Supplementary information to:

Non methane hydrocarbon (NMHC) fingerprints of major urban and agricultural emission sources active in South Asia for use in source apportionment studies

Ashish Kumar[1], Vinayak Sinha[1*], Muhammed Shabin[1], Haseeb Hakkim[1], Bernard Bonsang[2] and Valerie Gros[2]

[1] Department of Earth and Environmental Sciences, Indian Institute of Science Education and Research Mohali, Sector 81, S.A.S Nagar, Manauli PO, Punjab, 140306, India.

[2] LSCE, Laboratoire des Sciences du Climat et de l'Environnement, CNRS-CEA-UVSQ, IPSL, Université Paris Saclay, Orme des Merisiers, F91191 Gif-sur-Yvette, France.

Correspondence to: Dr. Vinayak Sinha (vsinha@iisermohali.ac.in)

Figure S1: Whole air sample collection from **a)** paddy stubble fire: flaming; **b)** paddy stubble fire: smouldering; **c)** garbage fire: flaming; and **d)** garbage fire: smouldering. The flaming and smouldering fires were distinguished based upon the presence of flame and white smoke as per past experiences (Chandra et al 2017, Kumar et al., 2018).

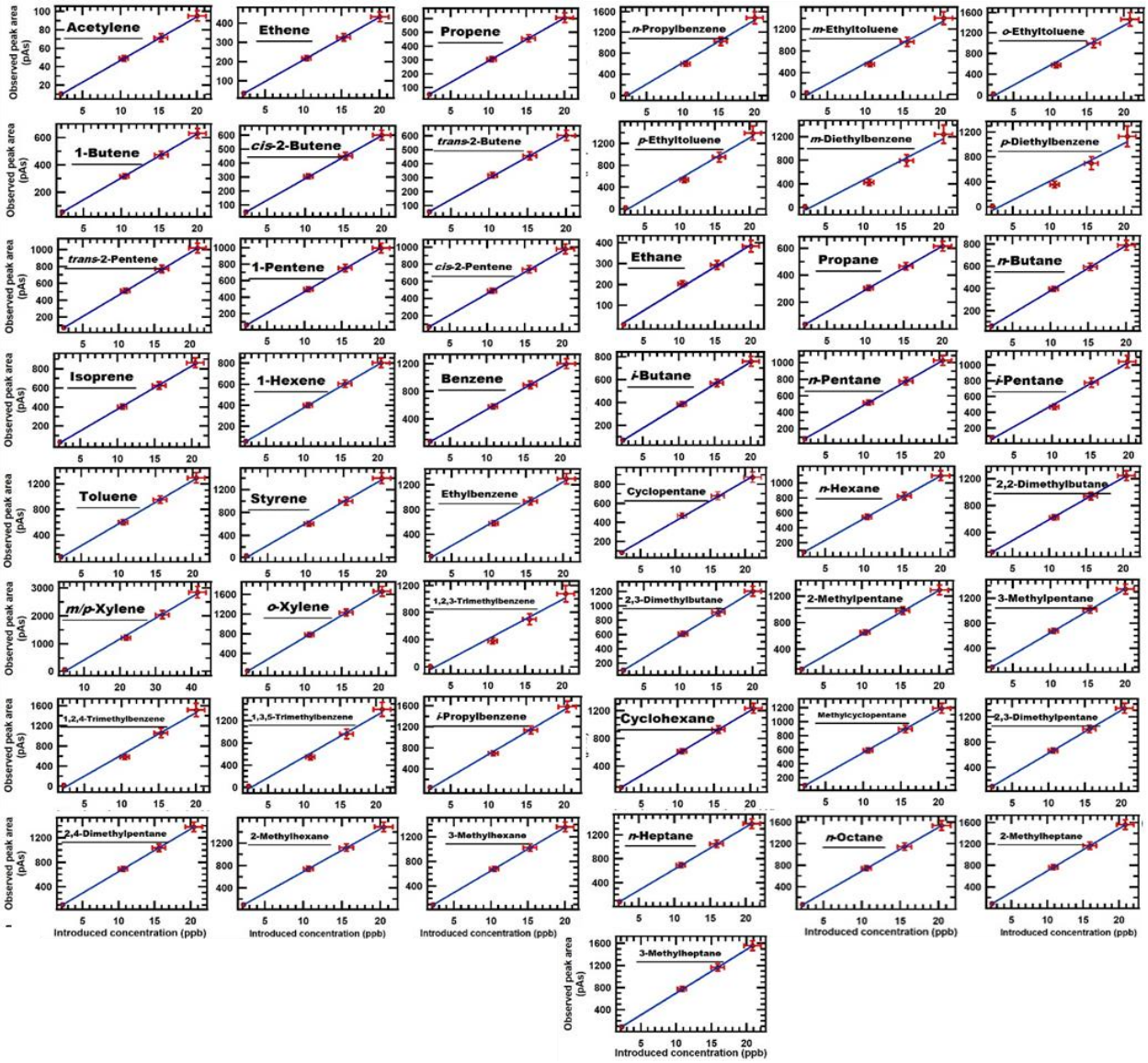
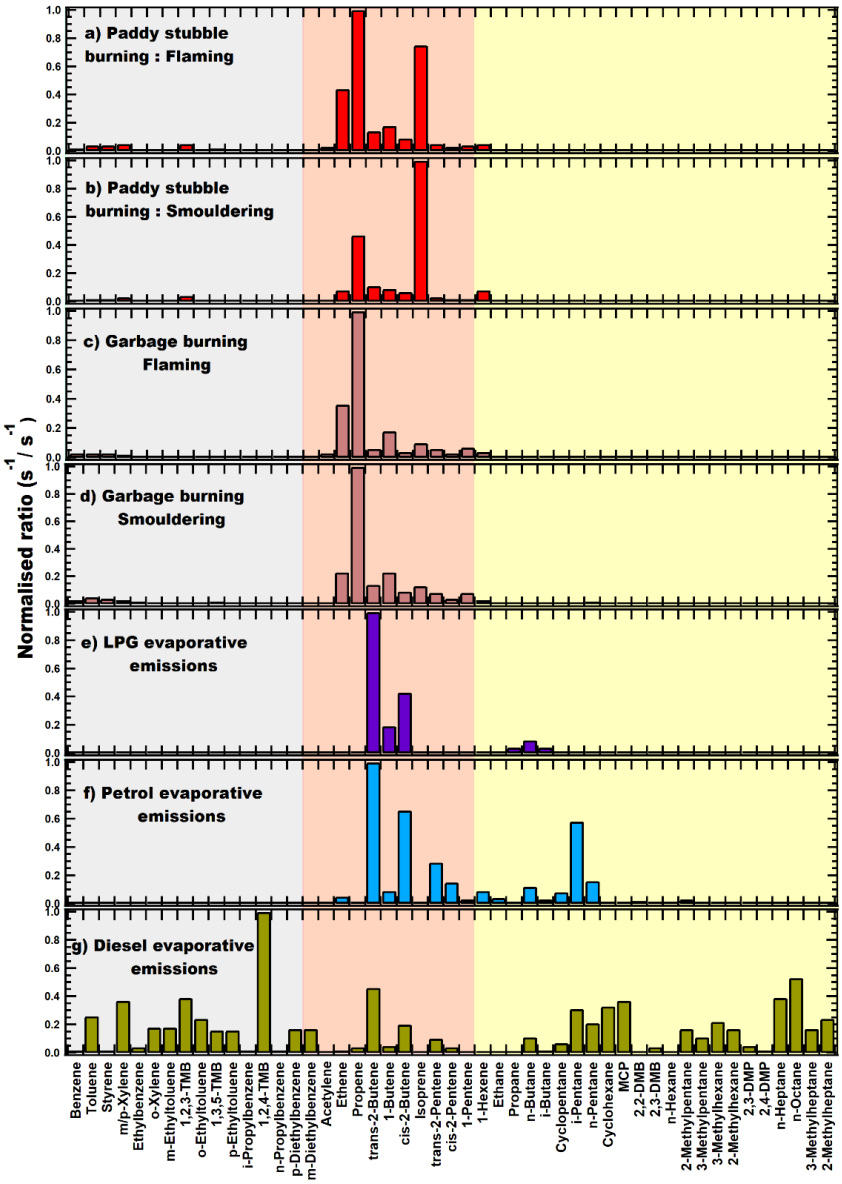


Figure S2: Sensitivity and linearity of VOCs in the calibration experiment (TD-GC-FID). Via dynamic dilution with zero air at four different mixing ratios (in the range of 2–20 ppb) using a standard gas calibration unit (GCU-s v2.1, Ionimed Analytik, Innsbruck, Austria). The horizontal error bars represent the root mean square propagation of errors due 5 % uncertainty in the VOC standard and 2% error for each of the two mass flow controllers used for calibration. The vertical error bars represent the uncertainty in instrumental measurements while sampling the standard gas at each dilution mixing ratio.

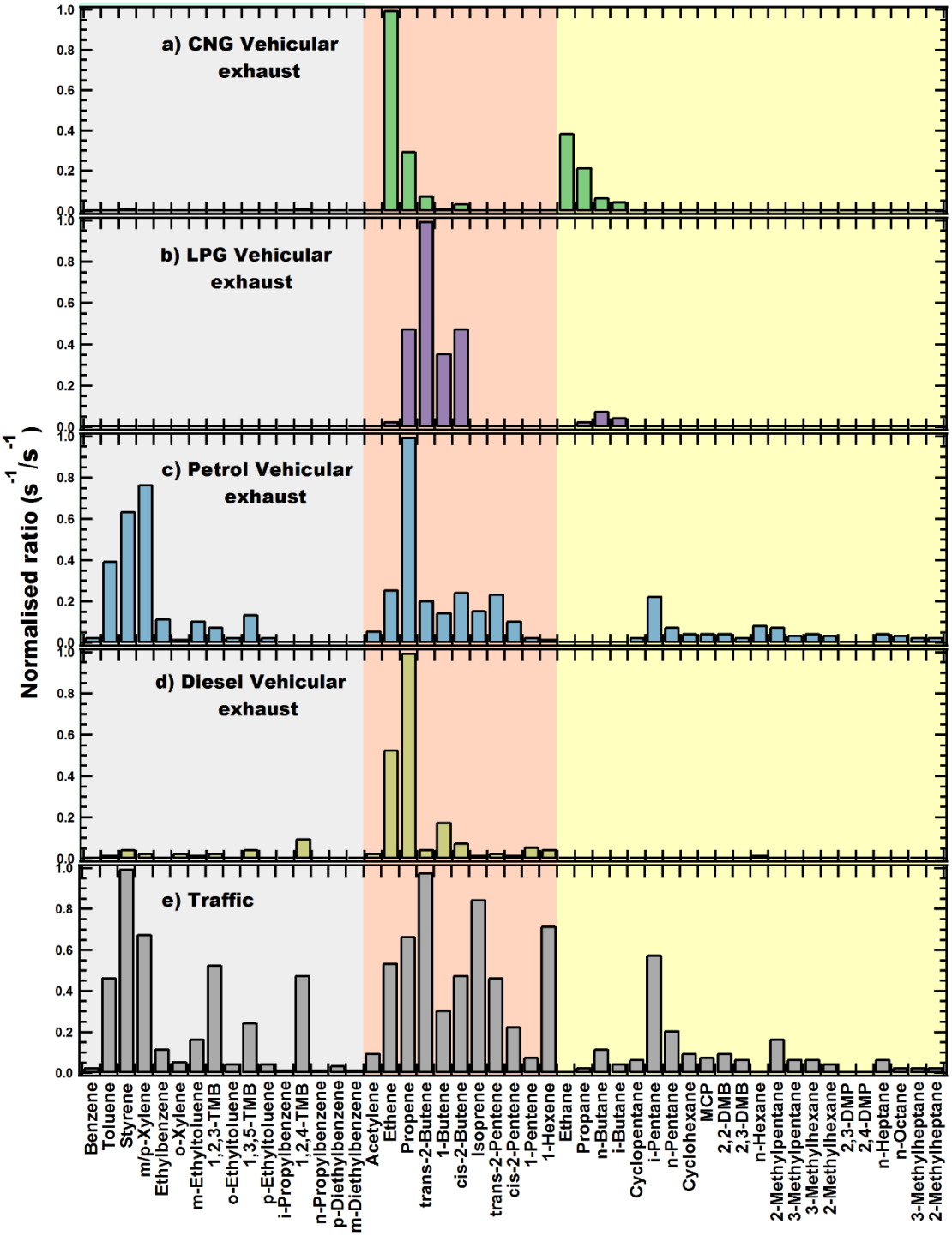


TMB: Trimethylbenzene; DMB: Dimethylbutane; DMP: Dimethylpentane; MCP: Methylcyclopentane

Figure S4: Normalized profiles of calculated OH reactivity (s^{-1}) in **a)** Paddy stubble burning: Flaming; **b)** Paddy stubble burning: Smouldering; **c)** Garbage burning: Flaming; **d)** Garbage burning: Smouldering; **e)** LPG evaporative emissions; **f)** Petrol evaporative emissions; **g)** Diesel evaporative emissions. The OH reactivities of the NMHCs are normalized to the NMHC with the maximum OH reactivity in the respective source sample as:

$$f = [Y_i]/[Y_{max}]$$

Where, $[Y_i]$ is the NMHC OH reactivity and $[Y_{max}]$ is the NMHC with the maximum OH reactivity in the respective source sample.



TMB: Trimethylbenzene; DMB: Dimethylbutane; DMP: Dimethylpentane; MCP: Methylcyclopentane

Figure S5: Normalized profiles of calculated OH reactivity (s^{-1}) in **a)** CNG vehicular exhaust; **b)** LPG vehicular exhaust; **c)** Petrol vehicular exhaust; **d)** Diesel vehicular exhaust; **e)** Traffic, derived from the TD-GC-FID measurements.

Table S1. Parameters for the GC oven temperature ramp program and FIDs (Flame ionization detectors).

Parameter	Value
Initial temp	30 ºC
Initial hold time	12 min
Rate 1	5 ºC/min
Final temperature 1	170 ºC
Hold time 1	1 min
Rate 2	15 ºC/min
Final temperature 2	200 ºC
Hold time 2	1 min
Total Run time	44 min
FID Temperature	250 ºC
FID Air flow	400 mL/min
FID H_2 fuel flow	40 mL/min
FID N_2 makeup flow	20 mL/min

Table S2: Details of VOC gas standards used in calibration experiments. Mixing ratios reported here are in ppm.
VOC Standard 1: Chemtron Science Laboratories Pvt. Ltd., Navi Mumbai, India.
VOC Standard 2: Apel Riemer Environmental. Inc., Colorado, USA.
Stated accuracy for both the gas standards was 5%.

Compounds	**Mixing ratios in VOC Standard 1**	**Mixing ratios in VOC Standard 2**	**Compounds**	**Mixing ratios in VOC Standard 1**	**Mixing ratios in VOC Standard 2**
Benzene	1.03	0.49	*o*-Xylene	1.01	
Cyclohexane	1.01		*m/p*-Xylene	2.06	
m-Diethylbenzene	1.02		Acetylene	0.99	
p-Diethylbenzene	1.01		*n*-Butane	0.99	
2,3-Dimethylpentane	1.01		1-Butene	0.99	
2,4-Dimethylpentane	1.01		*cis*-2-Butene	0.99	
Ethylbenzene	1.01		*trans*-2-Butene	0.99	
m-Ethyltoluene	1.01		Cyclopentane	1.04	
o-Ethyltoluene	1.03		2,2-Dimethylbutane	1.01	
p-Ethyltoluene	1.01		2,3-Dimethylbutane	0.99	
n-Heptane	1.03		Ethane	0.99	
i-Propylbenzene	1.01		Ethene	0.99	
Methylcyclopentane	1.01		*n*-Hexane	0.99	
2-Methylheptane	1.03		*i*-Butane	0.99	
3-Methylheptane	1.03		i-Pentane	0.98	
2-Methylhexane	1.01		1-Hexene	1.01	
3-Methylhexane	0.99		2-Methylpentane	0.99	
n-Octane	1.01		3-Methylpentane	0.99	
n-Propylbenzene	0.99		*n*-Pentane	1.01	
Styrene	0.99		*cis*-2-Pentene	1.01	
Toluene	1.01	0.47	*trans*-2-Pentene	1.04	
1,2,3-Trimethylbenzene	1.01		Propane	0.99	
1,2,4-Trimethylbenzene	0.99		Propene	0.99	
1,3,5-Trimethylbenzene	1.03		Isoprene	1.01	0.48

Table S3: Average sensitivity factors (pAs/ppb) and standard deviation (pAs/ppb) for 49 NMHCs obtained from thirteen calibration experiments performed between December 2016 and October 2018 using the calibration standard 1 (Chemtron Science Laboratories Pvt. Ltd., Navi Mumbai, India).

5

Compounds	Average sensitivity (pAs/ppb)	Standard deviation (pAs/ppb)	Compounds	Average sensitivity (pAs/ppb)	Standard deviation (pAs/ppb)
Acetylene	5.2	0.9	3-Methylpentane	81.4	7.7
Ethane	20.7	1.9	2,3-Dimethylpentane	74.4	6.8
Ethene	24.8	2.6	2,4-Dimethylpentane	79.2	6.6
Propane	35.9	3.2	*n*-Heptane	77.3	6.9
Propene	35.8	3.4	2-Methylhexane	86.5	7.3
n-Butane	46.4	4.5	3-Methylhexane	78.8	6.8
1-Butene	41.4	5.1	Toluene	74.6	6.6
cis-2-Butene	40.3	4.8	Ethylbenzene	74.8	7.3
trans-2-Butene	40.1	5.0	2-Methylheptane	85.7	7.4
i-Butane	45.3	4.4	3-Methylheptane	86.3	8.2
Cyclopentane	51.5	4.5	*n*-Octane	86.1	8.5
i-Pentane	56.4	5.4	Styrene	81.2	8.2
n-Pentane	58.4	5.5	*o*-Xylene	91.8	9.6
1-Pentene	57.8	5.1	*m/p*-Xylene	79.8	8.3
cis-2-Pentene	56.4	5.3	*m*-Ethyltoluene	79.2	9.3
trans-2-Pentene	56.6	5.3	*o*-Ethyltoluene	80.1	9.5
Isoprene	53.2	4.9	*p*-Ethyltoluene	79.3	9.6
Benzene	67.8	5.6	*i*-Propylbenzene	90.5	9.2
Cyclohexane	71.0	5.5	*n*-Propylbenzene	85.0	9.4
Methylcyclopentane	68.9	5.6	1,2,3-TMB	58.7	8.0
2,2-Dimethylbutane	70.6	6.6	1,2,4-TMB	78.8	10.6
2,3-Dimethylbutane	70.9	6.7	1,3,5-TMB	76.6	9.3
n-Hexane	62.4	6.1	*m*-Diethylbenzene	68.6	9.7
1-Hexene	45.9	4.1	*p*-Diethylbenzene	63.5	10.0

TMB: Trimethylbenzene