EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Field Test Experiments and Validation of CEN/TS 1948-4 Dioxin-like PCBs from stationary sources

– CEN/TC 264/WG 1 “Dioxins and PCBs (Emission)“ –

Annex 7a

Additional measurements at a shredder plant

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DANAK
Test Reg. No. 51

Test Report

FORCE TECHNOLOGY

CEN Validation measurements of DL-PCB and marker-PCB

Service contract WP 9a.
Field validation test at a Shredder plant using the filter/condenser method

February-March 2008

Reported by FORCE Technology

Accredited Report No.: 3685-01
Project No.: 107-28412
Project Manager: Ole Schleicher

GTS ADVANCED TECHNOLOGY GROUP

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1. Introduction

On behalf of Dr. Ljuba Woppowa, DIN Deutsches Institut für Normung e. V., FORCE Technology has carried out an extra validations measurement campaign for field validation test of DL-PCB and marker PCB using the filter/condenser method at a shredder plant.

The measurement campaign was carried out in the period from the 20th June to the 26th of June 2007, by technician Steen Meldorf and Project Manager Ole Schleicher.

Sampling and analyses of PCB was performed according to EN 1948-1, -2, -3 and CEN TS 1948-4

Sampling was carried out according to the FORCE Technology DS/EN ISO/IEC 17025 accreditation no. 51 from the Danish accreditation body DANAK.

Analysis was carried out by ERGO Forschungsgesellschaft GmbH i Hamburg in accordance to their to DIN EN ISO/IEC 17025 accreditation from the German Federal Pollution Control Act (§§ 26, 28).

Sampling campaign was planned to include six duplicate emissions measurements, three field blanks will be performed, and in order to check the PCB breakthrough, three of the sampling should have an additional adsorption unit, which are analyzed separately. Because of sampling failure, the number of duplicate samples was reduced to five, and the number of blanks was reduced to two, as described in paragraph 4 Comments.

For safety reason, it is not allowed to stay at the sampling site when the shredder is operating. The sampling device will be mounted in the sampling ports, and the pumps etc. will be placed outside the restricted area, where it can be watch over during the whole sampling period.

2. Plant description

The plant is a normal shredder plant for metal scrap, with a capacity of processing up to approximately 100 t/h scrap, with a production of approximately 80 t/h metal fractions.

All sorts of metal scarp are processed e.g. used cars, white goods, industrial metal waste and residues, demolition iron, etc. The white goods are collected and processed separately one day a week.

The following picture shows the variation in the composition of the scrap.

White goods

Mixed scrap

Mixed scrap

The daily working time is Monday to Thursday from 7 to 16 and Friday from 7 to 12:30.

The scrap is feed to the shredder via a chute, and from the shredder it is transported to sorting by a belt conveyer.

Waste gas/air from ventilation of the shredder and from the separation process, is first treated in cyclones to remove coarse particles, and followed by a venturi scrubber to remove smaller particles.

The off gas is discharged through a 20 m stack, where the measuring site is situated in the level of 10-14 meters.

Previously up to 22 µg/Nm³ marker-PC has been measured from this plant, and consequently relatively high concentrations of DL-PCB are expected.

The concentration of particles is normally within the range of 10 -15 mg/Nm³, and consequently a pre-filter of quarts wool will be used.

2.1. Sampling site

The air is discharged through a 20 m stack, where the measuring site is situated in the level of 10-14 meters. The inside diameter of the stack is 1,4 m and the flow is app. 65.000 m³/h with app. 4% H_2O and temperature of app. 35°C (summertime).

The sampling will be made through two 90° apart sampling ports, and the sampling points will be placed inside a circle with a diameter of app. 0,2 m in the centre of the stack. Gas velocity will also be continually measured in the same area as the sampling, through a third sampling port.

Sampling site and sampling ports

Stack and sampling site below the upper platform

2.2. Operations and production data

The plant has been in normal operation during sampling, except for the last sample no. 7, where a severe fire occurred after almost 4 hours of sampling. Repairing the plant would take several days, and consequently the sampling could not continue and was stopped.

Normal operation includes occasionally stops for a few or several minutes, because of problems with the shredder or conveyers. No unusual longer lasting stops have occurred during any of the samplings.

On average the production of sorted metal fractions is 80 t/h. The production is not measured on an hourly basis but only on a weekly basis, and consequently we could not get a figure for the precise production during the sampling.

Information about operations and production is not included in accreditation nr. 51.

3. Results

Sampling data are presented in Table 1.

Day	Sample	Filter/XAD	Date	Sampling	Temp.	Sampled volume	H2O	Flowrate
No.	No.	No.	dd-mm-yy	hh:mm	°C	m³(s,d)/h	Vol %	m³(s,d)/h
1	1A	6361	25-02-08	7:52-14:10	28	7,357	2,36	64.000
	1B	6362				7,873	2,08	
2	2A	6363	26-02-08	7:50-13:50	28	7,374	2,35	64.000
	2B	6364				6,653	2,68	
4	4A	6367	28-02-08	7:18-13:34	29	8,643	2,22	64.000
	4B	6368				7,771	2,56	
6	6A	6371	03-03-08	7:20-13:36	25	8,767	1,84	65.000
	6B	6372				8,218	2,05	
7	7A	6373	05-03-08	7:30-11:20	23	4,480	1,66	66.000
	7B	6376				4,006	1,92	
2	2A Extra	F359	26-02-08	7:50-13:50	28	7,374	-	-
4	4B Extra	F360	28-02-08	7:18-13:34	29	7,771	-	-
6	6A Extra	F361	03-03-08	7:20-13:36	25	8,767	-	-
4	B1	6374	28-02-08		29	8,207	Sampled volume is average of A and B	
5	B2	6375	29-02-08		25	8,492		

Table 1. Sampling data

The measured emissions are presented in Table 2.

Sample	Marker PCB µg/Nm³		DL-PCB WHO-TEQ/Nm³	
No.	Sample	Average	Sample	Average
1A	6,1	4,8	0,43	0,40
1B	3,5		0,36	
2A	19,1	22,6	0,81	0,88
2B	26,2		0,94	
4A	7,8	8,4	0,35	0,37
4B	8,9		0,38	
6A	5,3	7,3	0,29	0,42
6B	9,3		0,55	
7A	18,5	18,3	0,69	0,70
7B	18,2		0,70	

Table 2. Measured emissions

Break through values are presented in Table 3.

Sample No.	Marker PCB		DL-PCB	
	Sample µg/Nm³	Break through %	Sample WHO-TEQ/Nm³	Break through %
2AX	3,1	16	0,15	18
4BX	0,23	2,6	0,0015	0,38
6AX	0,28	5,3	0,0015	0,52

Table 3. Break through samples

All the analytical results and explanation of analytical problems are found in the analytical report from ERGO, attached as Appendix 1.

4. Comments

The sampling equipment could not be watch over during sampling, because of safety restrictions for staying in the area around the shredder, when it is in operation. Consequently any problems related to the sampling equipment could not be observed nor repaired during the sampling.

On the third day one of the samples had a severe leak in a glass joint, where vibrations apparently had loosen the clips. The filter was visibly less loaded with particles, than the other sample, and both samples had to be rejected.

On the fifth day one of the samples had a broken glass tube, probably caused by a flying metal piece. The filter was visibly less loaded with particles, than the other sample, and both samples had to be rejected.

The first extra XAD for break through measurement was mistakenly mounted with the plain filter after this last XAD. The filter is mounted before the XAD for all the other samples. The break through for this XAD is higher than 10 %, and it clearly demonstrate the necessity of using an efficient plain filter in the sampling equipment.

According to agreement with Dr. Ljuba Woppowa and Professor Bert van Bavel it decided to make an extra duplicate sample, as only four of the six duplicate samples were usable. Only one extra set of filter and XAD was available, and it was necessary to use the filter and XAD for the third blank for this extra sample.

For the analysis a 40 % aliquots of the extracted samples was used, and it could not be analyzed, because of an oily fraction in the samples, which could not be removed. The extra XAD for break through measurements and the blanks did not have such an oily fraction, and they could be analyzed. The problem showed up to be the very high concentrations of PCB in the samples, and the analyze was done on 0,2 % aliquots of the remaining 60 % of the samples. New “extraction standards” was added for the quantification.

Sample data is presented in Table 4.

Day	Date	No.	Sampling port	Filter/XAD No.	Extra XAD No.	Not analyzed	Remarks
Monday	25. February	1A	Left	6361			White goods processed during the main part of the sampling time
		1B	Right	6362			
Tuesday	26. February	2A	Left	6363	F359		Filter incorrect placed after the XAD
		2B	Right	6364			
Wednesday	27. February	3A	Left	6365		**X**	Leak in glass joint
		3B	Right	6366		**X**	
Thursday	28. February	4A	Left	6367			
		4B	Right	6368	F360		
Friday	29. February	5A	Left	6369		**X**	
		5B	Right	6370		**X**	Glass tube broken
Monday	3. March	6A	Left	6371	F361		
		6B	Right	6372			
Wednesday	5. March	7A	Left	6373			Reduced sampling time, because of a severe fire, which took the plant out of operation for several days.
		7B	Right	6376			
Tuesday	28. February	B1	Blank 1	6374			
Friday	29. February	B2	Blank 2	6375			

Table 4. Sample data

FORCE Technology
10/31/2008

Ole Schleicher
Project Manager

5. Annex

Annex 1 ERGO analytical report

Annex 1

Analytical report from ERGO

Report 0259-08-400_02

ERGO Forschungsgesellschaft mbH, Geierstr.1, 22305 Hamburg, Germany

Force Technology
Attn. Mr. Ole Schleicher
Park Allé 345
2605 BRØNDBY
DÄNEMARK

Report 0259-08-400_02.doc

1 Order

The order was given in writing on 11.03.2008, Force sags nr.: 107-28412, project manager Mr. Ole Schleicher, by the client mentioned above .

The order has the following internal project code: A-0259-08-400.

2 Sampling

The sampling was done by the customer.

3 Description of sample

Sample code	Client code	Matrix	Receipt of sample	Date of the test performance
H-08-03-0410	Force Task No.: 107-28412\1A, 6361\Sample for: CEN PCB\25/2-08	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0411	Force Task No.: 107-28412\1B, 6362\Sample for: CEN PCB\25/2-08	flue gas	11.03.2008	12.03.2008 – 26.06.2008

Sample code	Client code	Matrix	Receipt of sample	Date of the test performance
H-08-03-0412	Force Task No.: 107-28412\2A, 6363\Sample for: CEN PCB\26/2-08	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0413	Force Task No.: 107-28412\2A, F359\Sample for: CEN PCB\26/2-08	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0414	Force Task No.: 107-28412\2B, 6364\Sample for: CEN PCB\26/2-08	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0415	Force Task No.: 107-28412\4A, 6367\Sample for: CEN PCB	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0416	Force Task No.: 107-28412\4B, 6368\Sample for: CEN PCB	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0417	Force Task No.: 107-28412\4B, F360\Sample for: CEN PCB	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0418	Force Task No.: 107-28412\6A, 6371\Sample for: CEN PCB\3/3-08	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0419	Force Task No.: 107-28412\6A, F3611\Sample for: CEN PCB\3/3-08	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0420	Force Task No.: 107-28412\6B, 6372\Sample for: CEN PCB\3/3-08	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0421	Force Task No.: 107-28412\7A, 6373\Sample for: CEN PCB\5/3-08	flue gas	11.03.2008	12.03.2008 – 26.06.2008

Sample code	Client code	Matrix	Receipt of sample	Date of the test performance
H-08-03-0422	Force Task No.: 107-28412\7B, 6376\Sample for: CEN PCB\5/3-08	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0423	Force Task No.: 107-28412\Blank 1, 6374\Sample for: CEN PCB	flue gas	11.03.2008	12.03.2008 – 26.06.2008
H-08-03-0424	Force Task No.: 107-28412\Blank 2, 6375\Sample for: CEN PCB	flue gas	11.03.2008	12.03.2008 – 26.06.2008

4 Analytical methods

4.1 Dioxinlike PCBs in flue gas samples

The analysis of flue gas samples is performed according to prCEN/TS 1948-4:2006, using the delivered standards.

4.2 Marker-PCBs

Within the scope of the investigation, the PCBs 28, 52, 101, 138, 153 and 180 are determined. Before the extraction the following ^{13}C-UL-labeled internal standards are added to the sample, using the delivered standards:

2,4,4'-Tri-PCB (PCB-28)	^{13}C-UL
2,2',5,5'-Tetra-PCB (PCB-52)	^{13}C-UL
2,2',4,5,5'-Penta-PCB (PCB-101)	^{13}C-UL
2,2',3,4,4',5'-Hexa-PCB (PCB-138)	^{13}C-UL
2,2',4,4',5,5'-Hexa-PCB (PCB-153)	^{13}C-UL
2,2',3,4,4',5,5'-Hepta-PCB (PCB-180)	^{13}C-UL

After the spiking, the samples are extracted with appropriate solvents for ultratrace-analyses (e.g. nanograde). In the following, a column clean up is performed. The measurement is done by means of high resolution gaschromatography and mass spectrometry (HRGC/MS) using DB-5 capillary columns.

For each substance 2 isotope masses are measured. The quantification is carried out with the use of internal/external standard mixtures.

4.3 Problem description and –solving within the analysis of PCBs in this case

Reasons for the Problems within the analysis:

Since the samples were contaminated with PCBs loaded in part up to 50 times higher as usual, there were matrix effects, that caused the problems within the analysis. The contamination with oil caused the embarrassments within the concentration of the samples. The very high load was leading to the problems within the analysis so it was impossible to make a normal Clean up according to EN 1948.

The following clean up methods were tried:

Within the scope we tried the following clean ups without any success:

40% aliquot of each sample was taken. After using a silver column and in subsequence a Supelco SPE carbon column,

a.) we tried the purification by using an ERGO-Column Type A (Na_2SO_4\\$SiO_2$\\$H_2SO_4$/$SiO_2$\\$SiO_2$\\KOH/$SiO_2$).

b.) we tried the purification by using an ERGO-Column Type D, different layers (Na_2SO_4\\$SiO_2$\\$H_2SO_4$/$SiO_2$\\$SiO_2$\\KOH/$SiO_2$).

c.) in addition to a. and b. we tried the purification by using a pesticide column (Na_2SO_4\\Florisil/SiO_2\\$Al_2O_3$\\$Na_2SO_4$).

In every case there was an oily bright residue, that could not be reduced.

This residue was filled up to 1ml with toluene (instead of 100µl as usual) and blended with 5µl of the injection standard. No mono-ortho PCB, which are normally to detect in this fraction, was measurable.

It was possible to analyse PCB #169 out of the Dioxin fraction. The other non-ortho PCB's (#77, #81 and #126) could not be analysed in this fractions. We believe that the chromatographic behaviour of the carbon column was influenced by the disturbing components.

Furthermore we tried to remove the oily residue by using a H_2SO_4 multilayer column and a CsOH treatment as well. Even that does not work.

Regarding the clean up methods according prCEN/TS 1948-4:2006 (E) Chapter 8.3:

After the active carbon chromatography, the non-ortho-fraction had no residues, but the chromatographic characteristics had changed. So PCB #77, #81 and #126 were not detectable in this fraction.

The mono-ortho-fraction was treated according chapter 8.3b. The analysis was not possible, because of transients. The treatment of the sample according chapter 8.3a was not successful as well. After the sample treatment according chapter 8.3d, the Extract was diluted 1:10. Within the measurement there were lock mass breakdowns and so there was no MS-detection possible.

We made trials with a larger dimensioned AlOx-column and tried different variations with other columns, without solving the problems.

Analyses of the samples:

The samples were treated according to EN 1948 till the samples were extracted. After that, 0,02 percent aliquots were taken from the remaining 60 percent aliquot.

In the following the samples were doped again with: 10µl of the EN 1948-4 WHO Extr. Std. CIL and 10µl Marker-PCB Extr. Std. (10ng/ml). The samples were filled up with Toluene to 50µl. The sample H-08-03-0418 was filled up to 100µl.

The samples were injected for measurement into the GC-MS without any clean-up procedure. This was possible, because of the very high load with PCBs in the samples. So it was possible to use a high diluted aliquot for the analysis, were the content of PCBs was still high enough for the analysis and the disturbing contaminates were minimized strong enough to allow the analysis.

The PCB #169, was already analysed from the Dioxin fraction after the active carbon chromatography, as described above. The other parameters were calculated from the aliquots without any clean up.

5 Results

On the data sheets enclosed please find the detailed results.

The results are valid for the analyzed samples only in condition at delivery.

6 Final Remarks

For duplicating the report in parts a written permission by ERGO Forschungsgesellschaft mbH is required.

The samples are stored – on dependence of the test parameters – until the validation report has been approved and the WG1 will inform us that they do not need to be stored anymore.

Hamburg, 24.10.2008

ERGO Forschungsgesellschaft mbH

Bernd Schilling
sales & marketing

Dipl.-Ing. (FH) Dennis Binge
analytical service manager

	H-08-03-0410	H-08-03-0411	H-08-03-0412	H-08-03-0414	H-08-03-0413
Matrix	flue gas samples	flue gas samples	flue gas samples	flue gas samples	flue gas samples
					back up
	Force Task No.: 107-28412 1A, 6361 Sample for: CEN PCB 25/2-08	Force Task No.: 107-28412 1B, 6362 Sample for: CEN PCB 25/2-08	Force Task No.: 107-28412 2A, 6363 Sample for: CEN PCB 26/2-08	Force Task No.: 107-28412 2B, 6364 Sample for: CEN PCB 26/2-08	Force Task No.: 107-28412 2A, F359 Sample for: CEN PCB 26/2-08
Sampled volume, m³(s,d)/h	7,357	7,873	7,374	6,653	7,374
Values in:	ng/m³	ng/m³	ng/m³	ng/m³	ng/m³
3,3',4,4'-Tetra-CB 77	115	77	379	480	64
3,4,4',5-Tetra-CB 81	6,0	4,3	17	24	2,7
3,3',4,4',5-Penta-CB 126	2,0	1,7	3,8	3,9	0,81
3,3',4,4',5,5'-Hexa-CB 169[1)]	0,030	0,023	0,040	0,046	0,0054
Total non-ortho PCB	123	83	400	509	68
Total WHO-TEQ non-ortho PCB	0,21	0,18	0,42	0,44	0,087
2,3,3',4,4'-Penta-CB 105	412	323	738	923	133
2,3,4,4',5-Penta-CB 114	36	27	67	81	9,4
2,3',4,4',5-Penta-CB 118	1017	765	1957	2432	278
2',3,4,4',5-Penta-CB 123	18	15	33	43	5,5
2,3,3',4,4',5,-Hexa-CB 156	96	86	136	180	24
2,3,3',4,4',5'-Hexa-CB 157	24	23	33	44	5,7
2,3',4,4',5,5'-Hexa-CB 167	34	29	47	58	8,3
2,3,3',4,4',5,5'-Hepta-CB 189	4,1	3,4	4,6	5,9	1,3
Total mono-ortho PCB	1640	1271	3015	3767	465
Total WHO-TEQ mono-ortho PCB	0,22	0,18	0,39	0,49	0,061
PCB #28	2797	1197	10459	15476	1688
PCB #52	1326	821	5019	6111	794
PCB #101	904	649	1934	2630	332
PCB #138	508	408	776	855	140
PCB #153	442	342	711	926	110
PCB #180	107	113	167	170	24
total	6084	3530	19066	26169	3089

all PCB values calculated out of 0,02% of sample

[1)] = all PCB#169 values calculated out of 40% of sample

[2)] = all coplanar PCB values calculated out of 40% of sample

	Recoveries				
	H-08-03-0410	H-08-03-0411	H-08-03-0412	H-08-03-0413	H-08-03-0414
PCB #81	104	110	115	102	91
PCB #77	112	116	109	97	96
PCB #126	102	101	103	96	102
PCB #169	36	38	15	45	14
PCB #105	103	110	113	98	104
PCB #114	105	113	110	106	108
PCB #118	102	109	104	107	101
PCB #123	112	114	111	104	108
PCB #156	113	137	133	124	121
PCB #157	127	143	145	138	135
PCB #167	104	103	108	93	102
PCB #189	90	119	110	95	89
Sampling-PCB					
PCB-60	n.a.	n.a.	n.a.	n.a.	n.a.
PCB-127	n.a.	n.a.	n.a.	n.a.	n.a.
PCB-159	n.a.	n.a.	n.a.	n.a.	n.a.
PCB #28	114	105	118	104	108
PCB #52	116	102	108	99	101
PCB #101	143	123	132	111	110
PCB #153	105	120	105	115	97
PCB #138	100	110	105	103	105
PCB #180	103	101	99	104	113

	H-08-03-0415	H-08-03-0416	H-08-03-0417[2)]	H-08-03-0418	H-08-03-0420
Matrix	flue gas samples	flue gas samples	flue gas samples	flue gas samples	flue gas samples
			back up		
	Force Task No.: 107-28412 4A, 6367 Sample for: CEN PCB 28/2-08	Force Task No.: 107-28412 4B, 6368 Sample for: CEN PCB 28/2-08	Force Task No.: 107-28412 4B, F360 Sample for: CEN PCB 28/2-08	Force Task No.: 107-28412 6A, 6371 Sample for: CEN PCB 3/3-08	Force Task No.: 107-28412 6B, 6372 Sample for: CEN PCB 3/3-08
Sampled volume, m³(s,d)/h	8,643	7,771	7,771	8,767	8,218
Values in:	ng/m³	ng/m³	ng/m³	ng/m³	ng/m³
3,3',4,4'-Tetra-CB 77	139	162	0,21	87	119
3,4,4',5-Tetra-CB 81	6,4	6,8	0,015	3,7	5,4
3,3',4,4',5-Penta-CB 126	1,8	1,8	n.d.(0,004)	1,3	2,7
3,3',4,4',5,5'-Hexa-CB 169[1)]	0,023	0,027	n.d.(0,0002)	0,034	0,041
Total non-ortho PCB	147	170	0,23	92	127
Total WHO-TEQ non-ortho PCB	0,19	0,19	0,00038	0,14	0,28
2,3,3',4,4'-Penta-CB 105	319	386	n.d.(0,5)	273	483
2,3,4,4',5-Penta-CB 114	31	34	n.d.(0,5)	25	43
2,3',4,4',5-Penta-CB 118	787	917	n.d.(1)	687	1239
2',3,4,4',5-Penta-CB 123	14	17	n.d.(0,5)	12	23
2,3,3',4,4',5,-Hexa-CB 156	55	64	n.d.(0,6)	60	110
2,3,3',4,4',5'-Hexa-CB 157	13	16	n.d.(0,6)	15	26
2,3',4,4',5,5'-Hexa-CB 167	21	25	n.d.(0,5)	22	36
2,3,3',4,4',5,5'-Hepta-CB 189	2,2	2,9	n.d.(0,8)	2,0	4,5
Total mono-ortho PCB	1242	1461	n.d.	1095	1964
Total WHO-TEQ mono-ortho PCB	0,16	0,19	0,0011	0,15	0,26
PCB #28	4148	4470	175	2591	4457
PCB #52	1812	2415	51	1234	2205
PCB #101	1041	1124	4,9	821	1366
PCB #138	364	411	n.d.(0,5)	298	555
PCB #153	350	401	n.d.(0,5)	305	570
PCB #180	90	101	n.d.(0,7)	80	148
total	7805	8922	231	5329	9300

all PCB values calculated out of 0,02% of sample

[1)] = all PCB#169 values calculated out of 40% of sample

[2)] = all coplanar PCB values calculated out of 40% of sample

	Recoveries				
	H-08-03-0415	H-08-03-0416	H-08-03-0417	H-08-03-0418	H-08-03-0419
PCB #81	107	99	68	114	78
PCB #77	106	88	78	101	87
PCB #126	100	96	64	98	64
PCB #169	20	20	51	23	66
PCB #105	106	102	103	57	95
PCB #114	101	105	93	52	93
PCB #118	107	103	96	51	89
PCB #123	111	110	99	55	96
PCB #156	131	136	125	48	124
PCB #157	142	154	149	64	134
PCB #167	99	99	102	53	99
PCB #189	96	102	99	54	89
Sampling-PCB					
PCB-60	n.a.	n.a.	n.a.	n.a.	n.a.
PCB-127	n.a.	n.a.	n.a.	n.a.	n.a.
PCB-159	n.a.	n.a.	n.a.	n.a.	n.a.
PCB #28	115	98	102	103	95
PCB #52	113	96	97	112	94
PCB #101	112	112	105	130	104
PCB #153	101	97	117	124	103
PCB #138	101	89	103	125	107
PCB #180	103	111	114	132	104

	H-08-03-0419[2)]	H-08-03-0421	H-08-03-0422	H-08-03-0423[2)]	H-08-03-0424[2)]
Matrix	flue gas samples	flue gas samples	flue gas samples	flue gas samples	flue gas samples
	back up				
	Force Task No.: 107-28412 6A, F361 Sample for: CEN PCB 3/3-08	Force Task No.: 107-28412 7A, 6373 Sample for: CEN PCB 5/3-08	Force Task No.: 107-28412 7B, 6376 Sample for: CEN PCB 5/3-08	Force Task No.: 107-28412 Blank 1, 6374 Sample for: CEN PCB	Force Task No.: 107-28412 Blank 2, 6375 Sample for: CEN PCB
Sampled volume, m³(s,d)/h	8,767	4,480	4,006	8,207	8,492
Values in:	ng/m³	ng/m³	ng/m³	ng/m³	ng/m³
3,3',4,4'-Tetra-CB 77	0,29	340	369	0,058	0,18
3,4,4',5-Tetra-CB 81	0,019	17	17	0,0019	0,0085
3,3',4,4',5-Penta-CB 126	n.d.(0,004)	3,6	3,7	n.d.(0,002)	0,0023
3,3',4,4',5,5'-Hexa-CB 169[1)]	n.d.(0,0002)	0,047	0,046	n.d.(0,0002)	0,000094
Total non-ortho PCB	0,31	361	389	0,060	0,19
Total WHO-TEQ non-ortho PCB	0,00046	0,39	0,41	0,00020	0,00025
2,3,3',4,4'-Penta-CB 105	0,57	592	576	n.d.(0,4)	n.d.(0,3)
2,3,4,4',5-Penta-CB 114	n.d.(0,4)	53	59	n.d.(0,4)	n.d.(0,3)
2,3',4,4',5-Penta-CB 118	1,3	1411	1314	n.d.(0,8)	n.d.(0,8)
2',3,4,4',5-Penta-CB 123	n.d.(0,4)	25	25	n.d.(0,4)	n.d.(0,4)
2,3,3',4,4',5,-Hexa-CB 156	n.d.(0,5)	109	107	n.d.(0,5)	n.d.(0,4)
2,3,3',4,4',5'-Hexa-CB 157	n.d.(0,5)	27	25	n.d.(0,6)	n.d.(0,4)
2,3',4,4',5,5'-Hexa-CB 167	n.d.(0,5)	38	37	n.d.(0,5)	n.d.(0,4)
2,3,3',4,4',5,5'-Hepta-CB 189	n.d.(0,7)	5,4	4,8	n.d.(0,8)	n.d.(0,6)
Total mono-ortho PCB	1,9	2261	2148	n.d.	n.d.
Total WHO-TEQ mono-ortho PCB	0,0010	0,30	0,29	0,0010	0,00083
PCB #28	198	11413	11446	n.d.(1)	2,0
PCB #52	71	4214	3716	n.d.(1)	1,2
PCB #101	11	1495	1694	n.d.(2)	n.d.(1)
PCB #138	n.d.(0,5)	611	620	n.d.(0,5)	n.d.(0,5)
PCB #153	n.d.(0,5)	570	552	n.d.(0,5)	n.d.(0,4)
PCB #180	n.d.(0,6)	152	146	n.d.(0,7)	n.d.(0,5)
total	281	18456	18173	n.d.	3,2

all PCB values calculated out of 0,02% of sample

[1)] = all PCB#169 values calculated out of 40% of sample

[2)] = all coplanar PCB values calculated out of 40% of sample

	Recoveries				
	H-08-03-0420	H-08-03-0421	H-08-03-0422	H-08-03-0423	H-08-03-0424
PCB #81	111	114	120	86	67
PCB #77	88	121	106	94	86
PCB #126	91	113	112	57	57
PCB #169	19	23	28	48	42
PCB #105	99	118	113	105	112
PCB #114	106	115	105	100	114
PCB #118	106	111	117	98	110
PCB #123	107	121	115	104	116
PCB #156	123	132	131	123	150
PCB #157	133	155	158	136	171
PCB #167	97	103	103	88	106
PCB #189	107	112	100	87	108
Sampling-PCB					
PCB-60	n.a.	n.a.	n.a.	n.a.	n.a.
PCB-127	n.a.	n.a.	n.a.	n.a.	n.a.
PCB-159	n.a.	n.a.	n.a.	n.a.	n.a.
PCB #28	107	120	106	97	105
PCB #52	110	116	121	93	113
PCB #101	116	152	122	90	130
PCB #153	107	124	119	100	126
PCB #138	96	113	107	107	118
PCB #180	102	127	131	98	127

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