

## Supplementary information for

### A comparison of PAH emission samplings from domestic hot water boilers

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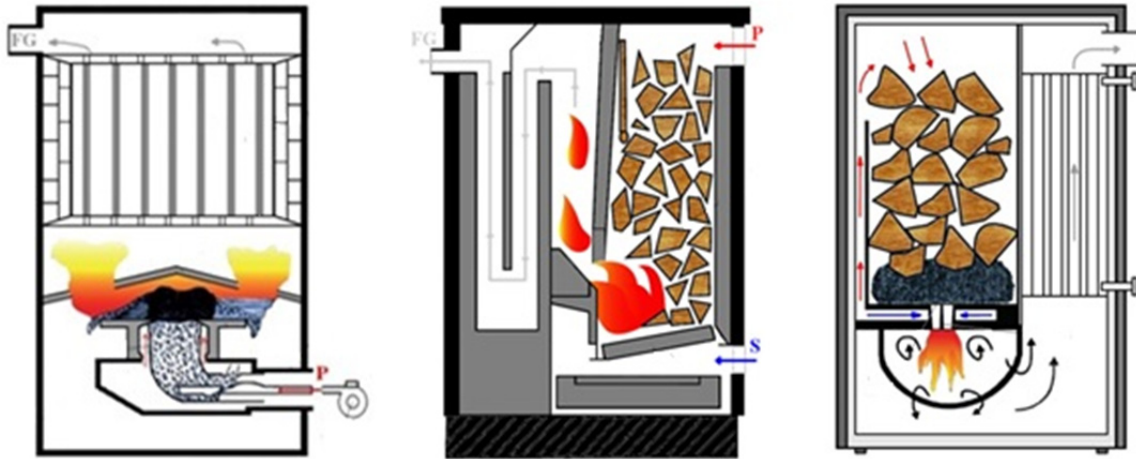
This PDF file includes:

2 figures and 5 tables are available for further information addressing experimental section and additional data.

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Automatic boiler (B1)

Boiler with down-draft  
combustion (B3)

Gasification boiler (B4, B5)

**Figure S1.** Schematic diagram of the tested combustion devices (Krpec et al., 2016).

Note: P – primary air (red), S – secondary air (blue), FG – flue gases (gray).



**Figure S2.** Photo of the Dekati Low-Pressure Impactor (DLPI, Dekati).

**Table S1.** Characteristics of the 4 PAHs.

<b>4 PAHs</b>	<b>Abbreviation <sup>b</sup></b>	<b>Benzene (and total) rings</b>	<b>Molecular weight</b>	<b>TEF <sup>c</sup></b>
	-	-	g/mol	-
Benzo[b]fluoranthene <sup>a</sup>	BbF	4 (5)	252	0.1
Benzo[k]fluoranthene <sup>a</sup>	BkF	4 (5)	252	0.1
Benzo[a]pyrene <sup>a</sup>	BaP	5	252	1
Indeno[1,2,3-cd]pyrene <sup>a</sup>	INP	5 (6)	276	0.1

**Note:** <sup>a</sup> indicates the particular PAHs in the sum of the 4 PAHs according to (EEA, 2013).

<sup>b</sup> indicates the abbreviation of the PAHs according to (Holoubek, 1996).

<sup>c</sup> indicates the toxicity equivalent factors (TEF) values according to (EPA, 2012).

**Table S2.** Specifications of the used fuels as received.

		<b>L1</b>	<b>L2</b>	<b>WP</b>	<b>WW</b>	<b>MF</b>
carbon	[% <sub>w</sub> ]	54.62	61.72	47.43	34.15	45.62
hydrogen	[% <sub>w</sub> ]	4.46	5.10	6.10	4.35	4.82
nitrogen	[% <sub>w</sub> ]	0.76	0.90	0.04	0.06	0.40
oxygen	[% <sub>w</sub> ]	19.05	14.44	40.00	29.85	26.57
sulfur	[% <sub>w</sub> ]	0.72	1.36	0.05	0.02	0.36
total water	[% <sub>w</sub> ]	15.51	9.04	6.00	31.20	19.88
ash	[% <sub>w</sub> ]	4.87	7.45	0.39	0.37	2.35
low calorific value	[MJ/kg]	22.61	25.84	17.02	11.89	20.13

**Table S3.** Summary of the EFs of particulate matter in the PM<sub>0.1</sub>, PM<sub>1</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> fractions.

Test no.	Fuel	$P_{nom}, P_{min}$	Output	TSP	PM <sub>0.1</sub>		PM <sub>1</sub>		PM <sub>2.5</sub>		PM <sub>10</sub>	
			[kW]	[mg/kg]	[mg/kg]	[%]	[mg/kg]	[%]	[mg/kg]	[%]	[mg/kg]	[%]
Automatic boiler (B1)												
1	L2	$P_{min}$	7.6	1267	184	15	1077	85	1133	89	1201	95
2	L2	$P_{nom}$	23.9	650	85	13	560	86	586	90	643	99
3	WP	$P_{min}$	7.7	206	69	28	178	93	181	94	197	98
4	WP	$P_{nom}$	24.8	102	28	34	95	86	96	88	99	95
Boiler with down-draft combustion (B3)												
18	L1	$P_{nom}$	22.8	448	23	5	405	90	437	98	445	99
19	WW	$P_{min}$	11.4	1666	56	3	1606	96	1638	98	1654	99
Gasification boiler (B4)												
20	MF	$P_{min}$	11.2	986	21	2	899	91	958	97	979	99
22	L1	$P_{min}$	12.8	229	46	20	213	93	220	96	226	99
23	L1	$P_{nom}$	25.8	144	31	22	118	82	131	92	139	97
Gasification boiler (B5)												
24	WW	$P_{min}$	9.5	663	40	6	639	96	649	98	660	100
25	WW	$P_{nom}$	19.2	264	43	16	195	74	213	81	255	96

**Table S4.** EF  $\Sigma$  4 PAHs in the DLPI fractions of PM<sub>0.1</sub>, PM<sub>0.1-1</sub>, PM<sub>1-2.5</sub>, PM<sub>2.5-10</sub> and in PUF.

Test no.	Fuel	$P_{nom}, P_{min}$	Test duration	DLPI coverage	No. of used DLPI	4 PAHs in PM <sub>0.1</sub>		4 PAHs in PM <sub>0.1-1</sub>		4 PAHs in PM <sub>1-2.5</sub>		4 PAHs in PM <sub>2.5-10</sub>		4 PAHs in PUF	
			[h]	[%]	[-]	[mg/kg]	[%]	[mg/kg]	[%]	[mg/kg]	[%]	[mg/kg]	[%]	[mg/kg]	[%]
Automatic boiler (B1)															
1	L2	$P_{min}$	4.4	72.6	4	0.172	16	0.831	79	0.041	4	0.006	1	0.002	0
2	L2	$P_{nom}$	4.3	56.9	3	0.011	21	0.032	60	0.004	7	0.005	10	0.001	2
3	WP	$P_{min}$	4.5	78.6	5	0.003	9	0.008	24	0.004	13	0.003	10	0.014	44
4	WP	$P_{nom}$	4.5	65.8	7	0.003	18	0.003	22	0.000	3	0.001	4	0.008	53
Boiler with down-draft combustion (B3)															
18	L1	$P_{nom}$	5.7	75.6	6	0.013	1	2.103	80	0.382	15	0.039	1	0.092	4
19	WW	$P_{min}$	2.5	55.9	6	0.046	3	0.761	57	0.065	5	0.020	2	0.434	33
Gasification boiler (B4)															
20	MF	$P_{min}$	4.5	60.9	5	0.013	2	0.260	38	0.056	8	0.017	3	0.341	50
22	L1	$P_{nom}$	6.8	74.9	5	0.035	17	0.084	42	0.006	3	0.004	2	0.073	36
23	L1	$P_{nom}$	3.9	81.7	3	0.003	31	0.005	48	0.001	7	0.001	8	0.001	6
Gasification boiler (B5)															
24	WW	$P_{min}$	4.0	79.1	5	0.024	6	0.077	19	0.011	3	0.064	16	0.220	56
25	WW	$P_{nom}$	3.7	92.9	3	0.006	3	0.010	5	0.005	3	0.018	9	0.162	81

**Table S5.** EF  $\Sigma$  4 PAHs in the cyclone fractions of PM<sub>2.5</sub>, PM<sub>2.5-10</sub> and in PUF.

Test no.	Fuel	$P_{\text{nom}}, P_{\text{min}}$	4 PAHs in PM <sub>2.5</sub>		4 PAHs in PM <sub>2.5-10</sub>		4 PAHs in PUF	
			[mg/kg]	[%]	[mg/kg]	[%]	[mg/kg]	[%]
Automatic boiler (B1)								
1	L2	$P_{\text{min}}$	0.58	86	0.09	13	0.002	1
2	L2	$P_{\text{nom}}$	0.03	73	0.01	24	0.001	3
3	WP	$P_{\text{min}}$	0.02	50	0.01	25	0.01	25
4	WP	$P_{\text{nom}}$	0.01	46	0.002	8	0.01	46
Boiler with down-draft combustion (B3)								
18	L1	$P_{\text{nom}}$	0.39	25	0.20	13	0.96	62
19	WW	$P_{\text{min}}$	1.04	80	0.20	15	0.07	5
Gasification boiler (B4)								
20	MF	$P_{\text{min}}$	1.64	98	0.02	1	0.01	1
22	L1	$P_{\text{nom}}$	0.21	81	0.05	19	0.001	0
23	L1	$P_{\text{nom}}$	0.01	67	0.003	20	0.002	13
Gasification boiler (B5)								
24	WW	$P_{\text{min}}$	0.61	94	0.03	5	0.01	1
25	WW	$P_{\text{nom}}$	0.13	81	0.01	6	0.02	13