviation and median), generated according to the two different guidelines, it can be concluded that no significant differences in the measured concentrations can be detected.

Introduction

Within the framework of the present document, the measured values carried out by using VDI and EN method of the sampling point "E" (Fig.1) are evaluated by means of statistical methods.

Plant Description

MVB (Fig.1) has 2 identical combustion lines equipped with a forward feed grate (5 grate zones and 2 grate steps) designed for incinerating 21.5 Mg of waste per hour. The flue gas cleaning system for each combustion unit consists of a selective non-catalytic reduction of NO_x (SNCR) by

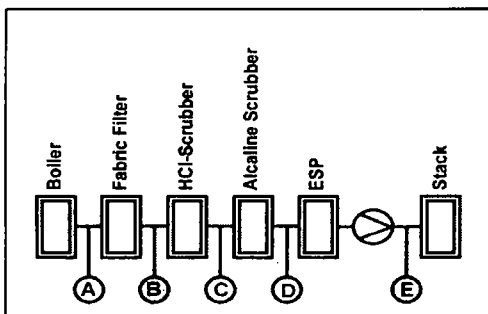


Fig.1 PCDD/F sampling points in the flue gas cleaning system of MVB

injection of steam-dispersed ammonia into the post-combustion chamber, a high temperature dust-removal system within the boiler between the super heater section and the economizer, an evaporative cooler, the injection of activated carbon, a bag house, a two step scrubber, an alkaline scrubber and a wet electrostatic precipitator (ESP).

Sampling Treatment and Analysis

Sampling and analysis of PCDD/F emissions were performed by MPU according to the German

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guideline VDI 3499 part 2 until June 1998. MPU used a validated PCDD/F sampling device in accordance to EN 1948, method "B3", suitable for net measurements since July 1998. Gaseous and particulate PCDD/F were isokinetically withdrawn and collected in a sampling train. Following sampling the collection components (nozzle, probe, filter holder, glass tube, condenser) are rinsed with acetone. XAD-2 and glass filter were Soxhlet extracted, rinsing solvent is added to the Soxhlet extract. Clean up is performed by multi layer silica and alumina columns. The analysis was performed using high resolution gas chromatography and high resolution mass spectrometry (HRGC/HRMS). Details are described in reference [3,4].

At the sampling point "E" the requirements regarding the upstream and downstream paths according to German guideline VDI 2066 [5] are met. All sampling campaigns were carried out during normal working conditions of the incinerator plant. The detection limit was 0.001 ng/Nm³ for all 2,3,7,8-substituted isomers. All data have been calculated to standard conditions (273 K, 1013 hPa) and operational oxygen content.

Figures 2-1 to 2-3 show the sample data and the mean values of I-TEQ of VDI 3499 method and EN 1948 method for line 1, in figures 2-4 to 2-6 the same for line 2 is shown.

	Mean value		Median		Std.deviation	
	VDI 3499 ng/Nm ³	EN 1948 ng/Nm ³	VDI 3499 ng/Nm ³	EN 1948 ng/Nm ³	VDI 3499 ng/Nm ³	EN 1948 ng/Nm ³
2,3,7,8 TCDD	0,0016	0,0011	0,0010	0,0010	0,0012	0,0009
1,2,3,7,8 PeCDD	0,0053	0,0045	0,0040	0,0040	0,0033	0,0020
1,2,3,4,7,8 HxCDD	0,0045	0,0051	0,0040	0,0040	0,0025	0,0026
1,2,3,6,7,8 HxCDD	0,0124	0,0181	0,0110	0,0140	0,0061	0,0089
1,2,3,7,8,9 HxCDD	0,0065	0,0087	0,0055	0,0076	0,0039	0,0051
1,2,3,4,6,7,8 HpCDD	0,0358	0,0744	0,0350	0,0610	0,0207	0,0394
OCDD	0,0340	0,0357	0,0280	0,0290	0,0209	0,0208
2,3,7,8 TCDF	0,0134	0,0110	0,0100	0,0110	0,0089	0,0053
1,2,3,7,8/ PeCDF	0,0101	0,0072	0,0080	0,0040	0,0062	0,0054
1,2,3,4,8 PeCDF						
2,3,4,7,8 HxCDF	0,0143	0,0125	0,0125	0,0080	0,0079	0,0098
1,2,3,4,7,8/ HxCDF	0,0085	0,0098	0,0070	0,0070	0,0056	0,0078
1,2,3,4,7,9 HxCDF						
1,2,3,6,7,8 HxCDF	0,0102	0,0128	0,0085	0,0090	0,0062	0,0092
1,2,3,7,8,9 HxCDF	0,0009	0,0017	0,0005	0,0010	0,0006	0,0017
2,3,4,6,7,8 HxCDF	0,0116	0,0129	0,0095	0,0100	0,0071	0,0078
1,2,3,4,6,7,8 HpCDF	0,0162	0,0295	0,0140	0,0210	0,0111	0,0241
1,2,3,4,7,8,9 HpCDF	0,0015	0,0027	0,0010	0,0020	0,0015	0,0018
OCDF	0,0078	0,0092	0,0040	0,0070	0,0117	0,0077
I-TEQ	0,0196	0,0189	0,0163	0,0155	0,0110	0,0109

Table 1: data line 1

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		Mean value	Mean value	Median	Median	Std.deviation	Std.deviation
		VDI 3499 ng/Nm3	EN 1948 ng/Nm3	VDI 3499 ng/Nm3	EN 1948 ng/Nm3	VDI 3499 ng/Nm3	EN 1948 ng/Nm3
2,3,7,8	TCDD	0,0017	0,0012	0,0020	0,0010	0,0014	0,0010
1,2,3,7,8	PeCDD	0,0055	0,0058	0,0050	0,0045	0,0026	0,0046
1,2,3,4,7,8	HxCDD	0,0052	0,0082	0,0050	0,0063	0,0028	0,0073
1,2,3,6,7,8	HxCDD	0,0137	0,0253	0,0120	0,0175	0,0078	0,0251
1,2,3,7,8,9	HxCDD	0,0070	0,0117	0,0060	0,0070	0,0046	0,0114
1,2,3,4,6,7,8	HpCDD	0,0431	0,0834	0,0350	0,0605	0,0313	0,0712
	OCDD	0,0351	0,0388	0,0305	0,0300	0,0222	0,0329
2,3,7,8	TCDF	0,0157	0,0118	0,0140	0,0085	0,0090	0,0130
1,2,3,7,8/ 1,2,3,4,8	PeCDF	0,0144	0,0059	0,0100	0,0056	0,0158	0,0034
2,3,4,7,8	PeCDF	0,0174	0,0117	0,0160	0,0089	0,0106	0,0090
1,2,3,4,7,8/ 1,2,3,4,7,9	HxCDF	0,0093	0,0075	0,0070	0,0057	0,0068	0,0041
1,2,3,6,7,8	HxCDF	0,0106	0,0108	0,0080	0,0086	0,0084	0,0068
1,2,3,7,8,9	HxCDF	0,0012	0,0017	0,0005	0,0011	0,0010	0,0012
2,3,4,6,7,8	HxCDF	0,0140	0,0150	0,0120	0,0127	0,0095	0,0104
1,2,3,4,6,7,8	HpCDF	0,0182	0,0234	0,0135	0,0176	0,0148	0,0134
1,2,3,4,7,8,9	HpCDF	0,0019	0,0029	0,0010	0,0024	0,0019	0,0018
	OCDF	0,0134	0,0130	0,0050	0,0070	0,0229	0,0147
	I-TEQ	0,0215	0,0205	0,0190	0,0156	0,0111	0,0159

Table 2: data line 2

Results and Discussion

Statistical data are presented in table 1 and 2. Firstly it must be highlighted that during the measurement period of nearly 7 years the clean gas concentration showed continuously a remarkable low level of about 1/5 of the limit value.

The differences between the I-TEQ mean values measured on basis of VDI on one side and EN at the other side are very small (less than 5%) for both incinerator lines. The other statistical characteristics, median and standard deviation, are showing slightly different results. For

Figure 2-1 to 2-3

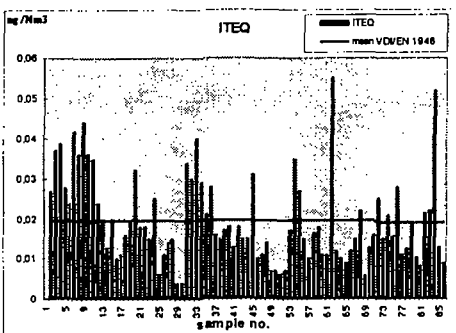
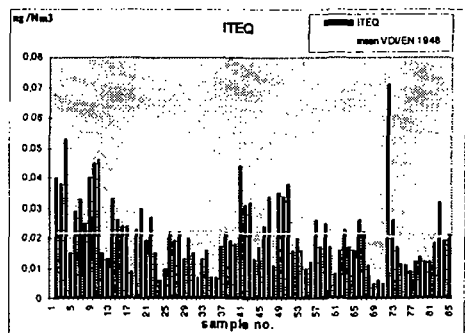


Figure 2-4 to 2-6



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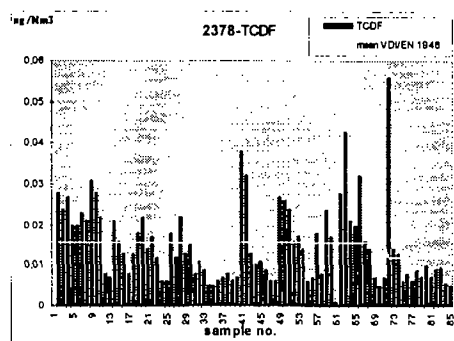
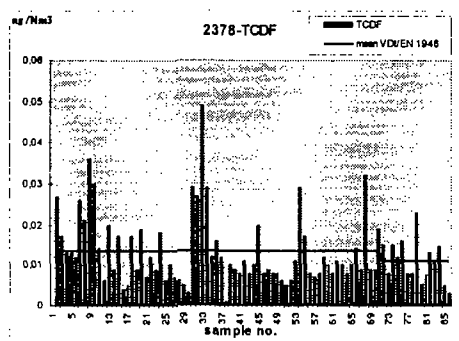
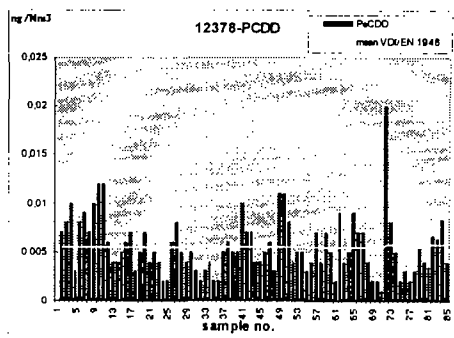
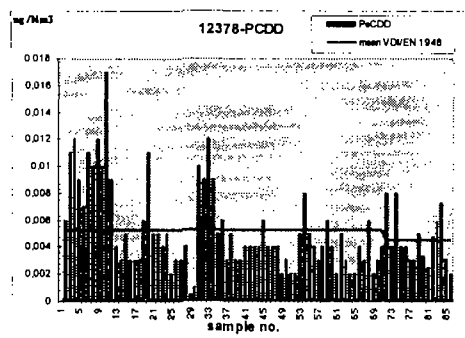


Fig. 2-1 to 2-3: data and mean values of VDI (no.1-73) and EN (no.74-88) method for line 1

Fig. 2-4 to 2-6: data and mean values of VDI (no.1-73) and EN (no.74-88) method for line 2

incinerator line 1 the differences are also very small, but for incinerator line 2 quite remarkable (about 30%). Nevertheless it cannot be concluded that the EN 1948 guideline is leading to different results with regard to standard deviation or median. The number of measurements carried out according to EN ($n = 15$ for line 1 and $n = 14$ for line 2) is still small compared to VDI measurements ($n = 70$ for each line).

Acknowledgement

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