

**Technical Report No. 3**

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

**2008 Calendar Year**

**Commercial Emissions:  
Results**



## ACKNOWLEDGMENTS

This study was performed with the help of organisations and individuals who should be recognised for their efforts.

Data provided by other government departments and service providers, including the Australian Bureau of Agricultural and Research Economics and Sciences, Australian Bureau of Statistics, Australian Paint Manufacturers Federation, Bureau of Transport Statistics, Department of Resources, Energy and Tourism, NSW Department of Health and Ageing, NSW Registry of Births, Deaths & Marriages, and Winetitles, were essential for the completion of this study.

The work of a number of individuals is acknowledged, including Mr Nick Agapides, Manager Major Air Projects and Mr Kelsey Bawden, Senior Technical Policy Advisor, for their efforts in project scoping or management, developing emission estimation methodologies, collecting activity data, developing databases, estimating emissions and/or preparing this report.

© Copyright State of NSW and the Environment Protection Authority

The Environment Protection Authority and the State of NSW are pleased to allow this material to be reproduced in whole or in part for educational and non-commercial use, provided the meaning is unchanged and its source, publisher and authorship are acknowledged.

Published by:

Environment Protection Authority

59 Goulburn Street

PO Box A290

Sydney South 1232

Phone: (02) 9995 5000 (switchboard)

Phone: 131 555 (environment information and publications requests)

Fax: (02) 9995 5999

TTY: (02) 9211 4723

Email: [info@environment.nsw.gov.au](mailto:info@environment.nsw.gov.au)

Website: [www.epa.nsw.gov.au](http://www.epa.nsw.gov.au)

ISBN 978-1-74293-464-8

EPA 2012/0047

August 2012

## **EXECUTIVE SUMMARY**

An air emissions inventory project for commercial sources has taken over 2 years to complete. The base year of the commercial inventory represents activities that took place during the 2008 calendar year and is accompanied by emission projections in yearly increments up to the 2036 calendar year. 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 MGA1 coordinates		North-east corner MGA1 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

<sup>1</sup>Map Grid of Australia based on the Geocentric Datum of Australia 1994 (GDA94) (ICSM, 2006).

The commercial emissions inventory includes emissions from 5153 businesses. A total of 23,228 emission sources have been included in the commercial emissions inventory, consisting of 459 point sources and 22,769 fugitive sources. Table ES-2 presents the number and type of emission sources included in the commercial emissions inventory for each area considered.

**Table ES-2: Emission source summary**

Area	Point sources	Fugitive sources	Total sources
Sydney	330	16,089	16,419
Newcastle	32	1,436	1,468
Wollongong	15	867	882
Non Urban	82	4,377	4,459
GMR	459	22,769	23,228

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).



The location of each emission source included in the commercial air emissions inventory is shown in Figure ES-2.

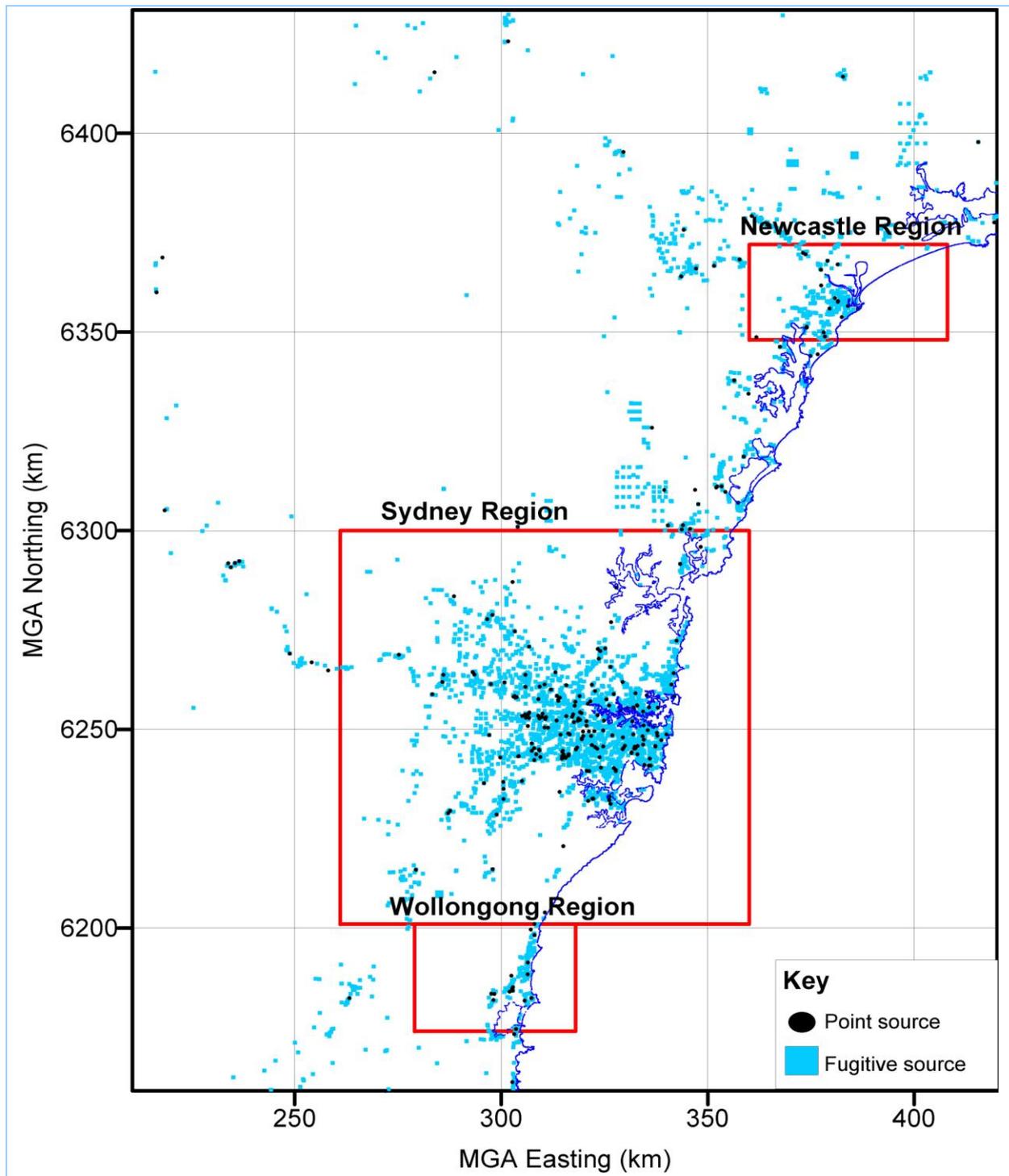


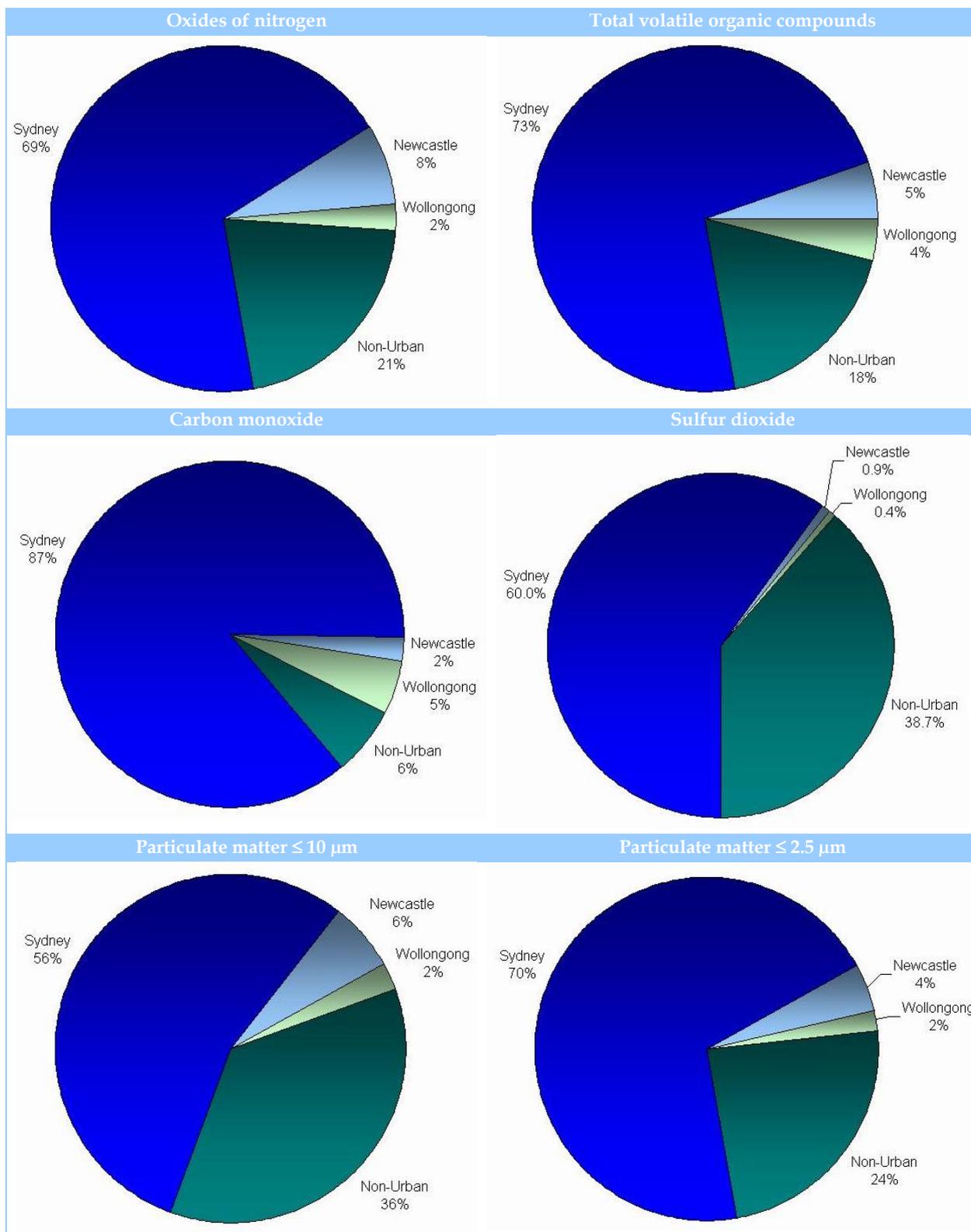
Figure ES-2: Commercial emission sources in the GMR

Table ES-3 shows the total estimated annual emissions (for selected substances) from all commercial sources in the GMR and in the Sydney, Newcastle, Wollongong and Non Urban regions.

**Table ES-3: Total estimated annual emissions from commercial sources in each region**

Substance	Emissions (tonne/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	1.52	0.210	0.0637	0.323	2.12
ACETALDEHYDE	2.58	0.002	0.0007	0.0042	2.59
BENZENE	38.2	3.23	2.54	11.1	55.1
CARBON MONOXIDE	335	9.20	19.7	24.3	389
FORMALDEHYDE	48.4	0.110	0.168	0.50	49.2
ISOMERS OF XYLENE	87.9	4.70	2.77	47.7	143
LEAD AND COMPOUNDS	0.394	0.0045	0.0013	0.0362	0.436
OXIDES OF NITROGEN	344	38.5	12.1	106	501
PARTICULATE MATTER $\leq 10 \mu\text{m}$	1,111	129	47.7	732	2,020
PARTICULATE MATTER $\leq 2.5 \mu\text{m}$	485	30.0	13.9	167	695
POLYCYCLIC AROMATIC HYDROCARBONS	0.012	0.0001	0.0002	0.0004	0.013
SULFUR DIOXIDE	108	1.62	0.73	69.8	180
TETRACHLOROETHYLENE	358	21.4	16.9	59.7	456
TOLUENE	424	18.1	10.3	66.8	520
TOTAL SUSPENDED PARTICULATE	3,332	327	121	2,416	6,195
TOTAL VOLATILE ORGANIC COMPOUNDS	6,652	476	358	1,689	9,176
TRICHLOROETHYLENE	58.7	0.00004	0.0001	0.016	58.7

Figure ES-3 shows the proportion of total estimated annual emissions (for selected substances) from all commercial sources in the GMR and in the Sydney, Newcastle, Wollongong and Non Urban regions.



**Figure ES-3: Proportion of total estimated annual emissions from commercial sources in each region**

Table ES-4 shows total estimated annual emissions (for selected substances) from each commercial source type in the GMR.

**Table ES-4: Total estimated annual emissions by commercial source type in the GMR**

Activity	Emissions (tonne/year)						
	CO	NO <sub>x</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	VOC
Agricultural machinery manufacturing	0	0	0	0	0	0	0.00023
Aircraft manufacturing	2.35	2.8	0.213	0.213	0.213	0.0146	0.154
Aluminium rolling, drawing, extruding	0	0	0.0705	0.0705	0.0705	0	0
Automotive component manufacturing n.e.c.	0.21	0.251	1.21	0.25	0.0771	0.00131	14
Automotive fuel retailing	0	0	0	0	0	0	4,910
Basic iron and steel manufacturing	5.42	8.6	14.9	9.91	8.32	0.0337	12.3
Basic non-ferrous metal manufacturing n.e.c.	0.936	1.12	15.8	10	7.55	0.134	0.965
Beer and malt manufacturing	4.77	5.68	3.39	3.39	3.39	8.91	21.9
Biscuit manufacturing	6.94	8.26	0.628	0.628	0.628	0.0432	0.454
Bread manufacturing	13.3	15.8	2.25	1.53	1.39	0.0826	143
Cake and pastry manufacturing	1.34	1.59	0.121	0.121	0.121	0.00832	12.2
Ceramic product manufacturing	28.6	6.44	49.6	30.8	23.2	47.7	0.63
Ceramic product manufacturing n.e.c.	0.0048	0.0348	0.00111	0.00108	0.00107	0	0.00084
Chemical product manufacturing n.e.c.	4.54	5.54	30.8	9.52	1.92	29.6	520
Chemical wholesaling	0	0	7.9	1.52	0.367	0	81.4
Concrete slurry manufacturing	0	0	20.2	7.06	1.12	0	0.00006
Confectionery manufacturing	0.353	1.41	0.0746	0.0708	0.0702	0.00481	1.35
Construction material mining n.e.c.	0	0	106	50.3	10.3	0	0.00603
Corrugated paperboard container manufacturing	4.82	5.74	0.436	0.436	0.436	0.03	0.316
Electrical cable and wire manufacturing	0	0	3.33	1.22	0.722	0	84
Electrical and equipment manufacturing n.e.c.	0.0368	0.422	0.429	0.429	0.429	0.00023	4.18
Explosive manufacturing	0	0	0	0	0	0	0.0213
Fabricated metal product manufacturing n.e.c.	1.64	3.41	12.4	4.85	3.48	0.0101	105
Food manufacturing n.e.c.	13	29.2	2.37	1.65	1.37	17.8	6.21
Fruit and vegetable processing	2.49	1.48	0.225	0.225	0.225	0.0155	0.163
Funeral directors,	3.07	6.73	0.318	0.0955	0.0636	11.9	0.283

*Air Emissions Inventory for the Greater Metropolitan Region of New South Wales*  
*Executive Summary*

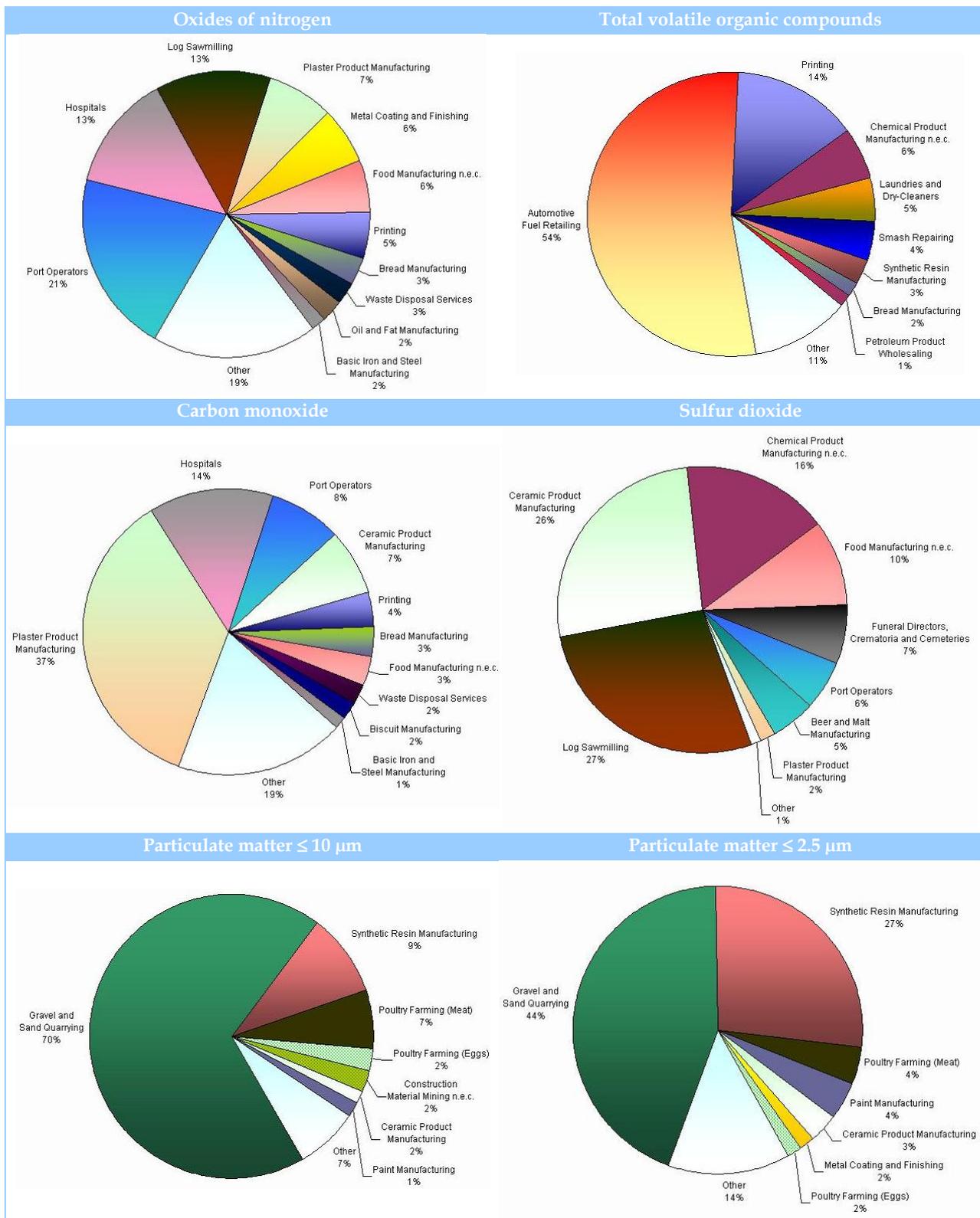
Activity	Emissions (tonne/year)						
	CO	NO <sub>x</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	VOC
crematoria and cemeteries							
Furniture manufacturing n.e.c.	1.59	1.9	0.15	0.145	0.144	0.00991	7.24
Gas supply	3.09	3.68	0.28	0.28	0.28	0.0192	0.202
Glass and glass product manufacturing	3.72	3.92	8.58	8.41	8.26	0.176	2.86
Gravel and sand quarrying	0	0	5,080	1,390	306	0	0.105
Hospitals	54.2	66.5	5.01	5	5	0.469	3.79
Ice-cream manufacturing	0.294	2.08	0.11	0.0964	0.0938	0.00639	0.438
Industrial gas manufacturing	0.00188	0.0136	2.77	0.75	0.0868	0	5.82
Ink manufacturing	0	0	0.688	0.619	0.611	0	10.6
Laundries and dry-cleaners	3.87	4.68	0.356	0.356	0.356	0.0245	474
Lifting and material handling equipment manufacturing	0	0.124	0.0245	0.0245	0.0245	0	0.745
Log sawmilling	3.29	64.8	45.2	18.4	7.42	49.5	90
Medicinal and pharmaceutical product manufacturing	2.96	3.61	0.27	0.27	0.27	0.0183	2.04
Metal coating and finishing	5.16	32.4	25	14.6	12.5	0.0321	21.5
Milk and cream processing	1.03	1.22	0.093	0.093	0.093	0.0064	0.0673
Mining and construction machinery manufacturing	0	0	0.00508	0.00114	0.00043	0	1.28
Non-building construction n.e.c.	0.0236	0.171	2.47	0.477	0.119	0	0.00412
Non-ferrous metal casting	0.0072	0.0288	0.384	0.244	0.183	0.0217	0.00064
Non-metallic mineral product manufacturing n.e.c.	0.485	0.577	0.0439	0.0439	0.0439	0.00302	106
Oil and fat manufacturing	5.32	11.4	0.482	0.482	0.482	0.0331	0.349
Organic industrial chemical manufacturing n.e.c.	0.0251	0.0299	0.00227	0.00227	0.00227	0.00016	4.54
Paint manufacturing	0	0	34.3	29.3	28.3	0	124
Paper product manufacturing n.e.c.	1.22	1.73	0.13	0.129	0.129	0.0319	0.498
Petroleum product wholesaling	0	0	2.35	0.504	0.0988	0	125
Plaster product manufacturing	138	37.3	16.1	13.6	7.81	3.4	3.41
Plastic bag and film manufacturing	0	0	0.899	0.899	0.832	0	17.7
Plastic injection-moulded product manufacturing	2.96	3.54	20.3	5.96	0.839	0.0218	0.441

2008 Calendar Year Commercial Emissions: Results  
Executive Summary

Activity	Emissions (tonne/year)						
	CO	NO <sub>x</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	VOC
Plastic product (rigid fibre reinforced) manufacturing	1.4	1.66	0.433	0.194	0.139	0.00869	43.4
Port operators	31.3	102	8.95	8.95	8.95	9.94	13.7
Poultry farming (eggs)	0	0	116	50.5	11.6	0	0
Poultry farming (meat)	1.16	1.38	303	132	30.3	0.00719	0.0757
Prepared animal and bird feed manufacturing	1.3	1.55	0.118	0.118	0.118	0.0101	0.0853
Printing	14.9	26	1.46	1.46	1.46	0.0933	1,320
Rail transport	0	0	0	0	0	0	0.00126
Railway equipment manufacturing	0	0	0	0	0	0	0.058
Road and bridge construction	0	0	12.7	3.5	0.407	0	0.0149
Rubber product Manufacturing n.e.c.	0.0072	0.0288	0.28	0.0769	0.0111	0.0102	0.00687
Scientific research	0.927	0.552	0.0839	0.0839	0.0839	0.00577	0.0607
Services to air transport	2.24	2.67	0.203	0.203	0.203	0.014	71.4
Smash repairing	0	0	0	0	0	0	393
Soap and other detergent manufacturing	0	0	2.35	0.665	0.0674	0	0.0289
Soft drink, cordial and syrup manufacturing	3.46	4.12	0.313	0.313	0.313	0.0215	2.24
Solid paperboard container manufacturing	0	0	0	0	0	0	15.3
Spirit manufacturing	0	0	0	0	0	0	66.8
Spring and wire product manufacturing	0.00512	0.781	5.48	1.16	0.383	0.00003	0.381
Steel pipe and tube manufacturing	0	0.744	5.81	4.78	4.56	0	0.00123
Structural metal product manufacturing n.e.c.	0	0	0.007	0.007	0.007	0	2.49
Structural steel fabricating	0	0	2.04	0.4	0.104	0	0
Synthetic resin manufacturing	1.46	1.73	212	191	189	0.00905	270
Waste disposal services	9.22	13	1.77	1.7	1.67	0.353	33.2
Wine manufacturing	0.00024	0.00175	0.00006	0.00005	0.00005	0	24.1
Wood product manufacturing n.e.c.	0.0005	0.0006	1.21	0.232	0.0561	0	5.42
Wooden furniture and upholstered seat manufacturing	0	0	0	0	0	0	1.77
<b>Grand total</b>	<b>389</b>	<b>501</b>	<b>6,190</b>	<b>2,020</b>	<b>695</b>	<b>180</b>	<b>9,180</b>

n.e.c., not elsewhere classified; PM<sub>2.5</sub>, particulate matter ≤ 2.5 µm; PM<sub>10</sub>, particulate matter ≤ 10 µm; TSP, total suspended particulate; VOC, volatile organic compounds

Figure ES-4 shows the proportion of total estimated annual emissions (for selected substances) from each commercial source type in the GMR.



**Figure ES-4: Proportion of total emissions by commercial source type in the GMR**

Table ES-5 shows total estimated annual emissions (for selected substances) from each commercial source type in the Sydney region.

**Table ES-5: Total estimated annual emissions by commercial source type in the Sydney region**

Activity	Emissions (tonne/year)						
	CO	NO <sub>x</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	VOC
Agricultural machinery manufacturing	0	0	0	0	0	0	0.00023
Aircraft manufacturing	2.35	2.8	0.213	0.213	0.213	0.0146	0.154
Automotive component manufacturing n.e.c.	0.208	0.247	1.21	0.25	0.0768	0.00129	12.7
Automotive fuel retailing	0	0	0	0	0	0	2,940
Basic iron and steel manufacturing	0.853	3.16	14.4	9.45	7.86	0.0053	12
Basic non-ferrous metal manufacturing n.e.c.	0.936	1.12	15.8	10	7.55	0.134	0.965
Beer and malt manufacturing	4.77	5.68	3.39	3.39	3.39	8.91	21.9
Biscuit manufacturing	6.94	8.26	0.628	0.628	0.628	0.0432	0.454
Bread manufacturing	11.6	13.8	1.05	1.05	1.05	0.0721	132
Cake and pastry manufacturing	1.34	1.59	0.121	0.121	0.121	0.00832	12.2
Ceramic product manufacturing	15.7	2.57	41.6	23.3	21.3	47.5	0.153
Chemical product manufacturing n.e.c.	4.54	5.54	30.8	9.51	1.91	29.6	510
Chemical wholesaling	0	0	6.75	1.29	0.313	0	81.4
Concrete slurry manufacturing	0	0	13.2	4.52	0.716	0	0.00006
Confectionery manufacturing	0.353	1.41	0.0746	0.0708	0.0702	0.00481	1.35
Corrugated paperboard container manufacturing	4.82	5.74	0.436	0.436	0.436	0.03	0.316
Electrical and equipment manufacturing n.e.c.	0.0368	0.422	0.429	0.429	0.429	0.00023	4.18
Fabricated metal product manufacturing n.e.c.	0.87	2.08	11.9	4.54	3.21	0.00532	103
Food manufacturing n.e.c.	6.9	8.22	0.714	0.642	0.629	0.0429	5.72
Fruit and vegetable processing	2.49	1.48	0.225	0.225	0.225	0.0155	0.163
Funeral directors, crematoria and cemeteries	1.95	4.27	0.202	0.0605	0.0403	7.51	0.18
Furniture manufacturing n.e.c.	0	0	0.00086	0.00017	0.00004	0	2.84
Gas supply	3.09	3.68	0.28	0.28	0.28	0.0192	0.202
Glass and glass product manufacturing	3.71	3.88	8.57	8.4	8.25	0.174	2.86
Gravel and sand quarrying	0	0	2590	646	145	0	0.0477
Hospitals	38	45.6	3.44	3.44	3.44	0.256	2.62
Ice-cream manufacturing	0.294	2.08	0.11	0.0964	0.0938	0.00639	0.438

*Air Emissions Inventory for the Greater Metropolitan Region of New South Wales*  
*Executive Summary*

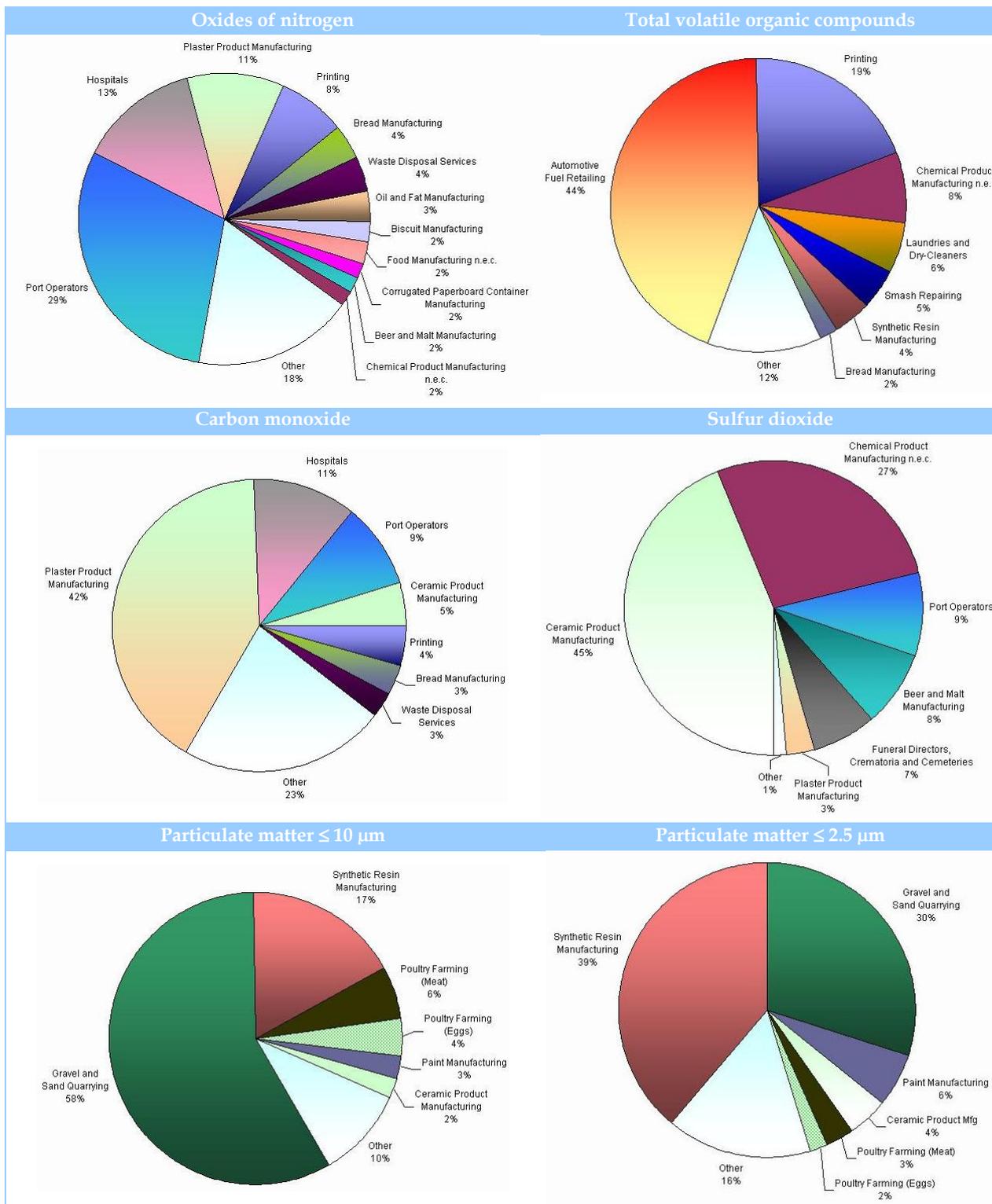
Activity	Emissions (tonne/year)						
	CO	NO <sub>x</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	VOC
Industrial gas manufacturing	0.00188	0.0136	2.77	0.75	0.0868	0	5.82
Ink manufacturing	0	0	0.688	0.619	0.611	0	10.6
Laundries and dry-cleaners	3.87	4.68	0.356	0.356	0.356	0.0245	372
Lifting and material handling equipment manufacturing	0	0.124	0.0245	0.0245	0.0245	0	0.745
Medicinal and pharmaceutical product manufacturing	2.44	2.99	0.223	0.223	0.223	0.0151	1.35
Metal coating and finishing	2.7	3.83	11.3	9.85	9.28	0.0168	20.9
Milk and cream processing	1.03	1.22	0.093	0.093	0.093	0.0064	0.0673
Non-building construction n.e.c.	0.0165	0.119	2.46	0.476	0.118	0	0.00288
Non-metallic mineral product manufacturing n.e.c.	0.485	0.577	0.0439	0.0439	0.0439	0.00302	106
Oil and fat manufacturing	5.32	11.4	0.482	0.482	0.482	0.0331	0.349
Organic industrial chemical manufacturing n.e.c.	0.0251	0.0299	0.00227	0.00227	0.00227	0.00016	4.54
Paint manufacturing	0	0	34.3	29.3	28.3	0	124
Paper product manufacturing n.e.c.	1.14	1.35	0.103	0.103	0.103	0.00707	0.471
Petroleum product wholesaling	0	0	1.78	0.341	0.0825	0	53
Plaster product manufacturing	138	37.3	16.1	13.6	7.81	3.4	3.41
Plastic bag and film manufacturing	0	0	0.899	0.899	0.832	0	17.7
Plastic injection-moulded product manufacturing	2.96	3.54	20.3	5.96	0.839	0.0218	0.441
Plastic product (rigid fibre reinforced) manufacturing	1.4	1.66	0.22	0.153	0.129	0.00869	20.4
Port operators	31.3	102	8.95	8.95	8.95	9.94	13.7
Poultry farming (eggs)	0	0	104	45.4	10.4	0	0
Poultry farming (meat)	1.16	1.38	147	64.1	14.8	0.00719	0.0757
Prepared animal and bird feed manufacturing	0.00144	0.00576	0.00032	0.00031	0.00031	0.00204	0.0001
Printing	14.9	26	1.46	1.46	1.46	0.0933	1,300
Railway equipment manufacturing	0	0	0	0	0	0	0.058
Road and bridge construction	0	0	12.6	3.44	0.394	0	0
Rubber product manufacturing n.e.c.	0	0	0.00191	0.00578	0	0	0.006
Scientific research	0.927	0.552	0.0839	0.0839	0.0839	0.00577	0.0607
Services to air transport	2.24	2.67	0.203	0.203	0.203	0.014	71.4
Smash repairing	0	0	0	0	0	0	308
Soap and other detergent manufacturing	0	0	2.35	0.665	0.0674	0	0.0289

2008 Calendar Year Commercial Emissions: Results  
Executive Summary

Activity	Emissions (tonne/year)						
	CO	NO <sub>x</sub>	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	VOC
Soft drink, cordial and syrup manufacturing	3.46	4.12	0.313	0.313	0.313	0.0215	2.24
Solid paperboard container manufacturing	0	0	0	0	0	0	15.3
Spirit manufacturing	0	0	0	0	0	0	66.8
Spring and wire product manufacturing	0.00452	0.00538	0.242	0.0468	0.0116	0.00003	0.00051
Steel pipe and tube manufacturing	0	0.744	1.91	1.27	1.05	0	0.00123
Structural metal product manufacturing n.e.c.	0	0	0.007	0.007	0.007	0	2.49
Structural steel fabricating	0	0	2.04	0.4	0.104	0	0
Synthetic resin manufacturing	0.9	1.07	212	191	189	0.0056	268
Waste disposal services	9.22	13	1.77	1.7	1.67	0.353	17.3
Wine manufacturing	0.00024	0.00175	0.00006	0.00005	0.00005	0	3.18
Wood product manufacturing n.e.c.	0.0005	0.0006	1.07	0.206	0.0499	0	0.00003
Wooden furniture and upholstered seat manufacturing	0	0	0	0	0	0	1.77
<b>Grand total</b>	<b>335</b>	<b>344</b>	<b>3,330</b>	<b>1,110</b>	<b>485</b>	<b>108</b>	<b>6,650</b>

n.e.c., not elsewhere classified; PM<sub>2.5</sub>, particulate matter ≤ 2.5 µm; PM<sub>10</sub>, particulate matter ≤ 10 µm; TSP, total suspended particulate; VOC, volatile organic compounds

Figure ES-5 shows the proportion of total estimated annual emissions (for selected substances) from each commercial source type in the Sydney region.



**Figure ES-5: Proportion of total emissions by commercial source type in the Sydney region**