

**Table S1:** On-road emission factors and molar fractions of the individual compounds lumped in the new lumped IVOC species.

<b>Lumped Species</b>	<b>N° Carbons</b>	<b>Compound</b>	<b>EFs for diesel vehicles (mg / kg<sub>fuel</sub>)</b>	<b>EFs for gasoline vehicles (mg / kg<sub>fuel</sub>)</b>	<b>Molar fraction</b>
<b>ALK6</b>	12	Dodecane	9.8	0.6	0.02
	13	Tridecane	10.3	0.4	0.02
	14	Tetradecane	6.0	0.2	0.01
	14	2,6,10-Trimethylundecane	6.1	0.2	0.01
	12	Hexylcyclohexane	1.5	0.0	<0.01
		Unspeciated b-alkanes B12	34.0	8.9	0.10
		Unspeciated b-alkanes B13	28.5	3.9	0.07
		Unspeciated b-alkanes B14	18.2	2.1	0.04
		Unspeciated cyclic alkanes B12	124.2	0	0.22
		Unspeciated cyclic alkanes B13	168.2	0	0.30
	Unspeciated cyclic alkanes B14	119.3	0	0.21	
<b>ALK7</b>	15	Pentadecane	5.5	0.1	0.02
	16	Hexadecane	4.3	0.1	0.01
	17	Heptadecane	3.4	<0.01	0.01
	15	2,6,10-Trimethyldodecane	3.0	0.1	0.01
	16	2,6,10-Trimethyltridecane	1.9	<0.01	0.01
	13	Heptylcyclohexane	1.3	<0.01	<0.01
	14	Octylcyclohexane	0.7	<0.01	<0.01
	15	Nonylcyclohexane	0.7	<0.01	<0.01
		Unspeciated b-alkanes B15	16.3	1.1	0.05
		Unspeciated b-alkanes B16	15.9	0.8	0.05
		Unspeciated b-alkanes B17	9.0	0.6	0.03
		Unspeciated cyclic alkanes B15	107.4	0	0.31
		Unspeciated cyclic alkanes B16	93.8	0	0.27
	Unspeciated cyclic alkanes B17	72.7	2.1	0.22	
<b>ALK8</b>	18	Octadecane	3.4	0.1	0.02
	19	Nonadecane	2.0	<0.01	0.01
	20	Eicosane	1.3	<0.01	0.01
	18	2,6,10-Trimethylpentadecane	2.3	<0.01	0.01
	19	Pristane	3.1	<0.01	0.01
	20	Phytane	2.1	<0.01	0.01
	16	Decylcyclohexane	0.4	<0.01	<0.01
	17	Undecylcyclohexane	0.3	<0.01	<0.01
	18	Dodecylcyclohexane	0.3	<0.01	<0.01
		Unspeciated b-alkanes B18	11.7	0.5	0.06
		Unspeciated b-alkanes B19	8.3	0.4	0.04
		Unspeciated b-alkanes B20	5.6	0.4	0.03
		Unspeciated cyclic alkanes B18	73.9	2.1	0.37
		Unspeciated cyclic alkanes B19	50.7	1.6	0.25
	Unspeciated cyclic alkanes B20	33.0	1.5	0.17	

<b>ALK9</b>	21	Heneicosane	0.7	<0.01	0.02
	22	Docosane	0.5	0.1	0.01
	19	Tridecylcyclohexane	0.2	<0.01	<0.01
	20	Tetradecylcyclohexane	0.1	<0.01	0.01
	21	Pentadecylcyclohexane	0.0	<0.01	<0.01
	22	Hexadecylcyclohexane	0.0	<0.01	<0.01
	23	Heptadecylcyclohexane	0.0	<0.01	<0.01
		Unspeciated b-alkanes B21	3.4	0.3	0.08
		Unspeciated b-alkanes B22	2.6	0.4	0.07
		Unspeciated cyclic alkanes B21	19.2	1.2	0.44
	Unspeciated cyclic alkanes B22	14.9	1.2	0.36	
<b>ARO3</b>	11	Pentylbenzene	0.5	0.2	0.25
	12	Hexylbenzene	0.4	0.1	0.15
	13	Heptylbenzene	0.5	<0.01	0.13
	14	Octylbenzene	0.2	<0.01	0.06
	15	Nonylbenzene	0.1	<0.01	0.03
	16	Decylbenzene	0.1	<0.01	0.20
	17	Undecylbenzene	0.1	<0.01	0.16
	18	Dodecylbenzene	<0.01	<0.01	0.01
	19	Tridecylbenzene	<0.01	<0.01	0.01
	20	Tetradecylbenzene	<0.01	<0.01	<0.01
	22	Pentadecylbenzene	<0.01	<0.01	<0.01
<b>PAH1</b>	10	Naphthalene	4.0	8.5	0.10
	11	2-methylnaphthalene	5.0	3.2	0.05
	11	1-methylnaphthalene	2.8	1.6	0.03
	12	C2-naphthalene	7.7	1.8	0.05
	13	Fluorene	0.2	0.1	<0.01
	14	Phenanthrene	0.4	0.3	<0.01
	15	C1-Phenanthrene	0.3	0.1	<0.01
	16	Fluoranthene	<0.01	0.1	<0.01
	16	Pyrene	0.1	0.1	<0.01
		Unspeciated aromatic compounds B12	0	44.7	0.46
	Unspeciated aromatic compounds B13	0	20.0	0.21	
	Unspeciated aromatic compounds B14	0	8.4	0.09	
<b>PAH2</b>	12	Acenaphthylene	0.2	0.4	0.05
	12	Acenaphthene	0.1	0.1	0.04
	13	C3-naphthalene	4.7	0.6	0.08
	13	C4-naphthalene	0.5	0.1	0.03
	14	C1-Fluorene	0.4	0.1	0.03
	14	Anthracene	<0.01	0.1	0.01
	16	C2-Phenanthrene/anthracene	0.2	0.1	0.01
17	C1-Fluoranthene/pyrene	<0.01	0.1	0.01	

		Unspeciated aromatic compounds B15	0	4.3	0.42
		Unspeciated aromatic compounds B16	0	3.4	0.33

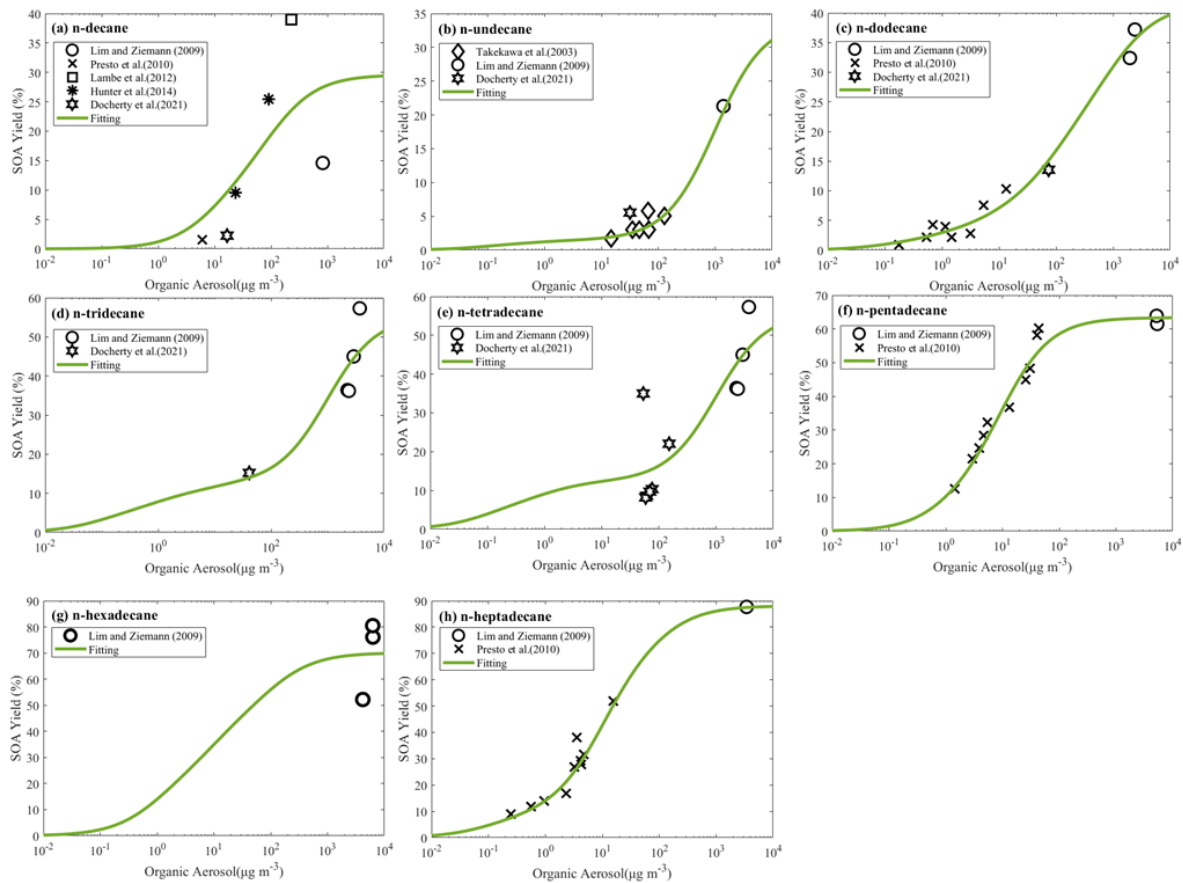
**Table S2:** The surrogate compounds assigned to the compounds with insufficient experimental yield data.

<b>Compound</b>	<b>Surrogate compound</b>
<i><b>Compounds lumped in ALK6</b></i>	
2,6,10-Trimethylundecane	n-undecane
Hexylcyclohexane	n-dodecane
Unspeciated b-alkanes B12	n-decane
Unspeciated b-alkanes B13	n-undecane
Unspeciated b-alkanes B14	n-dodecane
Unspeciated cyclic alkanes B12	n-dodecane
Unspeciated cyclic alkanes B13	n-tridecane
Unspeciated cyclic alkanes B14	n-tetradecane
<i><b>Compounds lumped in ALK7</b></i>	
2,6,10-Trimethyldodecane	n-dodecane
2,6,10-Trimethyltridecane	n-tridecane
Heptylcyclohexane	n-tridecane
Octylcyclohexane	n-tetradecane
Nonylcyclohexane	n-pentadecane
Unspeciated b-alkanes B15	n-tridecane
Unspeciated b-alkanes B16	n-tetradecane
Unspeciated b-alkanes B17	n-pentadecane
Unspeciated cyclic alkanes B15	n-pentadecane
Unspeciated cyclic alkanes B16	n-hexadecane
Unspeciated cyclic alkanes B17	n-heptadecane
<i><b>Compounds lumped in ALK8</b></i>	
Octadecane	n-heptadecane
Nonadecane	n-heptadecane
Eicosane	n-heptadecane
2,6,10-Trimethylpentadecane	n-pentadecane
Pristane	n-pentadecane
Phytane	n-hexadecane
Decylcyclohexane	n-hexadecane
Undecylcyclohexane	n-heptadecane
Dodecylcyclohexane	n-heptadecane
Unspeciated b-alkanes B18	n-heptadecane
Unspeciated b-alkanes B19	n-heptadecane
Unspeciated b-alkanes B20	n-heptadecane
Unspeciated cyclic alkanes B18	n-heptadecane
Unspeciated cyclic alkanes B19	n-heptadecane
Unspeciated cyclic alkanes B20	n-heptadecane
<i><b>Compounds lumped in ALK9</b></i>	
Heneicosane	n-heptadecane
Docosane	n-heptadecane
Tridecylcyclohexane	n-heptadecane
Tetradecylcyclohexane	n-heptadecane
Pentadecylcyclohexane	n-heptadecane
Hexadecylcyclohexane	n-heptadecane
Heptadecylcyclohexane	n-heptadecane
Unspeciated b-alkanes B21	n-heptadecane
Unspeciated b-alkanes B22	n-heptadecane
Unspeciated cyclic alkanes B21	n-heptadecane
Unspeciated cyclic alkanes B22	n-heptadecane

<b><i>Compounds lumped in PAH1</i></b>	
C2-naphthalene	2-methylnaphthalene
Fluorene	2-methylnaphthalene
Phenanthrene	2-methylnaphthalene
C1-Phenanthrene	2-methylnaphthalene
Fluoranthene	2-methylnaphthalene
Pyrene	2-methylnaphthalene
Unspeciated aromatic compounds B12	2-methylnaphthalene
Unspeciated aromatic compounds B13	2-methylnaphthalene
Unspeciated aromatic compounds B14	2-methylnaphthalene
<b><i>Compounds lumped in PAH2</i></b>	
Acenaphthylene	2-methylnaphthalene
Acenaphthene	2-methylnaphthalene
C3-naphthalene	2-methylnaphthalene
C4-naphthalene	2-methylnaphthalene
C1-Fluorene	2-methylnaphthalene
Anthracene	2-methylnaphthalene
C2-Phenanthrene/anthracene	2-methylnaphthalene
C1-Fluoranthene/pyrene	2-methylnaphthalene
Unspeciated aromatic compounds B15	2-methylnaphthalene
Unspeciated aromatic compounds B16	2-methylnaphthalene

**Table S3:** Estimated mass-based yields of the individual compounds.

<b>Speciated n-alkanes under high NO<sub>x</sub> conditions</b>	<b>Aerosol mass-based yields</b>				
	0.1 µg m <sup>-3</sup>	1 µg m <sup>-3</sup>	10 µg m <sup>-3</sup>	100 µg m <sup>-3</sup>	10 <sup>3</sup> µg m <sup>-3</sup>
n-decane (C <sub>10</sub> H <sub>22</sub> )	0	0	0.112	0.184	0
n-undecane (C <sub>11</sub> H <sub>24</sub> )	0.011	0.004	0	0	0.325
n-dodecane (C <sub>12</sub> H <sub>26</sub> )	0.014	0.022	0.043	0.153	0.183
n-tridecane (C <sub>13</sub> H <sub>28</sub> )	0.055	0.051	0.022	0	0.424
n-tetradecane (C <sub>14</sub> H <sub>30</sub> )	0.069	0.056	0	0	0.434
n-pentadecane (C <sub>15</sub> H <sub>32</sub> )	0	0.111	0.523	0	0
n-hexadecane (C <sub>16</sub> H <sub>34</sub> )	0	0.233	0.233	0.235	0
n-heptadecane (C <sub>17</sub> H <sub>36</sub> )	0.077	0.024	0.629	0.151	0
<b>Speciated PAH species</b>	<b>Aerosol mass-based yields</b>				
	0.1 µg m <sup>-3</sup>	1 µg m <sup>-3</sup>	10 µg m <sup>-3</sup>	100 µg m <sup>-3</sup>	10 <sup>3</sup> µg m <sup>-3</sup>
<b><i>High NO<sub>x</sub> conditions</i></b>					
naphthalene (C <sub>10</sub> H <sub>8</sub> )	0	0.02	0.35	0	0
1-methylnaphthalene (C <sub>11</sub> H <sub>10</sub> )	0	0	0.41	0.08	0.16
2-mehtylnaphthtalone (C <sub>11</sub> H <sub>10</sub> )	0	0.06	0.31	0.26	0.62
<b><i>Low NO<sub>x</sub> conditions</i></b>					
naphthalene (C <sub>10</sub> H <sub>8</sub> )	0	0.01	0.44	0	0
1-methylnaphthalene (C <sub>11</sub> H <sub>10</sub> )	0	0	0.63	0	0.07
2-mehtylnaphthtalone (C <sub>11</sub> H <sub>10</sub> )	0	0	0.46	0	0.05



**Figure S1:** Estimated SOA yields of linear alkanes with 10 to 17 carbons.