

MINISTER'S FOREWORD

When people think about air pollution, they most often think of heavy traffic and big industry. Whilst these are important contributors, the fact is air pollution comes from many different sources. Understanding what and where all these sources are is the first step toward cleaner air. That is what NSW's new Air Emissions Inventory is all about.

The 2007 *Air Emissions Inventory for the Greater Metropolitan Region in New South Wales* is the accumulation of three years of data collection and analysis. It looks at both human sources of air pollution, such as factories, buses and trucks, and natural sources, such as bushfires and windborne dust. It identifies over 90 different air pollutants.



The last significant inventory of this kind in NSW was published in 1996. That inventory formed the basis of our comprehensive NSW strategy called *Action for Air*, a 25-year air quality management plan for the Greater Metropolitan Region. *Action for Air* was published in 1998 and it helped us to successfully target air pollution by introducing:

- laws requiring special low-pollution summertime fuel
- new regulations for industry which slash pollution levels by up to five times. This is the equivalent of taking 100,000 diesel trucks off NSW roads over the next 20 years
- green car benchmarks which for the first time allow buyers to consider a vehicle's environmental performance.

In 2007, after ten years of action, we are again reviewing *Action for Air*, and this latest inventory will provide us with information we will need to shape the next steps in our attack on air pollution.

I would like to congratulate all those involved in producing this excellent report. Our actions to protect the community need to be based on the very best science. This new report - the 2007 *Air Emissions Inventory for the Greater Metropolitan Region in New South Wales* - gives us the best scientific basis for action in the State's history.

Verity Firth

Minister Assisting the Minister for Climate Change, Environment and Water (Environment)

EXECUTIVE SUMMARY

The Department of Environment and Climate Change NSW (DECC), in collaboration with Environment Protection Authority of Victoria (Ng, 2006), Pacific Air & Environment (Bawden et. al., 2006a & 2006b) and Optimised Operations (Tseng et. al., 2006a & 2006b), 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 criteria pollutants specified in the *Ambient Air Quality NEPM* (NEPC, 2003), including:

- Carbon monoxide (CO);
- Lead and compounds;
- Oxides of nitrogen (NO_x);
- Particulate matter < 10 μm (PM₁₀);
- Particulate matter < 2.5 μm (PM_{2.5});
- Sulfur dioxide (SO₂); and
- Total volatile organic compounds (VOCs), a surrogate for photochemical oxidants (as ozone).

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), respectively.



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

Table ES2 shows total estimated annual emissions from all biogenic and anthropogenic sources in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES2 Total estimated annual biogenic and anthropogenic emissions in each region

Substance	Region				
	Sydney	Newcastle	Wollongong	Non-Urban	GMR
Biogenic Total Annual Emissions (tonnes/year)					
CARBON MONOXIDE	27,346	176	145	160,737	188,405
LEAD AND COMPOUNDS	0.813	0.113	5.27×10^{-3}	4.099	5.030
OXIDES OF NITROGEN	1,585	103	52.034	11,604	13,344
PARTICULATE MATTER < 10 µm	2,699	93.261	15.767	14,629	17,436
PARTICULATE MATTER < 2.5 µm	2,331	44.245	13.530	12,680	15,069
SULFUR DIOXIDE	69.393	0.474	0.322	450	520
TOTAL VOCS	33,989	3,285	3,371	151,949	192,594
Anthropogenic Total Annual Emissions (tonnes/year)					
CARBON MONOXIDE	528,011	86,739	545,500	126,391	1,286,641
LEAD AND COMPOUNDS	29.044	2.405	6.497	42.982	80.929
OXIDES OF NITROGEN	92,768	9,864	12,299	177,123	292,054
PARTICULATE MATTER < 10 µm	21,305	2,948	3,034	47,841	75,128
PARTICULATE MATTER < 2.5 µm	13,126	1,687	2,193	13,493	30,499
SULFUR DIOXIDE	13,764	10,673	10,607	266,820	301,863
TOTAL VOCS	130,834	9,728	6,457	24,048	171,067
Biogenic and Anthropogenic Total Annual Emissions (tonnes/year)					
CARBON MONOXIDE	555,357	86,915	545,645	287,129	1,475,045
LEAD AND COMPOUNDS	29.858	2.518	6.503	47.081	85.960
OXIDES OF NITROGEN	94,353	9,967	12,351	188,727	305,398
PARTICULATE MATTER < 10 µm	24,004	3,041	3,050	62,470	92,564
PARTICULATE MATTER < 2.5 µm	15,457	1,731	2,207	26,173	45,568
SULFUR DIOXIDE	13,833	10,673	10,607	267,269	302,383
TOTAL VOCS	164,822	13,013	9,828	175,998	363,661

Table ES3 shows the proportion of total estimated annual biogenic and anthropogenic emissions from all biogenic and anthropogenic sources in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES3 Proportion of total estimated annual emissions from biogenic and anthropogenic sources in each region

Substance	Region				
	Sydney	Newcastle	Wollongong	Non-Urban	GMR
Biogenic Total					
Proportion of Annual Biogenic and Anthropogenic Emissions (%)					
CARBON MONOXIDE	4.92	0.20	0.03	56.0	12.8
LEAD AND COMPOUNDS	2.72	4.49	0.08	8.71	5.85
OXIDES OF NITROGEN	1.68	1.03	0.42	6.15	4.37
PARTICULATE MATTER < 10 µm	11.2	3.07	0.52	23.4	18.8
PARTICULATE MATTER < 2.5 µm	15.1	2.56	0.61	48.4	33.1
SULFUR DIOXIDE	0.50	4.44×10^{-3}	3.04×10^{-3}	0.17	0.17
TOTAL VOCS	20.6	25.2	34.3	86.3	53.0
Anthropogenic Total					
Proportion of Annual Biogenic and Anthropogenic Emissions (%)					
CARBON MONOXIDE	95.1	99.8	100.0	44.0	87.2
LEAD AND COMPOUNDS	97.3	95.5	99.9	91.3	94.1
OXIDES OF NITROGEN	98.3	99.0	99.6	93.9	95.6
PARTICULATE MATTER < 10 µm	88.8	96.9	99.5	76.6	81.2
PARTICULATE MATTER < 2.5 µm	84.9	97.4	99.4	51.6	66.9
SULFUR DIOXIDE	99.5	100.0	100.0	99.8	99.8
TOTAL VOCS	79.4	74.8	65.7	13.7	47.0

Figure ES2 shows the proportion of total estimated annual GMR biogenic emissions from all biogenic sources in the Sydney, Newcastle, Wollongong and Non-Urban regions.

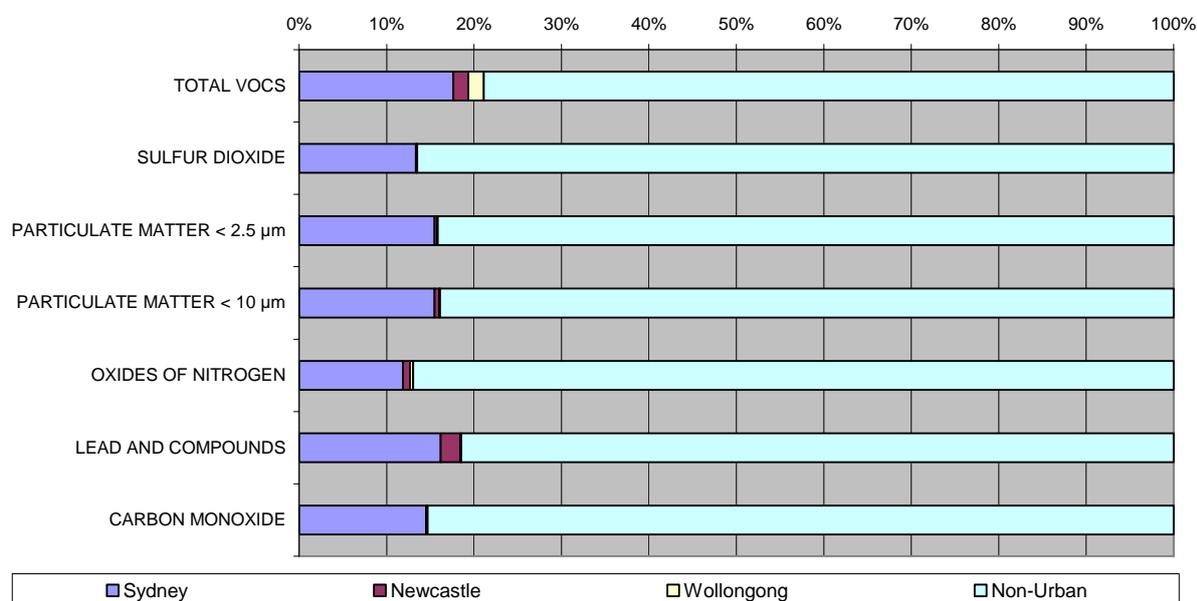


Figure ES2 Proportion of total estimated annual emissions from biogenic sources in each region

Figure ES3 shows the proportion of total estimated annual GMR anthropogenic emissions from all anthropogenic sources in the Sydney, Newcastle, Wollongong and Non-Urban regions.

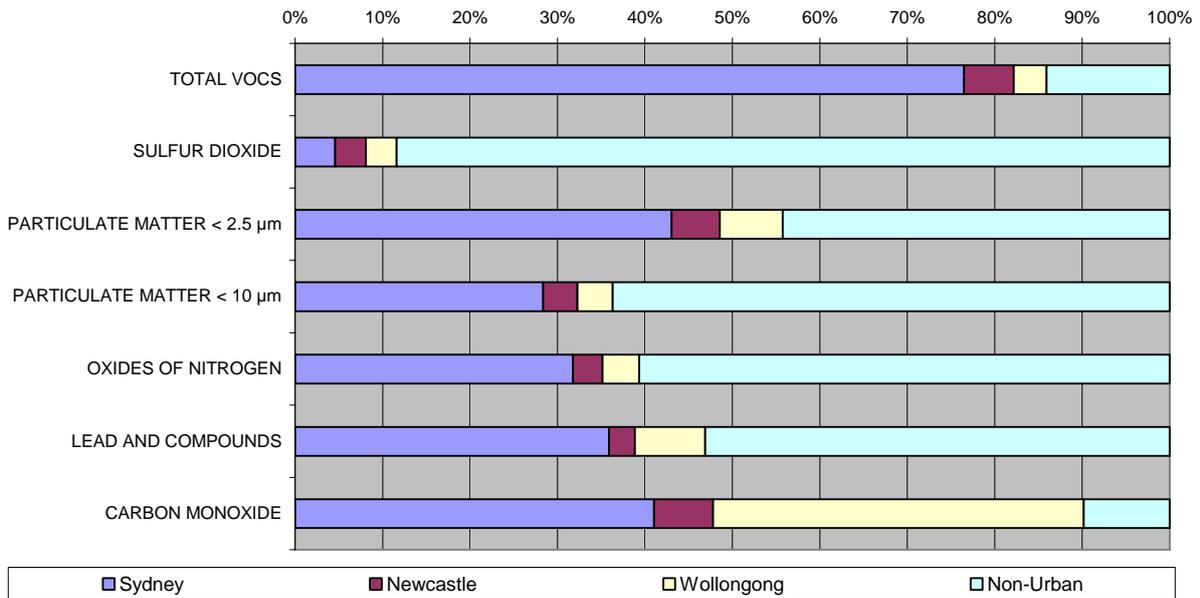


Figure ES3 Proportion of total estimated annual emissions from anthropogenic sources in each region

Figure ES4 shows the proportion of total estimated annual GMR biogenic and anthropogenic emissions from all biogenic and anthropogenic sources in the Sydney, Newcastle, Wollongong and Non-Urban regions.

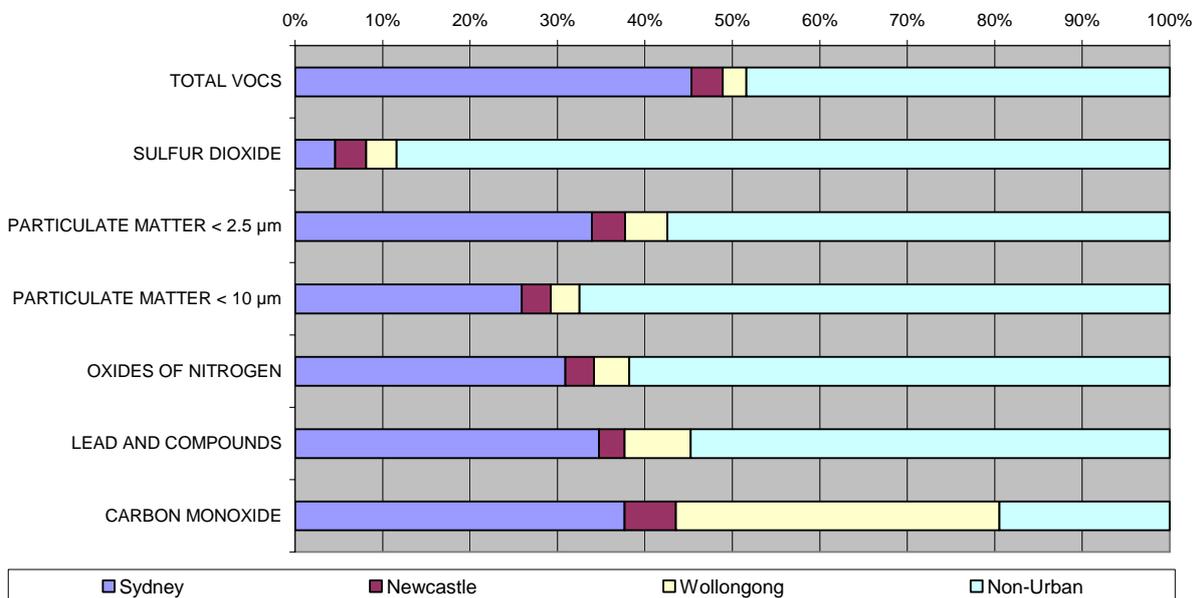


Figure ES4 Proportion of total estimated annual emissions from biogenic and anthropogenic sources in each region

Table ES4 shows total estimated annual emissions from each anthropogenic source type in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES5 shows the proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES4 Total estimated annual anthropogenic emissions by source type in each region

Substance	Anthropogenic Source Type					Anthropogenic Total
	Commercial	Domestic-Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
Annual Emissions (tonnes/year) - GMR						
CARBON MONOXIDE	1,801	90,516	603,133	32,144	559,047	1,286,641
LEAD AND COMPOUNDS	0.194	0.153	11.964	54.917	13.701	80.929
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
SULFUR DIOXIDE	71.005	143	295,819	4,170	1,660	301,863
TOTAL VOCS	13,844	67,303	17,786	7,640	64,493	171,067
Annual Emissions (tonnes/year) - Sydney						
CARBON MONOXIDE	1,265	67,221	8,004	20,251	431,270	528,011
LEAD AND COMPOUNDS	0.189	0.114	4.703	13.325	10.713	29.044
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
SULFUR DIOXIDE	48.074	108	10,980	1,374	1,254	13,764
TOTAL VOCS	9,973	51,929	13,989	4,772	50,171	130,834
Annual Emissions (tonnes/year) - Newcastle						
CARBON MONOXIDE	68.243	5,781	47,763	1,452	31,675	86,739
LEAD AND COMPOUNDS	8.18×10^{-4}	9.65×10^{-3}	0.246	1.441	0.708	2.405
OXIDES OF NITROGEN	134	105	1,728	2,950	4,947	9,864
PARTICULATE MATTER < 10 µm	173	423	1,706	469	177	2,948
PARTICULATE MATTER < 2.5 µm	49.137	408	808	253	169	1,687
SULFUR DIOXIDE	0.867	8.871	9,300	1,264	98.113	10,673
TOTAL VOCS	799	3,786	1,274	312	3,556	9,728

Substance	Anthropogenic Source Type					Anthropogenic Total
	Commercial	Domestic-Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
Annual Emissions (tonnes/year) - Wollongong						
CARBON MONOXIDE	104	3,636	521,795	793	19,173	545,500
LEAD AND COMPOUNDS	7.58×10^{-4}	6.15×10^{-3}	4.128	1.890	0.473	6.497
OXIDES OF NITROGEN	132	68.345	7,929	914	3,255	12,299
PARTICULATE MATTER < 10 µm	64.334	274	2,069	508	119	3,034
PARTICULATE MATTER < 2.5 µm	30.576	265	1,556	228	113	2,193
SULFUR DIOXIDE	1.225	5.757	10,290	250	59.448	10,607
TOTAL VOCS	624	2,618	788	232	2,195	6,457
Annual Emissions (tonnes/year) - Non-Urban						
CARBON MONOXIDE	364	13,877	25,571	9,649	76,929	126,391
LEAD AND COMPOUNDS	4.23×10^{-3}	0.023	2.887	38.260	1.807	42.982
OXIDES OF NITROGEN	512	262	151,847	10,092	14,410	177,123
PARTICULATE MATTER < 10 µm	1,652	961	34,844	9,883	501	47,841
PARTICULATE MATTER < 2.5 µm	467	929	7,373	4,244	479	13,493
SULFUR DIOXIDE	20.840	20.825	265,248	1,281	249	266,820
TOTAL VOCS	2,448	8,971	1,734	2,323	8,572	24,048

Table ES5 Proportion of total estimated annual anthropogenic emissions by source type in each region

Substance	Anthropogenic Source Type					Anthropogenic Total
	Commercial	Domestic-Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
Proportion of Annual Anthropogenic Emissions (%) - GMR						
CARBON MONOXIDE	0.14	7.04	46.9	2.50	43.5	100.0
LEAD AND COMPOUNDS	0.24	0.19	14.8	67.9	16.9	100.0
OXIDES OF NITROGEN	0.91	0.61	60.1	8.04	30.3	100.0
PARTICULATE MATTER < 10 µm	5.37	8.85	61.9	19.4	4.46	100.0
PARTICULATE MATTER < 2.5 µm	4.16	21.1	43.0	21.3	10.5	100.0
SULFUR DIOXIDE	0.02	0.05	98.0	1.38	0.55	100.0
TOTAL VOCS	8.09	39.3	10.4	4.47	37.7	100.0
Proportion of Annual Anthropogenic Emissions (%) - Sydney						
CARBON MONOXIDE	0.24	12.7	1.52	3.84	81.7	100.0
LEAD AND COMPOUNDS	0.65	0.39	16.2	45.9	36.9	100.0
OXIDES OF NITROGEN	2.02	1.46	15.1	10.3	71.1	100.0
PARTICULATE MATTER < 10 µm	10.1	23.4	37.1	17.4	12.0	100.0
PARTICULATE MATTER < 2.5 µm	5.51	36.8	25.8	13.4	18.5	100.0
SULFUR DIOXIDE	0.35	0.78	79.8	9.98	9.11	100.0
TOTAL VOCS	7.62	39.7	10.7	3.65	38.3	100.0
Proportion of Annual Anthropogenic Emissions (%) - Newcastle						
CARBON MONOXIDE	0.08	6.67	55.1	1.67	36.5	100.0
LEAD AND COMPOUNDS	0.03	0.40	10.2	59.9	29.4	100.0
OXIDES OF NITROGEN	1.36	1.06	17.5	29.9	50.2	100.0
PARTICULATE MATTER < 10 µm	5.88	14.3	57.9	15.9	6.02	100.0
PARTICULATE MATTER < 2.5 µm	2.91	24.2	47.9	15.0	10.0	100.0
SULFUR DIOXIDE	8.12×10^{-3}	0.08	87.1	11.8	0.92	100.0
TOTAL VOCS	8.22	38.9	13.1	3.21	36.6	100.0

Substance	Anthropogenic Source Type					Anthropogenic Total
	Commercial	Domestic-Commercial	Industrial	Off-Road Mobile	On-Road Mobile	
Proportion of Annual Anthropogenic Emissions (%) - Wollongong						
CARBON MONOXIDE	0.02	0.67	95.7	0.15	3.51	100.0
LEAD AND COMPOUNDS	0.01	0.09	63.5	29.1	7.27	100.0
OXIDES OF NITROGEN	1.07	0.56	64.5	7.43	26.5	100.0
PARTICULATE MATTER < 10 µm	2.12	9.03	68.2	16.7	3.92	100.0
PARTICULATE MATTER < 2.5 µm	1.39	12.1	71.0	10.4	5.17	100.0
SULFUR DIOXIDE	0.01	0.05	97.0	2.36	0.56	100.0
TOTAL VOCS	9.66	40.5	12.2	3.59	34.0	100.0
Proportion of Annual Anthropogenic Emissions (%) - Non-Urban						
CARBON MONOXIDE	0.29	11.0	20.2	7.63	60.9	100.0
LEAD AND COMPOUNDS	9.84×10^{-3}	0.05	6.72	89.0	4.20	100.0
OXIDES OF NITROGEN	0.29	0.15	85.7	5.70	8.14	100.0
PARTICULATE MATTER < 10 µm	3.45	2.01	72.8	20.7	1.05	100.0
PARTICULATE MATTER < 2.5 µm	3.46	6.88	54.6	31.5	3.55	100.0
SULFUR DIOXIDE	7.81×10^{-3}	7.80×10^{-3}	99.4	0.48	0.09	100.0
TOTAL VOCS	10.2	37.3	7.21	9.66	35.6	100.0

Figure ES5 shows the proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in the GMR.

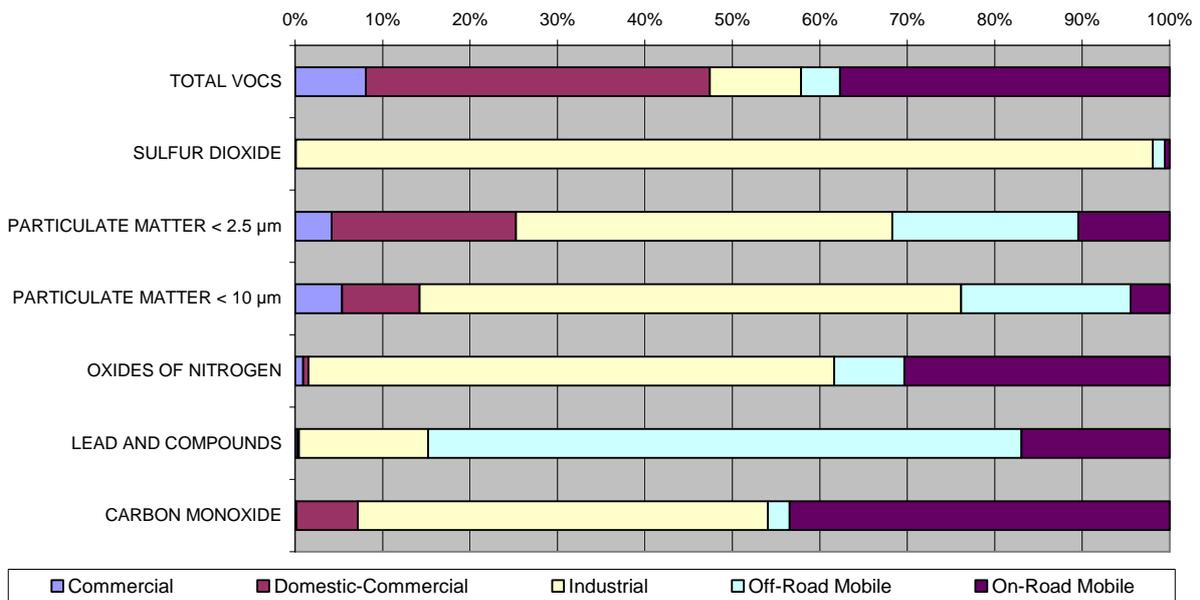


Figure ES5 Proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in the GMR

Figure ES6 shows the proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in the Sydney region.

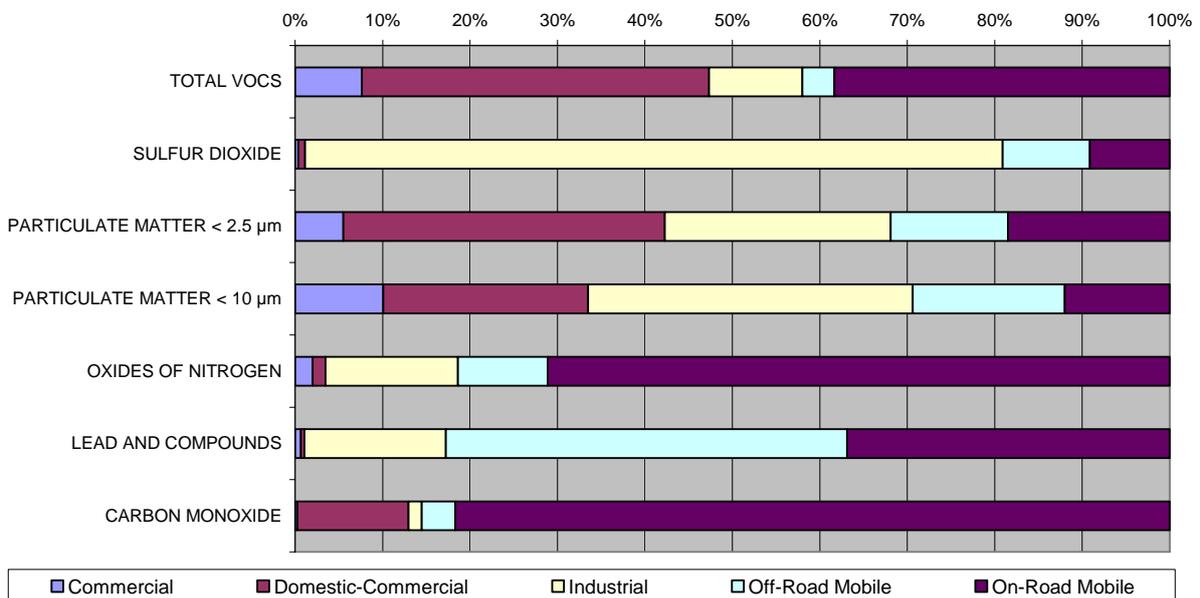


Figure ES6 Proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in Sydney region

Figure ES7 shows the proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in the Newcastle region.

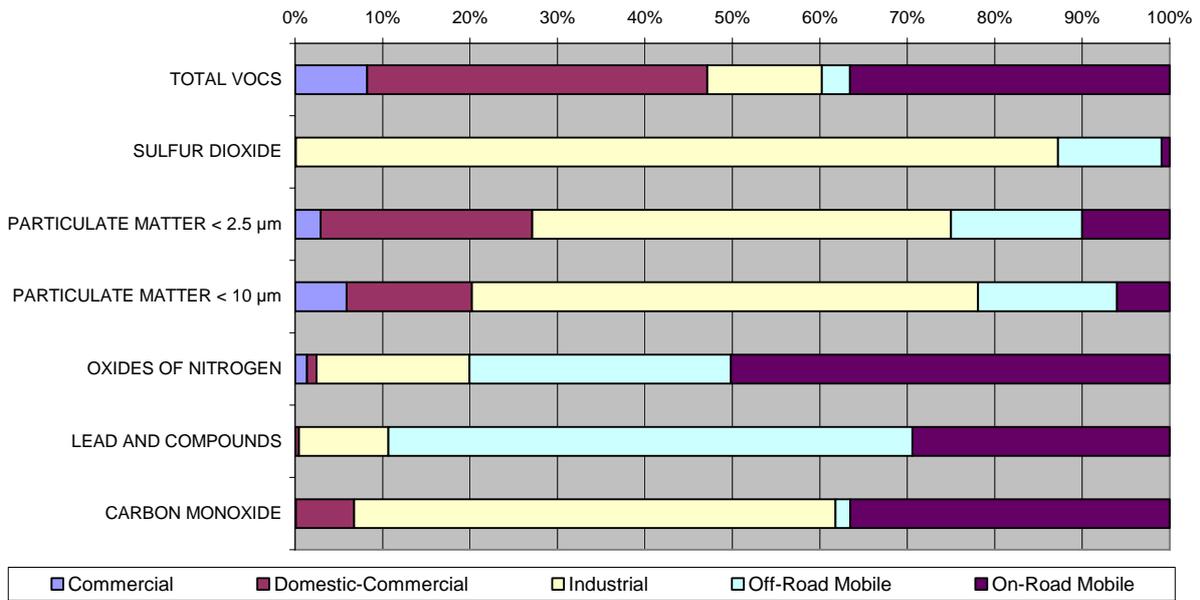


Figure ES7 Proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in Newcastle region

Figure ES8 shows the proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in the Wollongong region.

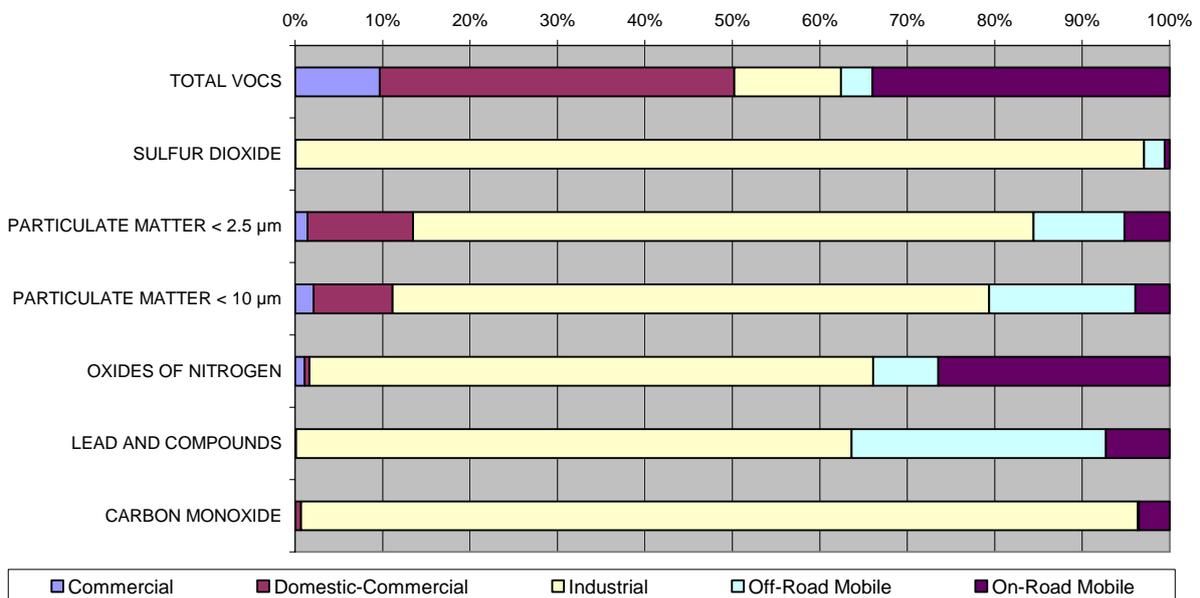


Figure ES8 Proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in Wollongong region

Figure ES9 shows the proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in the Non-Urban region.

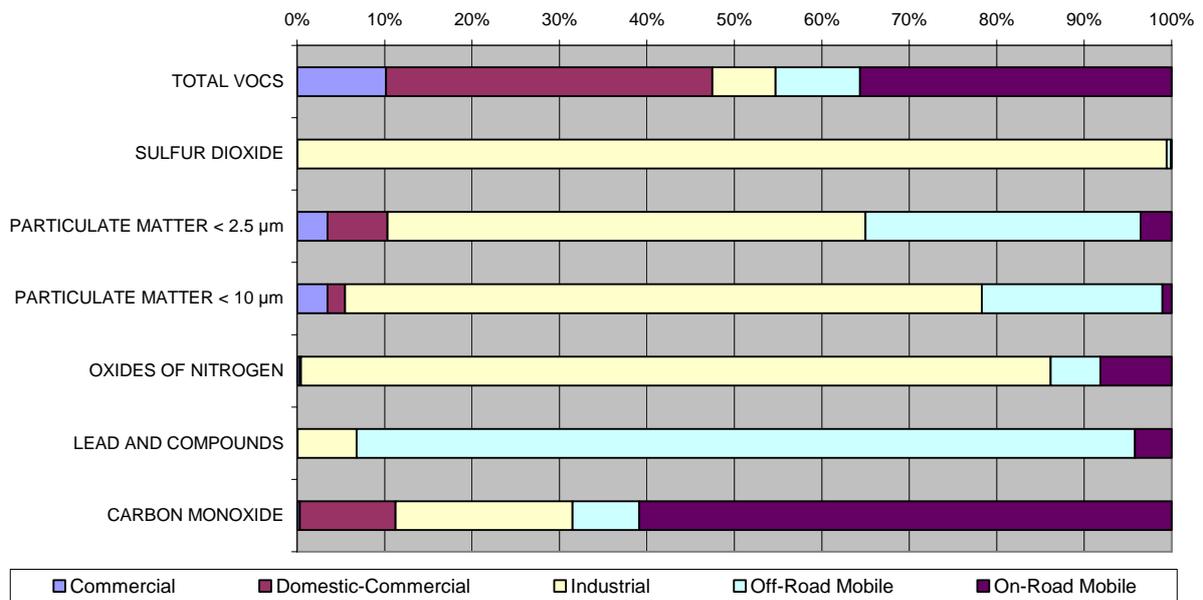


Figure ES9 Proportion of total estimated annual anthropogenic emissions from each anthropogenic source type in Non-Urban region

Table ES6 shows the ten largest anthropogenic sources of carbon monoxide emissions in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES6 Ten largest anthropogenic sources of carbon monoxide

Source Group	Source Type	Carbon Monoxide		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
GMR				
Industrial	Primary iron and steel production	520,451	40.5	40.5
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	413,721	32.2	72.6
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	71,129	5.53	78.1
Industrial	Primary aluminium production	57,393	4.46	82.6
On-Road Mobile	Exhaust Emissions - Other	51,579	4.01	86.6
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	41,580	3.23	89.8
Domestic-Commercial	Solid Fuel Combustion	37,079	2.88	92.7
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	12,424	0.97	93.7
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	11,292	0.88	94.6
Off-Road Mobile	Aircraft	10,489	0.82	95.4
All	Other	59,503	4.62	100.0
Sydney				
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	323,953	61.4	61.4
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	55,294	10.5	71.8
On-Road Mobile	Exhaust Emissions - Other	35,554	6.73	78.6
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	31,274	5.92	84.5
Domestic-Commercial	Solid Fuel Combustion	27,889	5.28	89.8
Off-Road Mobile	Aircraft	9,979	1.89	91.7
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	8,534	1.62	93.3
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	7,935	1.50	94.8
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	7,617	1.44	96.2
Off-Road Mobile	Recreational Boats	6,088	1.15	97.4
All	Other	13,894	2.63	100.0
Newcastle				
Industrial	Primary aluminium production	44,697	51.5	51.5
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	24,897	28.7	80.2
On-Road Mobile	Exhaust Emissions - Other	2,788	3.21	83.4
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	2,784	3.21	86.7
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	2,645	3.05	89.7
Industrial	Secondary iron and steel production	2,597	2.99	92.7
Domestic-Commercial	Solid Fuel Combustion	2,358	2.72	95.4
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	749	0.86	96.3
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	638	0.74	97.0
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	568	0.65	97.7
All	Other	2,018	2.33	100.0

Source Group	Source Type	Carbon Monoxide		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
Wollongong				
Industrial	Primary iron and steel production	520,451	95.4	95.4
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	14,415	2.64	98.1
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	2,050	0.38	98.4
On-Road Mobile	Exhaust Emissions - Other	1,848	0.34	98.8
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	1,725	0.32	99.1
Domestic-Commercial	Solid Fuel Combustion	1,538	0.28	99.4
Industrial	Metal plating or coating works	1,182	0.22	99.6
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	513	0.09	99.7
Off-Road Mobile	Recreational Boats	393	0.07	99.7
Domestic-Commercial	Lawn Mowing & Garden Equipment (POS)	352	0.06	99.8
All	Other	1,033	0.19	100.0
Non-Urban				
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	50,456	39.9	39.9
Industrial	Primary aluminium production	12,696	10.0	50.0
On-Road Mobile	Exhaust Emissions - Other	11,388	9.01	59.0
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	11,001	8.70	67.7
Industrial	Generation of electrical power from coal	6,856	5.42	73.1
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	5,937	4.70	77.8
Domestic-Commercial	Solid Fuel Combustion	5,294	4.19	82.0
Off-Road Mobile	Commercial Boats	3,274	2.59	84.6
Industrial	Cement or lime production	3,197	2.53	87.1
Off-Road Mobile	Recreational Boats	2,862	2.26	89.4
All	Other	13,429	10.6	100.0

Figure ES10 shows the ten largest anthropogenic sources of carbon monoxide emissions in the GMR.

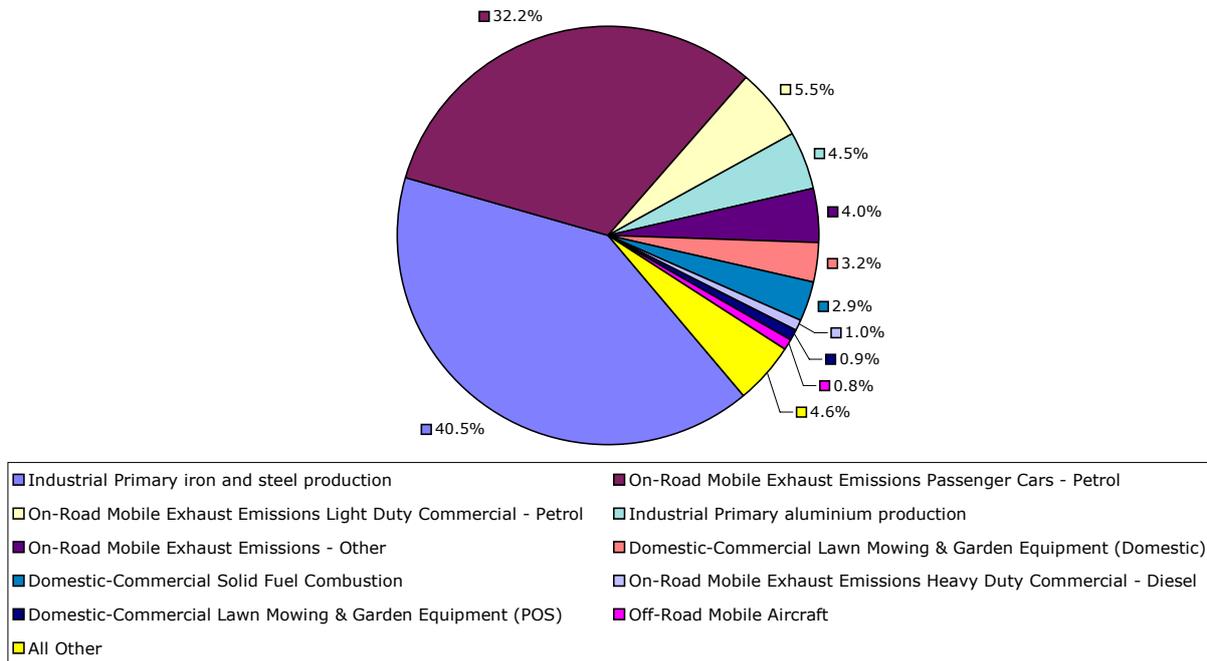


Figure ES10 Ten largest anthropogenic sources of carbon monoxide emissions in the GMR

Figure ES11 shows the ten largest anthropogenic sources of carbon monoxide emissions in the Sydney region.

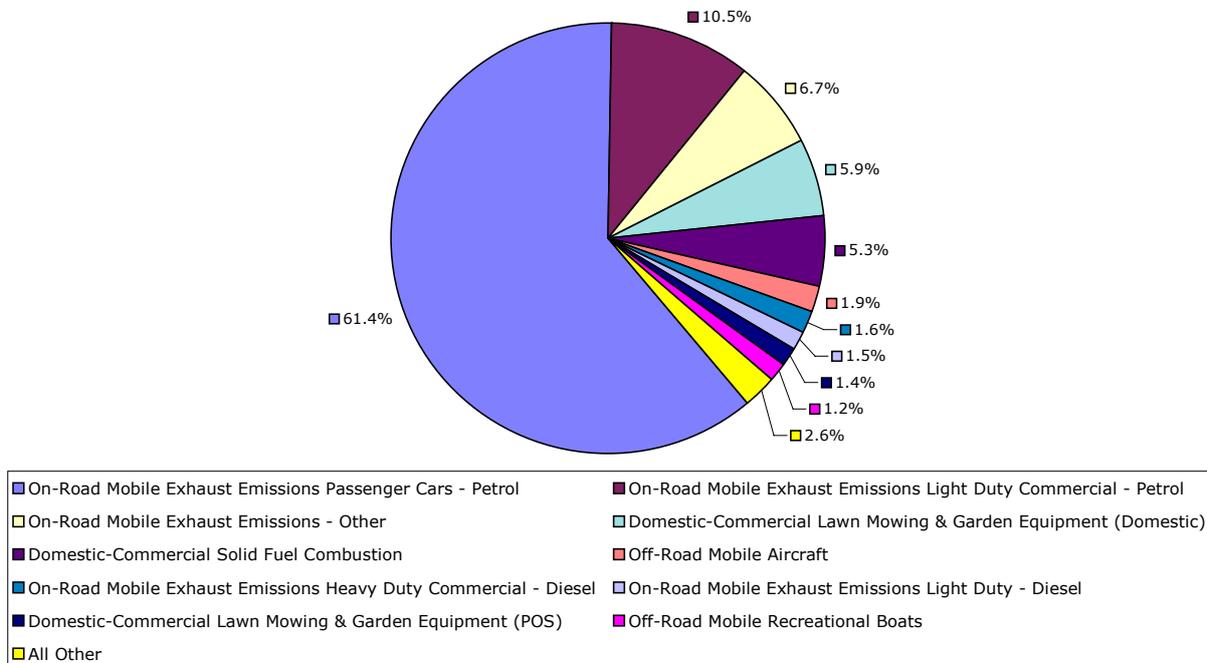


Figure ES11 Ten largest anthropogenic sources of carbon monoxide emissions in the Sydney region

Figure ES12 shows the ten largest anthropogenic sources of carbon monoxide emissions in the Newcastle region.

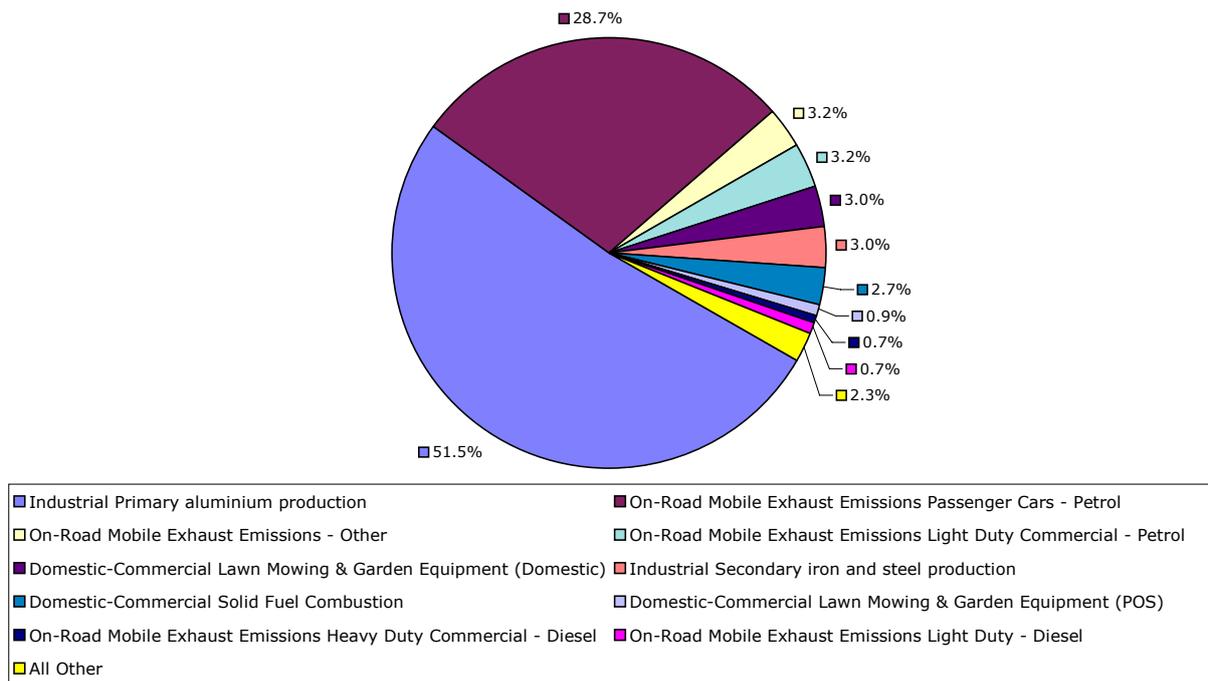


Figure ES12 Ten largest anthropogenic sources of carbon monoxide emissions in the Newcastle region

Figure ES13 shows the ten largest anthropogenic sources of carbon monoxide emissions in the Wollongong region.

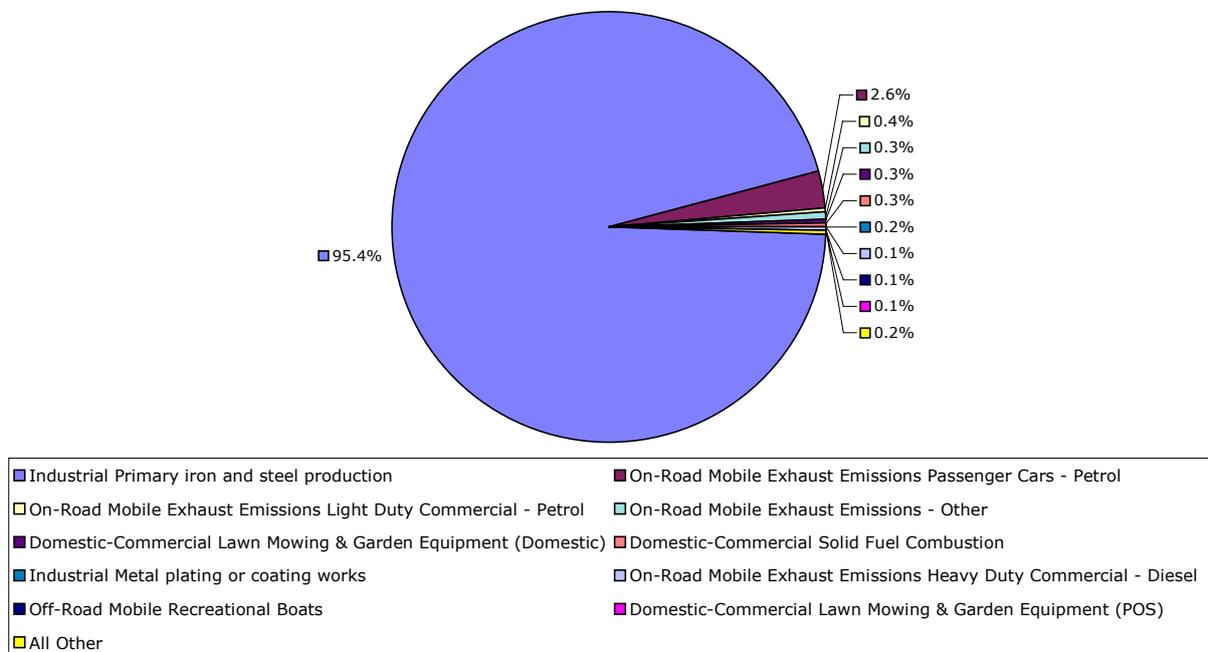


Figure ES13 Ten largest anthropogenic sources of carbon monoxide emissions in the Wollongong region

Figure ES14 shows the ten largest anthropogenic sources of carbon monoxide emissions in the Non-Urban region.

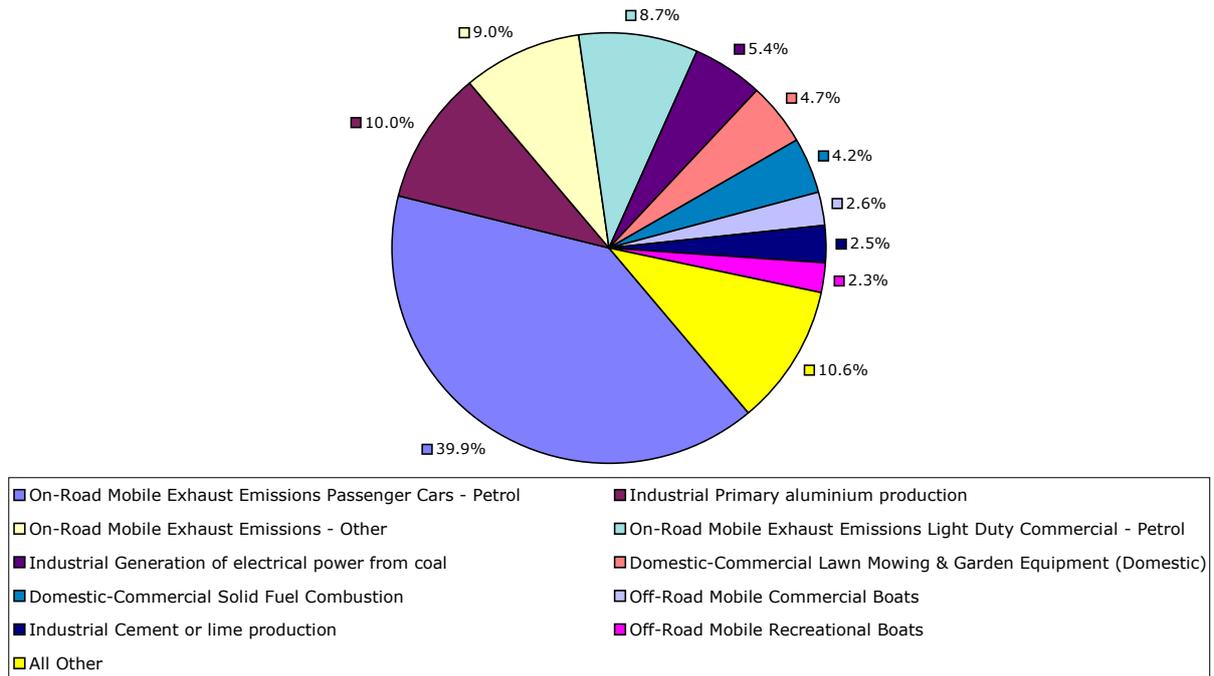


Figure ES14 Ten largest anthropogenic sources of carbon monoxide emissions in the Non-Urban region

Table ES7 shows the ten largest anthropogenic sources of lead and compounds emissions in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES7 Ten largest anthropogenic sources of lead and compounds

Source Group	Source Type	Lead and Compounds		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
GMR				
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	50.364	62.2	62.2
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	8.183	10.1	72.3
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	4.216	5.21	77.6
Industrial	Primary iron and steel production	3.852	4.76	82.3
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	2.881	3.56	85.9
Industrial	Production of container glass	2.280	2.82	88.7
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	1.440	1.78	90.5
Industrial	Coal mining	1.416	1.75	92.2
Industrial	Generation of electrical power from coal	1.033	1.28	93.5
Industrial	Battery production	0.952	1.18	94.7
All	Other	4.312	5.33	100.0
Sydney				
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	11.181	38.5	38.5
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	6.715	23.1	61.6
Industrial	Production of container glass	2.280	7.85	69.5
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	1.958	6.74	76.2
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	1.838	6.33	82.5
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	1.128	3.88	86.4
Industrial	Battery production	0.952	3.28	89.7
Industrial	Secondary non-ferrous production (excluding aluminium)	0.723	2.49	92.2
On-Road Mobile	Exhaust Emissions - Other	0.524	1.81	94.0
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	0.388	1.34	95.3
All	Other	1.357	4.67	100.0
Newcastle				
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	1.209	50.3	50.3
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	0.424	17.6	67.9
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	0.219	9.12	77.0
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	0.150	6.26	83.2
Industrial	Primary aluminium production	0.103	4.28	87.5
Industrial	Secondary iron and steel production	0.092	3.80	91.3
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	0.081	3.36	94.7
On-Road Mobile	Exhaust Emissions - Other	0.036	1.51	96.2
Industrial	Coal mining	0.033	1.36	97.6
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	0.016	0.68	98.2
All	Other	0.043	1.77	100.0

Source Group	Source Type	Lead and Compounds		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
Wollongong				
Industrial	Primary iron and steel production	3.825	58.9	58.9
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	1.813	27.9	86.8
On-Road Mobile	Exhaust Emissions Passenger Cars – Petrol	0.267	4.11	90.9
Industrial	Coke production	0.232	3.57	94.5
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial – Diesel	0.116	1.79	96.3
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	0.076	1.17	97.4
Industrial	Metal plating or coating works	0.058	0.89	98.3
On-Road Mobile	Exhaust Emissions Light Duty – Diesel	0.049	0.75	99.1
On-Road Mobile	Exhaust Emissions – Other	0.027	0.42	99.5
On-Road Mobile	Exhaust Emissions Light Duty Commercial – Petrol	0.013	0.20	99.7
All	Other	0.021	0.32	100.0
Non-Urban				
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	36.161	84.1	84.1
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	2.083	4.85	89.0
Industrial	Coal mining	1.374	3.20	92.2
Industrial	Generation of electrical power from coal	1.033	2.40	94.6
On-Road Mobile	Exhaust Emissions Passenger Cars – Petrol	0.777	1.81	96.4
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial – Diesel	0.657	1.53	97.9
Industrial	Cement or lime production	0.428	1.00	98.9
On-Road Mobile	Exhaust Emissions Light Duty – Diesel	0.183	0.43	99.3
On-Road Mobile	Exhaust Emissions – Other	0.135	0.31	99.6
On-Road Mobile	Exhaust Emissions Light Duty Commercial – Petrol	0.055	0.13	99.8
All	Other	0.097	0.22	100.0

Figure ES15 shows the ten largest anthropogenic sources of lead and compounds emissions in the GMR.

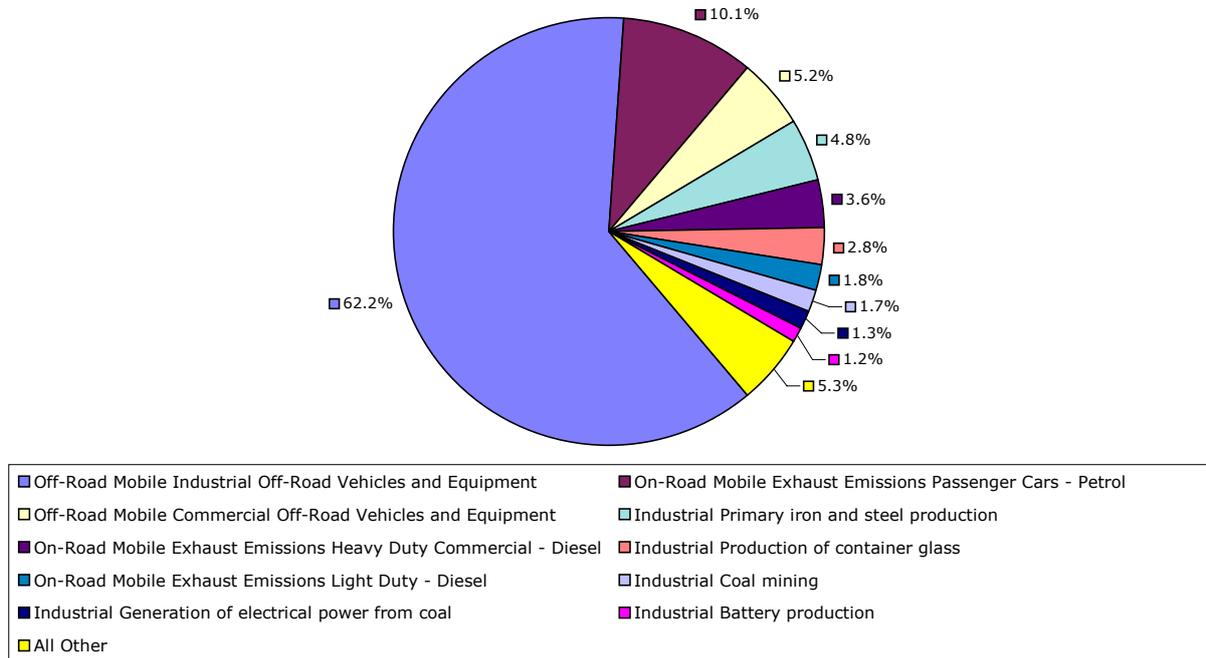


Figure ES15 Ten largest anthropogenic sources of lead and compounds emissions in the GMR

Figure ES16 shows the ten largest anthropogenic sources of lead and compounds emissions in the Sydney region.

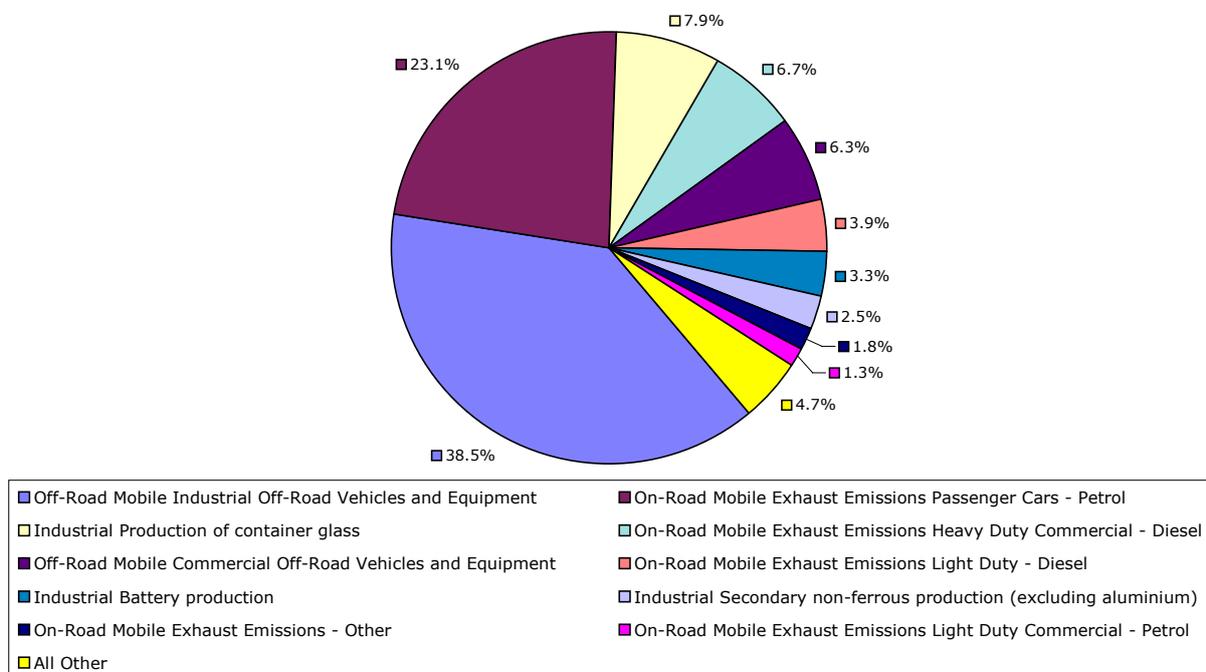


Figure ES16 Ten largest anthropogenic sources of lead and compounds emissions in the Sydney region

Figure ES17 shows the ten largest anthropogenic sources of lead and compounds emissions in the Newcastle region.

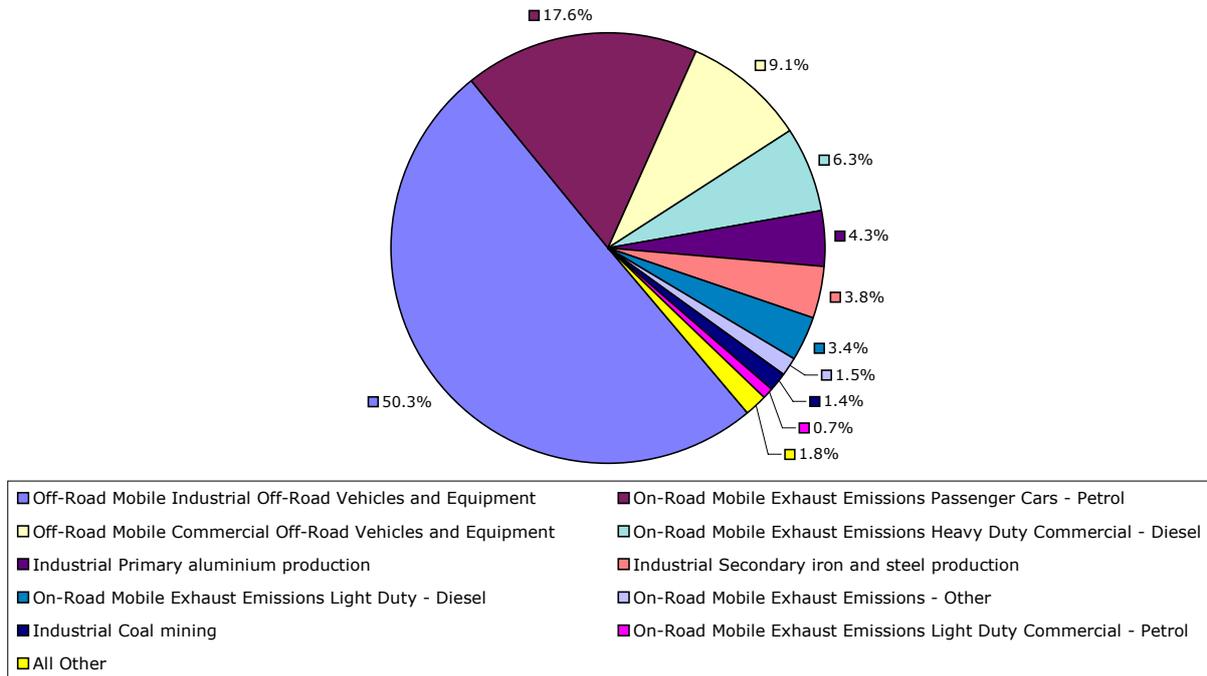


Figure ES17 Ten largest anthropogenic sources of lead and compounds emissions in the Newcastle region

Figure ES18 shows the ten largest anthropogenic sources of lead and compounds emissions in the Wollongong region.

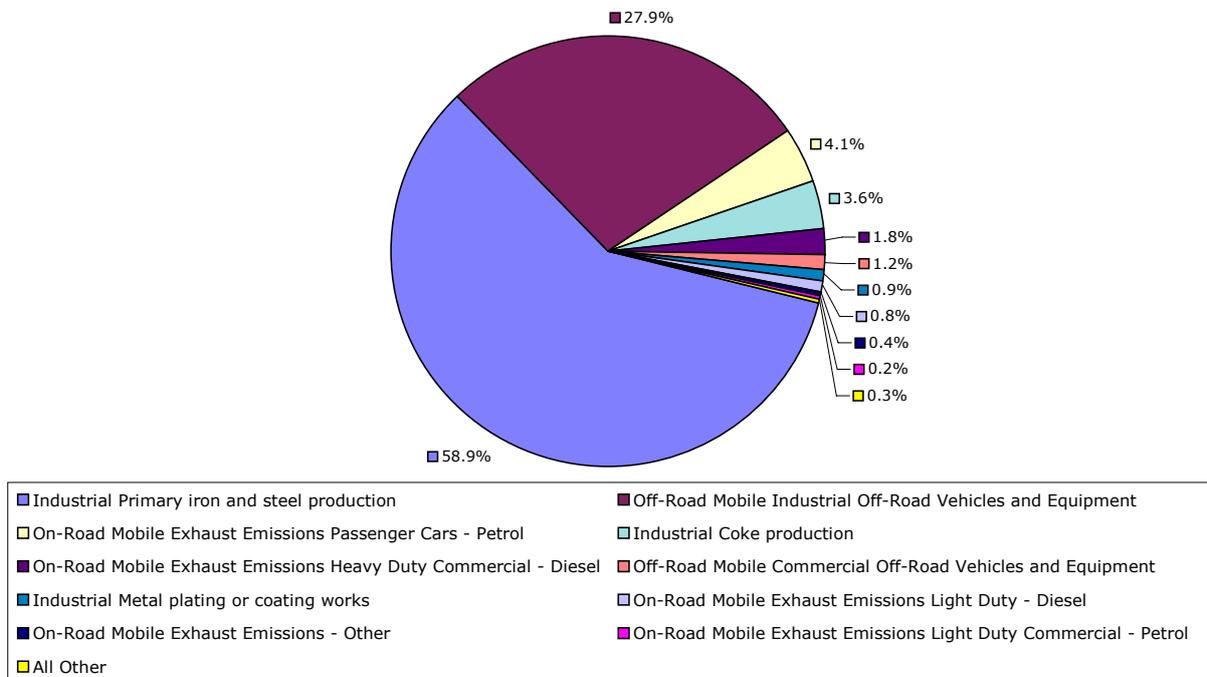
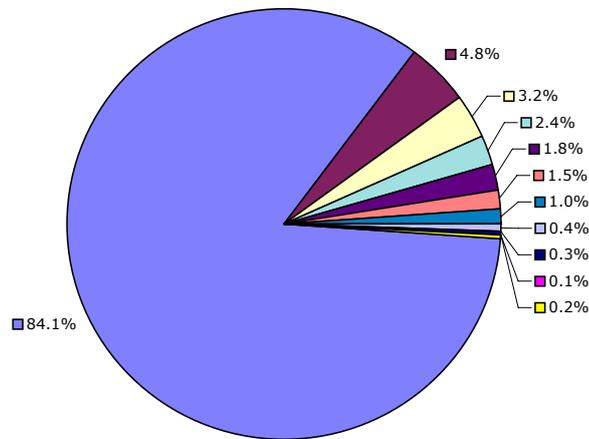


Figure ES18 Ten largest anthropogenic sources of lead and compounds emissions in the Wollongong region

Figure ES19 shows the ten largest anthropogenic sources of lead and compounds emissions in the Non-Urban region.



Off-Road Mobile Industrial Off-Road Vehicles and Equipment	Off-Road Mobile Commercial Off-Road Vehicles and Equipment
Industrial Coal mining	Industrial Generation of electrical power from coal
On-Road Mobile Exhaust Emissions Passenger Cars - Petrol	On-Road Mobile Exhaust Emissions Heavy Duty Commercial - Diesel
Industrial Cement or lime production	On-Road Mobile Exhaust Emissions Light Duty - Diesel
On-Road Mobile Exhaust Emissions - Other	On-Road Mobile Exhaust Emissions Light Duty Commercial - Petrol
All Other	

Figure ES19 Ten largest anthropogenic sources of lead and compounds emissions in the Non-Urban region

Table ES8 shows the ten largest anthropogenic sources of oxides of nitrogen emissions in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES8 Ten largest anthropogenic sources of oxides of nitrogen

Source Group	Source Type	Oxides of Nitrogen		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
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	8.66	75.2
Industrial	Primary iron and steel production	7,827	2.68	77.9
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	6,800	2.33	80.2
Off-Road Mobile	Commercial Ships	6,176	2.11	82.4
Industrial	Cement or lime production	6,115	2.09	84.5
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	5,851	2.00	86.5
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	5,287	1.81	88.3
Off-Road Mobile	Railways	3,350	1.15	89.4
All	Other	30,908	10.6	100.0
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	4.89	64.3
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	4,245	4.58	68.8
Off-Road Mobile	Aircraft	3,218	3.47	72.3
Industrial	Petroleum refining	2,789	3.01	75.3
Industrial	Generation of electrical power from gas	2,681	2.89	78.2
On-Road Mobile	Exhaust Emissions - Other	2,135	2.30	80.5
Industrial	Production of container glass	1,609	1.73	82.2
Off-Road Mobile	Railways	1,608	1.73	84.0
All	Other	14,866	16.0	100.0
Newcastle				
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	2,952	29.9	29.9
Off-Road Mobile	Commercial Ships	2,409	24.4	54.3
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	1,340	13.6	67.9
Industrial	Production of ammonium nitrate	1,056	10.7	78.6
Industrial	Primary aluminium production	296	3.00	81.6
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	265	2.69	84.3
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	217	2.20	86.5
On-Road Mobile	Exhaust Emissions - Other	173	1.76	88.3
Off-Road Mobile	Railways	168	1.70	90.0
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	163	1.65	91.6
All	Other	825	8.37	100.0

Source Group	Source Type	Oxides of Nitrogen		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
Wollongong				
Industrial	Primary iron and steel production	7,826	63.6	63.6
On-Road Mobile	Exhaust Emissions Passenger Cars – Petrol	1,743	14.2	77.8
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial – Diesel	1,067	8.68	86.5
Off-Road Mobile	Commercial Ships	432	3.52	90.0
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	245	1.99	92.0
On-Road Mobile	Exhaust Emissions Light Duty – Diesel	170	1.38	93.4
On-Road Mobile	Exhaust Emissions Light Duty Commercial – Petrol	164	1.33	94.7
Off-Road Mobile	Railways	137	1.12	95.8
On-Road Mobile	Exhaust Emissions – Other	112	0.91	96.7
Commercial	Hospitals (Except Psychiatric Hospitals)	84.673	0.69	97.4
All	Other	318	2.59	100.0
Non-Urban				
Industrial	Generation of electrical power from coal	145,440	82.1	82.1
On-Road Mobile	Exhaust Emissions Passenger Cars – Petrol	6,142	3.47	85.6
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial – Diesel	5,974	3.37	89.0
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	4,882	2.76	91.7
Industrial	Cement or lime production	4,778	2.70	94.4
Off-Road Mobile	Commercial Ships	1,729	0.98	95.4
Off-Road Mobile	Commercial Boats	1,452	0.82	96.2
Off-Road Mobile	Railways	1,437	0.81	97.0
Industrial	Coal mining	1,336	0.75	97.8
On-Road Mobile	Exhaust Emissions Light Duty Commercial – Petrol	937	0.53	98.3
All	Other	3,016	1.70	100.0

Figure ES20 shows the ten largest anthropogenic sources of oxides of nitrogen emissions in the GMR.

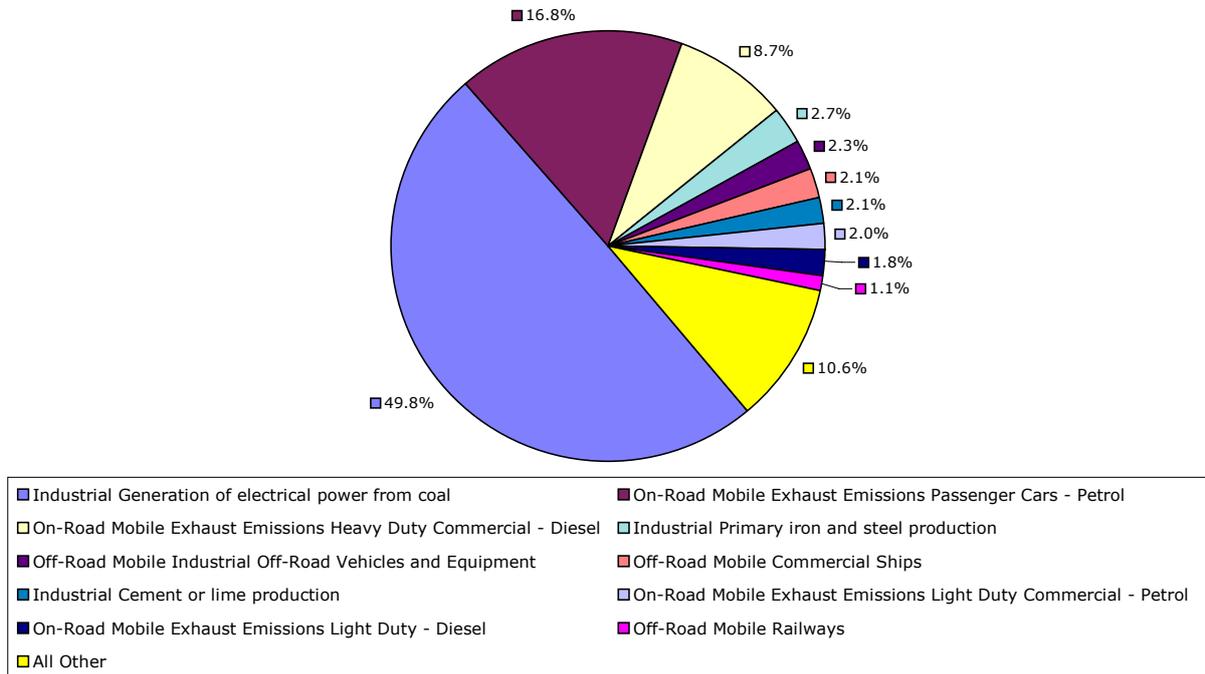


Figure ES20 Ten largest anthropogenic sources of oxides of nitrogen emissions in the GMR

Figure ES21 shows the ten largest anthropogenic sources of oxides of nitrogen emissions in the Sydney region.

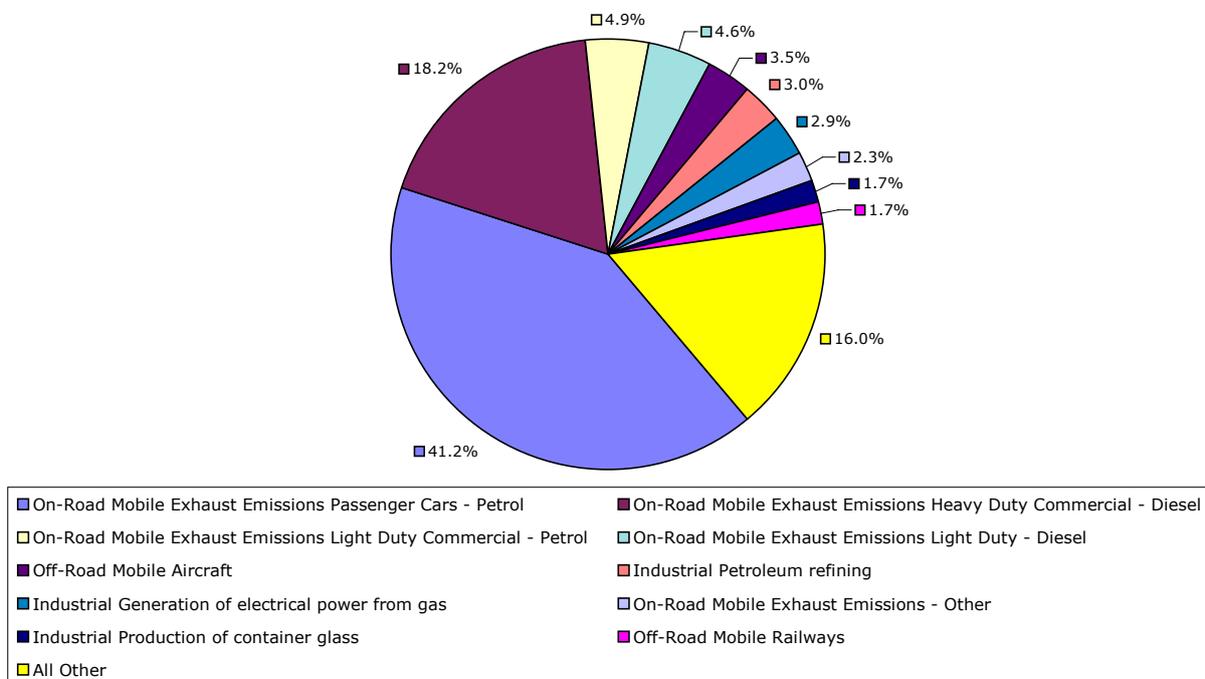


Figure ES21 Ten largest anthropogenic sources of oxides of nitrogen emissions in the Sydney region

Figure ES22 shows the ten largest anthropogenic sources of oxides of nitrogen emissions in the Newcastle region.

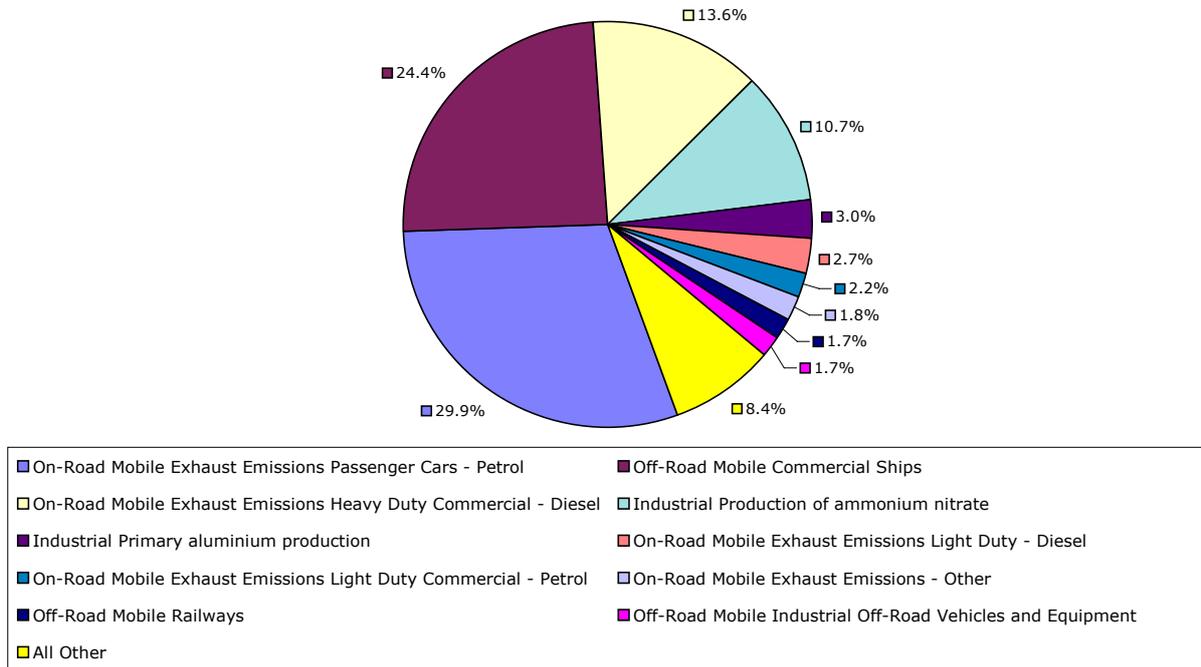


Figure ES22 Ten largest anthropogenic sources of oxides of nitrogen emissions in the Newcastle region

Figure ES23 shows the ten largest anthropogenic sources of oxides of nitrogen emissions in the Wollongong region.

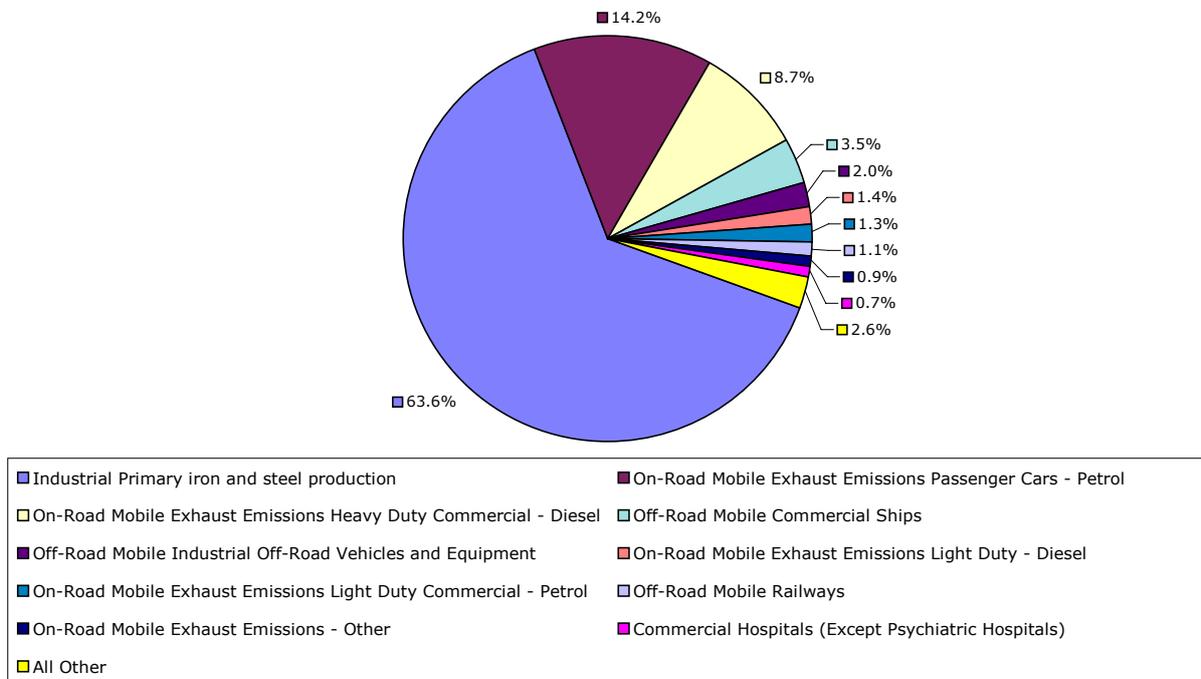


Figure ES23 Ten largest anthropogenic sources of oxides of nitrogen emissions in the Wollongong region

Figure ES24 shows the ten largest anthropogenic sources of oxides of nitrogen emissions in the Non-Urban region.

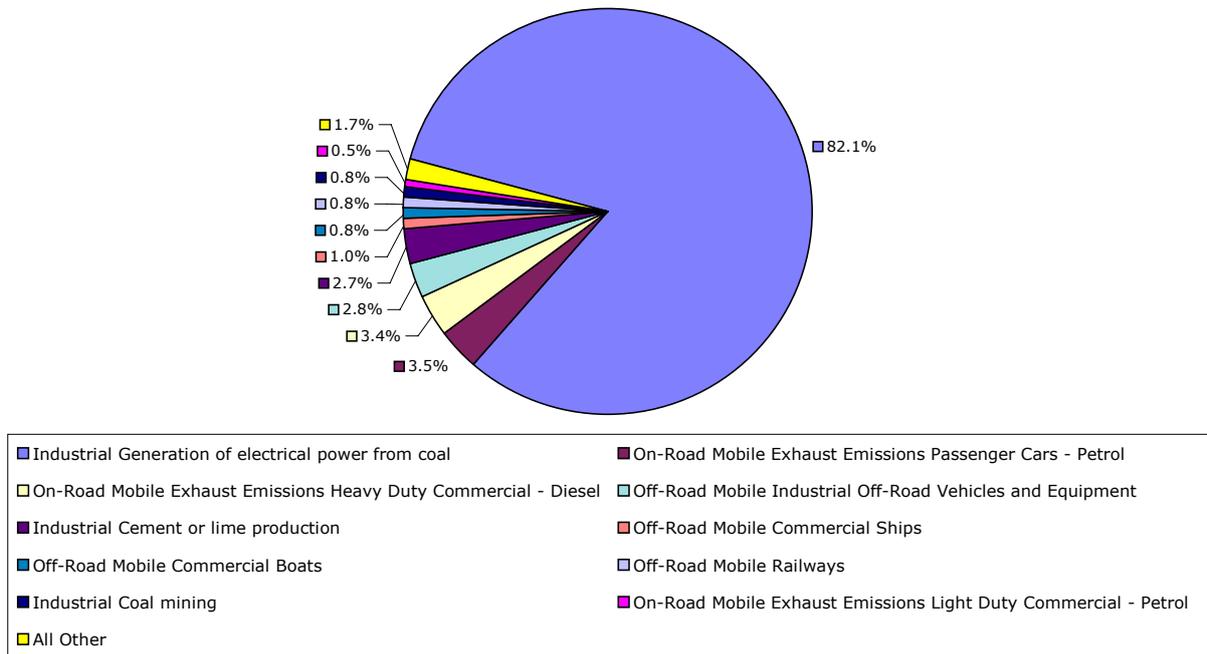


Figure ES24 Ten largest anthropogenic sources of oxides of nitrogen emissions in the Non-Urban region

Table ES9 shows the ten largest anthropogenic sources of particulate matter < 10 µm emissions in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES9 Ten largest anthropogenic sources of particulate matter < 10 µm

Source Group	Source Type	Particulate Matter < 10 µm		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
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	8.22	58.6
Industrial	Generation of electrical power from coal	4,816	6.41	65.0
Industrial	Other land-based extraction	3,472	4.62	69.6
Industrial	Crushing, grinding or separating works	2,513	3.34	73.0
Commercial	Poultry Farming (Meat)	1,841	2.45	75.4
Industrial	Hard-rock gravel quarrying	1,687	2.25	77.7
Industrial	Primary iron and steel production	1,620	2.16	79.8
Commercial	Gravel and Sand Quarrying	1,252	1.67	81.5
All	Other	13,915	18.5	100.0
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	9.63	44.5
Industrial	Other land-based extraction	1,768	8.30	52.8
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	867	4.07	56.9
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	866	4.06	61.0
Industrial	Ceramics production (excluding glass)	841	3.95	64.9
Commercial	Poultry Farming (Meat)	831	3.90	68.8
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	702	3.29	72.1
Commercial	Gravel and Sand Quarrying	560	2.63	74.7
All	Other	5,383	25.3	100.0
Newcastle				
Industrial	Coal mining	494	16.8	16.8
Domestic-Commercial	Solid Fuel Combustion	393	13.3	30.1
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	302	10.2	40.3
Industrial	Production of ammonium nitrate	210	7.13	47.5
Industrial	Hard-rock gravel quarrying	158	5.37	52.8
Industrial	Primary aluminium production	153	5.20	58.0
Industrial	Bitumen pre-mix or hotmix production	129	4.38	62.4
Industrial	Crushing, grinding or separating works	93,085	3.16	65.6
Off-Road Mobile	Commercial Ships	83,227	2.82	68.4
Commercial	Gravel and Sand Quarrying	80,570	2.73	71.1
All	Other	851	28.9	100.0

Source Group	Source Type	Particulate Matter < 10 µm		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
Wollongong				
Industrial	Primary iron and steel production	1,618	53.3	53.3
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	453	14.9	68.3
Domestic-Commercial	Solid Fuel Combustion	256	8.44	76.7
Industrial	Coal loading	180	5.94	82.6
Industrial	Coal mining	65,076	2.15	84.8
Industrial	Coal washery reject or slag landfilling	56,748	1.87	86.7
Industrial	Inert waste landfilling	44,668	1.47	88.1
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	41,731	1.38	89.5
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	37,628	1.24	90.7
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	34,438	1.14	91.9
All	Other	246	8.12	100.0
Non-Urban				
Industrial	Coal mining	24,587	51.4	51.4
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	9,036	18.9	70.3
Industrial	Generation of electrical power from coal	4,816	10.1	80.3
Industrial	Other land-based extraction	1,639	3.43	83.8
Industrial	Hard-rock gravel quarrying	1,404	2.93	86.7
Commercial	Poultry Farming (Meat)	953	1.99	88.7
Domestic-Commercial	Solid Fuel Combustion	881	1.84	90.5
Commercial	Gravel and Sand Quarrying	578	1.21	91.7
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	572	1.20	92.9
Industrial	Solid waste landfilling	392	0.82	93.8
All	Other	2,984	6.24	100.0

Figure ES25 shows the ten largest anthropogenic sources of particulate matter < 10 µm emissions in the GMR.

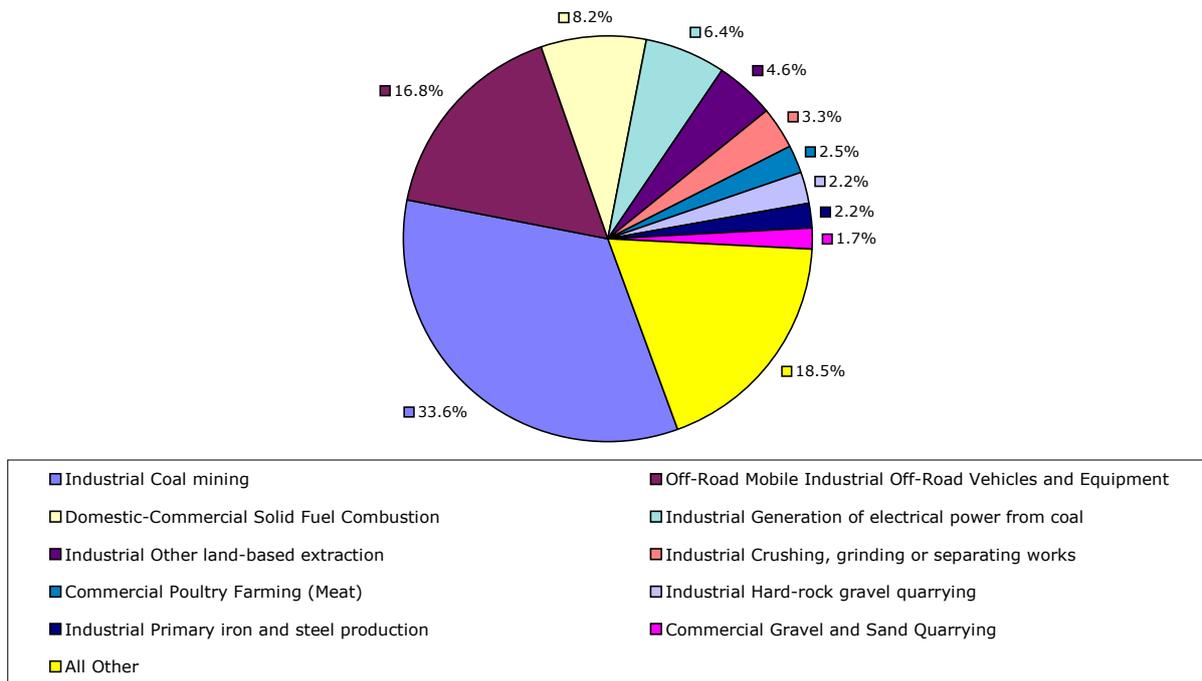


Figure ES25 Ten largest anthropogenic sources of particulate matter < 10 µm emissions in the GMR

Figure ES26 shows the ten largest anthropogenic sources of particulate matter < 10 µm emissions in the Sydney region.

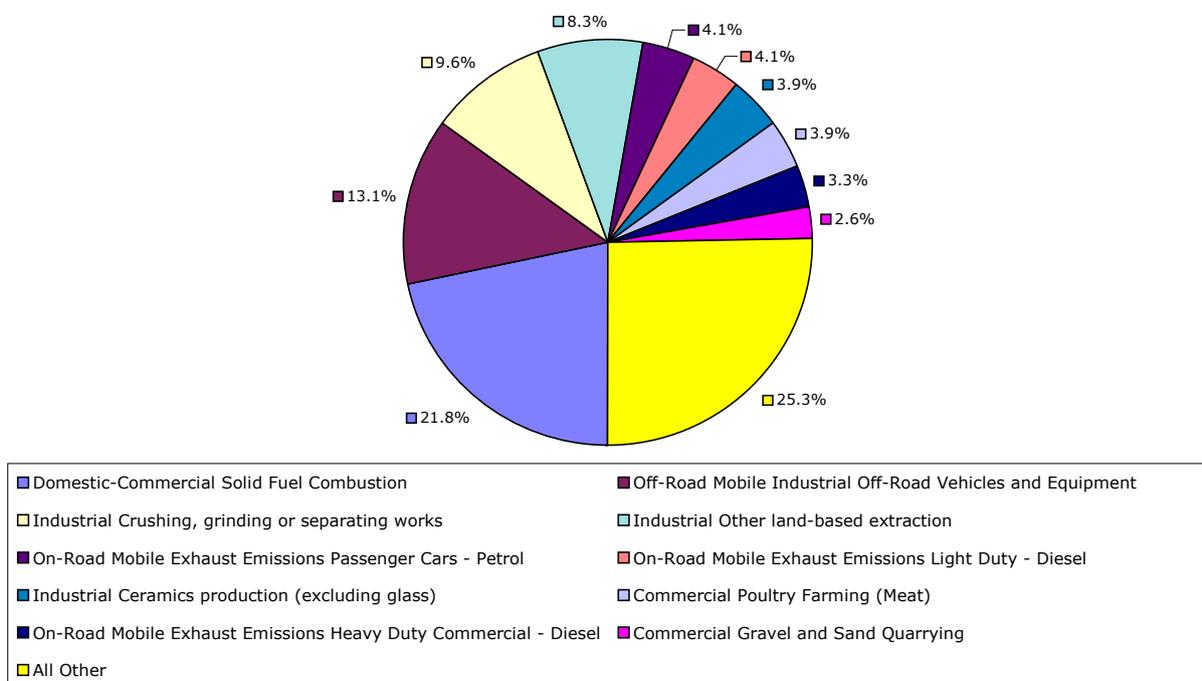


Figure ES26 Ten largest anthropogenic sources of particulate matter < 10 µm emissions in the Sydney region

Figure ES27 shows the ten largest anthropogenic sources of particulate matter < 10 µm emissions in the Newcastle region.

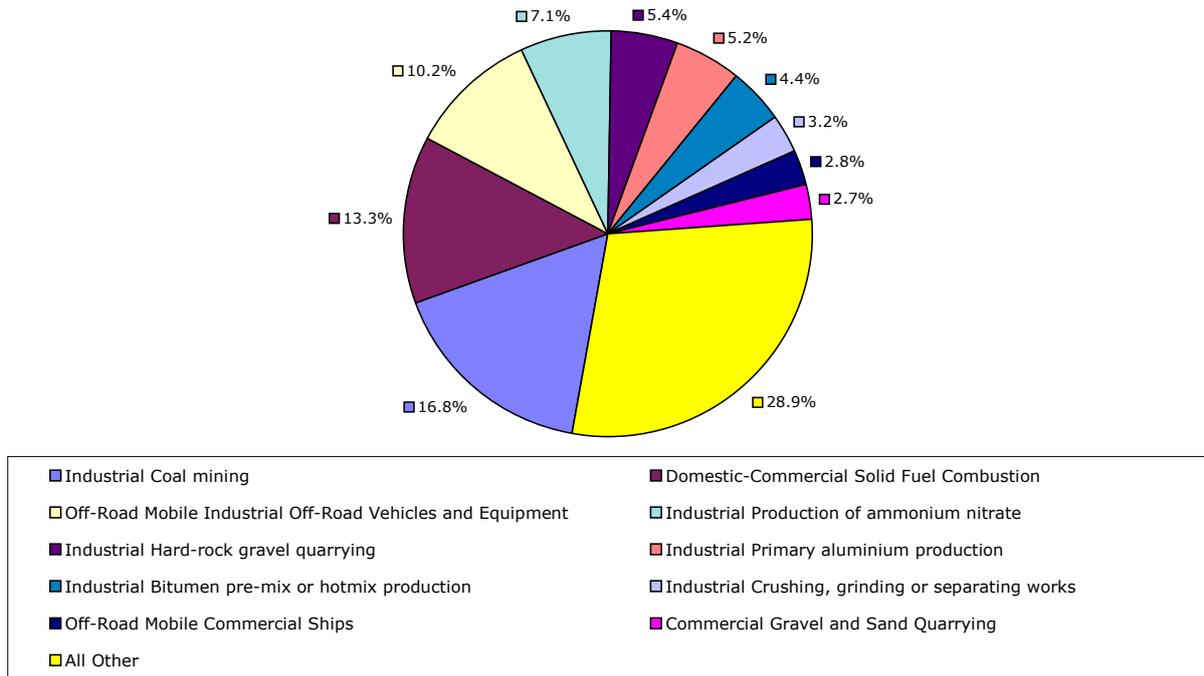


Figure ES27 Ten largest anthropogenic sources of particulate matter < 10 µm emissions in the Newcastle region

Figure ES28 shows the ten largest anthropogenic sources of particulate matter < 10 µm emissions in the Wollongong region.

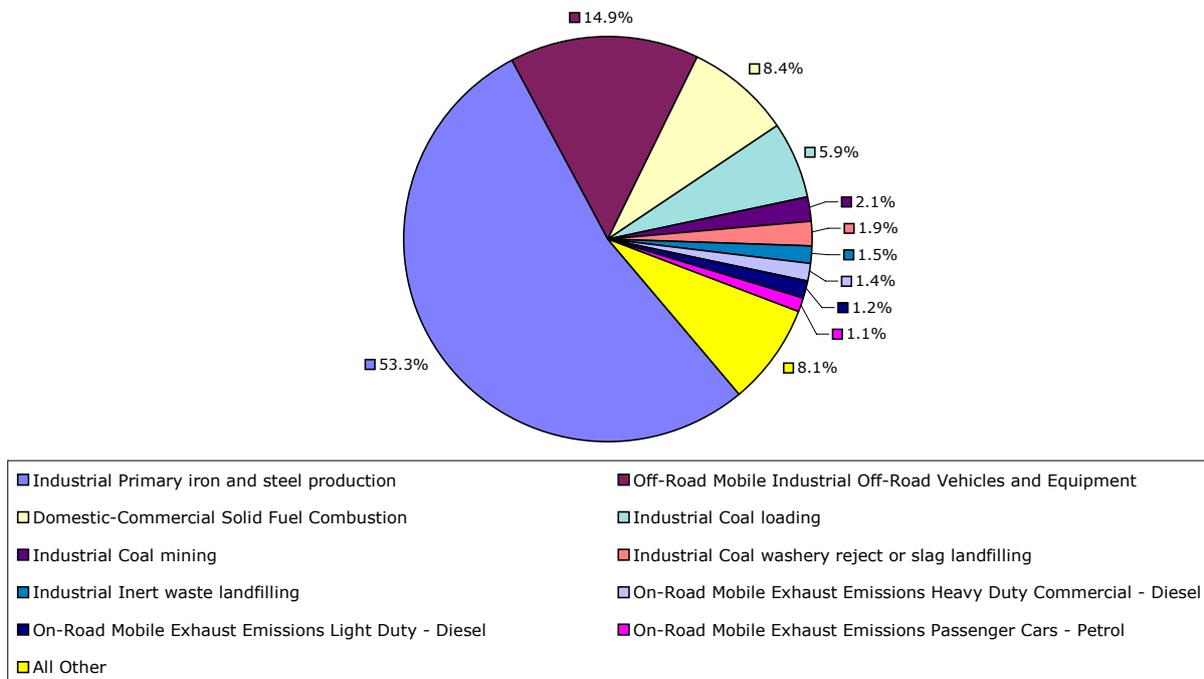


Figure ES28 Ten largest anthropogenic sources of particulate matter < 10 µm emissions in the Wollongong region

Figure ES29 shows the ten largest anthropogenic sources of particulate matter < 10 µm emissions in the Non-Urban region.

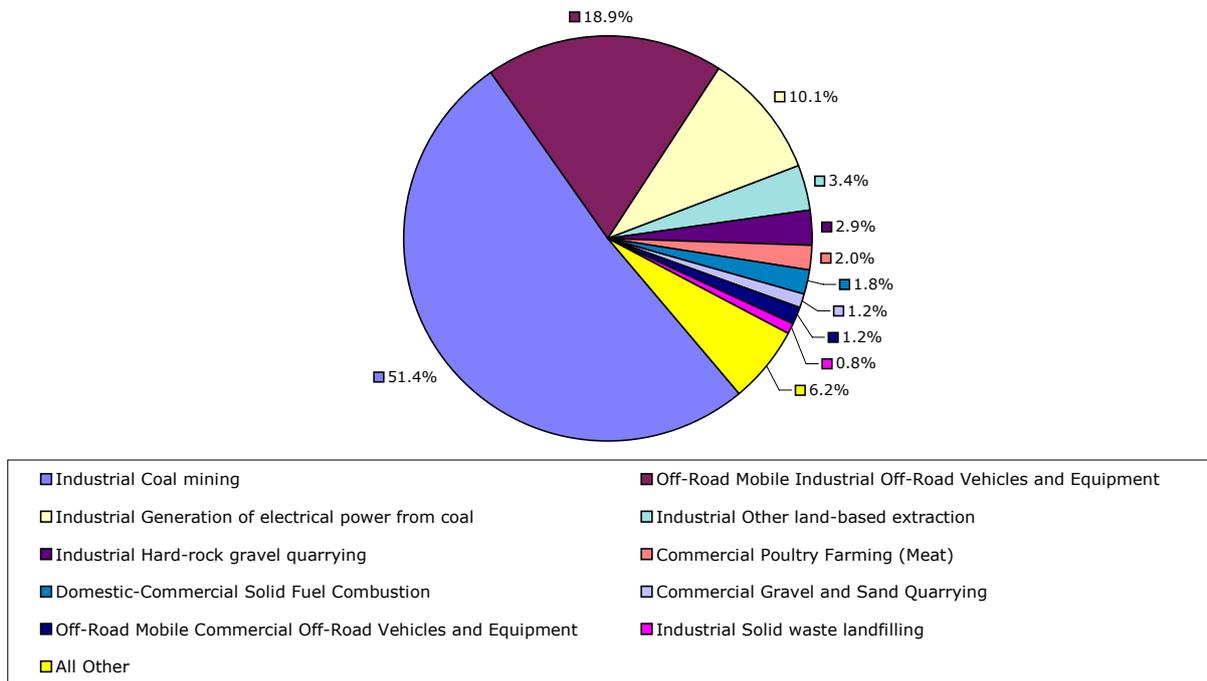


Figure ES29 Ten largest anthropogenic sources of particulate matter < 10 µm emissions in the Non-Urban region

Table ES10 shows the ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES10 Ten largest anthropogenic sources of particulate matter < 2.5 µm

Source Group	Source Type	Particulate Matter < 2.5 µm		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
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	5.60	55.9
Industrial	Primary iron and steel production	1,444	4.73	60.6
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	1,073	3.52	64.1
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	1,002	3.28	67.4
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	972	3.19	70.6
Industrial	Crushing, grinding or separating works	918	3.01	73.6
Industrial	Other land-based extraction	799	2.62	76.2
All	Other	7,253	23.8	100.0
Sydney				
Domestic-Commercial	Solid Fuel Combustion	4,503	34.3	34.3
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	1,152	8.78	43.1
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	840	6.40	49.5
Industrial	Crushing, grinding or separating works	807	6.15	55.6
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	797	6.08	61.7
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	681	5.19	66.9
Industrial	Ceramics production (excluding glass)	606	4.62	71.5
Industrial	Other land-based extraction	418	3.18	74.7
Commercial	Poultry Farming (Meat)	237	1.81	76.5
Industrial	Petroleum refining	237	1.80	78.3
All	Other	2,848	21.7	100.0
Newcastle				
Domestic-Commercial	Solid Fuel Combustion	381	22.6	22.6
Industrial	Production of ammonium nitrate	207	12.3	34.8
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	125	7.39	42.2
Industrial	Bitumen pre-mix or hotmix production	114	6.78	49.0
Industrial	Primary aluminium production	111	6.56	55.6
Off-Road Mobile	Commercial Ships	79.627	4.72	60.3
Industrial	Production of phosphate fertilizer	77.586	4.60	64.9
Industrial	Coal mining	70.989	4.21	69.1
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	60.125	3.56	72.6
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	52.316	3.10	75.7
All	Other	409	24.3	100.0

Source Group	Source Type	Particulate Matter < 2.5 µm		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
Wollongong				
Industrial	Primary iron and steel production	1,442	65.8	65.8
Domestic-Commercial	Solid Fuel Combustion	248	11.3	77.1
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	187	8.52	85.6
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	40,480	1.85	87.5
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	36,499	1.66	89.1
Industrial	Coke production	33,407	1.52	90.6
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	31,683	1.44	92.1
Industrial	Coal loading	19,440	0.89	93.0
Off-Road Mobile	Commercial Ships	14,292	0.65	93.6
Industrial	Coal mining	13,595	0.62	94.2
All	Other	126	5.76	100.0
Non-Urban				
Industrial	Coal mining	4,056	30.1	30.1
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	3,727	27.6	57.7
Industrial	Generation of electrical power from coal	1,708	12.7	70.3
Domestic-Commercial	Solid Fuel Combustion	855	6.33	76.7
Industrial	Other land-based extraction	368	2.73	79.4
Industrial	Hard-rock gravel quarrying	360	2.67	82.1
Commercial	Poultry Farming (Meat)	272	2.02	84.1
Off-Road Mobile	Commercial Off-Road Vehicles and Equipment	261	1.93	86.0
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	228	1.69	87.7
Industrial	Primary aluminium production	202	1.50	89.2
All	Other	1,456	10.8	100.0

Figure ES30 shows the ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the GMR.

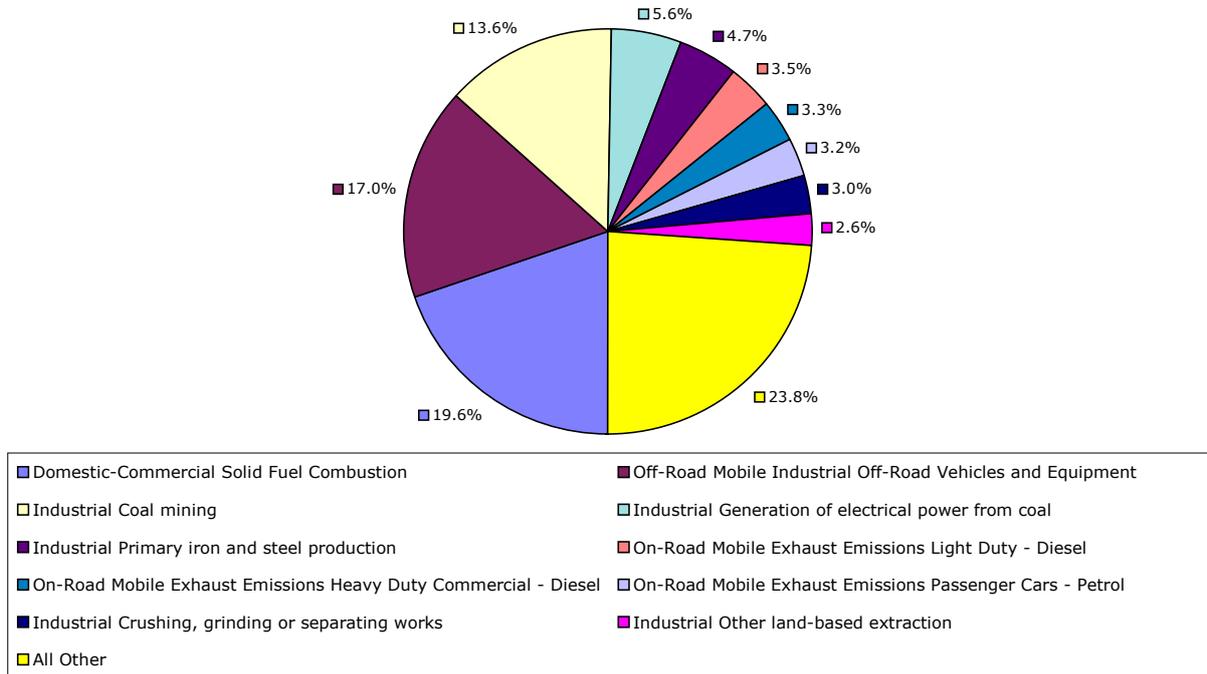


Figure ES30 Ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the GMR

Figure ES31 shows the ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the Sydney region.

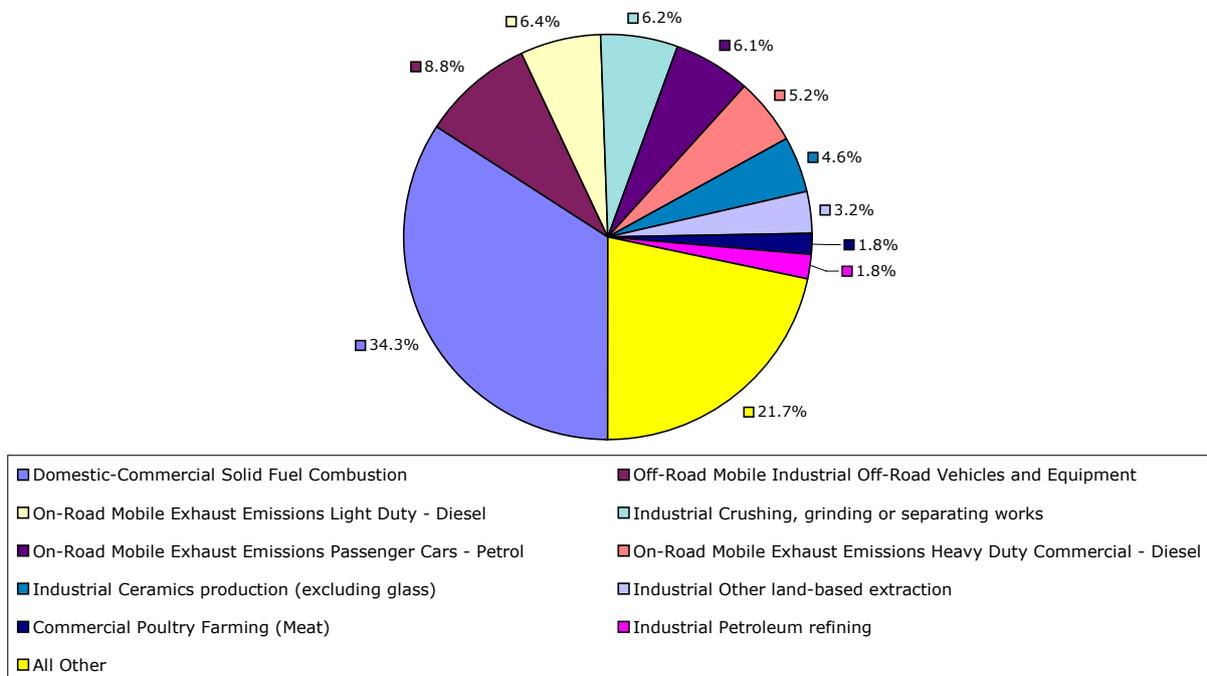


Figure ES31 Ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the Sydney region

Figure ES32 shows the ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the Newcastle region.

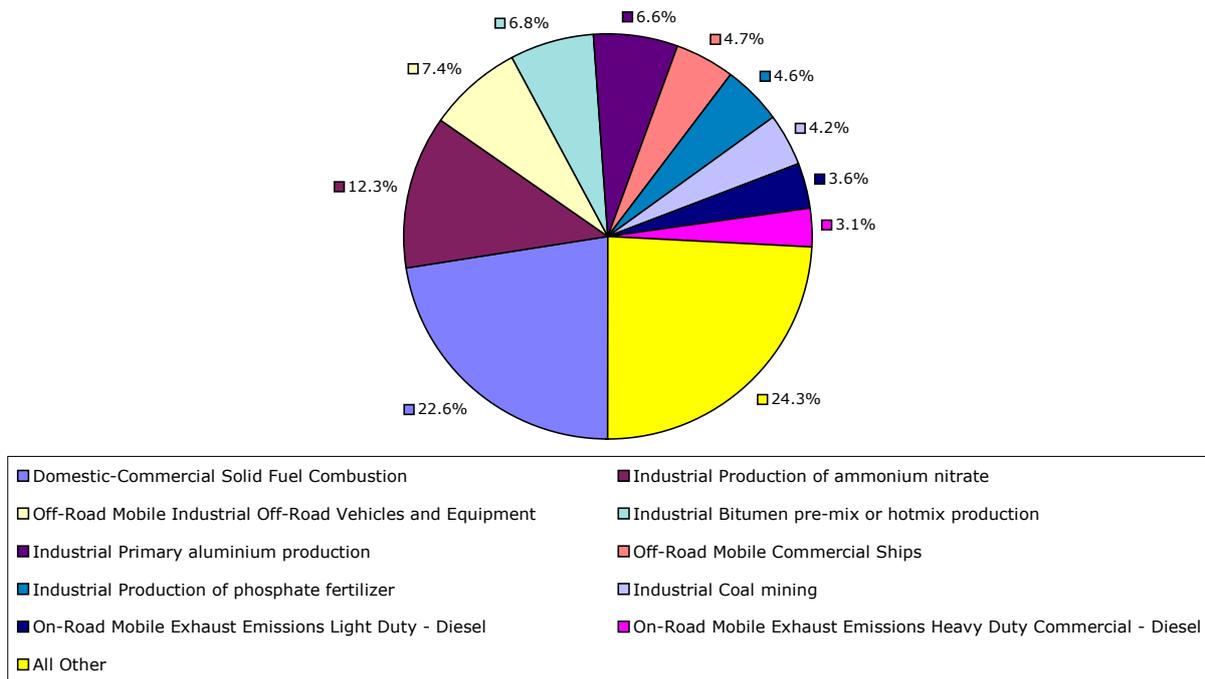


Figure ES32 Ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the Newcastle region

Figure ES33 shows the ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the Wollongong region.

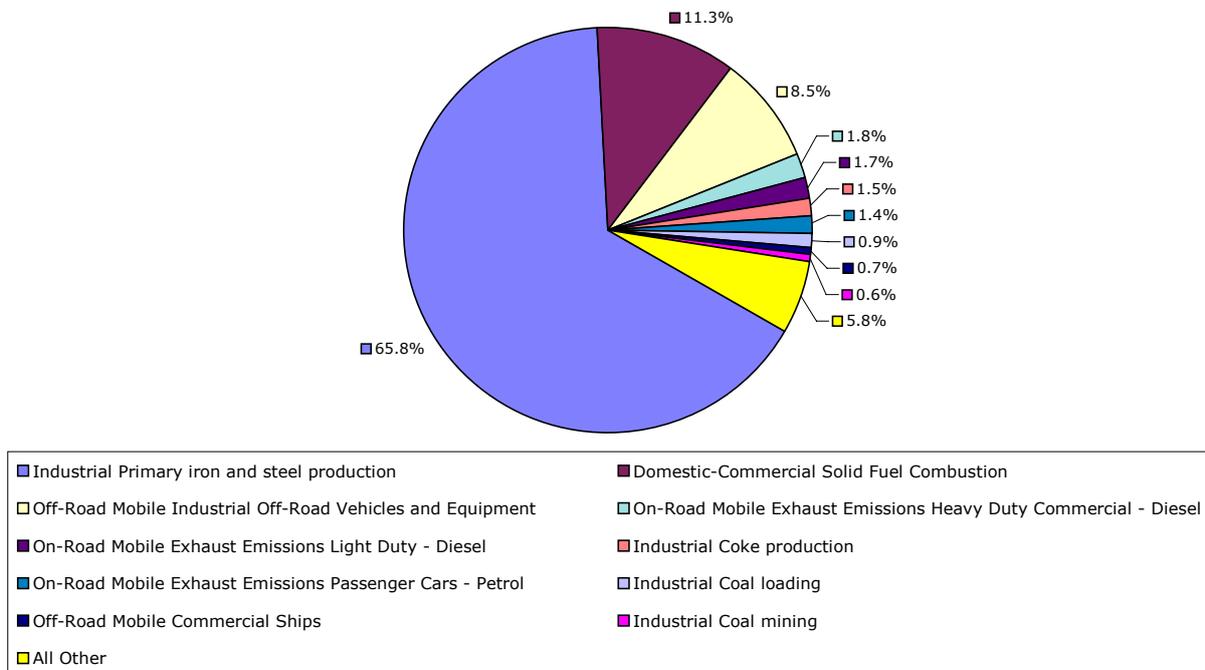


Figure ES33 Ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the Wollongong region

Figure ES34 shows the ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the Non-Urban region.

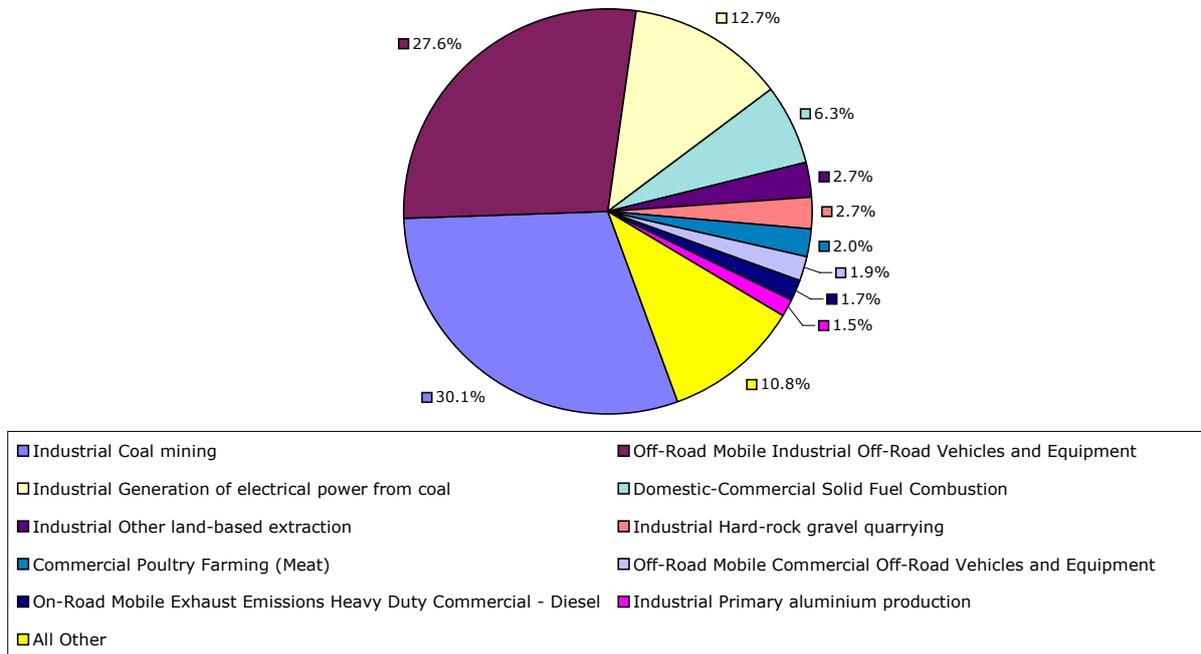


Figure ES34 Ten largest anthropogenic sources of particulate matter < 2.5 µm emissions in the Non-Urban region

Table ES11 shows the ten largest anthropogenic sources of sulfur dioxide emissions in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES11 Ten largest anthropogenic sources of sulfur dioxide

Source Group	Source Type	Sulfur Dioxide		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
GMR				
Industrial	Generation of electrical power from coal	261,317	86.6	86.6
Industrial	Primary aluminium production	12,589	4.17	90.7
Industrial	Primary iron and steel production	9,972	3.30	94.0
Industrial	Petroleum refining	6,953	2.30	96.3
Off-Road Mobile	Commercial Ships	3,148	1.04	97.4
Industrial	Storage of Petroleum and/or Petroleum Products	1,397	0.46	97.9
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	821	0.27	98.1
Industrial	Ceramics production (excluding glass)	690	0.23	98.4
Industrial	Production of container glass	646	0.21	98.6
Industrial	Coke production	553	0.18	98.7
All	Other	3,776	1.25	100.0
Sydney				
Industrial	Petroleum refining	6,953	50.5	50.5
Industrial	Storage of Petroleum and/or Petroleum Products	1,397	10.1	60.7
Off-Road Mobile	Commercial Ships	818	5.95	66.6
Industrial	Production of container glass	646	4.69	71.3
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	645	4.69	76.0
Industrial	Ceramics production (excluding glass)	522	3.79	79.8
Industrial	Petrochemical production	357	2.60	82.4
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	288	2.09	84.5
Industrial	Coke production	287	2.09	86.6
Industrial	Crushing, grinding or separating works	257	1.87	88.4
All	Other	1,593	11.6	100.0
Newcastle				
Industrial	Primary aluminium production	9,156	85.8	85.8
Off-Road Mobile	Commercial Ships	1,228	11.5	97.3
Industrial	Animal slaughtering	75.858	0.71	98.0
Industrial	Other chemical processing	52.787	0.49	98.5
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	51.490	0.48	99.0
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	23.706	0.22	99.2
Off-Road Mobile	Railways	23.413	0.22	99.4
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	18.499	0.17	99.6
Industrial	Primary non-ferrous production (excluding aluminium)	8.442	0.08	99.7
Domestic-Commercial	Solid Fuel Combustion	6.145	0.06	99.7
All	Other	28.519	0.27	100.0

Source Group	Source Type	Sulfur Dioxide		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
Wollongong				
Industrial	Primary iron and steel production	9,972	94.0	94.0
Industrial	Coke production	266	2.51	96.5
Off-Road Mobile	Commercial Ships	220	2.08	98.6
Industrial	Metal plating or coating works	30.121	0.28	98.9
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	29.384	0.28	99.2
Industrial	Production of phosphate fertilizer	20.720	0.20	99.4
Off-Road Mobile	Railways	19.198	0.18	99.5
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	15.945	0.15	99.7
On-Road Mobile	Exhaust Emissions Light Duty - Diesel	10.968	0.10	99.8
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	7.011	0.07	99.9
All	Other	14.498	0.14	100.0
Non-Urban				
Industrial	Generation of electrical power from coal	261,317	97.9	97.9
Industrial	Primary aluminium production	3,433	1.29	99.2
Off-Road Mobile	Commercial Ships	881	0.33	99.6
Off-Road Mobile	Railways	201	0.08	99.6
Industrial	Cement or lime production	193	0.07	99.7
Industrial	Ceramics production (excluding glass)	168	0.06	99.8
Off-Road Mobile	Industrial Off-Road Vehicles and Equipment	140	0.05	99.8
On-Road Mobile	Exhaust Emissions Heavy Duty Commercial - Diesel	97.738	0.04	99.9
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	95.640	0.04	99.9
Industrial	Coal mining	75.536	0.03	99.9
All	Other	218	0.08	100.0

Figure ES35 shows the ten largest anthropogenic sources of sulfur dioxide emissions in the GMR.

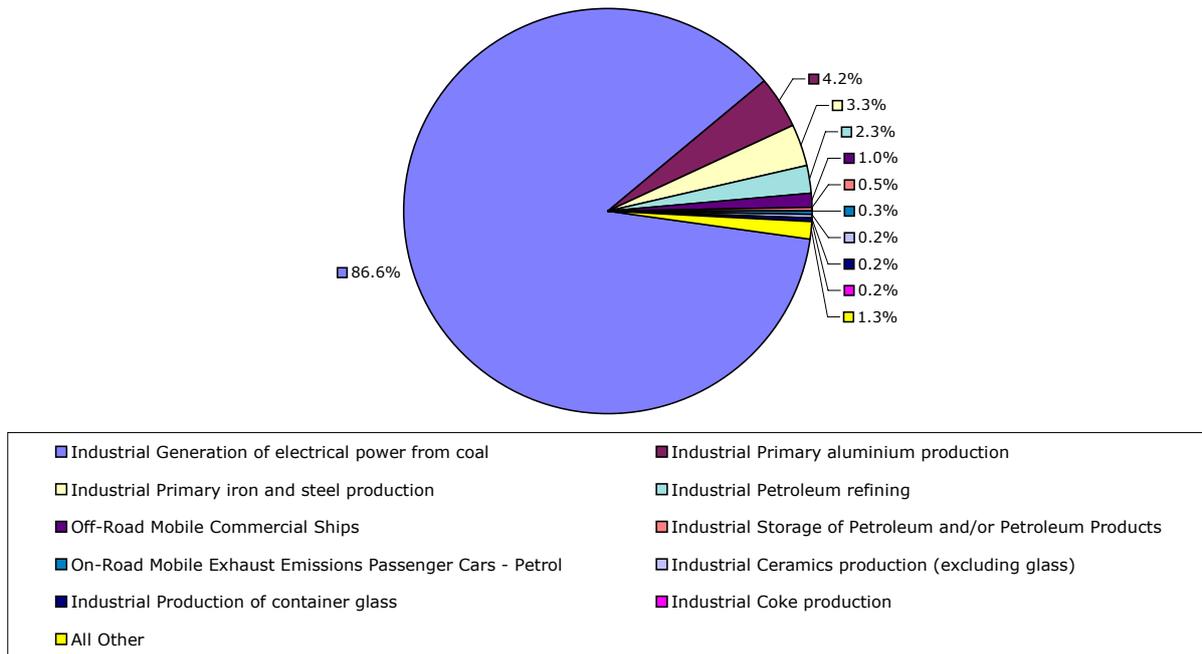


Figure ES35 Ten largest anthropogenic sources of sulfur dioxide emissions in the GMR

Figure ES36 shows the ten largest anthropogenic sources of sulfur dioxide emissions in the Sydney region.

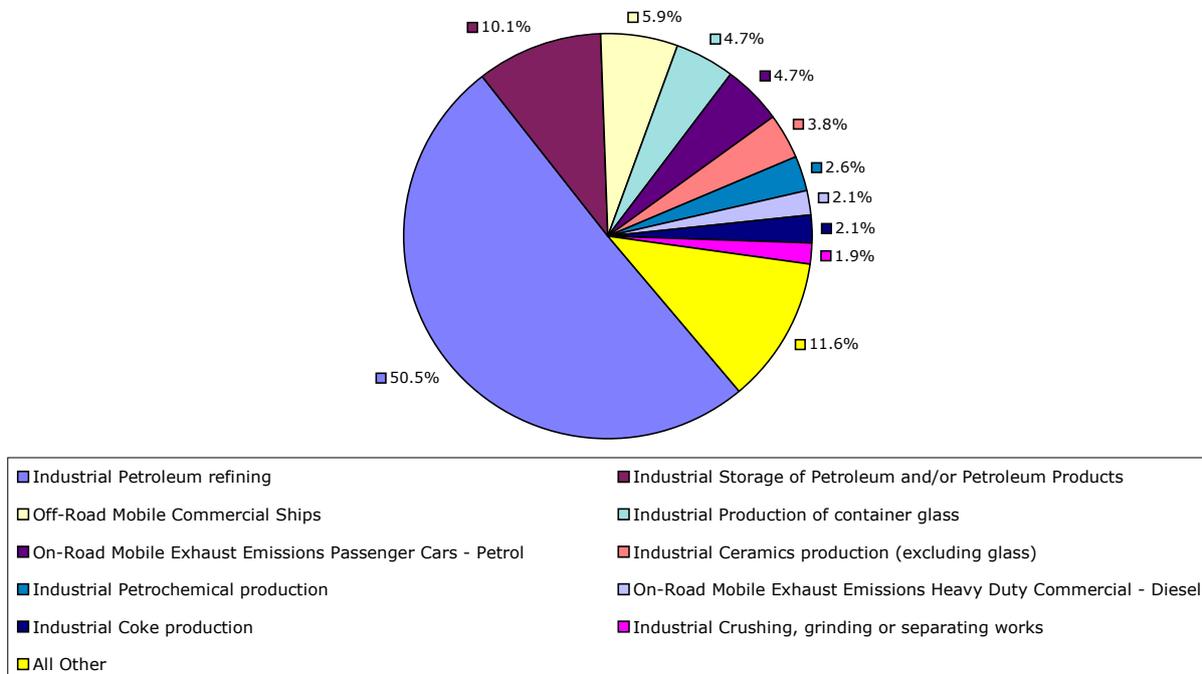


Figure ES36 Ten largest anthropogenic sources of sulfur dioxide emissions in the Sydney region

Figure ES37 shows the ten largest anthropogenic sources of sulfur dioxide emissions in the Newcastle region.

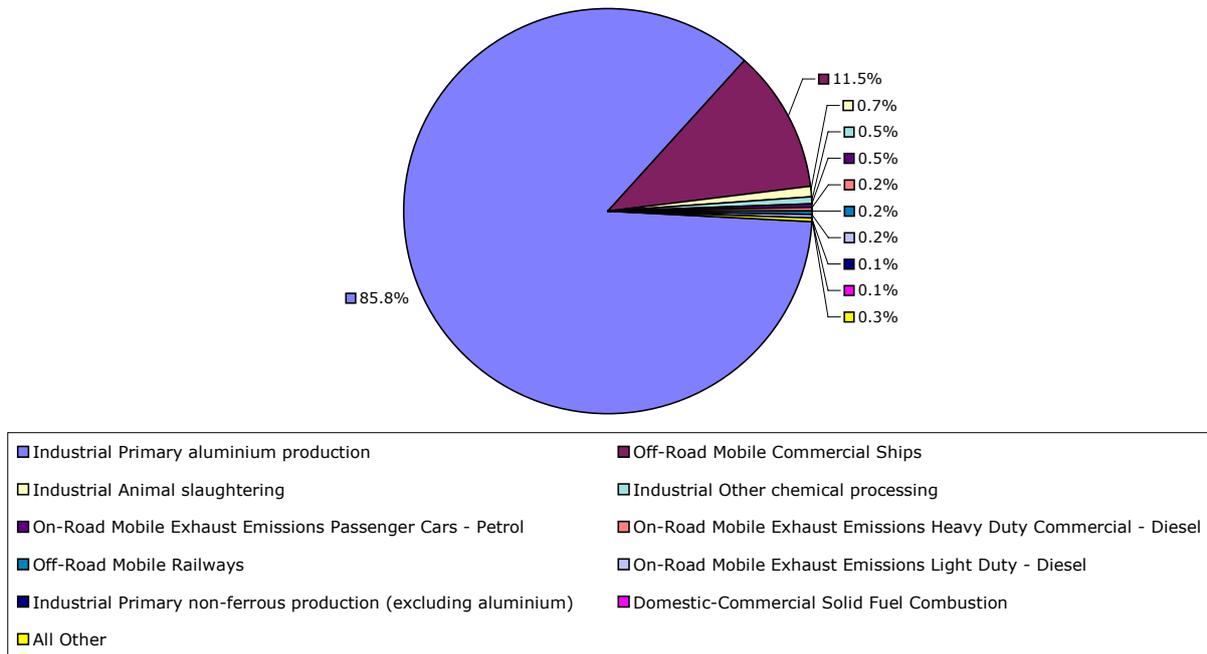


Figure ES37 Ten largest anthropogenic sources of sulfur dioxide emissions in the Newcastle region

Figure ES38 shows the ten largest anthropogenic sources of sulfur dioxide emissions in the Wollongong region.

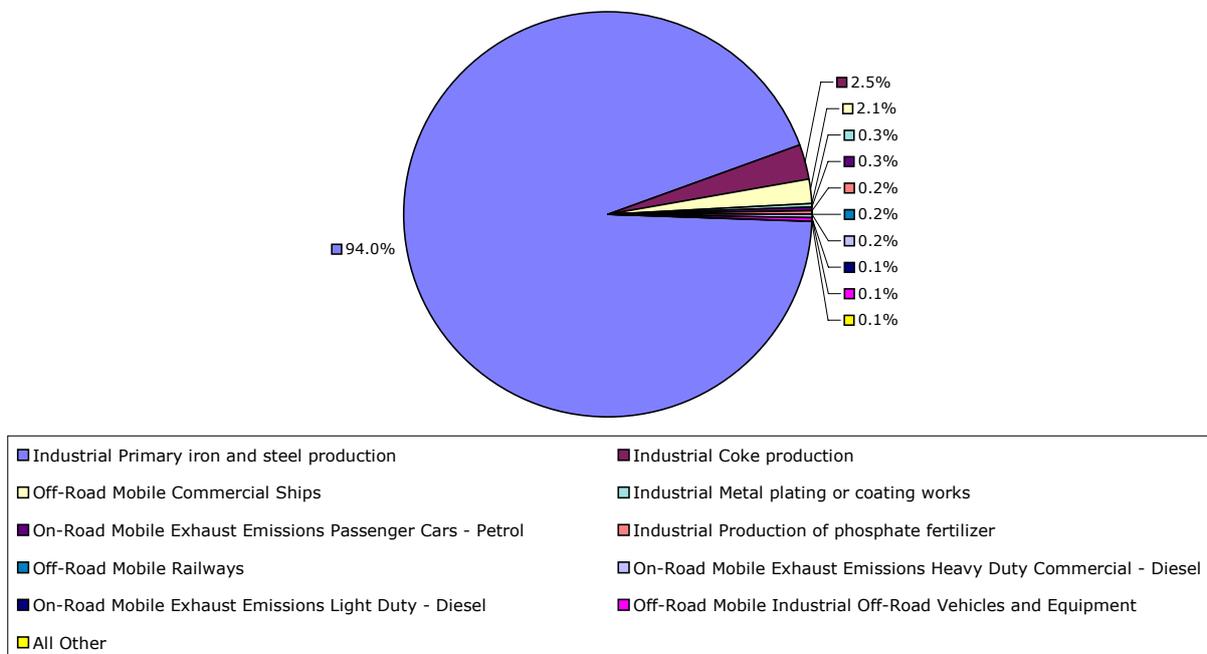
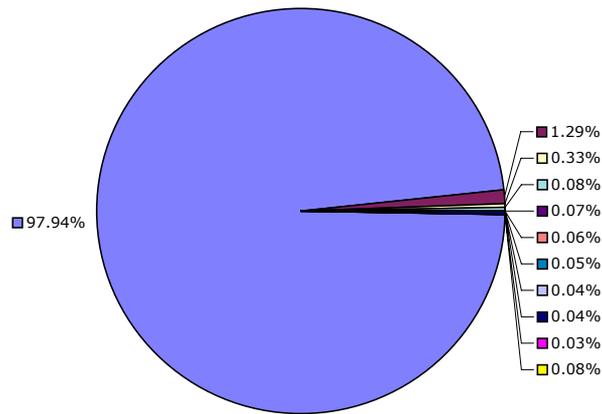


Figure ES38 Ten largest anthropogenic sources of sulfur dioxide emissions in the Wollongong region

Figure ES39 shows the ten largest anthropogenic sources of sulfur dioxide emissions in the Non-Urban region.



Industrial Generation of electrical power from coal	Industrial Primary aluminium production
Off-Road Mobile Commercial Ships	Off-Road Mobile Railways
Industrial Cement or lime production	Industrial Ceramics production (excluding glass)
Off-Road Mobile Industrial Off-Road Vehicles and Equipment	On-Road Mobile Exhaust Emissions Heavy Duty Commercial - Diesel
On-Road Mobile Exhaust Emissions Passenger Cars - Petrol	Industrial Coal mining
All Other	

Figure ES39 Ten largest anthropogenic sources of sulfur dioxide emissions in the Non-Urban region

Table ES12 shows the ten largest sources of total VOCs emissions in the GMR, Sydney, Newcastle, Wollongong and Non-Urban regions.

Table ES12 Ten largest anthropogenic sources of total VOCs

Source Group	Source Type	Total VOCs		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
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	9.88	44.5
On-Road Mobile	Evaporative Emissions - Petrol	14,956	8.74	53.3
Domestic-Commercial	Solid Fuel Combustion	12,663	7.40	60.7
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	5,916	3.46	64.1
On-Road Mobile	Exhaust Emissions - Other	5,829	3.41	67.5
Commercial	Automotive Fuel Retailing	5,625	3.29	70.8
Commercial	Smash Repairing	5,445	3.18	74.0
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	5,419	3.17	77.2
All	Other	39,033	22.8	100.0
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	9.01	54.7
Domestic-Commercial	Solid Fuel Combustion	9,524	7.28	62.0
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	4,627	3.54	65.5
Commercial	Smash Repairing	4,271	3.26	68.8
On-Road Mobile	Exhaust Emissions - Other	4,143	3.17	72.0
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	4,076	3.12	75.1
Commercial	Automotive Fuel Retailing	3,445	2.63	77.7
All	Other	29,149	22.3	100.0
Newcastle				
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	1,925	19.8	19.8
Domestic-Commercial	Aerosols and Solvents	1,360	14.0	33.8
Domestic-Commercial	Surface Coating	911	9.37	43.1
On-Road Mobile	Evaporative Emissions - Petrol	872	8.96	52.1
Domestic-Commercial	Solid Fuel Combustion	805	8.28	60.4
Commercial	Automotive Fuel Retailing	427	4.39	64.8
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	345	3.54	68.3
On-Road Mobile	Exhaust Emissions - Other	316	3.25	71.6
Commercial	Smash Repairing	289	2.97	74.5
Industrial	Production of ammonium nitrate	265	2.73	77.3
All	Other	2,212	22.7	100.0

Source Group	Source Type	Total VOCs		
		Annual Emissions (tonnes/year)	Proportion of Annual Anthropogenic Emissions (%)	Cumulative (%)
Wollongong				
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	1,133	17.6	17.6
Domestic-Commercial	Aerosols and Solvents	989	15.3	32.9
Domestic-Commercial	Surface Coating	660	10.2	43.1
Industrial	Primary iron and steel production	579	8.97	52.0
Domestic-Commercial	Solid Fuel Combustion	525	8.13	60.2
On-Road Mobile	Evaporative Emissions - Petrol	507	7.85	68.0
Commercial	Automotive Fuel Retailing	320	4.96	73.0
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	225	3.48	76.5
Commercial	Smash Repairing	210	3.25	79.7
On-Road Mobile	Exhaust Emissions - Other	206	3.20	82.9
All	Other	1,103	17.1	100.0
Non-Urban				
On-Road Mobile	Exhaust Emissions Passenger Cars - Petrol	3,937	16.4	16.4
Domestic-Commercial	Aerosols and Solvents	3,236	13.5	29.8
Domestic-Commercial	Surface Coating	2,215	9.21	39.0
Domestic-Commercial	Solid Fuel Combustion	1,808	7.52	46.6
On-Road Mobile	Evaporative Emissions - Petrol	1,795	7.46	54.0
Commercial	Automotive Fuel Retailing	1,433	5.96	60.0
On-Road Mobile	Exhaust Emissions - Other	1,163	4.83	64.8
Off-Road Mobile	Recreational Boats	1,077	4.48	69.3
On-Road Mobile	Exhaust Emissions Light Duty Commercial - Petrol	895	3.72	73.0
Domestic-Commercial	Lawn Mowing & Garden Equipment (Domestic)	774	3.22	76.2
All	Other	5,717	23.8	100.0

Figure ES40 shows the ten largest anthropogenic sources of total VOCs emissions in the GMR.

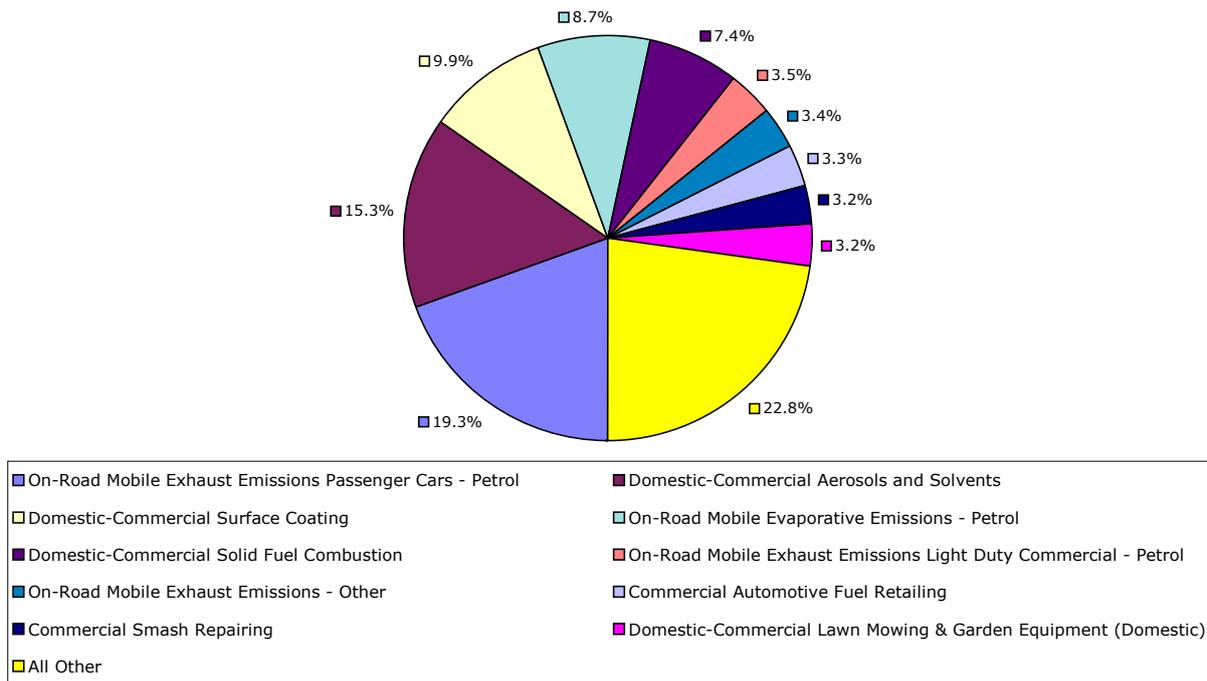


Figure ES40 Ten largest anthropogenic sources of total VOCs emissions in the GMR

Figure ES41 shows the ten largest anthropogenic sources of total VOCs emissions in the Sydney region.

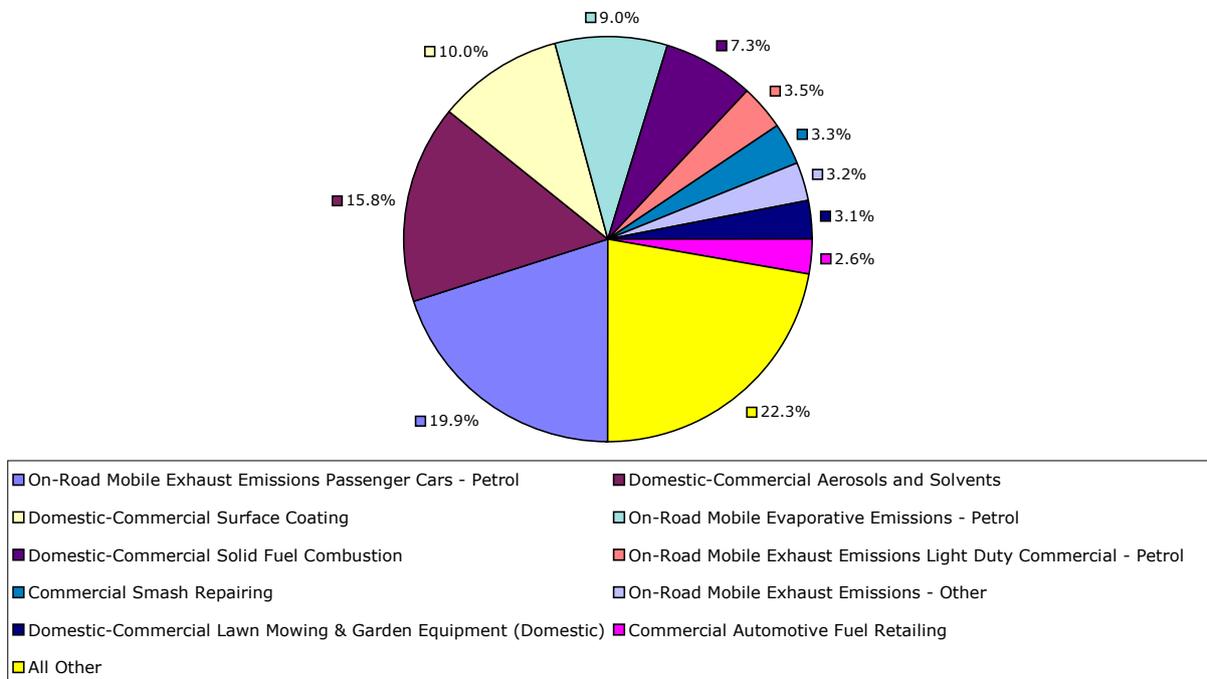


Figure ES41 Ten largest anthropogenic sources of total VOCs emissions in the Sydney region

Figure ES42 shows the ten largest anthropogenic sources of total VOCs emissions in the Newcastle region.

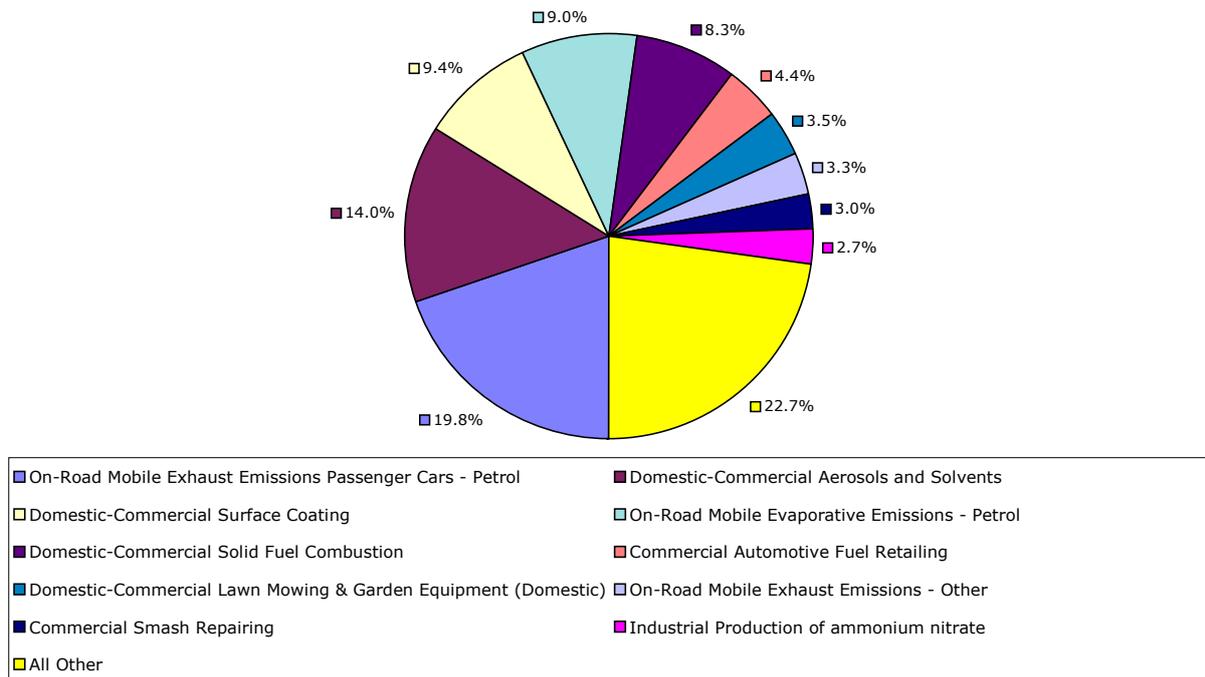


Figure ES42 Ten largest anthropogenic sources of total VOCs emissions in the Newcastle region

Figure ES43 shows the ten largest anthropogenic sources of total VOCs emissions in the Wollongong region.

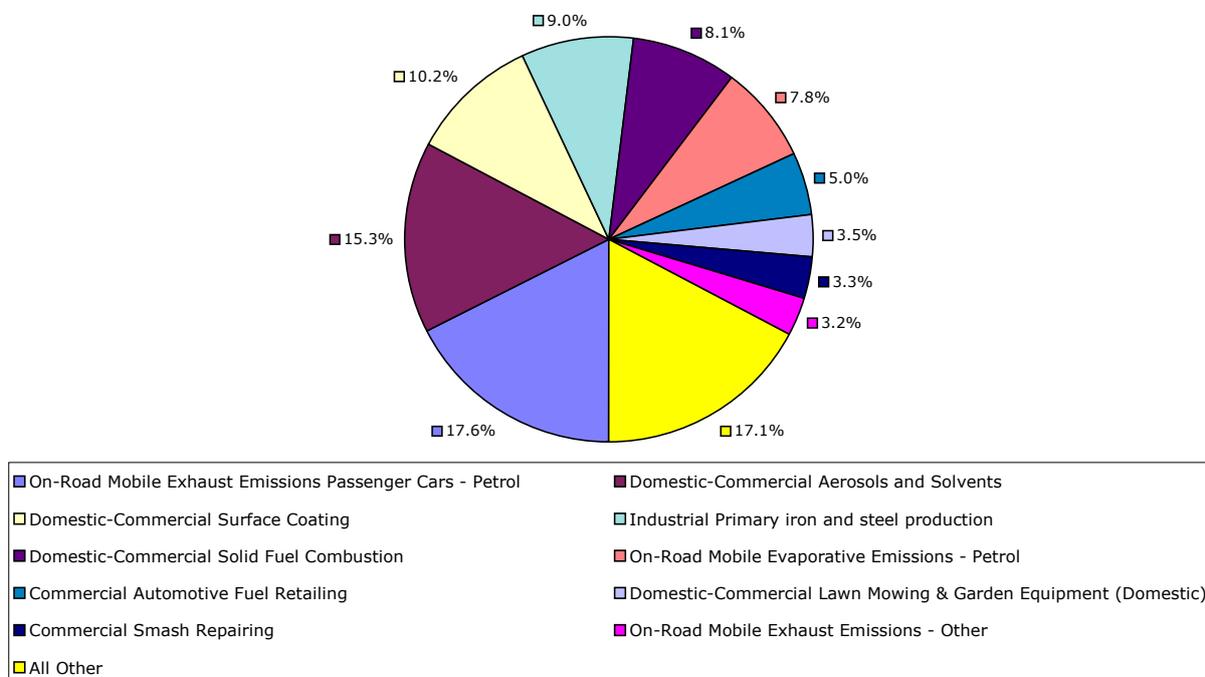


Figure ES43 Ten largest anthropogenic sources of total VOCs emissions in the Wollongong region

Figure ES44 shows the ten largest anthropogenic sources of total VOCs emissions in the Non-Urban region.

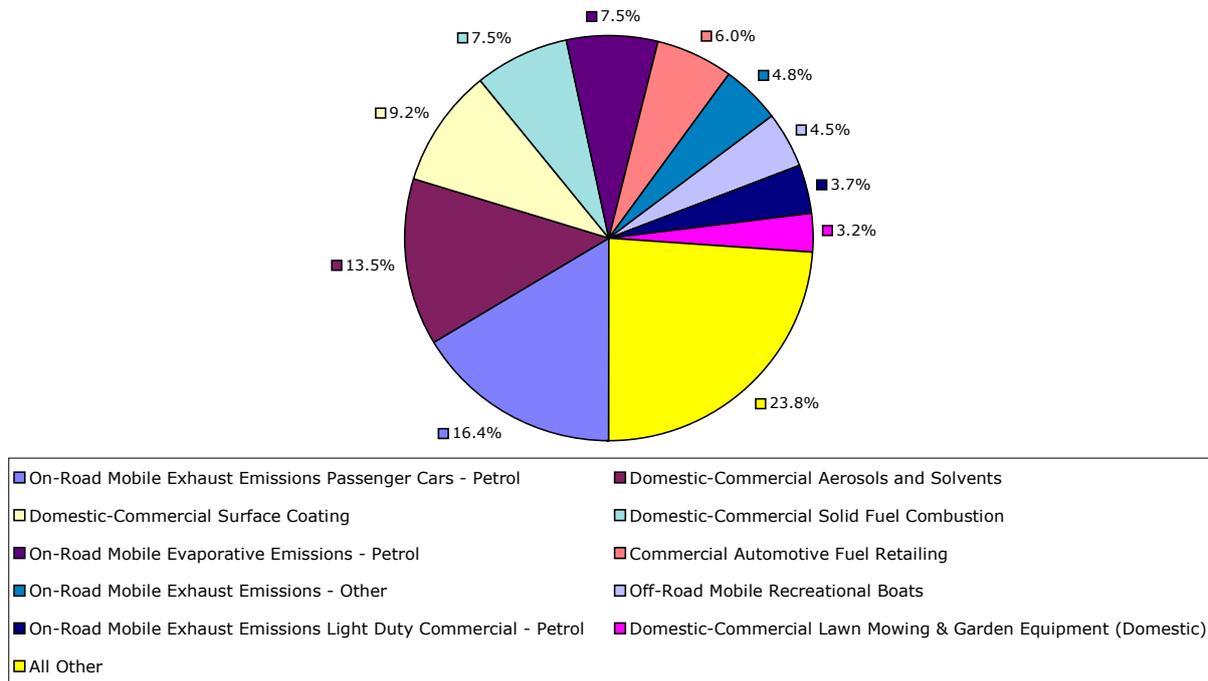


Figure ES44 Ten largest anthropogenic sources of total VOCs emissions in the Non-Urban region