Technical Report No. 7

Air Emissions Inventory for the Greater Metropolitan Region in New South Wales

2008 Calendar Year

On-Road Mobile Emissions: Results

ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

An air emissions inventory project for on-road mobile sources has taken over 2 years to complete. The base year of the on-road mobile inventory represents activities that took place during the 2008 calendar year and is accompanied by emission projections from 2011 through to the 2036 calendar year, in five yearly increments. The area included in the inventory covers the greater Sydney, Newcastle and Wollongong regions, known collectively as the Greater Metropolitan Region (GMR).

The inventory region defined as the GMR measures 210 km (east–west) by 273 km (north–south). The inventory region is defined in Table ES-1 and shown in Figure ES-1.

Table ES-1: Definition of Greater Metropolitan, Sydney, Newcastle and Wollongong regions

Region	South-west corner MGA[1] coordinates		North-east corner MGA[1] coordinates	
	Easting (km)	Northing (km)	Easting (km)	Northing (km)
Greater Metropolitan	210	6159	420	6432
Sydney	261	6201	360	6300
Newcastle	360	6348	408	6372
Wollongong	279	6174	318	6201

[1]Map Grid of Australia based on the Geocentric Datum of Australia 1994 (GDA94) (ICSM, 2006).

The on-road mobile emissions inventory includes the following sources:

- Exhaust emissions from petrol passenger vehicles;
- Exhaust emissions from light-duty diesel vehicles;
- Exhaust emissions from petrol light commercial vehicles;
- Exhaust emissions from heavy-duty diesel vehicles;
- Exhaust emissions from other vehicles;
- Evaporative emissions from all petrol vehicles; and
- Non-exhaust particulate matter (NEPM) emissions from all vehicles.

The pollutants inventoried include criteria pollutants specified in the Ambient Air Quality NEPM (NEPC, 2003), air toxics associated with the National Pollutant Inventory NEPM (NEPC, 2008) and the Air Toxics NEPM (NEPC, 2004) and any other pollutants associated with state-specific programs, i.e. Load Based Licensing (Protection of the Environment Operations (General) Regulation 2009 (PCO, 2010) and the Protection of the Environment Operations (Clean Air) Regulation 2010 (PCO, 2011).

Figure ES-1: Definition of Greater Metropolitan, Sydney, Newcastle and Wollongong regions

Table ES-2 presents total estimated annual emissions (for selected substances) from all on-road mobile sources in the GMR and the Sydney, Newcastle and Wollongong regions. Total estimated annual emissions are also presented for the region defined as Non Urban. This region is the area of the GMR minus the combined areas of the Sydney, Newcastle and Wollongong regions. The selected substances were chosen because they:

- Are the most common air pollutants found in airsheds according to the National Pollutant Inventory NEPM (NEPC, 2008);
- Are referred to in National Environment Protection Measures (NEPMs) for Ambient Air Quality (NEPC, 2003) and Air Toxics (NEPC, 2004); and
- Have been classified as priority air pollutants (NEPC, 2006).

Table ES-2: Total estimated annual emissions from on-road mobile sources in each region

Substance	Emissions (tonne/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	142	9.65	5.22	18.3	175
ACETALDEHYDE	101	7.30	3.79	16.1	128
BENZENE	624	42.7	23.0	82.3	772
CARBON MONOXIDE	123,712	8,369	4,786	16,944	153,812
FORMALDEHYDE	266	19.3	10.0	42.4	338
ISOMERS OF XYLENE	979	67.1	36.0	129	1,210
LEAD AND COMPOUNDS	2.82	0.227	0.112	0.495	3.65
OXIDES OF NITROGEN	45,392	3,902	2,184	9,453	60,932
PARTICULATE MATTER ≤ 10 µm	2,110	176	90.3	417	2,793
PARTICULATE MATTER ≤ 2.5 µm	1,553	131	68.2	319	2,071
POLYCYCLIC AROMATIC HYDROCARBONS	89.8	6.98	3.84	16.0	117
SULFUR DIOXIDE	210	15.1	8.13	35.0	269
TOLUENE	1,315	90.9	48.6	177	1,632
TOTAL SUSPENDED PARTICULATE	2,737	226	115	525	3,603
TOTAL VOLATILE ORGANIC COMPOUNDS	23,512	1,678	879	3,435	29,504

Figure ES-2 shows the proportions of total estimated GMR annual emissions (for selected substances) from on-road mobile sources in the Sydney, Newcastle, Wollongong and Non Urban regions.

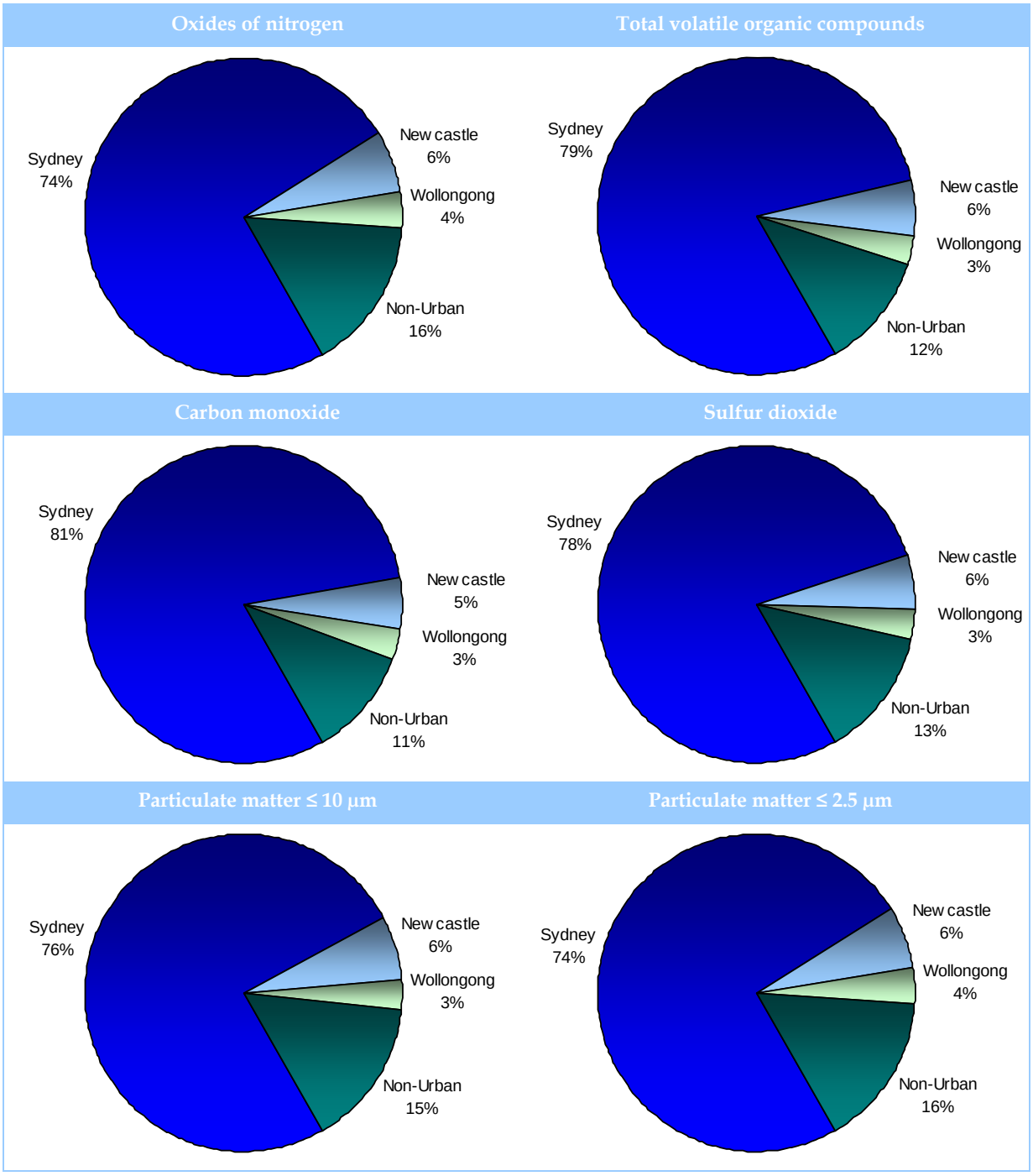

Figure ES-2: Proportions of total estimated GMR annual emissions from on-road mobile sources in each region

Table ES-3, Table ES-4, Table ES-5, Table ES-6, and Table ES-7 present total estimated annual emissions (for selected substances) from each on-road mobile source type in the GMR and in the Sydney, Newcastle, Wollongong and Non Urban regions, respectively.

Figure ES-3, Figure ES-4, Figure ES-5, Figure ES-6 and Figure ES-7 show the proportions of total estimated annual emissions (for selected substances) from each on-road mobile source type in the GMR and in the Sydney, Newcastle, Wollongong and Non Urban regions, respectively.

Table ES-3: Total estimated annual emissions by on-road mobile source type in the GMR

Substance	Emissions (tonne/year)							
	Petrol passenger vehicles - exhaust	Light-duty diesel vehicles - exhaust	Petrol light commercial vehicles - exhaust	Heavy-duty diesel vehicles - exhaust	Other vehicles - exhaust	All vehicles - evaporative	All vehicles - non-exhaust particulate matter	On-road mobile total
1,3 BUTADIENE	121	0.819	41.9	4.72	6.55	0	0	175
ACETALDEHYDE	54.2	7.75	18.7	44.7	2.46	0	0	128
BENZENE	474	2.17	164	12.5	25.6	94.3	0	772
CARBON MONOXIDE	93,437	1,176	48,731	5,705	4,762	0	0	153,812
FORMALDEHYDE	145	20.0	50.0	116	7.58	0	0	338
ISOMERS OF XYLENE	729	0.780	252	4.50	39.3	185	0	1,210
LEAD & COMPOUNDS	0.043	0.055	0.023	0.150	0.0033	0	3.38	3.65
OXIDES OF NITROGEN	27,515	3,060	8,679	21,419	259	0	0	60,932
PARTICULATE MATTER ≤ 10 µm	121	308	63.7	841	9.39	0	1,450	2,793
PARTICULATE MATTER ≤ 2.5 µm	115	299	60.7	816	8.95	0	771	2,071
POLYCYCLIC AROMATIC HYDROCARBONS	49.5	10.1	21.2	32.6	3.20	0	0	117
SULFUR DIOXIDE	181	9.01	41.2	36.2	1.49	0	0	269
TOLUENE	881	0.954	304	5.50	47.5	392	0	1,632
TOTAL SUSPENDED PARTICULATE	121	311	63.7	850	9.39	0	2,249	3,603
TOTAL VOLATILE ORGANIC COMPOUNDS	9,647	203	3,331	1,173	518	14,632	0	29,504

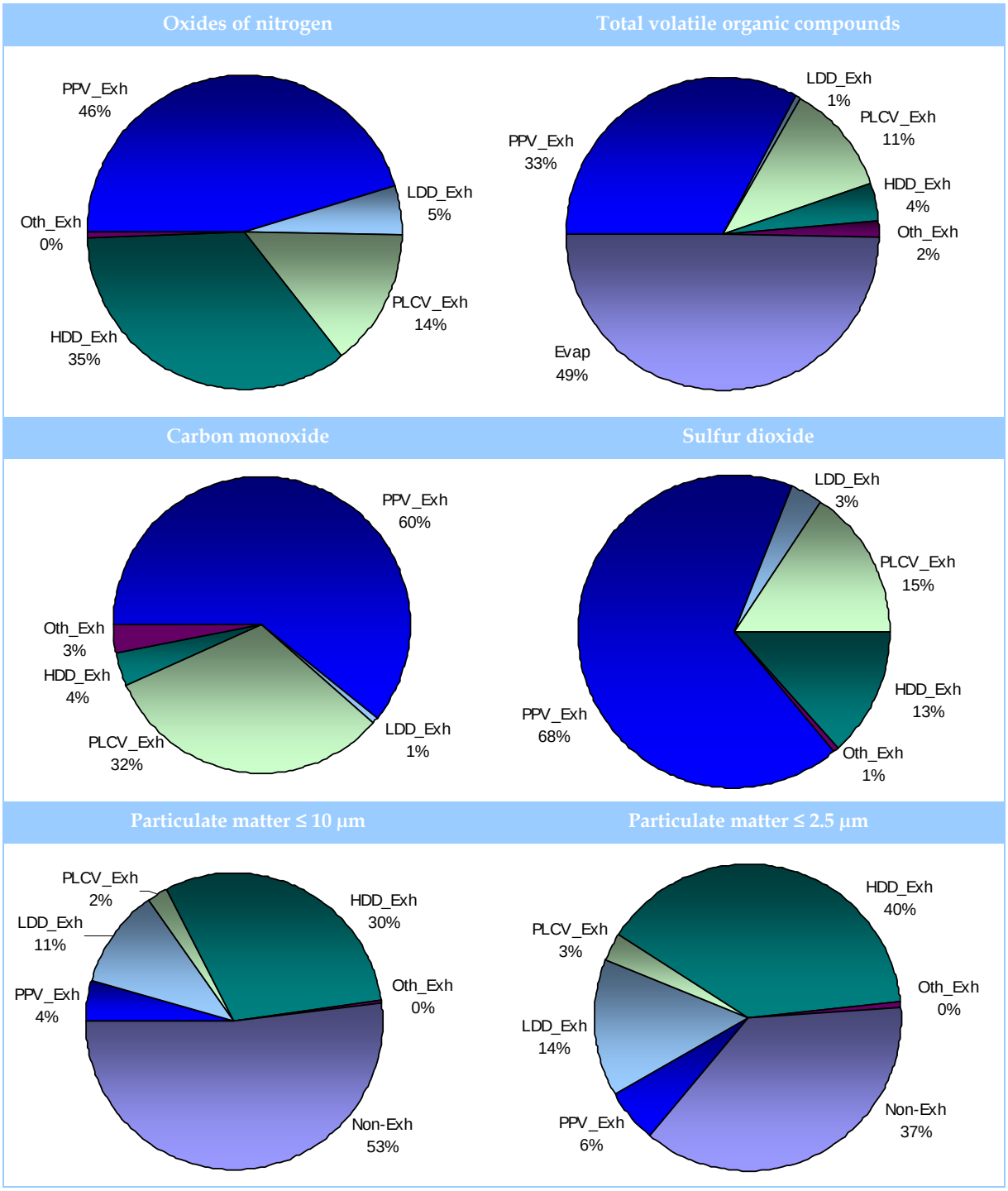

Figure ES-3: Proportions of total estimated annual emissions by on-road mobile source type* in the GMR

* PPV_Exh = Petrol passenger vehicle – exhaust, LDD_Exh = Light-duty diesel – exhaust, PLCV_Exh = Petrol light commercial vehicle – exhaust, HDD_Exh = Heavy-duty diesel – exhaust, Oth_Exh = Other vehicles – exhaust, Evap = Evaporative emissions all petrol vehicles, Non-Exh = Non-exhaust particulate matter – all vehicles

Table ES-4: Total estimated annual emissions by on-road mobile source type in the Sydney region

Substance	Emissions (tonne/year)							
	Petrol passenger vehicles - exhaust	Light-duty diesel vehicles - exhaust	Petrol light commercial vehicles - exhaust	Heavy-duty diesel vehicles - exhaust	Other vehicles - exhaust	All vehicles - evaporative	All vehicles - non-exhaust particulate matter	On-road mobile total
1,3 BUTADIENE	98.0	0.677	34.8	3.49	5.18	0	0	142
ACETALDEHYDE	43.8	6.41	15.6	33.0	1.95	0	0	101
BENZENE	382	1.79	136	9.23	20.3	74.2	0	624
CARBON MONOXIDE	75,067	951	39,923	4,081	3,691	0	0	123,712
FORMALDEHYDE	117	16.6	41.6	85.3	5.99	0	0	266
ISOMERS OF XYLENE	589	0.645	209	3.32	31.1	146	0	979
LEAD & COMPOUNDS	0.033	0.044	0.018	0.106	0.0025	0	2.62	2.82
OXIDES OF NITROGEN	21,575	2,417	6,799	14,423	178	0	0	45,392
PARTICULATE MATTER ≤ 10 µm	92.3	247	49.5	592	6.99	0	1,123	2,110
PARTICULATE MATTER ≤ 2.5 µm	87.9	239	47.2	574	6.67	0	597	1,553
POLYCYCLIC AROMATIC HYDROCARBONS	39.0	8.12	17.0	23.3	2.45	0	0	89.8
SULFUR DIOXIDE	144	7.25	33.3	24.6	1.13	0	0	210
TOLUENE	712	0.788	253	4.06	37.6	308	0	1,315
TOTAL SUSPENDED PARTICULATE	92.3	249	49.5	598	6.99	0	1,742	2,737
TOTAL VOLATILE ORGANIC COMPOUNDS	7,789	168	2,768	866	409	11,512	0	23,512

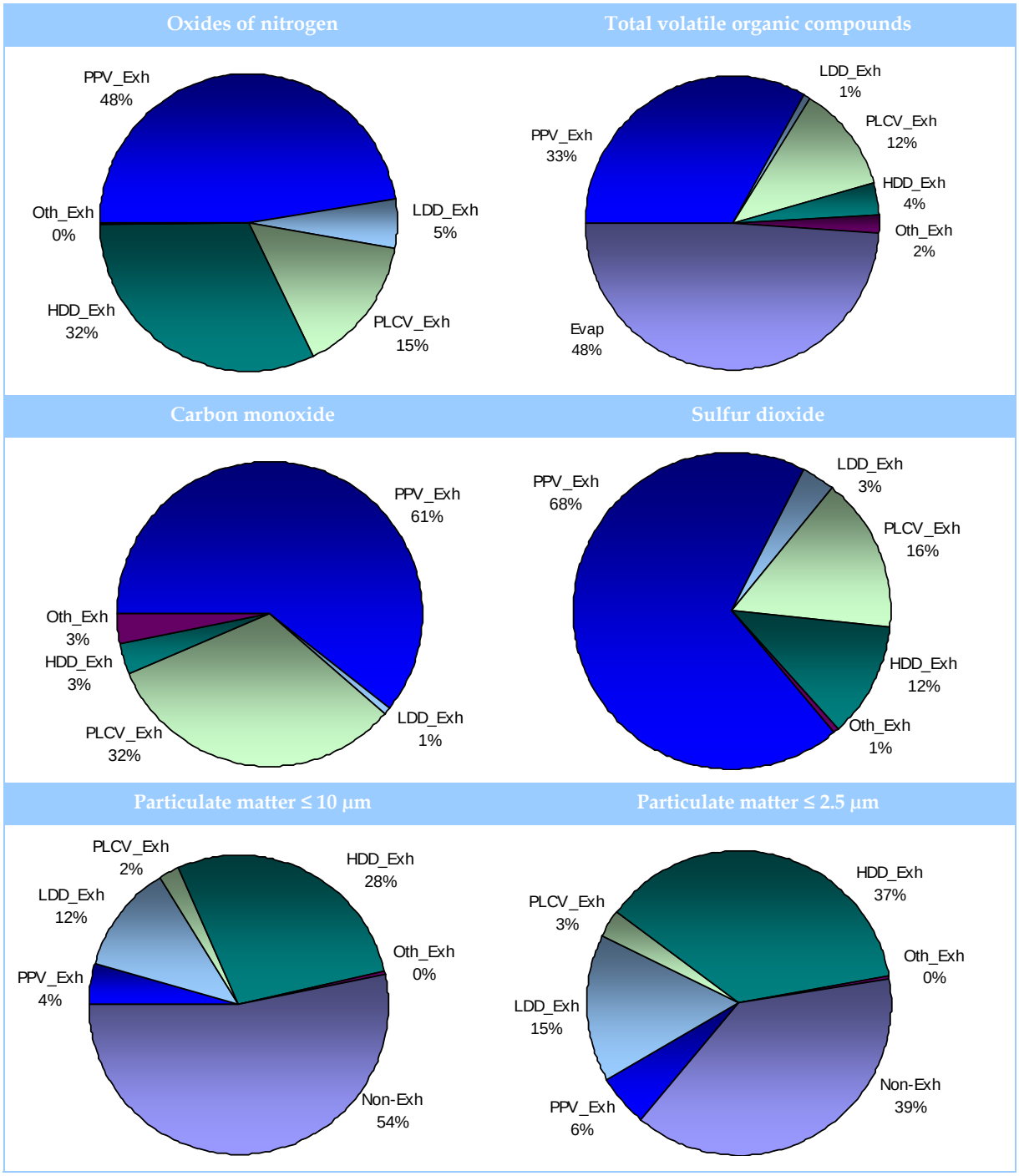

Figure ES-4: Proportions of total estimated annual emissions by on-road mobile source type in the Sydney region

Table ES-5: Total estimated annual emissions by on-road mobile source type in the Newcastle region

Substance	Emissions (tonne/year)							
	Petrol passenger vehicles - exhaust	Light-duty diesel vehicles - exhaust	Petrol light commercial vehicles - exhaust	Heavy-duty diesel vehicles - exhaust	Other vehicles - exhaust	All vehicles - evaporative	All vehicles - non-exhaust particulate matter	On-road mobile total
1,3 BUTADIENE	6.75	0.042	2.18	0.293	0.377	0	0	9.65
ACETALDEHYDE	3.02	0.400	0.976	2.77	0.142	0	0	7.30
BENZENE	26.3	0.112	8.52	0.775	1.47	5.51	0	42.7
CARBON MONOXIDE	4,997	66.1	2,650	375	280	0	0	8,369
FORMALDEHYDE	8.06	1.03	2.61	7.16	0.436	0	0	19.3
ISOMERS OF XYLENE	40.5	0.040	13.1	0.279	2.26	10.8	0	67.1
LEAD & COMPOUNDS	0.0026	0.0031	0.0014	0.010	0.0002	0	0.209	0.227
OXIDES OF NITROGEN	1,666	177	530	1,511	18.2	0	0	3,902
PARTICULATE MATTER ≤ 10 µm	7.27	17.3	3.91	57.2	0.592	0	89.8	176
PARTICULATE MATTER ≤ 2.5 µm	6.93	16.8	3.72	55.5	0.564	0	47.7	131
POLYCYCLIC AROMATIC HYDROCARBONS	2.86	0.558	1.21	2.16	0.193	0	0	6.98
SULFUR DIOXIDE	9.73	0.505	2.27	2.53	0.091	0	0	15.1
TOLUENE	49.0	0.049	15.9	0.341	2.73	22.9	0	90.9
TOTAL SUSPENDED PARTICULATE	7.27	17.5	3.91	57.8	0.592	0	139	226
TOTAL VOLATILE ORGANIC COMPOUNDS	537	10.5	174	72.7	29.8	855	0	1,678

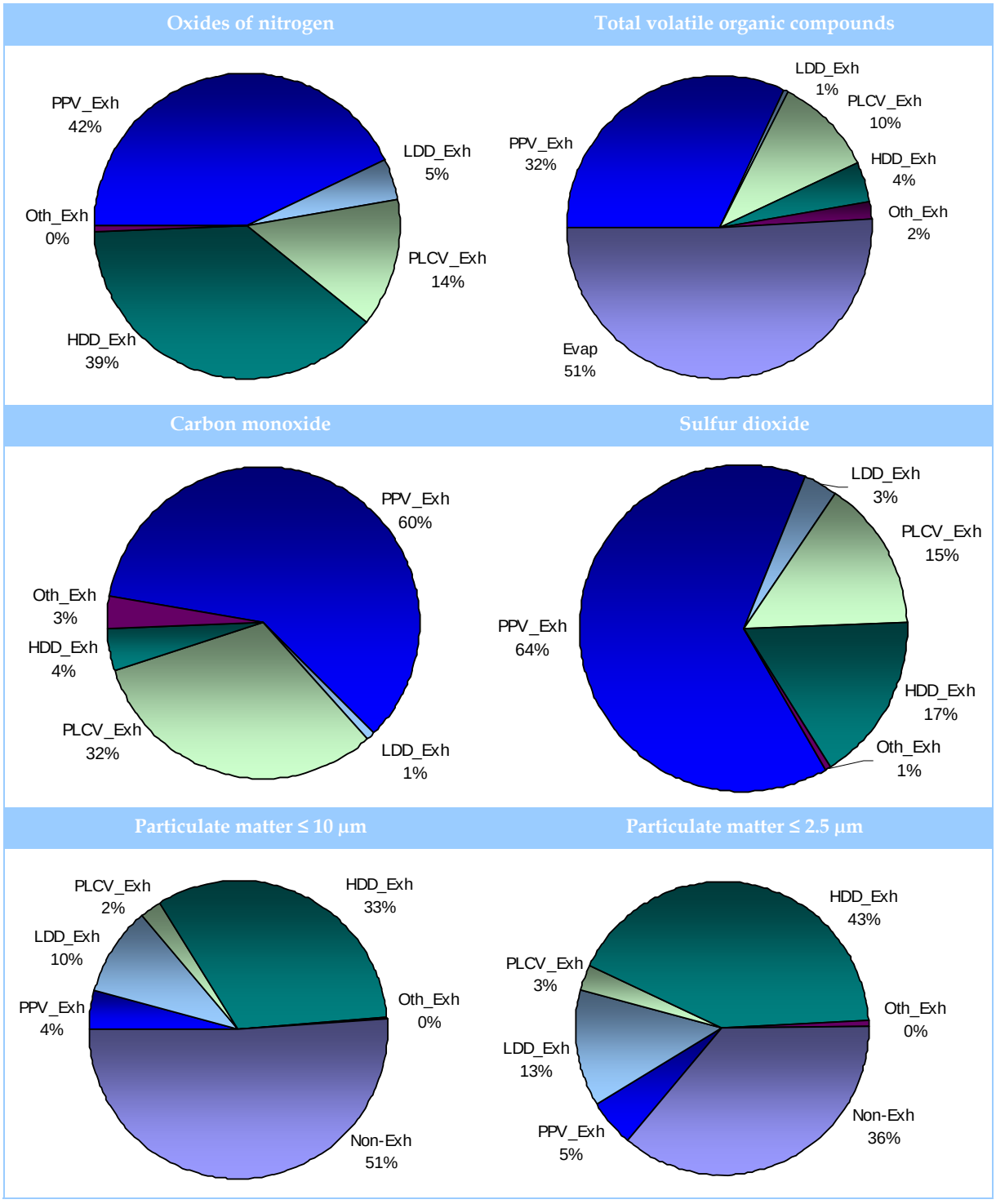

Figure ES-5: Proportions of total estimated annual emissions by on-road mobile source type in the Newcastle region

Table ES-6: Total estimated annual emissions by on-road mobile source type in the Wollongong region

Substance	Emissions (tonne/year)							
	Petrol passenger vehicles - exhaust	Light-duty diesel vehicles - exhaust	Petrol light commercial vehicles - exhaust	Heavy-duty diesel vehicles - exhaust	Other vehicles - exhaust	All vehicles - evaporative	All vehicles - non-exhaust particulate matter	On-road mobile total
1,3 BUTADIENE	3.69	0.022	1.19	0.141	0.178	0	0	5.22
ACETALDEHYDE	1.65	0.210	0.531	1.33	0.067	0	0	3.79
BENZENE	14.4	0.059	4.63	0.373	0.696	2.81	0	23.0
CARBON MONOXIDE	2,861	38.2	1,564	184	140	0	0	4,786
FORMALDEHYDE	4.40	0.542	1.42	3.45	0.206	0	0	10.0
ISOMERS OF XYLENE	22.2	0.021	7.13	0.134	1.07	5.52	0	36.0
LEAD & COMPOUNDS	0.0015	0.0019	0.0009	0.0052	0.0001	0	0.102	0.112
OXIDES OF NITROGEN	938	107	346	783	9.92	0	0	2,184
PARTICULATE MATTER ≤ 10 µm	4.14	10.4	2.58	29.0	0.314	0	43.9	90.3
PARTICULATE MATTER ≤ 2.5 µm	3.95	10.1	2.46	28.1	0.300	0	23.3	68.2
POLYCYCLIC AROMATIC HYDROCARBONS	1.59	0.329	0.744	1.08	0.098	0	0	3.84
SULFUR DIOXIDE	5.15	0.281	1.36	1.30	0.046	0	0	8.13
TOLUENE	26.8	0.026	8.62	0.164	1.29	11.7	0	48.6
TOTAL SUSPENDED PARTICULATE	4.14	10.5	2.58	29.3	0.314	0	68.0	115
TOTAL VOLATILE ORGANIC COMPOUNDS	293	5.50	94.4	35.0	14.1	436	0	879

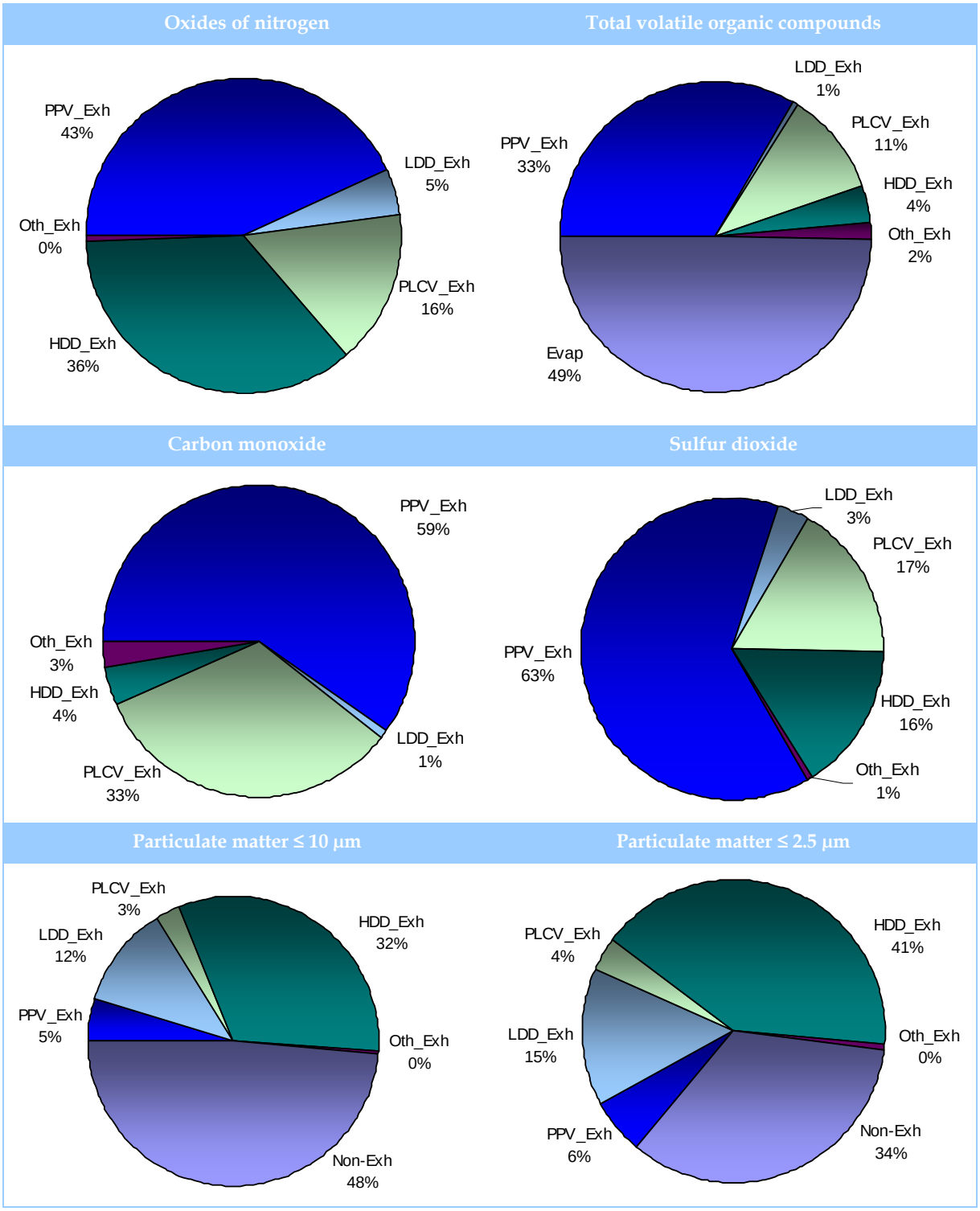

Figure ES-6: Proportions of total estimated annual emissions by on-road mobile source type in the Wollongong region

Table ES-7: Total estimated annual emissions by on-road mobile source type in the Non Urban region

Substance	Emissions (tonne/year)							
	Petrol passenger vehicles - exhaust	Light-duty diesel vehicles - exhaust	Petrol light commercial vehicles - exhaust	Heavy-duty diesel vehicles - exhaust	Other vehicles - exhaust	All vehicles - evaporative	All vehicles - non-exhaust particulate matter	On-road mobile total
1,3 BUTADIENE	12.9	0.077	3.71	0.805	0.815	0	0	18.3
ACETALDEHYDE	5.78	0.733	1.66	7.62	0.307	0	0	16.1
BENZENE	50.5	0.205	14.5	2.13	3.19	11.8	0	82.3
CARBON MONOXIDE	10,512	121	4,595	1,065	651	0	0	16,944
FORMALDEHYDE	15.4	1.90	4.42	19.7	0.944	0	0	42.4
ISOMERS OF XYLENE	77.7	0.074	22.3	0.766	4.90	23.1	0	129
LEAD & COMPOUNDS	0.0061	0.0060	0.0027	0.029	0.0005	0	0.451	0.495
OXIDES OF NITROGEN	3,336	359	1,004	4,702	52.0	0	0	9,453
PARTICULATE MATTER ≤ 10 µm	17.2	33.5	7.73	163	1.49	0	193	417
PARTICULATE MATTER ≤ 2.5 µm	16.4	32.5	7.37	159	1.42	0	103	319
POLYCYCLIC AROMATIC HYDROCARBONS	6.08	1.07	2.26	6.11	0.459	0	0	16.0
SULFUR DIOXIDE	21.8	0.973	4.24	7.77	0.224	0	0	35.0
TOLUENE	94.0	0.090	26.9	0.937	5.92	49.0	0	177
TOTAL SUSPENDED PARTICULATE	17.2	33.9	7.73	165	1.49	0	300	525
TOTAL VOLATILE ORGANIC COMPOUNDS	1,029	19.2	295	200	64.5	1,828	0	3,435

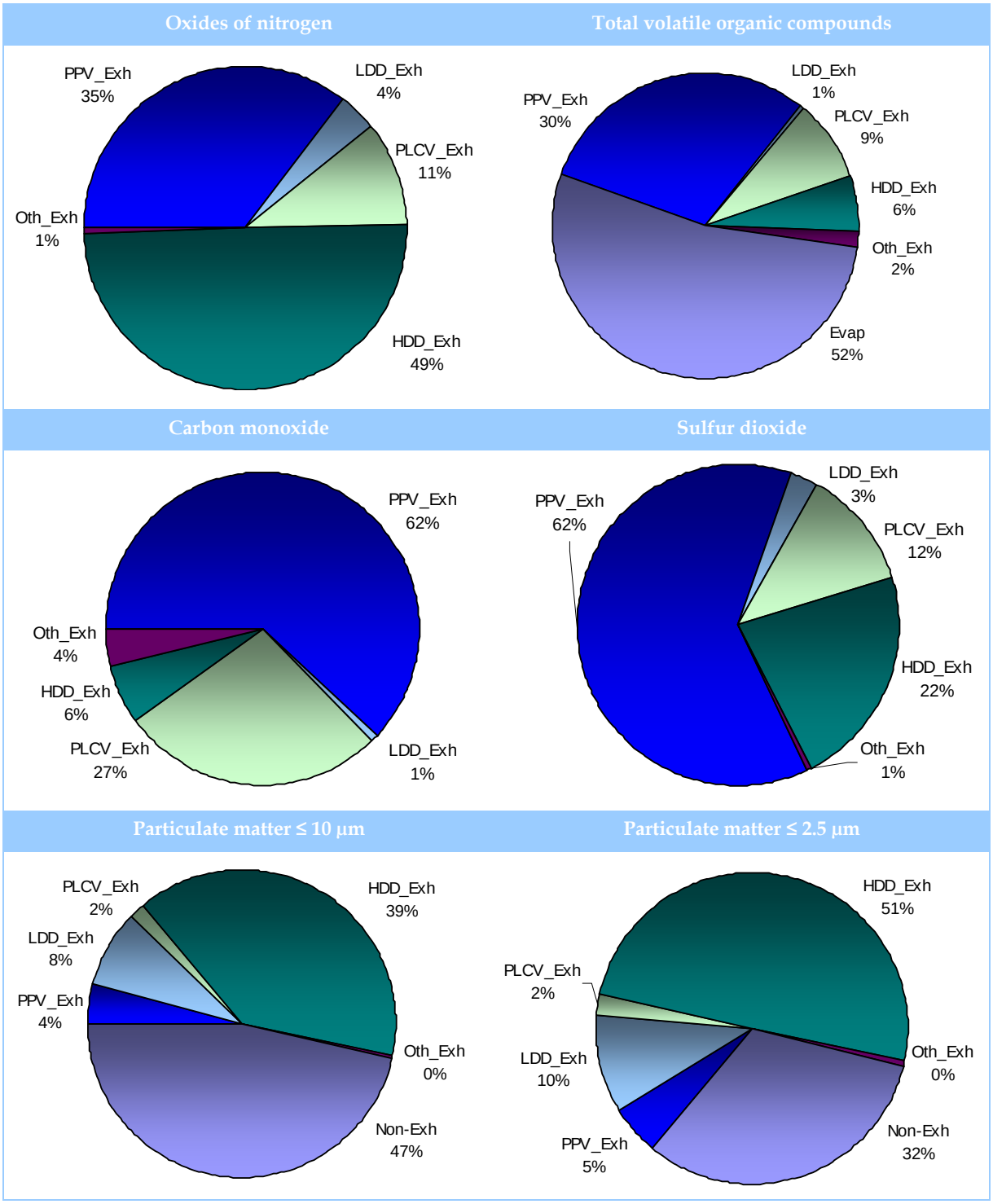

Figure ES-7: Proportions of total estimated annual emissions by on-road mobile source type in the Non Urban region