

Technical Report No. 5

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

2008 Calendar Year

**Industrial Emissions:
Results**



ACKNOWLEDGMENTS

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

Data provided by the 1,092 individual company premises that returned the industrial surveys 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.

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EXECUTIVE SUMMARY

An air emissions inventory project for industrial sources has taken over 2 years to complete. The base year of the industrial 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 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

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

The industrial emissions inventory includes emissions from 1,092 licensed facilities. A total of 9,775 emission sources have been included in the industrial emissions inventory, consisting of 1,750 point sources and 8,025 fugitive sources. Table ES-2 presents the number and type of emission sources included in the industrial emissions inventory for each area considered.

Table ES-2: Emission source summary

Area	Point sources	Fugitive sources	Total sources
Sydney	1,184	4,014	5,198
Newcastle	191	882	1,073
Wollongong	159	362	521
Non Urban	216	2,767	2,983
GMR	1,750	8,025	9,775

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

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

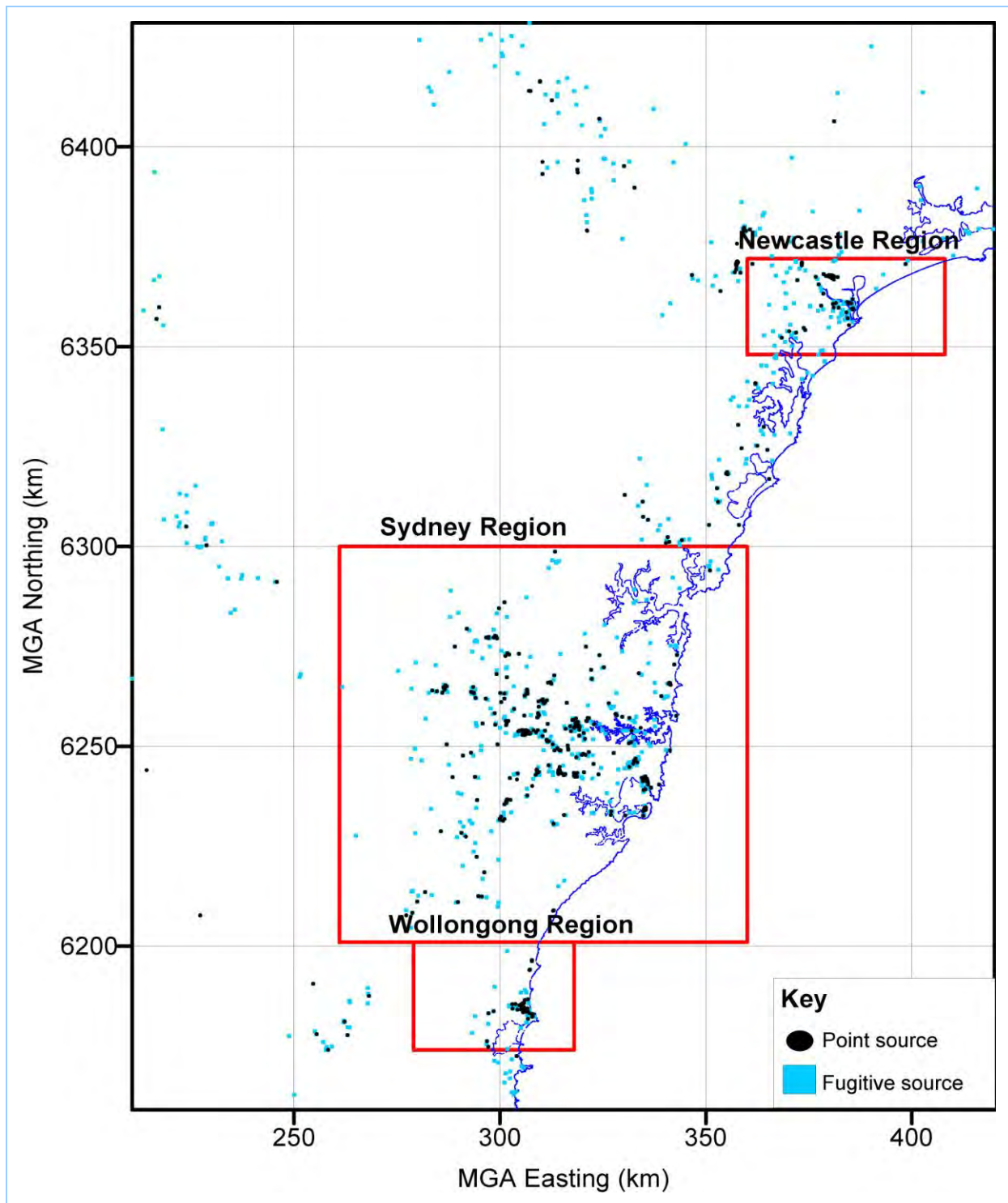


Figure ES-2: Industrial emission sources in the GMR

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

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

Substance	Emissions (tonne/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	1.55	0.83	1.5	2.97	6.85
ACETALDEHYDE	2.21	2.48	0.13	0.02	4.84
BENZENE	157	43.7	253	7.3	460
CARBON MONOXIDE	14,200	41,900	529,000	27,800	613,000
FORMALDEHYDE	234	7.62	14.9	4.11	260
ISOMERS OF XYLENE	152	33.1	8.97	519	713
LEAD AND COMPOUNDS	6.47	4.05	3.99	27.3	41.8
OXIDES OF NITROGEN	8,920	1,830	7,780	173,000	191,000
PARTICULATE MATTER ≤ 10 µm	6,210	3,740	2,100	61,200	73,200
PARTICULATE MATTER ≤ 2.5 µm	1,930	1,110	1,350	13,300	17,700
POLYCYCLIC AROMATIC HYDROCARBONS	2.05	6.77	34.1	4.03	46.9
SULFUR DIOXIDE	5,570	10,300	8,490	256,000	280,000
TETRACHLOROETHYLENE	12.6	3.36	1.12	16.9	34
TOLUENE	421	60.3	43.1	143	667
TOTAL SUSPENDED PARTICULATE	17,500	9,820	5,480	161,000	193,000
TOTAL VOLATILE ORGANIC COMPOUNDS	8,210	771	716	1,830	11,500
TRICHLOROETHYLENE	19.9	2.54	2.02	22.5	47

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

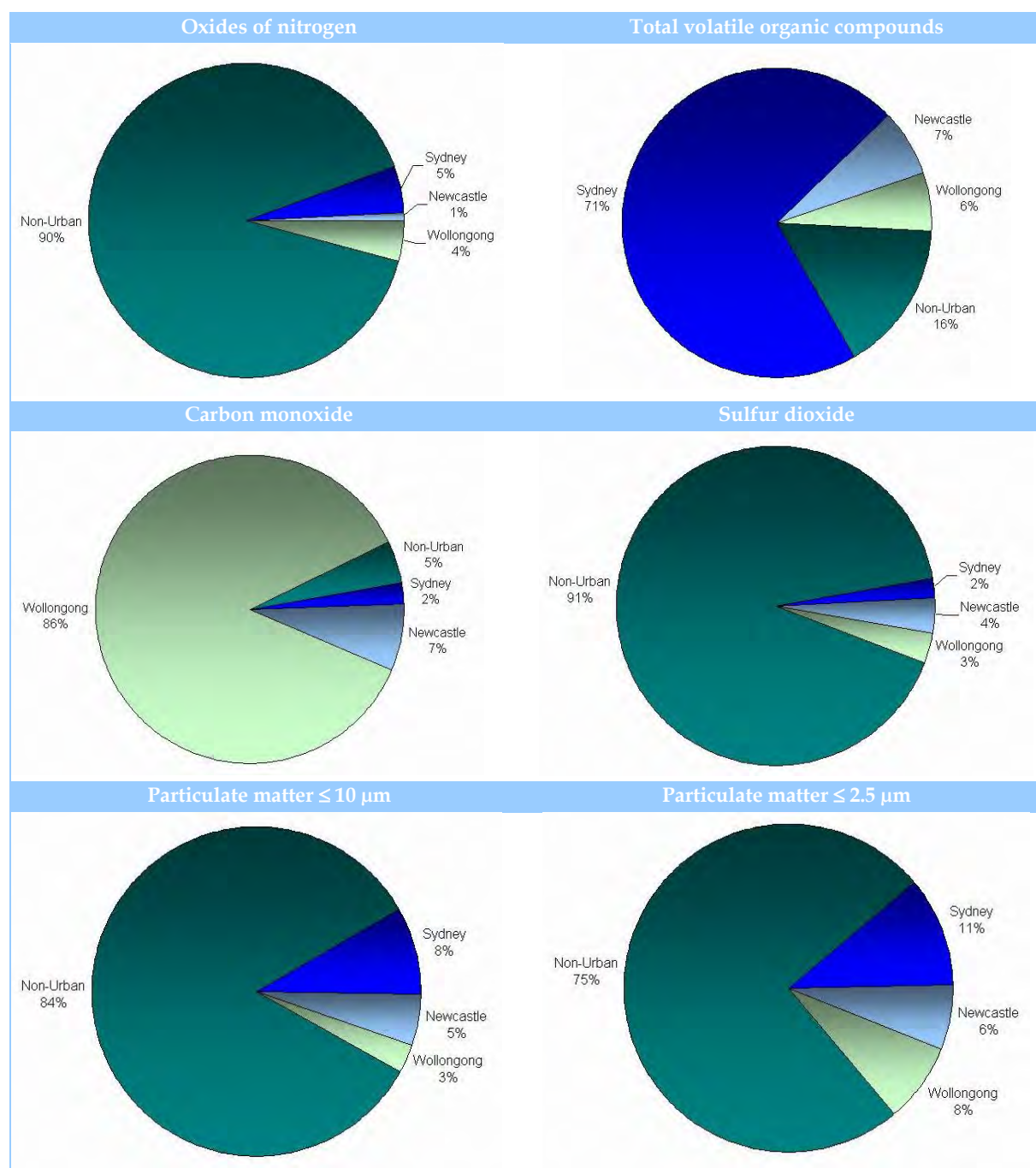


Figure ES-3: Proportion of total estimated annual emissions from industrial sources in each region

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

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

Activity	Emissions (tonne/year)						
	CO	NO _x	TSP	PM ₁₀	PM _{2.5}	SO ₂	VOC
Agricultural fertiliser (phosphate) production	1.09	0.501	44.3	40	38.4	0.00262	0.0288
Aluminium production (alumina)	53,000	511	862	391	255	13,900	15.8
Aluminium production (scrap metal)	69.4	44.7	46.7	23.9	19.4	27.2	35
Ammonium nitrate production	258	844	337	323	316	0.923	132
Animal accommodation	0.00922	0.0428	21.9	10.5	1.35	0.00005	0.0287
Battery production	0	0	3.95	3.94	3.94	0	0
Bird accommodation	1.98	4.82	724	319	71.4	0.0257	0.265
Bitumen mixing	267	27.4	146	91.4	53.6	9.69	29.3
Boat construction/maintenance (dry/float)	0.0201	0.0402	84.3	57.3	48.9	0.00029	16.7
Boat construction/maintenance (general)	0	0.578	15.4	12.8	11.7	0	40.7
Boat mooring and storage	0	0	0.785	0.151	0.0365	0	3.06
Brewing and distilling	8.22	18.6	1.82	1.24	1.14	0.0513	18.8
Cement or lime handling	97.6	23.6	122	58.1	13.8	2.52	213
Cement or lime production	1,670	5,020	1,240	679	582	379	6.84
Ceramics production	935	296	1,800	855	593	581	32.5
Chemical production	89.6	221	81.2	29.3	11.2	65.5	452
Chemical storage	0.128	0.152	0.0414	0.0176	0.0129	0.00079	0.0234
Coal washery reject or slag landfilling	0	0	33.7	16.6	3.29	0	0
Coal works	0.00031	0.00145	2,970	1,000	126	0	0.403
Coke production	6.55	24.7	163	71.6	59.5	455	0.578
Composting	24.6	39.3	466	176	31.7	0.0458	1120
Concrete works	7.73	9.33	396	129	22	0.0494	8.64
Container reconditioning	1.72	2.22	4.11	1.23	0.283	0.0117	73.1
Contaminated soil treatment	17.7	40.2	44.5	16.4	3.72	0.111	1.23
Crushing, grinding or separating	222	37.9	1560	405	86.6	5.88	9.03
Dairy animal accommodation	0	0	48.8	23.4	3	0	0.0246
Dairy processing	10.9	12	181	35.6	9.35	0.068	3.83
Explosives production	0.173	0.177	0.834	0.199	0.0315	0.00017	0.161
General agricultural processing	41.1	49	190	101	46.3	0.324	6.14
General animal products	29.6	53.9	3.89	2.91	2.74	0.187	3.21

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

Activity	Emissions (tonne/year)						
	CO	NO _x	TSP	PM ₁₀	PM _{2.5}	SO ₂	VOC
production							
General chemicals storage	3.14	3.86	66.3	13	3.35	31.2	8.83
Generation of electrical power from coal	7,530	166,000	8,280	6,520	3,340	251,000	904
Generation of electrical power from gas	2,220	2,360	84.9	84.9	84.9	17.8	411
Generation of electricity not coal or gas	283	130	2.17	2.04	2.01	10.9	34.5
Glass production (container)	35.2	1090	125	118	114	327	35.2
Glass production (float)	41	225	40.8	31.6	27.7	223	5.37
Hazardous, industrial or group A waste disposal	0	0	74.2	21.1	2.11	0	0
Hazardous, industrial or group A waste generation	0	0	0.0084	0.00161	0.00039	0	0
Helicopter-related activity	0	0	0	0	0	0	0.00324
Inert waste landfilling	1.61	0	71.8	35.5	7.07	0	18.3
Iron or steel production (iron ore)	528,000	7,510	4,590	1,750	1,220	8,220	452
Iron or steel production (scrap metal)	9,090	168	251	149	128	10.5	385
Land-based extractive activity	16.7	52.5	10,300	2,800	569	0.227	6.55
Metal plating or coating	1,080	93.1	100	52.2	40.8	24.3	467
Metal processing	130	85.2	90.1	35.9	23	1.91	91.7
Mining for coal	4,570	2,460	145,000	52,500	8,830	496	199
Mining for minerals	0	0	1,330	441	79	0	0.0591
Miscellaneous licensed discharges to waters (at any time)	0	0	28.9	8.11	0.848	0	0.023
Non-ferrous metal production (scrap)	281	16.2	7.83	4	3.37	130	2.16
Non-thermal treatment of waste	9.35	22.2	252	92.9	23.4	2.29	25.3
Other land-based extraction	5.28	0.531	4,670	1,360	152	0.00386	2.71
Paints/polishes/adhesives production	8.17	2.55	12.6	10.3	7.63	0.103	99.9
Paper or pulp production	59.4	135	7.84	5.86	5.51	0.371	6.14
Paper production using recycle materials	5.36	12.2	2.2	1.31	1.31	0.0334	0.44
Pesticides and related products production	0.245	0.387	2.34	1.94	1.67	0.00143	10.5
Petrochemical production	257	1,100	40.5	24	17.5	229	699
Petroleum products and fuel production	1,380	1,900	349	180	99.1	3120	1420
Petroleum products storage	1,460	533	56.3	45.3	43.5	737	864
Pharmaceutical and	10	14.8	1.64	1.05	0.945	0.0648	26.5

2008 Calendar Year Industrial Emissions: Results
Executive Summary

Activity	Emissions (tonne/year)						
	CO	NO _x	TSP	PM ₁₀	PM _{2.5}	SO ₂	VOC
veterinary products production							
Pig accommodation	0	0	0.088	0.0169	0.00409	0	0.0445
Plastics resins production	25.7	7.23	2.42	0.801	0.509	0.0142	128
Printing, packaging and visual media production	4.79	6.13	0.88	0.543	0.482	0.0297	1830
Railway systems activities	0	0	282	79.6	9.14	0	0.298
Recovery of waste	0.614	0.731	305	95.1	15.1	0.00382	5.78
Recovery of waste oil	7.73	15	2.19	1.08	0.874	6.17	1.32
Recovery of waste tyres	0	0	0.0134	0.00257	0.00062	0	0.261
Rendering or fat extraction	21.6	46.1	9.66	3.78	2.32	0.139	2.04
Road construction	0.203	0.943	108	25.5	3.66	0.0011	0.0689
Rubber products/tyre production	0.00851	0.02	0.0741	0.0496	0.0452	0.00011	3.65
Scrap metal processing	0	7.93	84.8	52.8	39.3	0	0.00829
Sewage treatment - large plants	53.8	116	11.1	4.25	2.96	0.149	70.1
Sewage treatment - small plants	1.88	1.98	79	21.2	2.99	0.0126	33.1
Shipping in bulk	0.014	0.0653	96.5	44.9	14.9	0.00008	22.5
Slaughtering or processing of animals	8.55	48.2	206	68.2	17.1	65.5	6.98
Soap and detergent production	4.49	4.34	0.781	0.48	0.426	0.791	69.2
Solid waste landfilling	8.38	0	138	60.4	11.6	0	118
Sterilisation activities	1.05	1.23	0.0983	0.0962	0.0958	0.00658	0.0692
Waste disposal (application to land)	43.2	0	4610	1,590	297	0	831
Waste storage	0.161	0.245	63.7	19.6	3.6	0.00099	0.787
Water-based extractive activity	0	0	24.2	10.3	1.84	0	0.398
Wood or timber milling or processing	30.8	1.6	13.8	7.81	2.92	0.0075	0.165
Grand total	613,000	191,000	193,000	73,200	17,700	280,000	11,500

PM_{2.5}, particulate matter ≤ 2.5 µm; PM₁₀, 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 industrial source type in the GMR.

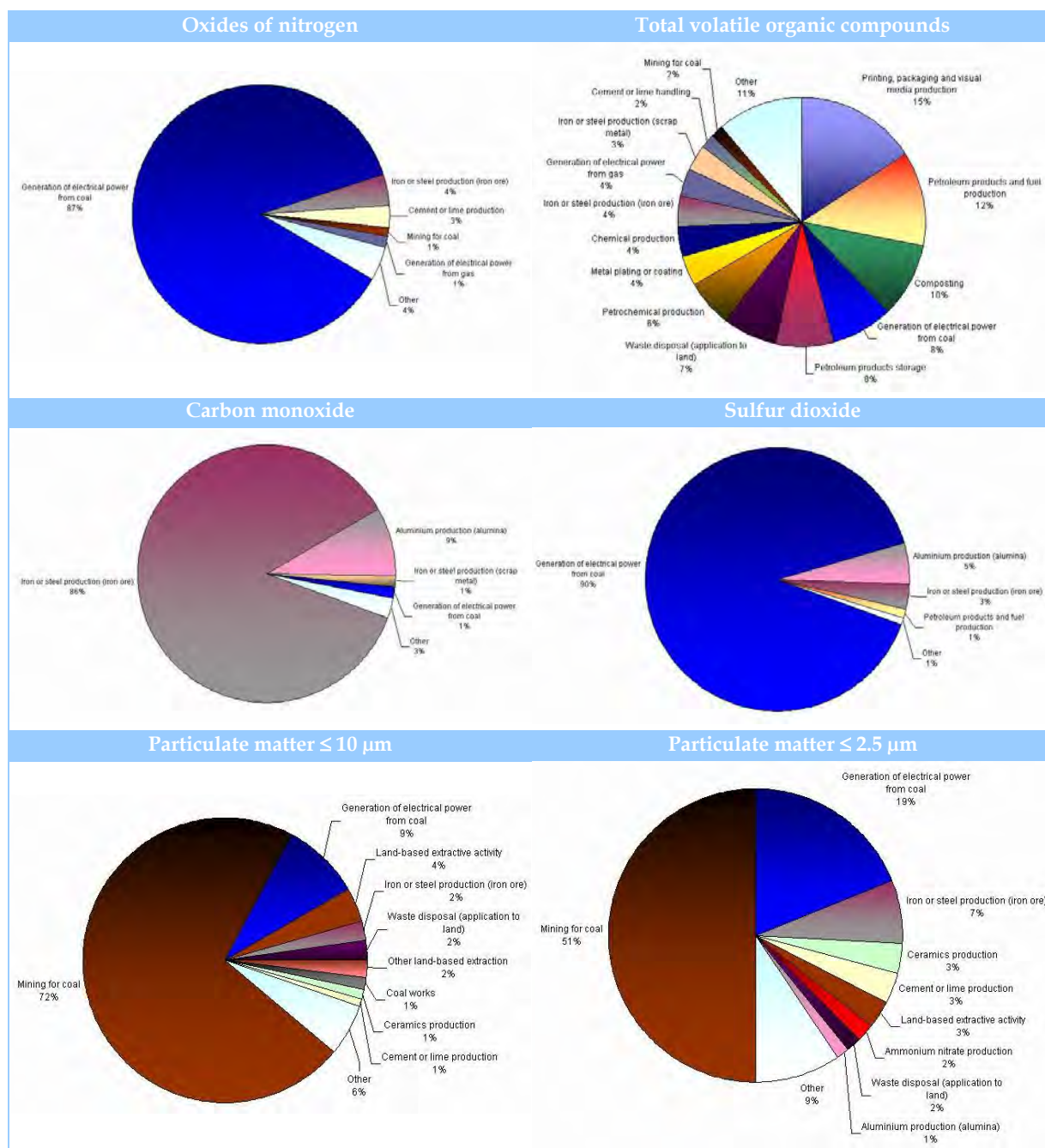


Figure ES-4: Proportion of total emissions by industry source type in the GMR

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

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

Activity	Emissions (tonne/year)						
	CO	NO _x	TSP	PM ₁₀	PM _{2.5}	SO ₂	VOC
Aluminium production (scrap metal)	46.9	33.8	24.9	9.56	9.18	22.2	34
Battery production	0	0	3.95	3.94	3.94	0	0
Bird accommodation	1.4	3.67	536	238	53.9	0.0174	0.195
Bitumen mixing	204	15.6	105	59.3	29	3.01	20.2
Boat construction/maintenance (dry/float)	0	0	0.165	0.0317	0.00766	0	4.54
Boat construction/maintenance (general)	0	0	14.8	12.6	11.5	0	30.8
Boat mooring and storage	0	0	0.396	0.076	0.0184	0	2.6
Brewing and distilling	8.22	18.6	1.82	1.24	1.14	0.0513	18.8
Cement or lime handling	97.2	23.1	100	49	12.3	2.52	213
Cement or lime production	47.2	808	51.9	40.8	37.7	8.19	1.28
Ceramics production	767	227	1,410	681	478	505	29.5
Chemical production	49.4	69.5	39.2	12.5	4.39	0.92	370
Chemical storage	0.128	0.152	0.0414	0.0176	0.0129	0.00079	0.0234
Coke production	3.45	12.8	109	43.1	31.9	237	0.227
Composting	24.6	39.3	420	156	28.2	0.0458	900
Concrete works	4.62	5.64	310	100	17	0.0301	4.94
Container reconditioning	1.72	2.21	4.01	1.21	0.278	0.0115	69.5
Contaminated soil treatment	17.7	40.2	23.6	8.55	2.43	0.111	1.2
Crushing, grinding or separating	221	37.4	1,450	372	80.6	5.88	8.33
Dairy animal accommodation	0	0	48.8	23.4	3	0	0.0246
Dairy processing	8.1	8.61	179	34.9	9.01	0.0504	3.01
General agricultural processing	23.3	27.9	161	85.8	40.8	0.213	2.94
General animal products production	27.2	50.8	2.8	2.53	2.48	0.169	2.96
General chemicals storage	0	0	65.3	12.5	3.03	0	8.59
Generation of electrical power from gas	1,640	2,080	49.3	49.3	49.3	14.8	352
Generation of electricity not coal or gas	282	129	2.12	1.99	1.96	10.9	34.4
Glass production (container)	35.2	1,090	125	118	114	327	35.2
Glass production (float)	41	225	40.8	31.6	27.7	223	5.37
Hazardous, industrial or group A waste D	0	0	74.2	21.1	2.11	0	0

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Activity	Emissions (tonne/year)						
	CO	NO _x	TSP	PM ₁₀	PM _{2.5}	SO ₂	VOC
Hazardous, industrial or group A waste G	0	0	0.00291	0.00056	0.00014	0	0
Helicopter-related activity	0	0	0	0	0	0	0.00233
Iron or steel production (scrap metal)	6,880	26.1	162	90.5	75.5	1.63	350
Land-based extractive activity	0	0	982	294	61.2	0	0.453
Metal plating or coating	20.7	27.5	37.1	28	27.1	0.134	111
Metal processing	83.6	8.33	11.7	5.97	4.94	0.91	25.4
Mining for coal	0.0685	0.161	1,100	410	52	0.00089	3.95
Miscellaneous licensed discharges to waters (at any time)	0	0	28.9	8.11	0.848	0	0.00394
Non-ferrous metal production (scrap)	281	16.2	7.83	4	3.37	130	2.16
Non-thermal treatment of waste	8.52	21	242	89.1	22.5	1.29	20.7
Other land-based extraction	5.02	0.00192	4460	1300	145	0.00001	2.67
Paints/polishes/adhesives production	8.17	2.55	12.6	10.3	7.63	0.103	99.9
Paper or pulp production	59.4	135	7.84	5.86	5.51	0.371	6.14
Paper production using recycle materials	5.36	12.2	2.2	1.31	1.31	0.0334	0.44
Pesticides and related products production	0.245	0.387	1.86	1.84	1.63	0.00143	10.5
Petrochemical production	257	1,100	40.5	24	17.5	229	699
Petroleum products and fuel production	1,380	1,890	347	179	98.4	3,110	1,420
Petroleum products storage	1,460	533	56.2	45.3	43.5	737	630
Pharmaceutical and veterinary products production	10	14.8	1.64	1.05	0.945	0.0648	26.5
Pig accommodation	0	0	0.088	0.0169	0.00409	0	0.0266
Plastics resins production	25.7	7.23	2.42	0.801	0.509	0.0142	128
Printing, packaging and visual media production	4.79	6.13	0.87	0.541	0.481	0.0297	1,740
Railway systems activities	0	0	282	79.6	9.14	0	0.298
Recovery of waste	0	0	283	87.7	13.6	0	0.671
Recovery of waste oil	5.66	6.76	1.96	0.86	0.662	0.0536	0.984
Recovery of waste tyres	0	0	0.0134	0.00257	0.00062	0	0.261
Rendering or fat extraction	17.6	39	8.97	3.33	1.91	0.114	1.68
Road construction	0.203	0.943	70.2	19.7	2.39	0.0011	0.0689
Rubber products/tyre production	0.00851	0.02	0.0741	0.0496	0.0452	0.00011	3.65
Scrap metal processing	0	4.81	83.8	52.6	39.3	0	0.00475
Sewage treatment - large plants	52.5	115	7.54	3.25	2.46	0.141	37.2

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Executive Summary

Activity	Emissions (tonne/year)						
	CO	NO _x	TSP	PM ₁₀	PM _{2.5}	SO ₂	VOC
Sewage treatment - small plants	0.688	0.694	55.4	15.8	1.74	0.0043	3.27
Shipping in bulk	0.014	0.0653	5.17	2.43	0.246	0.00008	0.00488
Slaughtering or processing of animals	4.96	6.3	96.1	19.5	4.78	0.0311	5.38
Soap and detergent production	4.49	4.34	0.781	0.48	0.426	0.791	69.2
Solid waste landfilling	6.47	0	38.1	18.4	3.59	0	73.4
Sterilisation activities	1.05	1.23	0.0983	0.0962	0.0958	0.00658	0.0692
Waste disposal (application to land)	29.1	0	3,610	1,220	226	0	578
Waste storage	0.161	0.245	51.5	16.1	3.25	0.00099	0.784
Water-based extractive activity	0	0	0.322	0.0918	0.00918	0	0.288
Grand total	14,200	8,920	17,500	6,210	1,930	5,570	8,210

PM_{2.5}, particulate matter ≤ 2.5 µm; PM₁₀, particulate matter ≤ 10 µm; TSP, total suspended particulate; VOC, volatile organic compounds

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

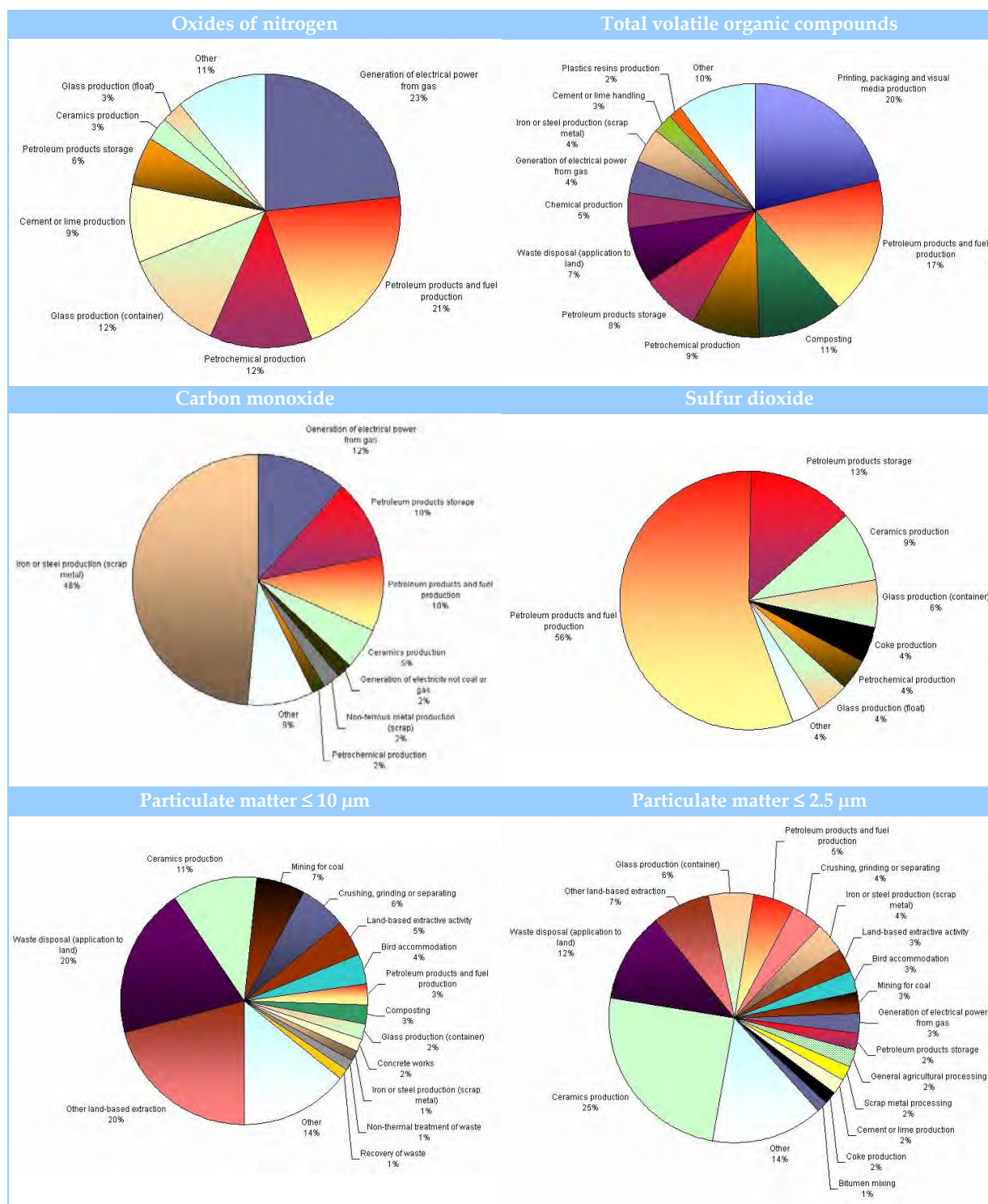


Figure ES-5: Proportion of total emissions by industry source type in the Sydney region