

EXECUTIVE SUMMARY

The Department of Environment and Climate Change NSW (DECC) has completed a three year air emissions inventory project. The base year of the inventory represents activities that took place during the 2003 calendar year and is accompanied by emission projections in yearly increments up to the 2031 calendar year. The area included in the study covers greater Sydney, Newcastle and Wollongong regions, known collectively as the Greater Metropolitan Region (GMR).

The study region defined as the GMR measures 210 km (east-west) by 273 km (north-south). The study region is defined in Table ES1 and shown in Figure ES1.

Table ES1 Definition of Greater Metropolitan, Sydney, Newcastle and Wollongong regions

Region	South-west corner MGA ¹ co-ordinates		North-east corner MGA ¹ co-ordinates	
	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 MGA = Map Grid of Australia based on the Geocentric Datum of Australia 1994 (GDA94) (ICSM, 2002).

The air emissions inventory includes emissions from biogenic (i.e. natural) and anthropogenic (i.e. human derived) sources.

The anthropogenic source groups included in the air emissions inventory are as follows:

- Commercial businesses (i.e. non-EPA-licensed);
- Domestic-commercial activities;
- Industrial premises (i.e. EPA-licensed);
- Off-road mobile (i.e. non-registered off-road vehicles and equipment); and
- On-road mobile (i.e. registered on-road vehicles).

The pollutants inventoried include criteria pollutants specified in the *Ambient Air Quality NEPM* (NEPC, 2003), air toxics associated with the *National Pollutant Inventory (NPI) NEPM* (NEPC, 2000) and the *Air Toxics NEPM* (NEPC, 2004) and any other pollutants associated with state specific programs, including: *Load Based Licensing (Protection of the Environment Operations (General) Regulation 1998* (PCO, 1998)); and *Protection of the Environment Operations (Clean Air) Regulation 2002* (PCO, 2005).

This report focuses on emissions of ozone precursors and particles from anthropogenic sources only, including:

- Oxides of nitrogen (NO_x);
- Particulate matter < 10 μm (PM₁₀);
- Particulate matter < 2.5 μm (PM_{2.5}); and
- Total volatile organic compounds (VOCs).

More detailed information about sources and emissions of other air pollutants from the biogenic, commercial businesses, domestic-commercial activities, industrial premises, off-road mobile and on-road mobile source groups can be found in the individual air emissions inventory reports (DECC, 2007a; DECC, 2007b; DECC, 2007c; DECC, 2007d; DECC, 2007e; DECC, 2007f; and DECC, 2007g), respectively.

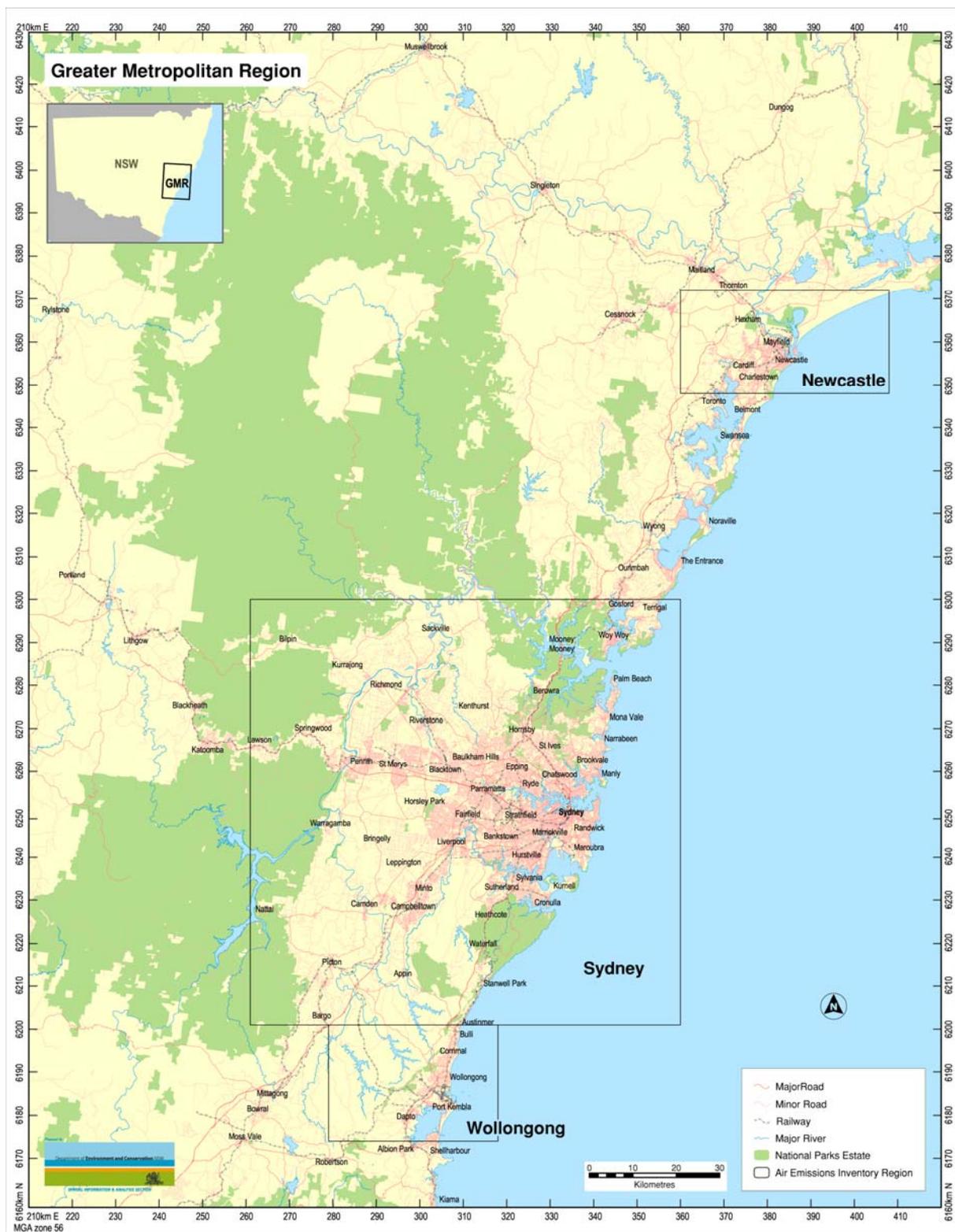


Figure ES1 Definition of Greater Metropolitan, Sydney, Newcastle and Wollongong regions

Table ES2 shows total estimated annual anthropogenic emissions of ozone precursors and particles from each anthropogenic source group in the GMR and Sydney region in 1992 and 2003. Increased and decreased changes in emissions are shown as **red bold** and **green bold** text, respectively.

Table ES3 shows the proportion of total estimated annual anthropogenic emissions of ozone precursors and particles from each anthropogenic source group in the GMR and Sydney region in 1992 and 2003.

Table ES2 Total estimated annual anthropogenic emissions by source group in the GMR and Sydney region in 1992 and 2003

Substance	Anthropogenic Source Group					Anthropogenic Total
	Commercial	Domestic-Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
2003 Annual Emissions (tonnes/year) – GMR						
OXIDES OF NITROGEN	2,648	1,791	175,537	23,470	88,609	292,054
PARTICULATE MATTER < 10 µm	4,032	6,651	46,530	14,566	3,349	75,128
PARTICULATE MATTER < 2.5 µm	1,270	6,428	13,127	6,486	3,188	30,499
TOTAL VOCS	13,844	67,303	17,786	7,640	64,493	171,067
1992¹ Annual Emissions (tonnes/year) – GMR						
OXIDES OF NITROGEN		6,580	123,300	9,810	98,990	238,680
PARTICULATE MATTER < 10 µm ²		16,170	67,510	9,230	7,120	100,030
TOTAL VOCS		85,670	20,550	9,510	93,380	209,110
Change in Annual Emissions (%) – GMR						
OXIDES OF NITROGEN		-32.5	+42.4	+139.2	-10.5	+22.4
PARTICULATE MATTER < 10 µm		-33.9	-31.1	+57.8	-53.0	-24.9
TOTAL VOCS		-5.3	-13.4	-19.7	-30.9	-18.2
2003 Annual Emissions (tonnes/year) – Sydney						
OXIDES OF NITROGEN	1,870	1,356	14,032	9,514	65,996	92,768
PARTICULATE MATTER < 10 µm	2,143	4,993	7,911	3,707	2,552	21,305
PARTICULATE MATTER < 2.5 µm	723	4,826	3,390	1,761	2,426	13,126
TOTAL VOCS	9,973	51,929	13,989	4,772	50,171	130,834
1992¹ Annual Emissions (tonnes/year) – Sydney						
OXIDES OF NITROGEN		4,810	13,440	3,080	80,400	101,730
PARTICULATE MATTER < 10 µm ²		9,210	8,320	1,830	6,100	25,460
TOTAL VOCS		70,020	16,820	6,300	77,520	170,660
Change in Annual Emissions (%) - Sydney						
OXIDES OF NITROGEN		-32.9	+4.4	+208.9	-17.9	-8.8
PARTICULATE MATTER < 10 µm		-22.5	-4.9	+102.5	-58.2	-16.3
TOTAL VOCS		-11.6	-16.8	-24.3	-35.3	-23.3

¹ Carnovale et. al. (1996).

² The 1992 and 2003 emission inventory estimates for particles are for total suspended particulate (TSP) matter and particulate matter < 10 µm (PM₁₀), respectively. While TSP and PM₁₀ emissions are not directly comparable, they have been presented for illustrative purposes.

Table ES3 Proportion of total estimated annual anthropogenic emissions by source group in the GMR and Sydney region in 1992 and 2003

Substance	Anthropogenic Source Group					Anthropogenic Total
	Commercial	Domestic-Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
Proportion of 2003 Annual Anthropogenic Emissions (%) – GMR						
OXIDES OF NITROGEN	0.9	0.6	60.1	8.0	30.3	100
PARTICULATE MATTER < 10 µm	5.4	8.9	61.9	19.4	4.5	100
PARTICULATE MATTER < 2.5 µm	4.2	21.1	43.0	21.3	10.5	100
TOTAL VOCS	8.1	39.3	10.4	4.5	37.7	100
		Domestic-Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
Proportion of 1992³ Annual Anthropogenic Emissions (%) - GMR						
OXIDES OF NITROGEN		2.8	51.7	4.1	41.5	100
PARTICULATE MATTER < 10 µm ⁴		16.2	67.5	9.2	7.1	100
TOTAL VOCS		41.0	9.8	4.5	44.7	100
	Commercial	Domestic-Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
Proportion of 2003 Annual Anthropogenic Emissions (%) - Sydney						
OXIDES OF NITROGEN	2.0	1.5	15.1	10.3	71.1	100
PARTICULATE MATTER < 10 µm	10.1	23.4	37.1	17.4	12.0	100
PARTICULATE MATTER < 2.5 µm	5.5	36.8	25.8	13.4	18.5	100
TOTAL VOCS	7.6	39.7	10.7	3.6	38.3	100
		Domestic-Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
Proportion of 1992³ Annual Anthropogenic Emissions (%) - Sydney						
OXIDES OF NITROGEN		4.7	13.2	3.0	79.0	100
PARTICULATE MATTER < 10 µm ⁴		36.2	32.7	7.2	24.0	100
TOTAL VOCS		41.0	9.9	3.7	45.4	100

³ Carnovale et. al. (1996).

⁴ The 1992 and 2003 emission inventory estimates for particles are for total suspended particulate (TSP) matter and particulate matter < 10 µm (PM₁₀), respectively. While TSP and PM₁₀ emissions are not directly comparable, they have been presented for illustrative purposes.

Figure A1 to Figure A8 in Appendix A (pages 33 to 36) show the proportion of total estimated annual anthropogenic emissions of oxides of nitrogen, particulate matter < 10 µm, particulate matter < 2.5 µm and total VOCs from each anthropogenic source group in the GMR and Sydney region respectively in 2003.

While it is difficult to draw comparisons between the 1992 and 2003 estimates due to differences in activity data, emission estimation techniques and source coverage, the following simple observations can be made:

- Annual oxides of nitrogen emissions in the GMR and Sydney region during 2003 are ~1.22 and ~0.91 times respectively more than 1992 estimates. Changes in GMR emissions are largely due to an increase in industrial (i.e. Generation of electrical power from coal) and off-road mobile (i.e. inclusion of commercial boats, commercial off-road vehicles and equipment, construction off-road vehicles and equipment and industrial off-road vehicles and equipment) emissions, while changes in Sydney region emissions are largely due to a decrease in on-road mobile emissions;
- Annual total VOCs emissions in the GMR and Sydney region during 2003 are ~0.82 and ~0.77 times respectively more than 1992 estimates. Changes in GMR and Sydney region emissions are largely due to a decrease in on-road mobile emissions; and
- Comparisons between TSP and PM₁₀/PM_{2.5} emission estimates cannot readily be made. Overall, annual PM₁₀/PM_{2.5} emission estimates would be higher in 2003 compared with 1992 due to a larger coverage of source types within the commercial, domestic-commercial, industrial and off-road mobile source groups.

Table ES4 and Table ES5 present the changes in priority ranking of source groups in the GMR and Sydney region based on 1992 and 2003 emission inventory estimates. Priority ranking 1 indicates the source group has the highest emissions, while priority ranking 4 indicates the source group has the lowest emissions. Changes in priority ranking are shown in **red bold** text.

Table ES4 Changes in annual priority ranking of source groups in the GMR – 1992 to 2003

Source Group	NO _x		Total VOCs		PM ₁₀		PM _{2.5}	
	1992	2003	1992	2003	1992 ⁵	2003	1992	2003
Domestic-Commercial	4	4	2	1	2	3	-	2
Industrial	1	1	3	3	1	1	-	1
Off-Road Mobile	3	3	4	4	3	2	-	3
On-Road Mobile	2	2	1	2	4	4	-	4

Table ES5 Changes in annual priority ranking of source groups in the Sydney region – 1992 to 2003

Source Group	NO _x		Total VOCs		PM ₁₀		PM _{2.5}	
	1992	2003	1992	2003	1992 ⁵	2003	1992	2003
Domestic-Commercial	3	4	2	1	1	2	-	1
Industrial	2	2	3	3	2	1	-	2
Off-Road Mobile	4	3	4	4	4	3	-	4
On-Road Mobile	1	1	1	2	3	4	-	3

While there are some changes in priority rankings of source groups when comparing 1992 and 2003 emission inventory estimates, the data presented in Table ES2 and Table ES3 shows that in broad terms, there has been little change in the source groups that should be the focus for reducing ozone precursor and particle emissions.

⁵ The 1992 and 2003 emission inventory estimates for particles are for total suspended particulate (TSP) matter and particulate matter < 10 µm (PM₁₀), respectively. While TSP and PM₁₀ emissions are not directly comparable, they have been presented for illustrative purposes.

Table ES6, Figure A9 and Figure A10 in Appendix A (pages 37 to 38) show anthropogenic sources of oxides of nitrogen emissions ranked in descending order according to total estimated annual emissions in the GMR and Sydney region. The individual and cumulative proportions of anthropogenic emissions are also shown for each source type.

Table ES6 Ranking of anthropogenic sources of oxides of nitrogen on an annual basis

Source Group	Source Type	Oxides of Nitrogen		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative Proportion (%)
GMR				
Industrial	Generation of electrical power from coal	145,440	49.8	49.8
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	49,011	16.8	66.6
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	25,289	8.7	75.2
Industrial	Primary iron and steel production	7,827	2.7	77.9
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	6,800	2.3	80.2
Off-Road Mobile	Commercial Ships	6,176	2.1	82.4
Industrial	Cement or lime production	6,115	2.1	84.5
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	5,851	2.0	86.5
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	5,287	1.8	88.3
Off-Road Mobile	Railways	3,350	1.1	89.4
Off-Road Mobile	Aircraft	3,267	1.1	90.5
On-Road Mobile	Exhaust Emissions - Other	3,171	1.1	91.6
Industrial	Petroleum refining	2,789	1.0	92.6
Industrial	Generation of electrical power from gas	2,681	0.9	93.5
Off-Road Mobile	Commercial Boats	2,478	0.8	94.3
Industrial	Production of container glass	1,609	0.6	94.9
Industrial	Coal mining	1,400	0.5	95.4
Commercial	Hospitals (Except Psychiatric Hospitals)	1,323	0.5	95.8
Industrial	Petrochemical production	1,199	0.4	96.2
Industrial	Production of ammonium nitrate	1,056	0.4	96.6
Industrial	Generation of electrical power from biogas	1,026	0.4	97.0
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	1,008	0.3	97.3
Commercial	Unaccounted Gaseous Fuel Combustion	1,006	0.3	97.6
Industrial	Storage of Petroleum and/or Petroleum Products	864	0.3	97.9
Industrial	Production of float glass	839	0.3	98.2
Domestic-Commercial	Gaseous Fuel Combustion	762	0.3	98.5
Industrial	Sewage Treatment - processing by large plants	604	0.2	98.7
Domestic-Commercial	Solid Fuel Combustion	480	0.2	98.9
Industrial	Primary aluminium production	343	0.1	99.0
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	269	0.1	99.1
Industrial	Crushing, grinding or separating works	248	0.1	99.1
Industrial	Ceramics production (excluding glass)	237	0.1	99.2
Off-Road Mobile	Construction Off-Road Vehicles and Equipment	218	0.1	99.3
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	177	0.1	99.4
All	Other	1,853	0.6	100

Source Group	Source Type	Oxides of Nitrogen		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative Proportion (%)
Sydney				
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	38,175	41.2	41.2
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	16,908	18.2	59.4
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	4,534	4.9	64.3
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	4,245	4.6	68.8
Off-Road Mobile	Aircraft	3,218	3.5	72.3
Industrial	Petroleum refining	2,789	3.0	75.3
Industrial	Generation of electrical power from gas	2,681	2.9	78.2
On-Road Mobile	Exhaust Emissions - Other	2,135	2.3	80.5
Industrial	Production of container glass	1,609	1.7	82.2
Off-Road Mobile	Railways	1,608	1.7	84.0
Off-Road Mobile	Commercial Ships	1,606	1.7	85.7
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	1,510	1.6	87.3
Industrial	Cement or lime production	1,337	1.4	88.8
Industrial	Petrochemical production	1,199	1.3	90.1
Industrial	Generation of electrical power from biogas	1,026	1.1	91.2
Industrial	Storage of Petroleum and/or Petroleum Products	864	0.9	92.1
Off-Road Mobile	Commercial Boats	853	0.9	93.0
Industrial	Production of float glass	839	0.9	93.9
Commercial	Hospitals (Except Psychiatric Hospitals)	827	0.9	94.8
Commercial	Unaccounted Gaseous Fuel Combustion	791	0.9	95.7
Industrial	Sewage Treatment - processing by large plants	601	0.6	96.3
Domestic-Commercial	Gaseous Fuel Combustion	599	0.6	97.0
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	440	0.5	97.4
Domestic-Commercial	Solid Fuel Combustion	361	0.4	97.8
Industrial	Crushing, grinding or separating works	239	0.3	98.1
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	181	0.2	98.3
Off-Road Mobile	Construction Off-Road Vehicles and Equipment	171	0.2	98.5
Industrial	Ceramics production (excluding glass)	161	0.2	98.6
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	133	0.1	98.8
Industrial	Paper production using recycled materials	121	0.1	98.9
Off-Road Mobile	Recreational Boats	109	0.1	99.0
Commercial	Port Operators	102	0.1	99.1
Industrial	Secondary aluminium production	58.4	0.1	99.2
Domestic-Commercial	Barbecues	54.6	0.1	99.3
All	Other	680	0.7	100.0

Table ES7, Figure A11 and Figure A12 in Appendix A (pages 39 to 40) show anthropogenic sources of total VOCs emissions ranked in descending order according to total estimated annual emissions in the GMR and Sydney region. The individual and cumulative proportions of anthropogenic emissions are also shown for each source type.

Table ES7 Ranking of anthropogenic sources of total VOCs on an annual basis

Source Group	Source Type	Total VOCs		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative Proportion (%)
GMR				
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	33,062	19.3	19.3
Domestic-Commercial	Aerosols and Solvents	26,220	15.3	34.7
Domestic-Commercial	Surface Coating	16,898	9.9	44.5
On-Road Mobile	Evaporative Emissions – Petrol	14,956	8.7	53.3
Domestic-Commercial	Solid Fuel Combustion	12,663	7.4	60.7
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	5,916	3.5	64.1
On-Road Mobile	Exhaust Emissions – Other	5,829	3.4	67.5
Commercial	Automotive Fuel Retailing	5,625	3.3	70.8
Commercial	Smash Repairing	5,445	3.2	74.0
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	5,419	3.2	77.2
Off-Road Mobile	Recreational Boats	3,626	2.1	79.3
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	3,583	2.1	81.4
Industrial	Petroleum refining	3,165	1.8	83.2
Industrial	Metal plating or coating works	2,484	1.5	84.7
Industrial	Printing	2,474	1.4	86.1
Domestic-Commercial	Cutback Bitumen	2,374	1.4	87.5
Domestic-Commercial	Natural Gas Leakage	1,988	1.2	88.7
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	1,643	1.0	89.7
Commercial	Printing	1,296	0.8	90.4
Industrial	Other metal processing	1,228	0.7	91.1
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	1,147	0.7	91.8
Off-Road Mobile	Loading and Unloading Fuels	1,129	0.7	92.5
Off-Road Mobile	Commercial Boats	1,044	0.6	93.1
Industrial	Generation of electrical power from coal	698	0.4	93.5
Industrial	Other chemical processing	673	0.4	93.9
Off-Road Mobile	Aircraft	666	0.4	94.3
Industrial	Primary iron and steel production	580	0.3	94.6
Industrial	Hazardous waste generation or storage	580	0.3	94.9
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	579	0.3	95.3
Industrial	Plastics production	552	0.3	95.6
Industrial	Generation of electrical power from gas	502	0.3	95.9
Industrial	Other Chemical Storage	469	0.3	96.2
Industrial	Solid waste landfilling	462	0.3	96.4
Industrial	Petrochemical production	457	0.3	96.7
All	Other	5,632	3.3	100

Source Group	Source Type	Total VOCs		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative Proportion (%)
Sydney				
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	26,066	19.9	19.9
Domestic-Commercial	Aerosols and Solvents	20,637	15.8	35.7
Domestic-Commercial	Surface Coating	13,112	10.0	45.7
On-Road Mobile	Evaporative Emissions - Petrol	11,783	9.0	54.7
Domestic-Commercial	Solid Fuel Combustion	9,524	7.3	62.0
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	4,627	3.5	65.5
Commercial	Smash Repairing	4,271	3.3	68.8
On-Road Mobile	Exhaust Emissions - Other	4,143	3.2	72.0
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	4,076	3.1	75.1
Commercial	Automotive Fuel Retailing	3,445	2.6	77.7
Industrial	Petroleum refining	3,165	2.4	80.1
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	2,597	2.0	82.1
Industrial	Printing	2,418	1.8	84.0
Industrial	Metal plating or coating works	2,327	1.8	85.8
Off-Road Mobile	Recreational Boats	2,292	1.8	87.5
Domestic-Commercial	Cutback Bitumen	1,826	1.4	88.9
Domestic-Commercial	Natural Gas Leakage	1,569	1.2	90.1
Commercial	Printing	1,170	0.9	91.0
Off-Road Mobile	Loading and Unloading Fuels	1,121	0.9	91.8
Industrial	Other metal processing	1,118	0.9	92.7
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	1,108	0.8	93.6
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	955	0.7	94.3
Industrial	Other chemical processing	625	0.5	94.8
Off-Road Mobile	Aircraft	621	0.5	95.2
Industrial	Plastics production	551	0.4	95.7
Industrial	Generation of electrical power from gas	502	0.4	96.0
Industrial	Petrochemical production	457	0.3	96.4
Off-Road Mobile	Commercial Boats	359	0.3	96.7
Industrial	Hazardous waste generation or storage	326	0.2	96.9
Industrial	Storage of Petroleum and/or Petroleum Products	265	0.2	97.1
Industrial	Solid waste landfilling	252	0.2	97.3
Commercial	Laundries and Dry-Cleaners	217	0.2	97.5
Industrial	Other Chemical Storage	177	0.1	97.6
Industrial	Composting and related reprocessing or treatment	176	0.1	97.7
All	Other	2,956	2.3	100

Table ES8, Figure A13 and Figure A14 in Appendix A (pages 41 to 42) show anthropogenic sources of particulate matter < 10 µm emissions ranked in descending order according to total estimated annual emissions in the GMR and Sydney region. The individual and cumulative proportions of anthropogenic emissions are also shown for each source type.

Table ES8 Ranking of anthropogenic sources of particulate matter < 10 µm on an annual basis

Source Group	Source Type	Particulate Matter < 10 µm		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative Proportion (%)
GMR				
Industrial	Coal mining	25,256	33.6	33.6
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	12,584	16.8	50.4
Domestic-Commercial	Solid Fuel Combustion	6,172	8.2	58.6
Industrial	Generation of electrical power from coal	4,816	6.4	65.0
Industrial	Other land-based extraction	3,472	4.6	69.6
Industrial	Crushing, grinding or separating works	2,513	3.3	73.0
Commercial	Poultry Farming (Meat)	1,841	2.5	75.4
Industrial	Hard-rock gravel quarrying	1,687	2.2	77.7
Industrial	Primary iron and steel production	1,620	2.2	79.8
Commercial	Gravel and Sand Quarrying	1,252	1.7	81.5
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	1,159	1.5	83.0
On-Road Mobile	Exhaust Emissions Light Duty – Diesel	1,106	1.5	84.5
Industrial	Ceramics production (excluding glass)	1,099	1.5	86.0
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	1,056	1.4	87.4
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	1,033	1.4	88.7
Industrial	Solid waste landfilling	928	1.2	90.0
Industrial	Concrete batching	606	0.8	90.8
Commercial	Poultry Farming (Eggs)	594	0.8	91.6
Industrial	Poultry production	444	0.6	92.2
Industrial	Primary aluminium production	433	0.6	92.7
Industrial	Mining (other than coal)	371	0.5	93.2
Industrial	Coal loading	310	0.4	93.6
Industrial	Cement or lime production	282	0.4	94.0
Industrial	Petroleum refining	265	0.4	94.4
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	251	0.3	94.7
Off-Road Mobile	Recreational Boats	233	0.3	95.0
Off-Road Mobile	Commercial Ships	213	0.3	95.3
Industrial	Production of ammonium nitrate	210	0.3	95.6
Industrial	Cement or lime handling	199	0.3	95.8
Industrial	Bitumen pre-mix or hotmix production	198	0.3	96.1
Industrial	Plastics production	194	0.3	96.4
Off-Road Mobile	Commercial Boats	167	0.2	96.6
Industrial	Inert waste landfilling	164	0.2	96.8
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	154	0.2	97.0
All	Other	2,244	3.0	100.0

Source Group	Source Type	Particulate Matter < 10 µm		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative Proportion (%)
Sydney				
Domestic-Commercial	Solid Fuel Combustion	4,642	21.8	21.8
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	2,794	13.1	34.9
Industrial	Crushing, grinding or separating works	2,051	9.6	44.5
Industrial	Other land-based extraction	1,768	8.3	52.8
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	867	4.1	56.9
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	866	4.1	61.0
Industrial	Ceramics production (excluding glass)	841	3.9	64.9
Commercial	Poultry Farming (Meat)	831	3.9	68.8
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	702	3.3	72.1
Commercial	Gravel and Sand Quarrying	560	2.6	74.7
Commercial	Poultry Farming (Eggs)	534	2.5	77.2
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	505	2.4	79.6
Industrial	Concrete batching	487	2.3	81.9
Industrial	Solid waste landfilling	484	2.3	84.2
Industrial	Poultry production	383	1.8	86.0
Industrial	Petroleum refining	265	1.2	87.2
Industrial	Plastics production	194	0.9	88.1
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	189	0.9	89.0
Off-Road Mobile	Recreational Boats	147	0.7	89.7
Industrial	Hard-rock gravel quarrying	125	0.6	90.3
Industrial	Production of float glass	113	0.5	90.8
Industrial	Coal mining	109	0.5	91.3
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	104	0.5	91.8
Industrial	Production of container glass	86.3	0.4	92.2
Off-Road Mobile	Aircraft	86.2	0.4	92.6
Industrial	Cement or lime production	71.5	0.3	93.0
Industrial	Storage of Petroleum and/or Petroleum Products	67.9	0.3	93.3
On-Road Mobile	Exhaust Emissions - Other	67.7	0.3	93.6
Industrial	Sewage Treatment - processing by small plants	66.9	0.3	93.9
Industrial	Composting and related reprocessing or treatment	63.8	0.3	94.2
Commercial	Unaccounted Gaseous Fuel Combustion	63.3	0.3	94.5
Commercial	Hospitals (Except Psychiatric Hospitals)	62.9	0.3	94.8
Industrial	Inert waste landfilling	61.8	0.3	95.1
Industrial	Bitumen pre-mix or hotmix production	60.8	0.3	95.4
All	Other	984	4.6	100.0

Table ES9, Figure A15 and Figure A16 in Appendix A (pages 43 to 44) show anthropogenic sources of particulate matter < 2.5 µm emissions ranked in descending order according to total estimated annual emissions in the GMR and Sydney region. The individual and cumulative proportions of anthropogenic emissions are also shown for each source type.

Table ES9 Ranking of anthropogenic sources of particulate matter < 2.5 µm on an annual basis

Source Group	Source Type	Particulate Matter < 2.5 µm		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative Proportion (%)
GMR				
Domestic-Commercial	Solid Fuel Combustion	5,986	19.6	19.6
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	5,191	17.0	36.6
Industrial	Coal mining	4,154	13.6	50.3
Industrial	Generation of electrical power from coal	1,708	5.6	55.9
Industrial	Primary iron and steel production	1,444	4.7	60.6
On-Road Mobile	Exhaust Emissions Light Duty – Diesel	1,073	3.5	64.1
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial – Diesel	1,002	3.3	67.4
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	972	3.2	70.6
Industrial	Crushing, grinding or separating works	918	3.0	73.6
Industrial	Other land-based extraction	799	2.6	76.2
Industrial	Ceramics production (excluding glass)	798	2.6	78.8
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	528	1.7	80.6
Commercial	Poultry Farming (Meat)	526	1.7	82.3
Industrial	Hard-rock gravel quarrying	435	1.4	83.7
Industrial	Primary aluminium production	312	1.0	84.7
Commercial	Gravel and Sand Quarrying	296	1.0	85.7
Industrial	Petroleum refining	237	0.8	86.5
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	231	0.8	87.2
Off-Road Mobile	Recreational Boats	214	0.7	87.9
Industrial	Production of ammonium nitrate	207	0.7	88.6
Off-Road Mobile	Commercial Ships	204	0.7	89.3
Industrial	Plastics production	192	0.6	89.9
Industrial	Solid waste landfilling	189	0.6	90.5
Industrial	Cement or lime production	175	0.6	91.1
Commercial	Poultry Farming (Eggs)	170	0.6	91.7
Off-Road Mobile	Commercial Boats	155	0.5	92.2
Industrial	Bitumen pre-mix or hotmix production	145	0.5	92.7
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	143	0.5	93.1
Industrial	Concrete batching	134	0.4	93.6
Industrial	Poultry production	120	0.4	94.0
Industrial	Production of float glass	111	0.4	94.3
Commercial	Hospitals (Except Psychiatric Hospitals)	101	0.3	94.7
Off-Road Mobile	Railways	90.1	0.3	94.9
Industrial	Production of container glass	86.3	0.3	95.2
All	Other	1,454	4.8	100

Source Group	Source Type	Particulate Matter < 2.5 µm		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative Proportion (%)
Sydney				
Domestic-Commercial	Solid Fuel Combustion	4,503	34.3	34.3
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	1,152	8.8	43.1
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	840	6.4	49.5
Industrial	Crushing, grinding or separating works	807	6.2	55.6
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	797	6.1	61.7
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	681	5.2	66.9
Industrial	Ceramics production (excluding glass)	606	4.6	71.5
Industrial	Other land-based extraction	418	3.2	74.7
Commercial	Poultry Farming (Meat)	237	1.8	76.5
Industrial	Petroleum refining	237	1.8	78.3
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	230	1.8	80.1
Industrial	Plastics production	192	1.5	81.5
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	173	1.3	82.8
Commercial	Poultry Farming (Eggs)	153	1.2	84.0
Commercial	Gravel and Sand Quarrying	136	1.0	85.0
Off-Road Mobile	Recreational Boats	135	1.0	86.1
Industrial	Concrete batching	114	0.9	86.9
Industrial	Production of float glass	111	0.8	87.8
Industrial	Poultry production	106	0.8	88.6
Industrial	Solid waste landfilling	98.5	0.8	89.3
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	96.3	0.7	90.1
Industrial	Production of container glass	86.3	0.7	90.7
Off-Road Mobile	Aircraft	80.0	0.6	91.3
Industrial	Storage of Petroleum and/or Petroleum Products	67.7	0.5	91.9
Commercial	Unaccounted Gaseous Fuel Combustion	63.3	0.5	92.3
Commercial	Hospitals (Except Psychiatric Hospitals)	62.9	0.5	92.8
On-Road Mobile	Exhaust Emissions - Other	62.3	0.5	93.3
Off-Road Mobile	Commercial Boats	53.4	0.4	93.7
Off-Road Mobile	Commercial Ships	53.1	0.4	94.1
Domestic-Commercial	Gaseous Fuel Combustion	47.8	0.4	94.5
Industrial	Cement or lime production	47.3	0.4	94.8
Industrial	Generation of electrical power from gas	46.4	0.4	95.2
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	46.1	0.4	95.5
Industrial	Petrochemical production	45.3	0.3	95.9
All	Other	541	4.1	100