

1 **Supplementary Figure Legends:**

2 **Figure S1** Location of 3 sampling villages selected in this study

3 **Figure S2** Stoves used in this study: a) Heated Kang b) Traditional coal stove c)

4 Semi-gasifier stove

5 **Figure S3** Profiles of VOCs emitted from heating and cooking activities

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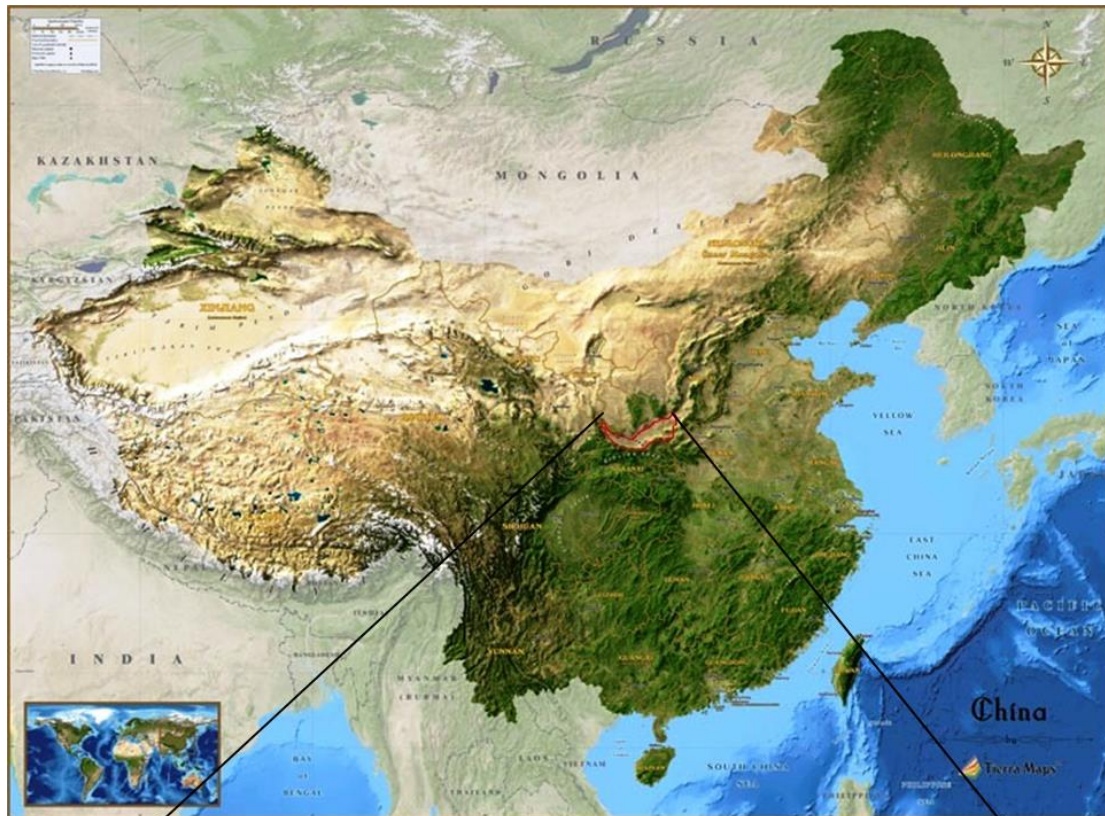


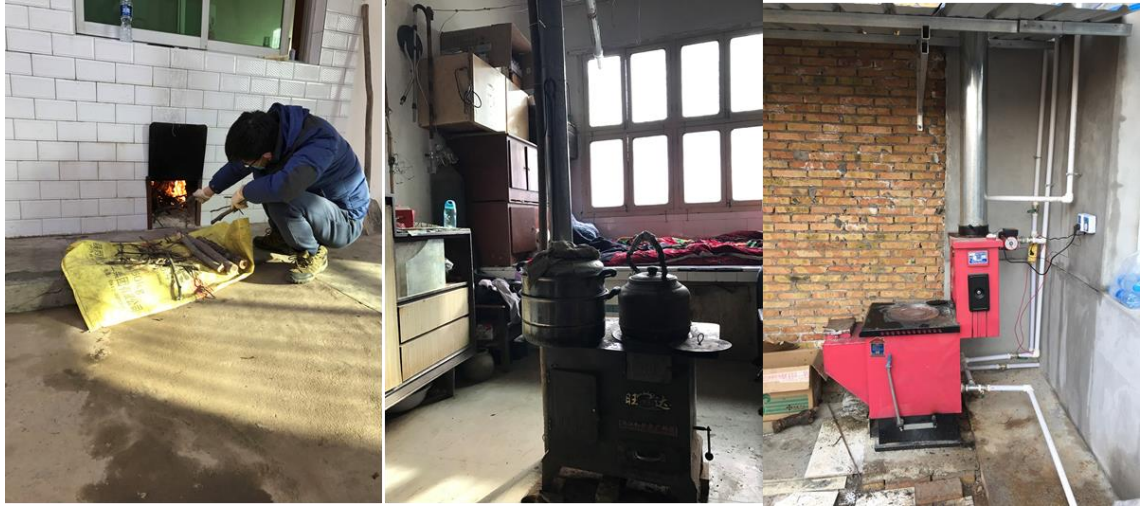
Figure S1

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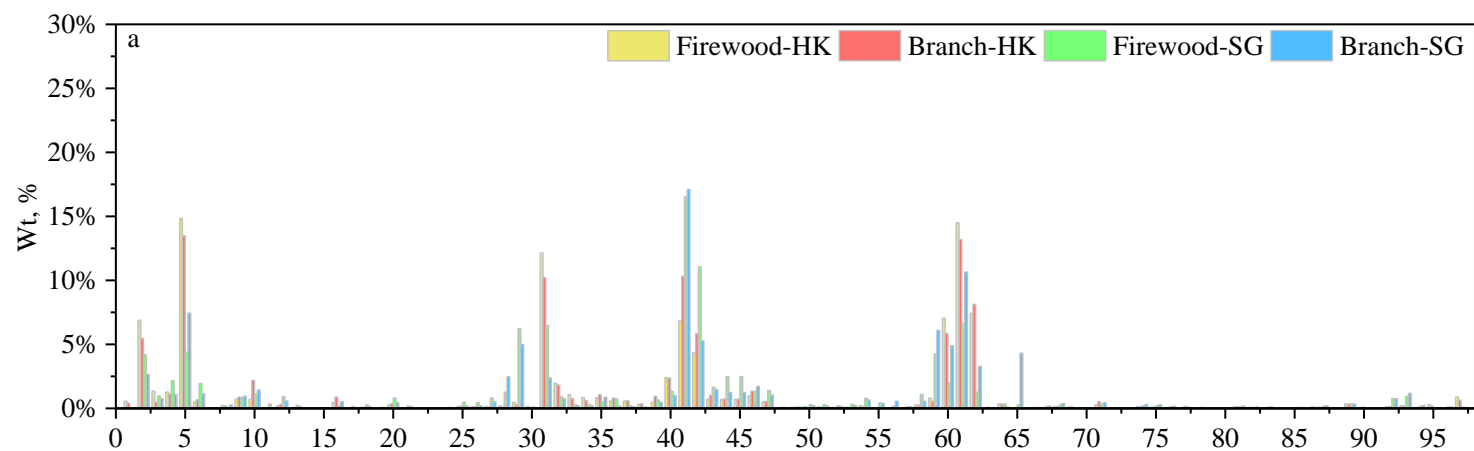
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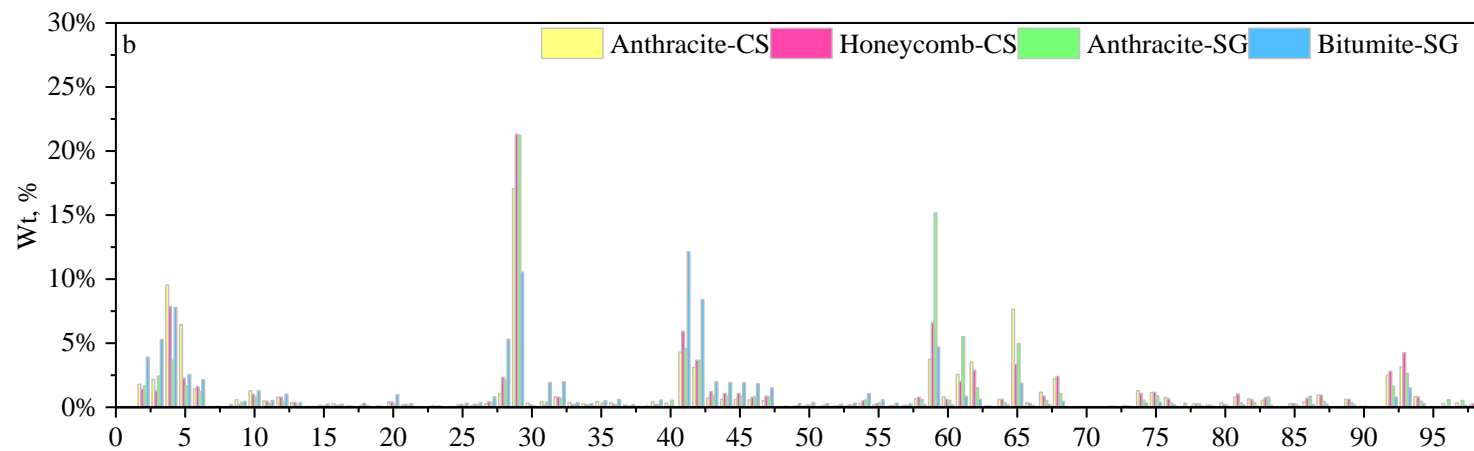
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Figure S2

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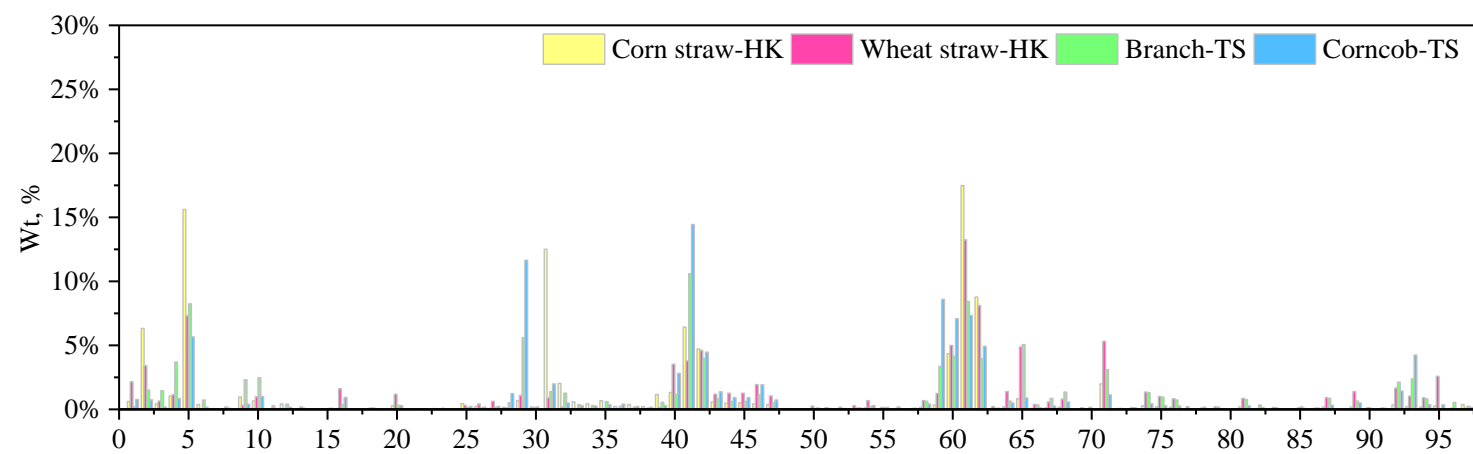


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Figure S3



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Table S1 Solid fuel and stoves used in this study

Purpose	Heating					
Fuel type	Wood				Straw	
Stove type	Heated Kang		Semi-gasifier Stove		Heated Kang	
Fuel used	Firewood	Branch	Firewood	Branch	Maize straw	Wheat straw
Abbreviation	Firewood-HK	Branch-HK	Firewood-SG	Branch-SG	Maize-HK	Wheat-HK
Sample No.	2	2	2	2	2	2
Purpose	Heating				Cooking	
Fuel type	Coal				Wood and straw	
Stove type	Traditional coal stove		Semi-gasifier stove		Traditional cooking stove	
Fuel used	Anthracite	Honeycomb	Anthracite	Bitumite	Branch	Corn cob
Abbreviation	Anthracite-CS	Honeycomb-CS	Anthracite-SG	Bitumite-SG	Branch-TS	Corn cob-TS
Sample No.	2	2	2	2	2	2

Table S2 MDL of VOC species in analysis method used in this study (ppbv)

No.	Species	MDL (ppbv)	No.	Species	MDL (ppbv)
1	Ethane	0.033	50	m-Ethyltoluene	0.001
2	Propane	0.019	51	p-Ethyltoluene	0.002
3	Isobutane	0.024	52	1,3,5-Trimethylbenzene	0.003
4	n-Butane	0.017	53	o-Ethyltoluene	0.004
5	iso-Pentane	0.002	54	1,2,4-Trimethylbenzene	0.005
6	n-Pentane	0.020	55	1,2,3-Trimethylbenzene	0.006
7	2,2-Dimethylbutane	0.004	56	m-Diethylbenzene	0.007
8	Cyclopentane	0.013	57	p-Diethylbenzene	0.008
9	2,3-Dimethylbutane	0.004	58	4-Ethyltoluene	0.009
10	2-Methylpentane	0.024	59	Naphthalene	0.010
11	3-Methylpentane	0.006	60	Acrolein	0.011
12	n-Hexane	0.019	61	Acetone	0.012
13	Methylcyclopentane	0.008	62	Methyl ethyl ketone	0.013
14	2,4-Dimethylpentane	0.004	63	Methyl Isobutyl Ketone	0.014
15	Cyclohexane	0.005	64	Methyl butyl ketone	0.015
16	2-Methylhexane	0.007	65	Ethanol	0.016
17	2,3-Dimethylpentane	0.007	66	Isopropyl Alcohol	0.017
18	3-Methylhexane	0.006	67	Methyl tert-butyl ether	0.018
19	2,2,4-Trimethylpentane	0.010	68	Ethyl Acetate	0.019
20	n-Heptane	0.007	69	Methyl Methacrylate	0.020
21	Methylcyclohexane	0.005	70	Freon-12	0.021
22	2,3,4-Trimethylpentane	0.007	71	Chloromethane	0.022
23	2-Methylheptane	0.005	72	Freon-114	0.023
24	3-Methylheptane	0.006	73	Vinyl chloride	0.024
25	n-Octane	0.005	74	Bromomethane	0.025
26	n-Nonane	0.004	75	Freon-11	0.026
27	n-Decane	0.003	76	1,1-Dichloroethene	0.027
28	Undecane	0.004	77	Methylene Chloride	0.028
29	Dodecane	0.004	78	Freon-113	0.029
30	Ethylene	0.039	79	trans-1,2-Dichloroethene	0.030
31	Propylene	0.042	80	1,1-Dichloroethane	0.031
32	1-Butene	0.008	81	cis-1,2-Dichloroethene	0.032
33	trans-2-Butene	0.010	82	Chloroform	0.033
34	cis-2-Butene	0.006	83	1,2-Dichloroethane	0.034
35	Isoprene	0.005	84	1,1,1-Trichloroethane	0.035
36	1-Pentene	0.013	85	Carbon Tetrachloride	0.036
37	trans-2-Pentene	0.012	86	1,2-Dichloropropane	0.037
38	cis-2-Pentene	0.006	87	Trichloroethene	0.038
39	1-Hexene	0.003	88	cis-1,3-Dichloropropene	0.039
40	1,3-Butadiene	0.029	89	1,1,2-Trichloroethane	0.040
41	Benzene	0.015	90	1,1,2,2-Tetrachloroethane	0.041
42	Toluene	0.022	91	Benzyl Chloride	0.042
43	Ethylbenzene	0.004	92	1,3-Dichlorobenzene	0.043
44	m-Xylene	0.012	93	1,4-Dichlorobenzene	0.044
45	p-Xylene	0.012	94	1,2-Dichlorobenzene	0.045

46	Styrene	0.006	95	Acetylene	0.046
47	o-Xylene	0.003	96	Carbon disulfide	0.047
48	Isopropylbenzene	0.004	97	Tetrahydrofuran	0.048
49	n-Propylbenzene	0.003	98	1,4-Dioxane	0.049

24 Table S3 Background concentrations of 98 VOC species in three sampling sites ($\mu\text{g}\cdot\text{m}^{-3}$)

No.	Species	Village 1	Village 2	Village 3	No.	Species	Village 1	Village 2	Village 3
1	Ethane	0.1	1.5	4.8	50	m-Ethyltoluene	0.0	0.0	0.0
2	Propane	0.0	1.8	0.9	51	p-Ethyltoluene	0.0	0.0	0.0
3	Isobutane	4.5	0.9	0.0	52	1,3,5-Trimethylbenzene	0.0	0.0	0.0
4	n-Butane	0.0	0.7	0.0	53	o-Ethyltoluene	0.0	0.0	0.0
5	iso-Pentane	2.5	0.1	0.9	54	1,2,4-Trimethylbenzene	0.0	0.0	0.0
6	n-Pentane	0.0	0.0	0.0	55	1,2,3-Trimethylbenzene	0.0	0.0	0.0
7	2,2-Dimethylbutane	0.0	0.0	0.0	56	m-Diethylbenzene	0.0	0.0	0.0
8	Cyclopentane	0.0	3.2	0.0	57	p-Diethylbenzene	0.0	0.0	0.0
9	2,3-Dimethylbutane	0.0	0.0	0.0	58	4-Ethyltoluene	0.2	0.1	0.0
10	2-Methylpentane	0.0	0.0	0.0	59	Naphthalene	0.0	0.0	0.0
11	3-Methylpentane	0.0	0.0	0.0	60	Acrolein	0.2	0.0	0.0
12	n-Hexane	0.2	0.0	0.0	61	Acetone	1.4	0.0	0.3
13	Methylcyclopentane	0.0	0.0	0.0	62	Methyl ethyl ketone	0.0	0.0	0.0
14	2,4-Dimethylpentane	0.0	0.0	0.0	63	Methyl Isobutyl Ketone	0.0	0.0	0.0
15	Cyclohexane	0.0	0.0	0.0	64	Methyl butyl ketone	10.0	1.6	0.4
16	2-Methylhexane	0.0	0.0	0.0	65	Ethanol	37.9	0.0	0.1
17	2,3-Dimethylpentane	0.0	0.0	0.0	66	Isopropyl Alcohol	0.0	0.0	0.0
18	3-Methylhexane	0.0	0.0	0.0	67	Methyl tert-butyl ether	0.0	0.0	0.0
19	2,2,4-Trimethylpentane	0.0	0.0	0.0	68	Ethyl Acetate	0.0	0.0	0.0
20	n-Heptane	0.0	0.0	0.0	69	Methyl Methacrylate	0.0	0.0	0.0
21	Methylcyclohexane	0.0	0.0	0.0	70	Freon-12	0.0	0.0	0.0
22	2,3,4-Trimethylpentane	0.0	0.0	0.0	71	Chloromethane	0.5	0.7	0.9
23	2-Methylheptane	0.0	0.0	0.0	72	Freon-114	0.0	0.0	0.0
24	3-Methylheptane	0.0	0.0	0.0	73	Vinyl chloride	0.0	0.0	0.0
25	n-Octane	0.0	0.0	0.0	74	Bromomethane	0.0	0.0	0.0
26	n-Nonane	0.0	0.0	0.0	75	Freon-11	0.0	1.0	0.0
27	n-Decane	0.0	0.0	0.0	76	1,1-Dichloroethene	0.0	0.0	0.0
28	Undecane	0.0	0.0	0.0	77	Methylene Chloride	0.2	0.2	0.0
29	Dodecane	0.0	0.0	0.0	78	Freon-113	0.0	0.0	0.0
30	Ethylene	0.1	0.7	0.1	79	trans-1,2-Dichloroethene	0.0	0.0	0.0
31	Propylene	1.0	1.6	0.8	80	1,1-Dichloroethane	0.0	0.0	0.0
32	1-Butene	1.1	0.0	0.2	81	cis-1,2-Dichloroethene	0.0	0.0	0.0
33	trans-2-Butene	0.0	0.1	0.0	82	Chloroform	0.0	0.0	0.0
34	cis-2-Butene	0.0	0.1	0.0	83	1,2-Dichloroethane	0.0	0.0	0.0
35	Isoprene	0.0	0.0	0.0	84	1,1,1-Trichloroethane	0.0	0.0	0.0
36	1-Pentene	0.0	0.0	0.0	85	Carbon Tetrachloride	8.8	5.0	0.9
37	trans-2-Pentene	0.0	0.0	0.0	86	1,2-Dichloropropane	0.0	0.0	0.0
38	cis-2-Pentene	0.0	0.0	0.0	87	Trichloroethene	0.0	0.0	0.0
39	1-Hexene	0.0	0.0	0.0	88	cis-1,3-Dichloropropene	0.0	0.0	0.0
40	1,3-Butadiene	1.0	0.2	0.0	89	1,1,2-Trichloroethane	0.0	0.0	0.0
41	Benzene	2.8	1.6	0.3	90	1,1,2,2-Tetrachloroethane	0.9	0.4	0.0
42	Toluene	1.0	0.2	0.0	91	Benzyl Chloride	0.0	0.0	0.0
43	Ethylbenzene	0.1	0.0	0.0	92	1,3-Dichlorobenzene	0.3	0.0	0.0
44	m-Xylene	0.8	0.2	0.0	93	1,4-Dichlorobenzene	0.0	0.0	0.0
45	p-Xylene	0.2	0.0	0.0	94	1,2-Dichlorobenzene	0.0	0.1	0.0

46	Styrene	0.2	0.1	0.0	95	Acetylene	3.6	4.0	6.4
47	o-Xylene	0.1	0.0	0.0	96	Carbon disulfide	0.1	1.1	0.1
48	Isopropylbenzene	0.0	0.0	0.0	97	Tetrahydrofuran	0.0	0.0	0.0
49	n-Propylbenzene	0.1	0.0	0.0	98	1,4-Dioxane	0.0	0.0	0.0

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Table S4 Concentration of VOC species measured in diluted smoke ($\mu\text{g}\cdot\text{m}^{-3}$)

No.	Species	Firewood-HK1		Branch -HK		Corn straw- HK		Wheat straw- HK		Branch - TS		Corncob - TS	
		Avg	SD	Avg	SD	Avg	SD	Avg	SD	Avg	SD	Avg	SD
1	Ethane	20.8	7.1	14.9	2.5	8.3	5.7	5.3	4.0	0.7	0.8	7.1	10.0
2	Propane	255	68.5	235	123	90.4	3.0	8.9	4.4	4.9	0.1	6.9	9.8
3	Isobutane	49.9	41.1	21.0	13.2	6.5	2.7	1.8	0.6	4.7	3.0	1.7	2.4
4	n-Butane	47.4	12.9	49.4	29.1	15.4	6.7	3.1	0.8	11.9	2.2	7.7	10.9
5	iso-Pentane	550	119	572	266	217	63.3	25.3	17.2	26.7	2.2	51.8	30.2
6	n-Pentane	18.5	2.9	28.9	15.8	4.9	6.7	0.0	0.0	2.4	0.0	1.6	2.3
7	2,2-Dimethylbutane	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
8	Cyclopentane	8.4	2.9	7.3	1.6	2.5	3.6	0.4	0.5	0.0	0.0	0.0	0.0
9	2,3-Dimethylbutane	27.0	0.8	37.2	15.6	12.7	12.3	1.4	1.9	7.5	3.6	3.7	4.1
10	2-Methylpentane	26.1	30.8	81.2	9.4	8.7	7.5	3.0	0.7	8.0	3.2	9.2	11.6
11	3-Methylpentane	1.4	0.4	2.0	0.7	0.2	0.2	0.1	0.1	0.9	0.2	0.7	0.1
12	n-Hexane	7.8	0.4	13.5	7.0	5.7	3.3	0.3	0.4	1.3	0.2	1.6	0.1
13	Methylcyclopentane	1.9	0.3	3.2	1.2	0.4	0.4	0.1	0.1	0.6	0.1	0.8	0.4
14	2,4-Dimethylpentane	0.3	0.1	0.3	0.1	0.5	0.6	0.0	0.1	0.1	0.1	0.2	0.1
15	Cyclohexane	2.0	0.2	2.4	0.9	0.4	0.3	0.2	0.2	0.2	0.1	0.8	0.8
16	2-Methylhexane	17.4	21.4	36.6	14.2	0.7	0.9	5.7	4.5	1.2	0.6	8.5	8.3
17	2,3-Dimethylpentane	1.0	0.1	1.6	0.7	0.4	0.6	0.0	0.0	0.2	0.0	0.1	0.1
18	3-Methylhexane	2.8	0.3	3.1	2.0	0.6	0.9	0.2	0.2	0.3	0.2	1.0	0.7
19	2,2,4-Trimethylpentane	0.1	0.0	0.2	0.1	0.7	1.0	0.0	0.0	0.1	0.0	0.3	0.1
20	n-Heptane	9.5	0.6	15.6	7.7	4.1	1.6	4.2	3.3	1.0	0.2	2.7	2.2
21	Methylcyclohexane	0.9	0.2	1.9	0.5	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1
22	2,3,4-Trimethylpentane	0.3	0.2	0.4	0.2	0.2	0.2	0.0	0.1	0.0	0.0	0.1	0.2
23	2-Methylheptane	0.5	0.1	0.4	0.0	0.9	0.8	0.2	0.3	0.1	0.2	0.8	1.0
24	3-Methylheptane	0.2	0.1	0.3	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.2	0.3

25	n-Octane	5.2	0.3	8.1	3.8	5.8	6.4	1.0	0.4	0.4	0.1	2.0	2.2
26	n-Nonane	4.8	0.7	6.0	2.7	2.8	3.4	1.3	0.5	0.4	0.0	1.6	1.9
27	n-Decane	5.2	0.6	4.7	0.5	1.0	0.6	1.9	0.5	0.6	0.1	2.1	2.2
28	Undecane	7.0	0.4	4.8	0.4	2.4	2.2	0.4	0.5	1.7	1.9	11.2	10.7
29	Dodecane	17.1	0.3	12.1	6.2	10.2	5.5	2.9	1.1	18.1	6.5	106	98.8
30	Ethylene	5.0	5.4	0.0	0.0	2.5	2.4	0.5	0.5	0.6	0.0	0.3	0.4
31	Propylene	451	110	448	270	177	18.9	2.9	1.2	4.5	1.3	18.2	25.7
32	1-Butene	72.6	23.9	81.8	57.5	29.3	3.7	0.8	0.9	4.1	0.0	4.5	6.3
33	trans-2-Butene	39.2	11.6	33.8	23.1	8.4	0.3	0.2	0.3	1.2	0.2	2.7	3.8
34	cis-2-Butene	31.2	11.0	27.3	18.9	6.1	0.0	0.2	0.2	0.9	0.2	2.3	2.8
35	Isoprene	30.0	11.6	46.6	26.4	9.0	6.9	0.1	0.2	1.9	0.4	3.4	4.9
36	1-Pentene	20.6	3.5	35.6	22.0	3.0	2.6	0.3	0.3	0.8	0.8	3.7	0.7
37	trans-2-Pentene	21.0	6.0	25.6	14.9	4.9	5.0	0.1	0.2	0.6	0.2	2.1	0.5
38	cis-2-Pentene	11.5	3.5	15.1	8.2	2.8	2.9	0.1	0.1	0.4	0.1	1.6	0.0
39	1-Hexene	18.0	1.6	42.0	29.7	15.3	14.5	0.6	0.7	1.8	0.2	2.7	0.8
40	1,3-Butadiene	88.9	28.1	105	66.7	18.9	0.4	10.3	0.4	3.8	0.9	13.2	18.6
41	Benzene	254	5.3	406	57.1	88.9	30.2	11.0	0.1	34.2	1.0	132	54.5
42	Toluene	161	12.5	237	63.9	62.8	51.3	13.7	1.4	12.9	2.9	40.9	26.8
43	Ethylbenzene	26.7	1.4	40.4	7.0	7.4	7.6	3.6	0.5	2.7	0.8	12.5	13.3
44	m-Xylene	103	7.8	117	15.2	20.3	28.8	14.4	0.2	7.6	2.5	33.1	36.0
45	p-Xylene	52.2	4.0	59.3	7.8	10.2	14.5	7.0	0.2	3.6	1.3	16.6	18.4
46	Styrene	35.9	1.4	50.8	3.1	5.8	2.7	5.6	0.1	3.7	1.3	17.5	19.1
47	o-Xylene	19.1	1.3	20.8	1.3	5.2	3.2	3.0	0.0	1.6	0.5	6.7	7.1
48	Isopropylbenzene	1.2	0.1	1.7	0.1	0.2	0.3	0.1	0.1	0.1	0.0	0.6	0.6
49	n-Propylbenzene	2.7	0.1	2.7	0.2	0.1	0.1	0.2	0.0	0.1	0.1	0.3	0.1
50	m-Ethyltoluene	5.1	2.3	2.7	0.4	0.6	0.1	0.7	0.0	0.2	0.0	1.0	1.0
51	p-Ethyltoluene	4.5	3.1	2.7	0.4	0.4	0.0	0.4	0.0	0.2	0.0	0.6	0.6
52	1,3,5-Trimethylbenzene	3.1	0.1	2.4	0.3	0.5	0.0	0.5	0.0	0.2	0.1	0.7	0.7
53	o-Ethyltoluene	3.5	0.0	2.8	0.6	0.7	0.1	0.9	0.0	0.3	0.1	1.0	1.1

54	1,2,4-Trimethylbenzene	7.7	0.0	4.9	1.5	1.7	0.9	1.9	0.4	0.8	0.1	2.6	2.8
55	1,2,3-Trimethylbenzene	2.2	0.0	1.3	0.5	0.5	0.2	0.5	0.1	0.4	0.1	1.5	1.5
56	m-Diethylbenzene	0.6	0.5	0.6	0.2	0.2	0.1	0.2	0.0	0.6	0.6	0.5	0.5
57	p-Diethylbenzene	0.1	0.0	0.3	0.4	0.2	0.0	0.1	0.1	0.2	0.0	0.8	0.8
58	4-Ethyltoluene	10.2	0.0	8.2	1.1	2.1	1.1	2.3	1.2	2.0	0.1	3.9	2.7
59	Naphthalene	5.3	1.1	3.8	0.2	0.7	0.7	0.7	0.6	1.9	0.3	8.2	9.2
60	Acrolein	261	52.3	262	179	62.1	0.4	14.4	0.2	13.4	0.4	64.8	5.1
61	Acetone	538	116	559	260	248	12.5	38.3	0.4	27.2	0.9	67.1	6.1
62	Methyl ethyl ketone	4.3	0.0	4.5	0.2	2.9	0.6	2.5	0.0	2.5	0.0	2.5	0.0
63	Methyl Isobutyl Ketone	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
64	Methyl butyl ketone	12.6	1.7	12.2	0.7	2.6	1.7	5.1	4.3	2.1	0.2	4.5	3.7
65	Ethanol	0.0	0.0	12.9	18.3	12.1	0.0	13.9	1.2	16.3	4.0	8.2	1.0
66	Isopropyl Alcohol	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0
67	Methyl tert-butyl ether	2.4	0.0	2.3	0.1	1.7	0.1	1.7	0.0	2.8	0.4	2.4	0.2
68	Ethyl Acetate	32.8	4.1	25.6	4.0	5.3	0.4	0.4	0.5	0.8	0.1	1.4	0.6
69	Methyl Methacrylate	3.4	0.0	4.7	2.2	0.5	0.7	0.0	0.0	0.0	0.0	1.2	1.8
70	Freon-12	2.1	0.2	1.7	0.2	0.2	0.0	0.5	0.3	0.0	0.0	0.0	0.0
71	Chloromethane	10.0	3.2	21.8	8.4	28.4	0.9	16.0	2.6	10.0	0.0	10.4	0.8
72	Freon-114	0.3	0.0	0.3	0.0	0.2	0.0	0.2	0.0	0.3	0.0	0.2	0.0
73	Vinyl chloride	0.8	0.0	1.2	0.2	0.4	0.0	0.4	0.0	0.4	0.0	0.6	0.3
74	Bromomethane	5.3	0.3	4.7	0.4	4.0	0.2	3.9	0.0	4.2	0.0	4.0	0.1
75	Freon-11	3.7	0.1	3.5	0.1	2.8	0.1	3.0	0.2	3.1	0.1	2.7	0.7
76	1,1-Dichloroethene	2.6	0.3	2.9	0.7	2.5	0.2	2.4	0.0	2.4	0.0	2.4	0.0
77	Methylene Chloride	0.8	0.2	1.0	0.8	0.4	0.6	0.2	0.3	1.7	0.0	0.2	0.2
78	Freon-113	0.8	0.0	0.8	0.0	0.3	0.0	0.3	0.1	0.6	0.0	0.6	0.0
79	trans-1,2-Dichloroethene	0.9	0.4	1.3	0.2	0.6	0.0	0.6	0.0	0.6	0.0	0.6	0.0
80	1,1-Dichloroethane	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3
81	cis-1,2-Dichloroethene	51.3	2.4	88.7	46.0	50.3	3.8	4.1	0.5	8.2	1.4	9.5	0.9
82	Chloroform	2.7	0.4	3.8	1.0	0.4	0.6	0.1	0.1	1.1	0.1	1.4	0.3

83	1,2-Dichloroethane	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
84	1,1,1-Trichloroethane	0.0	0.0	0.0	0.0	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0
85	Carbon Tetrachloride	0.7	0.0	0.8	0.1	0.4	0.0	0.4	0.1	0.6	0.0	0.7	0.0
86	1,2-Dichloropropane	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.3	0.2	0.9	0.6
87	Trichloroethene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	cis-1,3-Dichloropropene	1.9	0.3	3.2	1.4	0.4	0.6	0.5	0.7	0.1	0.2	0.8	0.8
89	1,1,2-Trichloroethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	1,1,2,2-Tetrachloroethane	0.7	0.4	3.8	0.6	0.3	0.1	0.4	0.2	0.3	0.1	0.2	0.1
91	Benzyl Chloride	5.1	0.0	4.9	0.0	4.9	0.1	4.8	0.0	6.9	0.7	13.1	8.1
92	1,3-Dichlorobenzene	2.2	0.1	1.8	0.1	1.4	0.0	1.5	0.2	1.3	0.0	1.4	0.0
93	1,4-Dichlorobenzene	8.1	0.3	7.2	0.3	3.1	0.2	3.0	0.2	7.7	1.6	38.8	4.7
94	1,2-Dichlorobenzene	2.9	0.0	2.7	0.0	2.6	0.0	2.6	0.0	2.6	0.0	3.4	1.1
95	Acetylene	10.4	0.4	7.2	1.8	4.1	3.9	6.9	2.6	0.1	0.1	3.2	4.6
96	Carbon disulfide	1.7	0.0	2.0	0.9	0.4	0.0	0.7	0.6	0.0	0.0	0.0	0.0
97	Tetrahydrofuran	0.4	0.5	1.5	0.2	0.0	0.0	0.0	0.0	0.5	0.2	1.1	0.2
98	1,4-Dioxane	2.9	0.0	2.9	0.1	2.6	0.0	2.6	0.0	2.8	0.0	3.0	0.2

No.	Species	Anthracite- CS		Honeycomb -CS		Anthracite- SG		Bitumite -SG		Firewood -SG		Branch-SG	
		Avg	SD	Avg	SD	Avg	SD	Avg	SD	Avg	SD	Avg	SD
1	Ethane	0.1	0.1	0.2	0.3	0.3	0.4	0.0	0.0	0.1	0.1	0.0	0.0
2	Propane	5.7	1.4	5.2	2.8	14.9	11.9	46.7	1.6	87.1	42.1	38.3	12.8
3	Isobutane	6.8	3.3	4.7	6.6	19.1	6.4	55.4	34.8	21.2	16.2	10.9	3.8
4	n-Butane	30.1	8.0	28.7	19.7	30.5	16.6	81.4	52.3	43.1	9.3	15.5	4.7
5	iso-Pentane	20.4	1.8	8.3	4.3	15.2	13.0	31.8	4.8	97.4	80.1	107	109
6	n-Pentane	4.6	0.1	5.8	3.2	10.8	8.3	25.9	0.1	37.0	1.0	16.6	13.8
7	2,2-Dimethylbutane	0.2	0.0	0.2	0.1	0.4	0.3	0.9	0.2	0.8	0.6	0.5	0.6
8	Cyclopentane	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.9	1.3	1.8	3.9	5.3
9	2,3-Dimethylbutane	1.9	1.9	0.8	0.7	2.7	0.3	7.1	7.1	14.2	9.4	13.7	2.2

10	2-Methylpentane	4.1	1.3	3.6	2.5	7.0	5.7	14.8	3.4	21.0	2.1	20.8	10.4
11	3-Methylpentane	1.6	0.2	1.7	1.2	2.4	1.5	5.8	2.3	5.8	3.6	0.7	1.0
12	n-Hexane	2.4	0.1	2.9	2.1	3.7	1.5	11.3	4.2	17.8	1.8	8.3	7.6
13	Methylcyclopentane	1.1	0.2	1.3	0.6	1.4	0.5	3.8	2.1	4.3	2.1	1.8	1.5
14	2,4-Dimethylpentane	0.1	0.0	0.3	0.1	0.3	0.1	0.6	0.8	0.3	0.4	0.0	0.0
15	Cyclohexane	0.6	0.1	0.3	0.2	1.2	0.9	2.7	0.4	0.4	0.5	0.7	0.8
16	2-Methylhexane	0.9	0.2	0.5	0.4	1.8	2.3	2.4	2.3	3.6	0.4	7.5	6.1
17	2,3-Dimethylpentane	0.3	0.2	0.4	0.1	0.5	0.3	0.9	1.2	3.4	4.5	0.1	0.1
18	3-Methylhexane	0.5	0.5	1.1	0.5	1.3	0.6	1.2	1.6	5.1	0.4	2.0	1.7
19	2,2,4-Trimethylpentane	0.1	0.2	0.3	0.1	0.8	0.7	0.5	0.7	0.3	0.4	1.1	1.0
20	n-Heptane	1.3	0.1	1.5	0.4	2.0	1.4	14.2	10.3	17.8	13.8	6.7	0.7
21	Methylcyclohexane	0.5	0.1	0.8	0.3	1.3	0.7	3.2	0.7	3.4	0.2	1.8	1.4
22	2,3,4-Trimethylpentane	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.2	0.3	0.1	0.1
23	2-Methylheptane	0.2	0.2	0.5	0.1	0.6	0.8	1.2	1.3	0.6	0.8	0.2	0.2
24	3-Methylheptane	0.0	0.0	0.1	0.1	0.4	0.2	0.5	0.6	1.4	0.3	0.0	0.0
25	n-Octane	0.6	0.0	0.9	0.3	1.3	1.0	4.0	1.0	11.3	13.5	2.8	0.3
26	n-Nonane	0.5	0.1	0.8	0.3	1.6	1.4	4.5	1.7	10.3	9.6	3.0	0.4
27	n-Decane	0.8	0.1	1.5	0.4	3.1	2.3	9.6	0.9	15.9	1.7	7.3	4.5
28	Undecane	3.4	4.3	8.5	4.0	15.5	0.0	54.6	39.3	23.7	2.1	35.5	30.6
29	Dodecane	53.9	20.6	77.7	38.2	139.8	56.2	134.3	32.1	120.7	14.8	71.8	10.7
30	Ethylene	1.0	0.4	0.7	0.0	0.9	0.4	0.7	0.0	1.6	0.8	0.3	0.5
31	Propylene	1.4	0.2	0.6	0.9	4.0	4.8	27.7	20.2	123.9	4.6	34.3	23.6
32	1-Butene	2.6	0.7	2.9	0.9	5.0	0.7	20.7	13.4	18.2	7.0	11.1	3.5
33	trans-2-Butene	1.2	0.4	0.8	0.4	2.3	2.4	4.4	0.7	5.7	1.2	3.2	1.6
34	cis-2-Butene	0.9	0.2	0.7	0.4	1.8	1.9	3.3	0.7	5.7	1.1	3.3	1.7
35	Isoprene	1.4	0.9	0.5	0.4	2.9	1.8	6.3	0.6	11.5	10.1	12.4	3.1
36	1-Pentene	1.1	0.4	0.9	0.4	1.6	1.1	8.6	5.3	16.7	16.8	2.6	2.0
37	trans-2-Pentene	0.5	0.2	0.4	0.2	0.8	0.7	2.6	1.4	4.7	4.5	2.0	0.4
38	cis-2-Pentene	0.3	0.1	0.2	0.1	0.5	0.4	1.6	0.7	2.4	3.3	1.2	0.4

39	1-Hexene	1.3	0.5	0.7	0.4	1.8	1.1	7.1	1.0	16.3	22.6	6.8	1.7
40	1,3-Butadiene	1.1	0.5	0.4	0.1	3.9	0.2	0.8	0.0	26.8	9.2	8.3	10.7
41	Benzene	13.6	1.9	21.7	8.2	39.7	28.5	150	19.2	326	66.1	246	28.0
42	Toluene	9.8	1.2	13.4	4.6	32.2	25.0	104	13.6	215	26.1	75.9	14.2
43	Ethylbenzene	2.3	0.6	4.4	1.3	8.3	6.9	24.0	0.0	33.0	9.9	21.1	4.2
44	m-Xylene	7.4	1.7	15.3	4.2	15.2	4.1	6.9	1.6	179	34.2	54.2	20.0
45	p-Xylene	3.4	0.9	7.5	2.1	19.3	9.4	7.5	5.2	86.2	24.4	28.9	8.1
46	Styrene	1.8	0.1	2.8	1.1	8.3	9.7	27.3	22.7	31.9	38.6	24.5	16.9
47	o-Xylene	1.6	0.3	3.2	0.8	7.3	6.9	19.1	4.4	29.9	19.9	15.0	0.0
48	Isopropylbenzene	0.1	0.0	0.2	0.1	0.4	0.3	1.1	0.2	1.6	0.8	0.4	0.6
49	n-Propylbenzene	0.1	0.0	0.3	0.2	1.1	1.1	3.4	0.8	1.9	0.5	1.2	1.0
50	m-Ethyltoluene	0.3	0.1	0.6	0.1	1.5	1.6	5.4	4.4	6.5	6.2	3.0	0.9
51	p-Ethyltoluene	0.2	0.1	0.4	0.1	1.6	1.6	3.9	2.4	6.7	6.0	2.7	1.4
52	1,3,5-Trimethylbenzene	0.2	0.1	0.4	0.1	1.1	0.8	2.8	0.0	4.1	2.3	2.1	0.2
53	o-Ethyltoluene	0.3	0.1	0.7	0.2	1.6	1.7	4.2	2.0	7.4	6.7	3.2	1.1
54	1,2,4-Trimethylbenzene	1.0	0.1	1.8	0.5	5.1	4.0	13.0	1.0	16.4	8.1	9.3	0.2
55	1,2,3-Trimethylbenzene	0.6	0.1	1.1	0.3	3.2	3.5	7.9	4.2	10.4	14.5	5.8	3.0
56	m-Diethylbenzene	0.2	0.0	0.5	0.2	1.3	1.4	3.9	0.4	3.7	1.8	8.2	8.3
57	p-Diethylbenzene	0.3	0.0	0.6	0.1	1.0	0.4	2.8	1.6	2.1	2.5	1.7	1.8
58	4-Ethyltoluene	2.1	0.1	2.8	0.4	5.2	4.1	2.7	0.9	22.3	10.3	7.9	3.9
59	Naphthalene	2.1	0.3	4.3	1.1	16.4	19.4	5.1	4.0	7.0	8.5	9.2	11.1
60	Acrolein	2.5	1.3	2.2	0.4	4.6	2.7	2.3	0.2	40.7	16.5	70.3	24.6
61	Acetone	8.1	3.4	7.3	1.6	38.6	4.6	11.9	6.9	130	29.9	153	38.9
62	Methyl ethyl ketone	2.5	0.0	3.7	1.8	2.5	0.0	2.5	0.0	2.5	0.0	2.5	0.0
63	Methyl Isobutyl Ketone	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
64	Methyl butyl ketone	1.9	0.2	2.3	0.3	2.7	0.8	2.7	1.4	8.2	9.3	4.7	4.5
65	Ethanol	24.2	8.7	12.2	0.7	36.9	3.8	24.8	9.3	7.0	8.7	62.0	22.0
66	Isopropyl Alcohol	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0
67	Methyl tert-butyl ether	3.7	0.1	3.2	0.8	4.3	2.7	2.9	1.2	2.0	0.1	2.6	0.8

68	Ethyl Acetate	1.1	0.7	0.3	0.0	3.0	3.4	1.7	1.3	1.7	1.0	0.9	0.4
69	Methyl Methacrylate	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	2.0	2.8	0.8	1.2
70	Freon-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	Chloromethane	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.1	0.5	0.7
72	Freon-114	0.3	0.0	0.3	0.1	0.5	0.1	0.5	0.2	0.4	0.1	0.3	0.0
73	Vinyl chloride	0.4	0.0	0.4	0.1	0.5	0.1	0.4	0.0	0.5	0.1	0.5	0.1
74	Bromomethane	4.1	0.2	3.9	0.1	4.1	0.3	3.9	0.0	4.2	0.4	4.3	0.6
75	Freon-11	3.6	0.2	4.2	0.8	7.0	2.3	5.1	1.4	4.2	0.6	4.1	0.3
76	1,1-Dichloroethene	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0
77	Methylene Chloride	1.0	0.1	0.2	0.1	3.9	1.9	0.3	0.2	2.9	3.4	1.6	1.9
78	Freon-113	0.8	0.1	0.9	0.2	2.2	1.1	1.5	0.9	1.2	0.6	1.1	0.3
79	trans-1,2-Dichloroethene	0.6	0.0	0.6	0.0	0.6	0.0	0.6	0.0	0.7	0.1	0.6	0.0
80	1,1-Dichloroethane	1.1	1.0	0.8	0.6	1.4	0.9	0.6	0.0	0.4	0.1	0.4	0.4
81	cis-1,2-Dichloroethene	15.7	0.3	8.5	0.6	24.2	9.8	11.7	3.9	99.0	36.1	13.6	7.0
82	Chloroform	2.1	0.5	2.1	1.4	2.9	1.5	1.2	0.2	1.3	0.5	1.8	1.4
83	1,2-Dichloroethane	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
84	1,1,1-Trichloroethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	4.0	0.0	0.0
85	Carbon Tetrachloride	0.9	0.1	1.0	0.4	1.9	0.8	1.4	0.8	0.8	0.1	0.9	0.1
86	1,2-Dichloropropane	1.3	0.9	2.6	1.2	6.1	0.2	2.9	1.5	1.5	1.2	1.7	1.5
87	Trichloroethene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	cis-1,3-Dichloropropene	0.1	0.2	0.4	0.1	0.5	0.1	0.5	0.3	0.4	0.4	0.8	0.9
89	1,1,2-Trichloroethane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	1,1,2,2-Tetrachloroethane	0.2	0.0	0.2	0.0	0.9	0.9	0.6	0.5	1.2	1.4	0.7	0.6
91	Benzyl Chloride	7.8	0.7	10.2	1.7	12.0	0.8	9.4	0.9	14.6	0.5	10.8	1.3
92	1,3-Dichlorobenzene	1.3	0.0	1.4	0.0	2.4	1.5	1.3	0.0	2.5	1.6	1.9	0.8
93	1,4-Dichlorobenzene	9.9	1.6	15.5	4.1	19.5	1.8	19.7	6.7	19.5	10.0	16.9	3.1
94	1,2-Dichlorobenzene	2.6	0.0	2.9	0.4	3.5	1.3	3.6	0.8	3.4	1.0	3.3	0.8
95	Acetylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
96	Carbon disulfide	0.0	0.0	0.0	0.0	3.1	3.3	0.0	0.0	1.7	2.4	0.7	0.9

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97	Tetrahydrofuran	1.7	0.7	2.8	1.2	5.9	1.0	2.0	0.4	1.6	0.2	1.6	0.1
98	1,4-Dioxane	3.0	0.2	3.5	0.2	3.3	0.1	2.9	0.1	3.0	0.2	2.9	0.2

Table S5 Profiles of VOCs measured in solid fuel burning in this study ($\mu\text{g}\cdot\text{kg}^{-1}$)

No.	Species	Wood heating				Residue heating		Coal heating				Cooking	
		Heated Kang		semi-gasifier stove		Heated Kang		Traditional coal stove		semi-gasifier stove		Old fashioned stove	
		Firewood	Branch	Firewood	Branch	Maize	Wheat	Anthracite	Honeycomb	Anthracite	Bitumite	Branch	Corncob
1	Ethane	13.6	7.6	0.1	0.0	13.7	40.4	0.0	0.0	0.2	0.0	2.5	24.9
2	Propane	167	102	107	63.6	139	64.1	1.4	0.7	10.0	39.0	17.2	24.3
3	Isobutane	32.6	8.9	24.5	18.2	9.6	12.2	1.7	0.6	14.6	52.8	16.4	6.1
4	n-Butane	31.0	21.2	55.3	25.7	22.9	21.6	7.4	3.7	22.0	77.8	42.0	27.2
5	iso-Pentane	360	253	111	178	344	137	5.0	1.1	10.0	25.5	93.6	182
6	n-Pentane	12.1	12.5	49.1	27.6	8.4	0.3	1.1	0.8	7.4	21.5	8.4	5.7
7	2,2-Dimethylbutane	0.1	0.1	1.2	0.8	0.0	0.0	0.0	0.0	0.3	0.7	0.4	0.2
8	Cyclopentane	5.5	3.4	2.1	6.5	4.4	1.6	0.0	0.0	0.0	2.2	0.0	0.0
9	2,3-Dimethylbutane	17.6	16.6	21.2	22.7	21.3	6.1	0.5	0.1	2.3	4.5	26.3	12.9
10	2-Methylpentane	17.1	40.8	28.5	34.5	14.4	18.4	1.0	0.5	4.7	13.0	28.0	32.2
11	3-Methylpentane	0.9	0.9	8.6	1.2	0.4	0.3	0.4	0.2	1.7	5.2	3.2	2.3
12	n-Hexane	5.1	5.9	23.3	13.8	9.3	1.4	0.6	0.4	2.8	10.2	4.6	5.5
13	Methylcyclopentane	1.2	1.5	6.2	3.0	0.7	0.3	0.3	0.2	1.0	3.5	2.2	2.8
14	2,4-Dimethylpentane	0.2	0.1	0.3	0.0	0.8	0.2	0.0	0.0	0.2	0.7	0.4	0.7
15	Cyclohexane	1.3	1.1	0.5	1.1	0.7	0.8	0.1	0.0	0.8	2.3	0.8	2.8
16	2-Methylhexane	11.4	16.4	4.7	12.4	1.2	30.4	0.2	0.1	1.0	2.4	4.3	30.0
17	2,3-Dimethylpentane	0.6	0.7	3.5	0.2	0.7	0.2	0.1	0.0	0.4	0.5	0.6	0.3
18	3-Methylhexane	1.8	1.3	6.8	3.4	1.1	1.2	0.1	0.1	1.0	0.7	1.1	3.5
19	2,2,4-Trimethylpentane	0.1	0.1	0.3	1.8	1.3	0.0	0.0	0.0	0.6	0.3	0.5	0.9
20	n-Heptane	6.2	6.8	20.5	11.1	6.5	22.0	0.3	0.2	1.4	9.8	3.6	9.4
21	Methylcyclohexane	0.6	0.9	4.5	3.0	0.2	0.8	0.1	0.1	0.9	2.8	0.6	0.8
22	2,3,4-Trimethylpentane	0.2	0.2	0.2	0.2	0.3	0.2	0.0	0.0	0.2	0.1	0.1	0.5
23	2-Methylheptane	0.3	0.2	0.6	0.3	1.4	0.9	0.1	0.1	0.3	1.2	0.5	2.8
24	3-Methylheptane	0.1	0.2	1.8	0.0	0.1	0.2	0.0	0.0	0.3	0.3	0.4	0.7
25	n-Octane	3.4	3.6	11.9	4.6	9.9	5.9	0.2	0.1	0.8	3.1	1.6	7.1
26	n-Nonane	3.1	2.7	11.5	4.9	4.9	7.9	0.1	0.1	1.1	3.4	1.3	5.6

27	n-Decane	3.4	2.3	20.8	12.2	1.6	11.9	0.2	0.2	2.1	8.1	2.0	7.4
28	Undecane	4.6	2.3	32.1	59.0	3.5	2.1	0.8	1.1	12.8	53.0	6.0	39.2
29	Dodecane	11.2	5.3	157	119	15.0	20.3	13.3	10.1	127	105	63.5	374
30	Ethylene	3.3	0.0	2.3	0.5	4.3	2.3	0.3	0.1	0.7	0.6	2.2	1.0
31	Propylene	295	192	164.2	57.0	276	16.9	0.3	0.1	2.4	19.0	15.8	63.8
32	1-Butene	47.4	34.1	22.7	18.5	44.7	3.5	0.6	0.4	4.0	19.8	14.3	15.7
33	trans-2-Butene	25.6	14.1	7.3	5.3	12.9	1.0	0.3	0.1	1.4	3.5	4.2	9.5
34	cis-2-Butene	20.4	11.4	7.4	5.4	9.4	0.7	0.2	0.1	1.2	2.9	3.3	8.2
35	Isoprene	19.6	20.1	13.0	20.7	14.8	0.5	0.3	0.1	2.1	5.1	6.8	12.1
36	1-Pentene	13.5	15.2	18.4	4.4	5.0	1.1	0.3	0.1	1.1	6.1	2.7	13.2
37	trans-2-Pentene	13.8	11.0	5.2	3.3	8.2	0.5	0.1	0.0	0.5	1.9	2.1	7.5
38	cis-2-Pentene	7.5	6.6	2.4	2.0	4.8	0.3	0.1	0.0	0.3	1.2	1.2	5.5
39	1-Hexene	11.7	17.5	16.5	11.3	25.6	2.9	0.3	0.1	1.3	5.7	6.2	9.4
40	1,3-Butadiene	58.1	44.2	33.7	23.9	29.2	66.2	0.3	0.1	3.2	0.7	13.3	90.4
41	Benzene	166	193	419	409	141	71.1	3.4	2.8	27.3	121	120	464
42	Toluene	105	109	280	126	104	86.5	2.4	1.7	21.8	83.7	45.3	143
43	Ethylbenzene	17.5	19.1	41.8	35.0	12.5	22.3	0.6	0.6	5.6	19.9	9.5	43.9
44	m-Xylene	16.7	13.9	63.0	29.5	10.9	23.7	0.5	0.5	5.3	19.1	7.1	29.2
45	p-Xylene	16.7	13.9	63.0	29.5	11.5	23.7	0.5	0.5	5.3	19.1	7.1	29.2
46	Styrene	23.4	25.3	33.7	40.7	9.4	36.4	0.5	0.4	5.0	18.2	12.9	61.6
47	o-Xylene	12.5	10.1	35.3	24.8	8.5	19.6	0.4	0.4	4.7	15.0	5.8	23.5
48	Isopropylbenzene	0.8	0.8	1.9	0.7	0.4	0.8	0.0	0.0	0.2	0.8	0.4	2.0
49	n-Propylbenzene	1.8	1.4	2.6	2.0	0.2	1.0	0.0	0.0	0.7	2.7	0.5	1.0
50	m-Ethyltoluene	3.3	1.4	7.2	4.9	0.9	4.7	0.1	0.1	1.0	3.6	0.7	3.5
51	p-Ethyltoluene	3.0	1.4	7.6	4.5	0.6	2.6	0.0	0.0	1.0	2.8	0.8	2.0
52	1,3,5-Trimethylbenzene	2.0	1.2	4.9	3.4	0.8	3.3	0.1	0.1	0.8	2.3	0.7	2.3
53	o-Ethyltoluene	2.3	1.4	8.3	5.4	1.0	5.5	0.1	0.1	1.0	3.1	1.1	3.7
54	1,2,4-Trimethylbenzene	5.0	2.6	20.0	15.4	2.5	12.9	0.2	0.2	3.4	10.6	2.7	9.3
55	1,2,3-Trimethylbenzene	1.4	0.7	10.5	9.6	0.8	2.9	0.2	0.1	2.0	5.7	1.6	5.2
56	m-Diethylbenzene	0.4	0.3	4.5	13.6	0.2	1.3	0.1	0.1	0.8	3.1	2.2	1.9

57	p-Diethylbenzene	0.0	0.1	3.3	2.8	0.3	0.9	0.1	0.1	0.7	2.6	0.8	2.8
58	4-Ethyltoluene	6.6	4.2	27.3	13.1	3.4	12.9	0.5	0.4	3.6	2.1	7.1	13.5
59	Naphthalene	19.2	10.5	107.7	145.6	7.5	23.3	2.9	3.1	90.7	47.0	38.1	276
60	Acrolein	171	110	50.5	117	95.9	93.8	0.6	0.3	3.3	1.9	47.1	227
61	Acetone	352	247	167	254	385	249	2.0	0.9	32.9	8.5	95.7	235
62	Methyl ethyl ketone	180	152	32.0	78.6	194	152	2.8	1.4	9.1	6.3	45.1	158
63	Methyl Isobutyl Ketone	1.2	1.4	0.5	0.3	0.0	4.3	0.1	0.0	0.4	0.3	0.8	2.9
64	Methyl butyl ketone	8.3	5.9	8.8	2.6	4.3	26.2	0.5	0.3	2.1	2.0	7.3	16.0
65	Ethanol	0.0	0.0	7.3	103.0	18.6	91.7	6.0	1.6	29.8	18.8	57.4	28.8
66	Isopropyl Alcohol	0.7	0.5	1.5	1.9	1.7	7.2	0.3	0.1	0.9	0.9	3.9	3.9
67	Methyl tert-butyl ether	1.6	1.1	2.8	4.4	2.6	10.8	0.9	0.4	3.1	2.2	9.7	8.6
68	Ethyl Acetate	3.0	2.5	6.4	9.1	3.9	15.1	1.7	1.1	6.4	4.5	15.4	18.4
69	Methyl Methacrylate	2.2	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4
70	Freon-12	1.4	0.8	0.0	0.0	0.3	3.1	0.0	0.0	0.0	0.0	0.0	0.0
71	Chloromethane	6.6	9.8	8.5	11.0	43.9	99.7	0.0	0.0	0.0	0.0	35.2	36.6
72	Freon-114	0.2	0.1	0.5	0.6	0.3	1.3	0.1	0.0	0.4	0.3	0.9	0.8
73	Vinyl chloride	0.5	0.6	0.7	0.9	0.7	2.8	0.1	0.1	0.4	0.4	1.5	2.0
74	Bromomethane	3.5	2.3	5.5	7.2	6.2	25.3	1.0	0.5	3.4	3.2	14.8	14.0
75	Freon-11	2.4	1.7	5.4	6.7	4.3	18.9	0.9	0.6	5.3	3.9	10.8	9.5
76	1,1-Dichloroethene	1.7	1.3	3.2	4.0	3.9	15.5	0.6	0.3	2.0	2.0	8.4	8.4
77	Methylene Chloride	1.1	0.9	3.7	2.4	0.6	4.0	0.0	0.0	1.9	0.0	0.0	0.0
78	Freon-113	0.5	0.4	1.5	1.7	0.4	1.9	0.2	0.1	1.6	1.1	1.9	2.0
79	trans-1,2-Dichloroethene	0.6	0.6	0.8	0.9	0.9	3.6	0.1	0.1	0.5	0.5	2.0	2.0
80	1,1-Dichloroethane	0.0	0.0	0.6	0.6	0.0	0.0	0.3	0.1	1.0	0.5	0.0	0.0
81	cis-1,2-Dichloroethene	2.8	2.2	3.3	4.1	4.5	16.0	0.6	0.5	2.1	2.1	8.7	8.7
82	Chloroform	1.8	1.7	1.6	2.9	0.7	0.6	0.5	0.3	2.1	0.9	3.9	4.8
83	1,2-Dichloroethane	0.3	0.7	2.1	2.6	0.0	0.0	0.4	0.4	4.7	1.6	1.8	3.8
84	1,1,1-Trichloroethane	0.1	0.0	0.1	0.2	0.1	0.6	0.0	0.0	0.1	0.1	0.3	0.3
85	Carbon Tetrachloride	0.5	0.4	1.0	1.6	0.6	2.2	0.2	0.1	1.4	1.0	2.2	2.4
86	1,2-Dichloropropane	0.0	0.0	1.8	2.9	0.0	0.0	0.3	0.3	5.1	2.1	1.2	3.1

87	Trichloroethene	1.9	1.4	4.0	4.9	4.1	17.1	0.7	0.4	2.7	2.4	9.7	10.5
88	cis-1,3-Dichloropropene	0.0	0.0	0.1	0.1	0.1	0.4	0.0	0.0	0.1	0.1	0.2	0.2
89	1,1,2-Trichloroethane	8.3	5.9	8.8	7.9	4.3	26.2	0.5	0.3	2.1	2.0	7.3	16.0
90	1,1,2,2-Tetrachloroethane	0.5	1.9	1.3	1.1	0.5	2.5	0.1	0.0	0.6	0.4	1.0	0.9
91	Benzyl Chloride	0.3	0.2	0.5	0.5	0.5	2.1	0.0	0.0	0.0	0.0	1.0	1.0
92	1,3-Dichlorobenzene	3.3	2.4	19.3	18.0	7.5	31.3	1.9	1.3	9.8	7.9	24.2	45.9
93	1,4-Dichlorobenzene	5.3	3.5	23.7	28.1	4.8	19.5	2.5	2.0	15.9	15.0	27.1	136.4
94	1,2-Dichlorobenzene	1.9	1.3	4.3	5.4	4.0	16.9	0.7	0.4	2.7	2.8	9.2	11.9
95	Acetylene	6.8	3.3	0.0	0.3	5.8	48.6	0.0	0.0	0.0	0.0	0.4	11.4
96	Carbon disulfide	0.5	0.4	3.0	2.7	0.7	1.6	0.2	0.0	3.6	0.3	6.1	1.1
97	Tetrahydrofuran	21.4	12.1	2.5	1.5	8.3	1.8	0.3	0.0	3.2	1.7	2.7	4.9
98	1,4-Dioxane	0.5	0.4	1.3	1.3	0.9	3.9	0.1	0.1	10.6	0.8	2.1	2.6

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34 **Table S6** Coefficient of divergence among VOCs profiles emitted from solid fuel burning*

	Firewood -HK	Branch -HK	Firewood -SG	Branch -SG	Corn straw -HK	Wheat straw-HK	Anthracite -CS	Honeycomb -CS	Anthracite -SG	Bitumite -SG	Branch - -TS	Corn hub -TS
Firewood-HK	0											
Branch-HK	0.23	0										
Firewood-SG	0.55	0.58	0									
Branch-SG	0.53	0.55	0.35	0								
Corn straw-HK	0.70	0.66	0.78	0.76	0							
Wheat straw-HK	0.71	0.68	0.81	0.80	0.52	0						
Anthracite-CS	0.81	0.79	0.86	0.86	0.61	0.61	0					
Honeycomb-CS	0.85	0.83	0.90	0.90	0.66	0.65	0.32	0				
Anthracite-SG	0.63	0.63	0.61	0.58	0.67	0.67	0.72	0.80	0			
Bitumite-SG	0.57	0.59	0.47	0.46	0.72	0.75	0.77	0.84	0.46	0		
Branch-TS	0.57	0.57	0.53	0.48	0.71	0.75	0.84	0.88	0.47	0.52	0	
Corn hub-TS	0.54	0.57	0.49	0.44	0.81	0.84	0.89	0.92	0.63	0.56	0.45	0

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$$CD_{jk} = \sqrt{\frac{1}{p} \sum_{i=1}^p \left(\frac{x_{ij} - x_{ik}}{x_{ij} + x_{ik}} \right)^2}$$

37 where, x_{ij} represents the average concentration for a chemical component i at site j , j and k represent two samples, and p is the number of
 38 chemical components
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41 **Table S7** Proximate Analysis results of solid fuel used in this study

Fuel type	Moisture, %	Ash, %	Volatile Matters, VM%	Fixed Carbon, %	Calorific value, MJ·kg ⁻¹
Firewood	4.39	2.15	82.96	10.51	19.03
Branch	4.37	2.72	79.66	13.25	17.92
Wheat straw	4.39	8.90	67.36	19.32	18.52
Maize straw	6.10	4.70	76.00	13.20	17.73
Corn cob	4.87	5.93	71.95	17.25	17.72
Anthracite	0.88	9.72	6.12	83.28	29.68
Honeycomb briquette	3.00	32.34	4.99	59.67	20.37
Bitumite	7.98	7.98	33.20	50.84	22.02

42 *Proximate Analysis Was Conducted by the Analytical Center of Chinese Academy of Guangzhou Institute of Energy Conversion

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44 **Table S8** Parameters in evaluation of O₃ contribution from solid fuel burning in Guanzhong Plain

Box model – Atmospheric capacity parameters				Emission rate of OFP			
Dimensions	300km in length ^a	100 km in width ^a	516.2m in height ^b	Biomass fuels consumed	1.59E9 kg ^f	Coal used	2.50E9 kg ^f
Atmospheric volume of Guanzhong Plain	1.55E13 m ³ ^c			EFs of OFP	4.51 g·kg ⁻¹ ^g	EFs of OFP	0.62 g·kg ⁻¹ ^h
				Heating periods	100 days ⁱ		
O ₃ concentration	28.8 µg·m ⁻³ ^d			OFP emission rate	7.17E4 kg·day ⁻¹ ^j	OFP emission rate	1.55E4 kg·day ⁻¹ ^j
O ₃ atmospheric capacity	4.46E5 kg ^e			Total OFP emission rate	8.72E4 kg·day ⁻¹ ^k		

45 a Sun, Shen et al. (2017)

46 b [http://apps.ecmwf.int/datasets/data/interim-full-daily/levtype=sfc/ boundary layer](http://apps.ecmwf.int/datasets/data/interim-full-daily/levtype=sfc/boundary%20layer)

47 c Expressed as volume = length * width * height

48 d <http://www.zhb.gov.cn/hjzl/dqhj/cskqzlzkyb/>, average O₃ concentration in winter of 2013

49 e Expressed as Atmospheric capacity = [O₃] * Atmospheric volume

50 f Shaanxi Province Statistical Yearbook 2013

51 g Average OFP value of biomass fuels heating burning in this study

52 h Account as bitumite only, use OFP of bitumite-SG in this study

53 i Sun, Shen et al. (2017)

54 j Expressed as OFP emission rate = Total fuels consumed * EFs of OFP / Heating period (unit: kg·day⁻¹)

55 k Expressed as Total OFP emission rate = OFP emission rate (biomass) + OFP emission rate (coal)

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57 **Table S9** Parameters in evaluation of SOA contribution from solid fuel burning in Guanzhong Plain

Box model – Atmospheric capacity parameters				Emission rate of SOAP			
Dimensions	300km in length ^a	100 km in width ^a	516.2m in height ^b	Biomass fuels consumed	1.59E9 kg ^g	Coal used	2.50E9 kg ^g
Atmospheric volume of Guanzhong Plain	1.55E13 m ³ ^c			EFs of SOAP	24.33 mg·kg ⁻¹ ^h	EFs of SOAP	16.40 mg·kg ⁻¹ ⁱ
				Heating periods	100 days ^j		
PM _{2.5} concentration	142.6 µg·m ⁻³ ^d	SOA fraction	15.5% ^e	SOAP emission rate	387 kg·day ⁻¹ ^k	SOAP emission rate	410kg·day ⁻¹ ^k
SOA atmospheric capacity	3.42E5 kg ^f			Total SOAP emission rate	797 kg·day ⁻¹ ^m		

58 a Sun et al., 2017

59 b <http://apps.ecmwf.int/datasets/data/interim-full-daily/levtype=sfc/> boundary layer

60 c Expressed as volume = length * width * height

61 d <http://www.zhb.gov.cn/hjzl/dqhj/cskqzlkzyb/>, average O₃ concentration in winter of 2013

62 e Huang et al. (2014)

63 f Expressed as Atmospheric capacity = [PM_{2.5}] * Atmospheric volume

64 g Shaanxi Province Statistical Yearbook 2013

65 h Average SOAP value of biomass fuels heating burning in this study

66 i Account as bitumite only, use SOAP of bitumite-SG in this study

67 j Sun et al., 2017

68 k Expressed as SOAP emission rate = Total fuels consumed * EFs of SOAP / Heating period (unit: kg·day⁻¹)

69 m Expressed as Total SOAP emission rate = SOAP emission rate (biomass) + SOAP emission rate (coal)

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