

Supplemental Information for:

On-Road Emission Rates of PAH and n-Alkane Compounds from Heavy-Duty

Diesel Vehicles

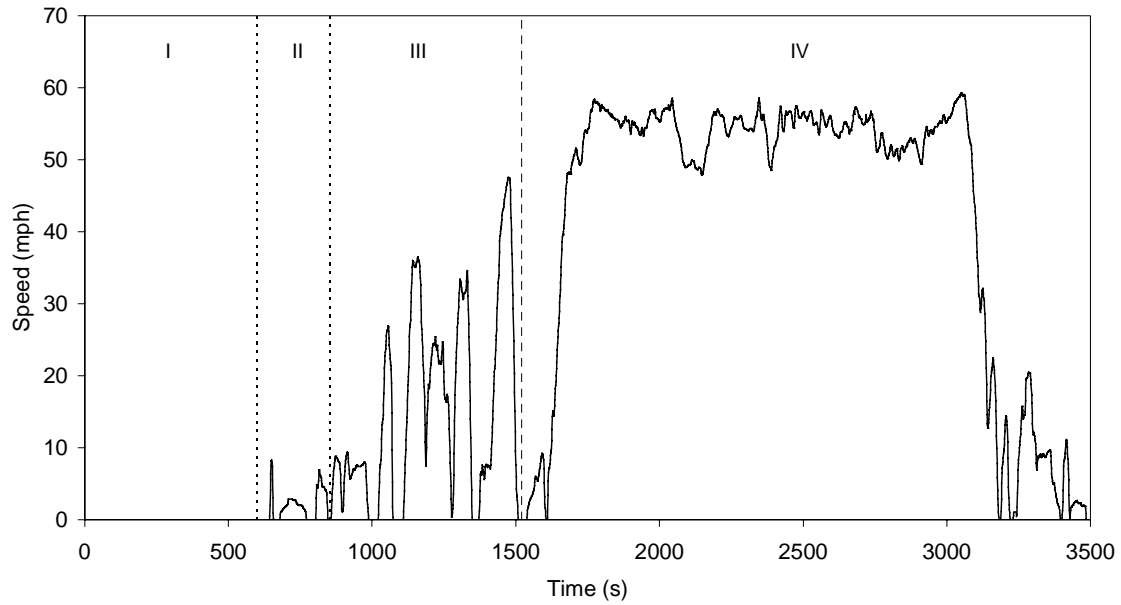


Figure S1: The ARB Four-Phase Cycle consists of Cold-Start/Idle (I), Creep (II), Transient (III) and Cruise (IV) Phases.

	Cold-Start/Idle (ng min ⁻¹)	Creep (ng mi ⁻¹)	Transient (ng mi ⁻¹)	Cruise (ng mi ⁻¹)
Naphthalene	0.627	24.0	13.2	1.92
Acenaphthylene	0.126	4.83	2.66	0.387
Acenaphthene	0.390	14.9	8.20	1.19
Fluorene	0.481	18.4	10.1	1.47
Phenanthrene	1.18	45.3	25.0	3.63
Anthracene	1.18	45.3	25.0	3.63
Fluoranthene	0.849	32.5	17.9	2.60
Pyrene	0.849	32.5	17.9	2.60
Benz(a)anthracene	0.558	21.3	11.7	1.70
Chrysene	0.558	21.3	11.7	1.70
Benzo(b)fluoranthene	0.345	13.2	7.27	1.05
Benzo(k)fluoranthene	0.345	13.2	7.27	1.05
Benzo(a)pyrene	0.454	17.3	9.54	1.39
Indeno[1,2,3-cd]pyrene	0.220	8.41	4.62	0.674
Dibenz[a,h]anthracene	0.220	8.41	4.62	0.674
Benzo[ghi]perylene	0.239	9.13	5.02	0.732
Tetradecane	19.9	761	419	61.0
Hexadecane	4.24	162	89.2	13.0
Octadecane	8.02	307	169	24.6
Nonadecane	16.5	631	348	50.6
Eicosane	16.5	631	348	50.6
Docosane	16.5	631	348	50.6
Tetracosane	8.22	314	173	25.2
Hexacosane	8.22	314	173	25.2
Octacosane	8.22	314	173	25.2
Triacontane	8.22	314	173	25.2
Hexatriacontane	8.22	314	173	25.2

Table S1: Lower detection limits for PAHs and n-alkanes during this test campaign.

	Cold-Start/Idle (ng min ⁻¹)	Creep (ng mi ⁻¹)	Transient (ng mi ⁻¹)	Cruise (ng mi ⁻¹)
Naphthalene	10200	505000	276000	20100
Acenaphthylene	53.1	1440	437	83.5
Acenaphthene	206	5480	2720	362
Fluorene	443	16700	11100	1630
Phenanthrene	1512	51800	39200	5090
Anthracene	500.	9870	4970	754
Fluoranthene	32.3	1140	1080	220
Pyrene	58.5	1830	1880	243
Benz(a)anthracene	1.27	32.2	23.7	2.96
Chrysene	1.60	38.9	35.1	3.79
Benzo(b)fluoranthene	1.15	21.4	7.49	1.54
Benzo(k)fluoranthene	0.66	17.3	7.22	1.99
Benzo(a)pyrene	1.34	28.9	5.25	1.87
Indeno[1,2,3-cd]pyrene	0.97	50.2	18.4	3.36
Dibenz[a,h]anthracene	1.02	72.5	20.2	4.08
Benzo[ghi]perylene	0.68	93.7	22.1	5.18
Tetradecane	2760	148000	58200	8740
Hexadecane	1840	87800	34600	5350
Octadecane	679	29500	13900	2150
Nonadecane	221	11100	5300	729
Eicosane	202	7990	3800	725
Docosane	83.3	3180	1550	277
Tetracosane	39.3	2070	854	138
Hexacosane	20.3	1430	502	79.2
Octacosane	19.9	1210	540.	91.4
Triacontane	17.3	851	418	76.8
Hexatriacontane	67.5	1860	1150	137

Table S2: Fleet averaged emission rates of individual organic species over the ARB Four Phase Cycle.

1996 DDC Series 60

	Idle ($\mu\text{g min}^{-1}$)	Creep ($\mu\text{g mi}^{-1}$)	Transient ($\mu\text{g mi}^{-1}$)	Cruise ($\mu\text{g mi}^{-1}$)
Naphthalene	34400 \pm 5600	2530000 \pm 995000	1370000 \pm 700000	181 \pm 6.57
Acenaphthylene	17.1 \pm 3.45	560 \pm 145	164 \pm 4.24	5.55 \pm 0.252
Acenaphthene	99.9 \pm 51.8	3370 \pm 972	1810 \pm 18.2	12.9 \pm 0.889
Fluorene	104 \pm 70.7	3540 \pm 1689	1810 \pm 126	5.79 \pm 0.668
Phenanthrene	22.0 \pm 11.6	584 \pm 140	248 \pm 54.6	31.4 \pm 0.490
Anthracene	29.6 \pm 12.7	623 \pm 363	245 \pm 155	2.63 \pm 0.199
Fluoranthene	4.16 \pm 0.659	104 \pm 25.0	53.2 \pm 18.4	7.77 \pm 1.60
Pyrene	6.95 \pm 3.11	184 \pm 70.5	81.1 \pm 7.73	18.8 \pm 6.49
Benz(a)anthracene	1.00 \pm 0.705	9.42 \pm 1.10	1.41 \pm 0.448	0.659 \pm 0.355
Chrysene	0.995 \pm 0.532	3.95 \pm 0.837	0.966 \pm 0.048	0.346 \pm 0.158
Benzo(b)fluoranthene	1.24 \pm 0.603	5.51 \pm 1.50	1.58 \pm 0.226	0.422 \pm 0.243
Benzo(k)fluoranthene	1.18 \pm 0.739	5.35 \pm 1.77	0.834 \pm 0.083	0.160 \pm 0.043
Benzo(a)pyrene	0.681 \pm 0.498	13.7 \pm 2.64	0.354 \pm 0.148	0.241 \pm 0.075
Indeno[1,2,3-cd]pyrene	0.977 \pm 0.409	1.95 \pm 0.301	BDL	0.247 \pm 0.117
Dibenz[a,h]anthracene	1.40 \pm 0.915	2.21 \pm 0.486	BDL	0.266 \pm 0.180
Benzo[ghi]perylene	0.267 \pm 0.087	2.54 \pm 0.056	BDL	BDL
Tetradecane	1750 \pm 876	208000 \pm 32400	98800 \pm 30400	418 \pm 32.2
Hexadecane	2520 \pm 1080	96400 \pm 26200	39800 \pm 4590	740 \pm 41.5
Octadecane	547 \pm 184	17700 \pm 5910	2540 \pm 642	659 \pm 12.2
Nonadecane	103 \pm 47.8	4240 \pm 1070	1890 \pm 112	452 \pm 0.896
Eicosane	94.4 \pm 44.9	3490 \pm 1196	1540 \pm 280	354 \pm 13.3
Docosane	98.3 \pm 26.6	3090 \pm 1380	2220 \pm 267	406 \pm 1.35
Tetracosane	64.9 \pm 4	3750 \pm 2457	2460 \pm 245	389 \pm 33.7
Hexacosane	50.9 \pm 0.498	3070 \pm 1897	1940 \pm 404	296 \pm 56.9
Octacosane	77.4 \pm 4.47	2980 \pm 1058	2550 \pm 549	426 \pm 96.4
Triacontane	51.3 \pm 3.91	1850 \pm 395	1720 \pm 468	339 \pm 54.5
Hexatriacontane	7.30 \pm 2.94	289 \pm 94.4	196 \pm 79.9	8.33 \pm 1.43

Table S3: PAH and n-alkane emission rates of individual vehicles. Uncertainty is the range of the measurements.

1997 DDC Series 60

	Idle ($\mu\text{g min}^{-1}$)	Creep ($\mu\text{g mi}^{-1}$)	Transient ($\mu\text{g mi}^{-1}$)	Cruise ($\mu\text{g mi}^{-1}$)
Naphthalene	556 \pm 80.0	18200 \pm 7690	10800 \pm 1390	1060 \pm 474
Acenaphthylene	18.0 \pm 0.565	1020 \pm 286	253 \pm 62.4	53.3 \pm 0.987
Acenaphthene	15.4 \pm 3.48	764 \pm 403	207 \pm 17.7	25.6 \pm 2.47
Fluorene	35.0 \pm 5.83	1710 \pm 549	676 \pm 376	63.3 \pm 7.45
Phenanthrene	50.7 \pm 11.2	2460 \pm 804	964 \pm 299	119 \pm 12.2
Anthracene	2.51 \pm 0.0975	117 \pm 22.6	69.9 \pm 40.3	7.17 \pm 0.409
Fluoranthene	6.37 \pm 1.69	188 \pm 87.8	130 \pm 43.5	16.5 \pm 3.44
Pyrene	14.0 \pm 4.60	400 \pm 162	276 \pm 123	35.4 \pm 11.0
Benz(a)anthracene	0.987 \pm 0.622	33.4 \pm 22.6	14.1 \pm 9.90	1.08 \pm 0.179
Chrysene	1.18 \pm 0.711	36.3 \pm 27.3	39.5 \pm 11.9	0.978 \pm 0.330
Benzo(b)fluoranthene	1.21 \pm 0.546	61.4 \pm 46.3	18.6 \pm 4.48	2.42 \pm 1.22
Benzo(k)fluoranthene	1.10 \pm 0.483	41.7 \pm 25.7	17.0 \pm 3.01	2.30 \pm 1.04
Benzo(a)pyrene	0.734 \pm 0.586	17.5 \pm 9.53	8.23 \pm 1.57	0.987 \pm 0.277
Indeno[1,2,3-cd]pyrene	2.46 \pm 0.732	174 \pm 74.4	44.1 \pm 19.0	7.33 \pm 4.52
Dibenz[a,h]anthracene	3.96 \pm 2.60	341 \pm 184	73.9 \pm 24.2	12.3 \pm 9.35
Benzo[ghi]perylene	4.84 \pm 2.49	463 \pm 195	90.2 \pm 28.2	13.7 \pm 10.7
Tetradecane	221 \pm 50.6	27500 \pm 12100	3990 \pm 721	1313 \pm 17.0
Hexadecane	310 \pm 103	40500 \pm 14500	6290 \pm 323	1893 \pm 51.4
Octadecane	297 \pm 83.3	21300 \pm 6360	4760 \pm 520	1113 \pm 67.5
Nonadecane	206 \pm 49.3	10600 \pm 3640	2600 \pm 359	607 \pm 25.6
Eicosane	148 \pm 26.9	7640 \pm 3440	2050 \pm 289	404 \pm 40.1
Docosane	69.1 \pm 21.2	4080 \pm 2160	2220 \pm 383	209 \pm 27.3
Tetracosane	36.1 \pm 3.81	1950 \pm 1160	1270 \pm 261	128 \pm 17.3
Hexacosane	17.5 \pm 5.59	1110 \pm 746	460 \pm 24.2	54.4 \pm 6.44
Octacosane	18.5 \pm 10.8	1880 \pm 562	275 \pm 55.1	36.5 \pm 3.58
Triacontane	17.8 \pm 9.36	2170 \pm 911	255 \pm 83.2	30.5 \pm 6.50
Hexatriacontane	101 \pm 24.3	1320 \pm 428	22.2 \pm 8.55	207 \pm 8.61

Table S3 (cont'd): PAH and n-alkane emission rates of individual vehicles.
Uncertainty is the range of the measurements.

1997 Cummins N14

	Idle ($\mu\text{g min}^{-1}$)	Creep ($\mu\text{g mi}^{-1}$)	Transient ($\mu\text{g mi}^{-1}$)	Cruise ($\mu\text{g mi}^{-1}$)
Naphthalene	435±117	33900±8950	18200 ± 1670	1230 ± 133
Acenaphthylene	4.22±1.42	1120±82.9	390 ± 91.7	14.8±5.00
Acenaphthene	4.39±1.69	1020±101	900 ± 303	12.3±1.92
Fluorene	5.70±2.21	951±377	1200 ± 646	288±135
Phenanthrene	5.87±1.96	11300±5110	7920 ± 814	67.2±35.1
Anthracene	3.98±1.30	431±163	188 ± 10.9	9.71 ± 6.79
Fluoranthene	1.23±0.16	1360±301	836 ± 52.0	17.1 ± 7.44
Pyrene	2.03±0.66	1650±752	1040 ± 108	62.0 ± 11.5
Benz(a)anthracene	0.319±0.124	39.6±11.3	8.98 ± 4.93	2.01 ± 0.405
Chrysene	0.275±0.102	47.9±13.6	9.72 ± 3.89	2.80 ± 1.15
Benzo(b)fluoranthene	0.405±0.211	34.0±17.5	3.14 ± 1.68	2.30 ± 1.10
Benzo(k)fluoranthene	0.189±0.128	43.4±18.6	5.43 ± 0.82	3.45 ± 0.942
Benzo(a)pyrene	0.619±0.068	57.2±24.8	7.17 ± 3.45	5.02 ± 1.12
Indeno[1,2,3-cd]pyrene	0.743±0.132	162±58.2	32.5 ± 11.6	18.2±9.81
Dibenz[a,h]anthracene	0.963±0.096	172±37.5	23.8 ± 11.5	19.1 ± 12.8
Benzo[ghi]perylene	BDL	207±64.8	19.7 ± 5.64	21.6 ± 15.6
Tetradecane	50.3±29.4	22100±15200	11100 ± 374	383 ± 145
Hexadecane	98.9±31.0	27500±11200	15100 ± 3190	490 ± 44.5
Octadecane	113±43.2	18200±7690	12500 ± 3300	401 ± 67.6
Nonadecane	93.4±42.7	12800±6710	8500 ± 2140	282 ± 74.3
Eicosane	68.6±24.6	8810±3230	4650 ± 1130	273 ± 41.6
Docosane	66.6±30.5	4140±1901	2090 ± 752	308 ± 62.0
Tetracosane	34.9±10.2	1430±601	784 ± 121	134 ± 25.8
Hexacosane	14.0±3.10	560±278	322 ± 43.3	44.7 ± 6.63
Octacosane	11.6±3.68	518±274	264 ± 33.3	29.6 ± 5.37
Triacosane	7.38±1.69	414±240	197 ± 18.9	30.7 ± 7.79
Hexatriacontane	7.75±2.19	452±162	18.7 ± 6.73	21.9 ± 3.06

Table S3 (cont'd): PAH and n-alkane emission rates of individual vehicles.
Uncertainty is the range of the measurements.

1998 DDC Series 60

	Idle ($\mu\text{g min}^{-1}$)	Creep ($\mu\text{g mi}^{-1}$)	Transient ($\mu\text{g mi}^{-1}$)	Cruise ($\mu\text{g mi}^{-1}$)
Naphthalene	1100 \pm 73.1	13600 \pm 7870	12300 \pm 2380	2060 \pm 607
Acenaphthylene	81.7 \pm 22.2	908 \pm 245	438 \pm 77.4	98.4 \pm 44.8
Acenaphthene	26.5 \pm 6.50	316 \pm 155	232 \pm 27.5	28.7 \pm 4.13
Fluorene	186 \pm 46.1	1640 \pm 1100	631 \pm 117	105 \pm 27.2
Phenanthrene	353 \pm 133	2510 \pm 1380	1420 \pm 391	256 \pm 83.5
Anthracene	5.95 \pm 2.97	67.6 \pm 2.87	20.1 \pm 0.85	1.34 \pm 0.242
Fluoranthene	8.67 \pm 5.69	146 \pm 66.6	59.9 \pm 23.4	23.8 \pm 10.8
Pyrene	23.2 \pm 10.8	354 \pm 211	144 \pm 50.5	31.3 \pm 11.1
Benzo(a)anthracene	0.808 \pm 0.243	15.0 \pm 8.63	8.62 \pm 0.62	0.706 \pm 0.380
Chrysene	1.26 \pm 0.62	16.0 \pm 9.60	7.06 \pm 0.22	0.623 \pm 0.469
Benzo(b)fluoranthene	0.458 \pm 0.135	9.85 \pm 5.84	6.52 \pm 0.32	0.265 \pm 0.119
Benzo(k)fluoranthene	0.0845 \pm 0.0417	3.70 \pm 1.71	2.70 \pm 0.12	0.198 \pm 0.0580
Benzo(a)pyrene	0.238 \pm 0.0853	6.81 \pm 2.41	4.06 \pm 1.74	0.157 \pm 0.105
Indeno[1,2,3-cd]pyrene	0.409 \pm 0.272	5.64 \pm 1.35	0.741 \pm 0.277	0.0598 \pm 0.0375
Dibenz[a,h]anthracene	0.394 \pm 0.208	7.25 \pm 2.19	0.851 \pm 0.489	0.0444 \pm 0.0291
Benzo[ghi]perylene	0.352 \pm 0.128	4.74 \pm 2.82	0.571 \pm 0.311	0.0204 \pm 0.0116
Tetradecane	774 \pm 204	15200 \pm 7800	13100 \pm 2290	2640 \pm 315
Hexadecane	627 \pm 221	16500 \pm 10300	7250 \pm 629	1600 \pm 127
Octadecane	403 \pm 146	11500 \pm 6340	4590 \pm 1310	876 \pm 104
Nonadecane	186 \pm 81.4	5490 \pm 3480	2570 \pm 446	405 \pm 53.6
Eicosane	120 \pm 52.9	3000 \pm 1490	2070 \pm 476	283 \pm 62.4
Docosane	36.4 \pm 12.5	3910 \pm 1160	588 \pm 74.2	106 \pm 21.4
Tetracosane	19.1 \pm 5.67	5360 \pm 3030	358 \pm 24.1	60.1 \pm 16.7
Hexacosane	7.68 \pm 1.68	4840 \pm 1970	169 \pm 31.4	24.0 \pm 10.2
Octacosane	6.84 \pm 1.49	2560 \pm 480	178 \pm 21.2	22.8 \pm 9.28
Triacontane	6.72 \pm 3.27	662 \pm 239	173 \pm 39.9	27.3 \pm 10.4
Hexatriacontane	27.4 \pm 12.7	1870 \pm 714	740 \pm 381	46.4 \pm 21.8

Table S3 (cont'd): PAH and n-alkane emission rates of individual vehicles.
Uncertainty is the range of the measurements.

1998 DDC Series 60

	Idle ($\mu\text{g min}^{-1}$)	Creep	Transient ($\mu\text{g mi}^{-1}$)	Cruise ($\mu\text{g mi}^{-1}$)
Naphthalene	11700 \pm 537		184000 \pm 10900	33700 \pm 1040
Acenaphthylene	13.2 \pm 3.58		92.5 \pm 68.7	39.4 \pm 2.98
Acenaphthene	74.6 \pm 2.11		638 \pm 343	195 \pm 3.36
Fluorene	217 \pm 24.0		1420 \pm 667	577 \pm 19.9
Phenanthrene	687 \pm 57.1		5010 \pm 1420	1750 \pm 32.2
Anthracene	38.9 \pm 6.05		593 \pm 86.4	97.3 \pm 9.97
Fluoranthene	17.5 \pm 1.14		163 \pm 127	841 \pm 392
Pyrene	37.9 \pm 5.05		326 \pm 244	101 \pm 7.99
Benz(a)anthracene	0.941 \pm 0.206		14.1 \pm 0.378	2.81 \pm 0.117
Chrysene	1.11 \pm 0.357		14.2 \pm 0.410	2.95 \pm 0.279
Benzo(b)fluoranthene	0.0856 \pm 0.0553		0.590 \pm	0.228 \pm 0.0271
Benzo(k)fluoranthene	0.0507 \pm 0.0161		0.560 \pm 0.357	0.0766 \pm 0.0367
Benzo(a)pyrene	0.0783 \pm 0.0438		BDL	0.0461 \pm 0.00510
Indeno[1,2,3-cd]pyrene	0.0891 \pm 0.0561		BDL	0.0548 \pm 0.0160
Dibenz[a,h]anthracene	0.313 \pm 0.232		1.51 \pm 0.691	0.116 \pm 0.0298
Benzo[ghi]perylene	0.196 \pm 0.109		BDL	0.0569 \pm 0.0329
Tetradecane	822 \pm 44.7		8160 \pm 4990	2510 \pm 228
Hexadecane	838 \pm 48.6		7780 \pm 5400	2410 \pm 150
Octadecane	223 \pm 65.3		1760 \pm 702	869 \pm 104
Nonadecane	106 \pm 37.7		1170 \pm 411	350 \pm 32.2
Eicosane	162 \pm 28.2		1740 \pm 536	437 \pm 60.5
Docosane	44.9 \pm 19.6		714 \pm 185	210 \pm 25.9
Tetracosane	22.0 \pm 2.33		273 \pm 77.9	77.3 \pm 9.73
Hexacosane	10.4 \pm 2.86		140 \pm 35.4	35.8 \pm 7.93
Octacosane	9.07 \pm 5.09		175 \pm 48.1	33.8 \pm 13.6
Triacontane	11.2 \pm 4.13		196 \pm 75.5	32.1 \pm 11.0
Hexatriacontane	61.1 \pm 17.2		815 \pm 640	142 \pm 10.1

Table S3 (cont'd): PAH and n-alkane emission rates of individual vehicles.
Uncertainty is the range of the measurements.

1998 DDC Series 60

	Idle ($\mu\text{g min}^{-1}$)	Creep ($\mu\text{g mi}^{-1}$)	Transient ($\mu\text{g mi}^{-1}$)	Cruise ($\mu\text{g mi}^{-1}$)
Naphthalene	2030 \pm 757	28900 \pm 6094	45700 \pm 89.4	12200 \pm 176
Acenaphthylene	15.3 \pm 6.22	343 \pm 16.3	150 \pm 2.42	31.5 \pm 3.02
Acenaphthene	25.8 \pm 11.4	140 \pm 19.1	52.6 \pm 1.08	13.4 \pm 5.32
Fluorene	184 \pm 94.3	1400 \pm 184	994 \pm 5.82	420 \pm 82.9
Phenanthrene	991 \pm 437	6290 \pm 877	5620 \pm 401	1870 \pm 302
Anthracene	48.4 \pm 8.50	355 \pm 20.6	298 \pm 45.2	95.5 \pm 8.06
Fluoranthene	39.1 \pm 15.9	278 \pm 35.8	225 \pm 42.6	62.2 \pm 8.11
Pyrene	93.6 \pm 34.1	601 \pm 94.2	477 \pm 17.5	140 \pm 21.9
Benz(a)anthracene	1.80 \pm 0.769	16.3 \pm 1.93	10.9 \pm 0.612	3.37 \pm 0.563
Chrysene	2.74 \pm 1.39	17.7 \pm 3.24	12.2 \pm 0.237	4.42 \pm 0.715
Benzo(b)fluoranthene	0.131 \pm 0.0746	3.42 \pm 0.648	0.479 \pm 0.155	0.197 \pm 0.0482
Benzo(k)fluoranthene	0.0670 \pm 0.0298	1.23 \pm 0.646	0.097 \pm 0.06	0.119 \pm 0.0397
Benzo(a)pyrene	0.167 \pm 0.0385	2.82 \pm 1.01	0.486 \pm 0.08	0.106 \pm 0.0219
Indeno[1,2,3-cd]pyrene	0.255 \pm 0.0537	2.61 \pm 0.701	BDL	0.0486 \pm 0.0358
Dibenz[a,h]anthracene	0.563 \pm 0.302	5.49 \pm 0.744	BDL	0.120 \pm 0.0749
Benzo[ghi]perylene	BDL	0.54 \pm 0.0801	BDL	0.0187 \pm 0.00204
Tetradecane	280 \pm 67.7	8560 \pm 1270	9320 \pm 41.2	2120 \pm 70.5
Hexadecane	429 \pm 109	13600 \pm 532	10400 \pm 76.7	2300 \pm 96.1
Octadecane	438 \pm 185	14000 \pm 1310	9290 \pm 61.9	1390 \pm 147
Nonadecane	267 \pm 78.5	7450 \pm 1410	3440 \pm 61.4	686 \pm 69.3
Eicosane	249 \pm 63.3	4290 \pm 556	2230 \pm 109	730 \pm 77.5
Docosane	101 \pm 36.2	1930 \pm 161	1030 \pm 30.2	248 \pm 8.82
Tetracosane	43.7 \pm 13.7	725 \pm 51.9	442 \pm 16.9	87.0 \pm 7.24
Hexacosane	18.9 \pm 3.96	400 \pm 34.1	196 \pm 6.71	45.2 \pm 3.91
Octacosane	11.3 \pm 2.77	291 \pm 89.0	121 \pm 7.08	21.5 \pm 3.35
Triacosane	11.6 \pm 3.55	342 \pm 125	149 \pm 8.29	28.0 \pm 2.10
Hexatriacontane	67.5 \pm 27.9	1700 \pm 280	1960 \pm 467	319 \pm 130

Table S3 (cont'd): PAH and n-alkane emission rates of individual vehicles.
Uncertainty is the range of the measurements.

1998 CAT C-12

	Idle ($\mu\text{g min}^{-1}$)	Creep ($\mu\text{g mi}^{-1}$)	Transient ($\mu\text{g mi}^{-1}$)	Cruise ($\mu\text{g mi}^{-1}$)
Naphthalene	5420±2340	19300±4970	164000±8000	28400±7910
Acenaphthylene	155±108	2230±24.5	833±59.3	176±23.0
Acenaphthene	280±114	16100±6630	8830±187	1070±133
Fluorene	1610±892	71000±5440	60300±7176	8650±1730
Phenanthrene	5710±2140	236000±38000	227000±52600	29300±3980
Anthracene	166±69.1	5930±663	6090±647	665±116
Fluoranthene	121±42.5	4560±752	4380±1120	602±113
Pyrene	231±81.0	8100±1433	7780±2050	1070±222
Benz(a)anthracene	3.62±0.896	81.6±12.9	79.7±23.8	10.6±2.22
Chrysene	4.32±1.92	115±36.6	116±34.2	15.4±3.09
Benzo(b)fluoranthene	4.38±1.39	21.1±7.12	8.40±4.00	0.752±0.147
Benzo(k)fluoranthene	1.18±0.510	17.5±4.31	7.30±5.51	0.874±0.104
Benzo(a)pyrene	3.89±1.48	12.0±2.55	3.56±0.403	1.03±0.224
Indeno[1,2,3-cd]pyrene	2.98±1.89	33.3±5.84	8.27±3.80	4.47±0.144
Dibenz[a,h]anthracene	0.359±0.174	36.0±8.44	8.02±3.90	4.93±0.171
Benzo[ghi]perylene	0.377±0.133	31.5±7.87	6.57±3.58	4.12±1.83
Tetradecane	1800±922	85100±6880	21400±112	6010±353
Hexadecane	1900±1140	130000±51300	36500±5920	6840±239
Octadecane	748±382	34400±7510	18400±3000	2630±792
Nonadecane	578±249	23800±6050	13800±4520	540±362
Eicosane	256±118	10500±2180	5620±1380	1080±526
Docosane	81.8±44.1	2430±361	1780±409	297±15.5
Tetracosane	35.4±16.1	1140±256	944±304	125±15.6
Hexacosane	16.0±5.70	574±70.6	538±140	64.9±6.55
Octacosane	14.0±5.17	520±99.0	489±106	56.5±6.76
Triacontane	14.4±6.13	509±73.7	454±59.8	53.7±2.52
Hexatriacontane	55.8±14.6	1410±353	1310±122	112±0.454

Table S3 (cont'd): PAH and n-alkane emission rates of individual vehicles.
Uncertainty is the range of the measurements.

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	Idle ($\mu\text{g min}^{-1}$)	Creep ($\mu\text{g mi}^{-1}$)	Transient ($\mu\text{g mi}^{-1}$)	Cruise ($\mu\text{g mi}^{-1}$)
Naphthalene	14100±4750	247000±63600	236000±48000	26000±11200
Acenaphthylene	98.2±29.4	1022±452	417±286	50.7±5.74
Acenaphthene	762±335	2570±822	1020±354	418±122
Fluorene	15.5±6.99	2620±1780	34.4±17.7	636±54.7
Phenanthrene	1330±152	25300±1550	21000±1250	2480±242
Anthracene	4070±545	67100±10700	34800±19000	5630±281
Fluoranthene	0.850±0.239	BDL	2249±197	228±30.5
Pyrene	1.95±0.743	BDL	4609±1317	452±65.8
Benz(a)anthracene	0.299±0.0980	BDL	45.0±6.79	1.40±0.482
Chrysene	0.318±0.216	BDL	85.2±15.4	1.21±0.380
Benzo(b)fluoranthene	2.48±1.43	3.67±1.37	15.2±5.06	7.44±2.26
Benzo(k)fluoranthene	2.08±0.0911	BDL	14.5±4.19	10.7±1.39
Benzo(a)pyrene	5.50±0.0995	91.3±12.0	18.3±5.84	8.57±4.35
Indeno[1,2,3-cd]pyrene	0.743±0.463	22.1±9.73	27.7±13.8	BDL
Dibenz[a,h]anthracene	1.22±0.533	16.4±8.92	26.2±20.2	BDL
Benzo[ghi]perylene	0.0365±0.0214	40.5±7.49	38.1±24.4	7.14±2.86
Tetradecane	890±134	54000±17500	17700±1900	1710±571
Hexadecane	182±105	6610±960	12400±5400	1280±79.6
Octadecane	657±134	15400±912	15200±2370	1820±589
Nonadecane	74.6±16.2	4990±3700	3180±2160	724±176
Eicosane	216±68.9	5120±1770	3260±837	703±146
Docosane	120±40.7	1960±622	1150±231	229±66.9
Tetracosane	53.4±12.1	1030±413	548±77.4	95.1±33.0
Hexacosane	30.5±6.16	575±229	395±83.1	51.6±20.8
Octacosane	22.1±3.11	456±283	303±125	57.8±30.4
Triacontane	21.0±0.749	494±339	286±136	49.6±24.6
Hexatriacontane	61.2±1.36	941±217	1070±39.8	106±31.1

Table S3 (cont'd): PAH and n-alkane emission rates of individual vehicles.
Uncertainty is the range of the measurements.