

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.

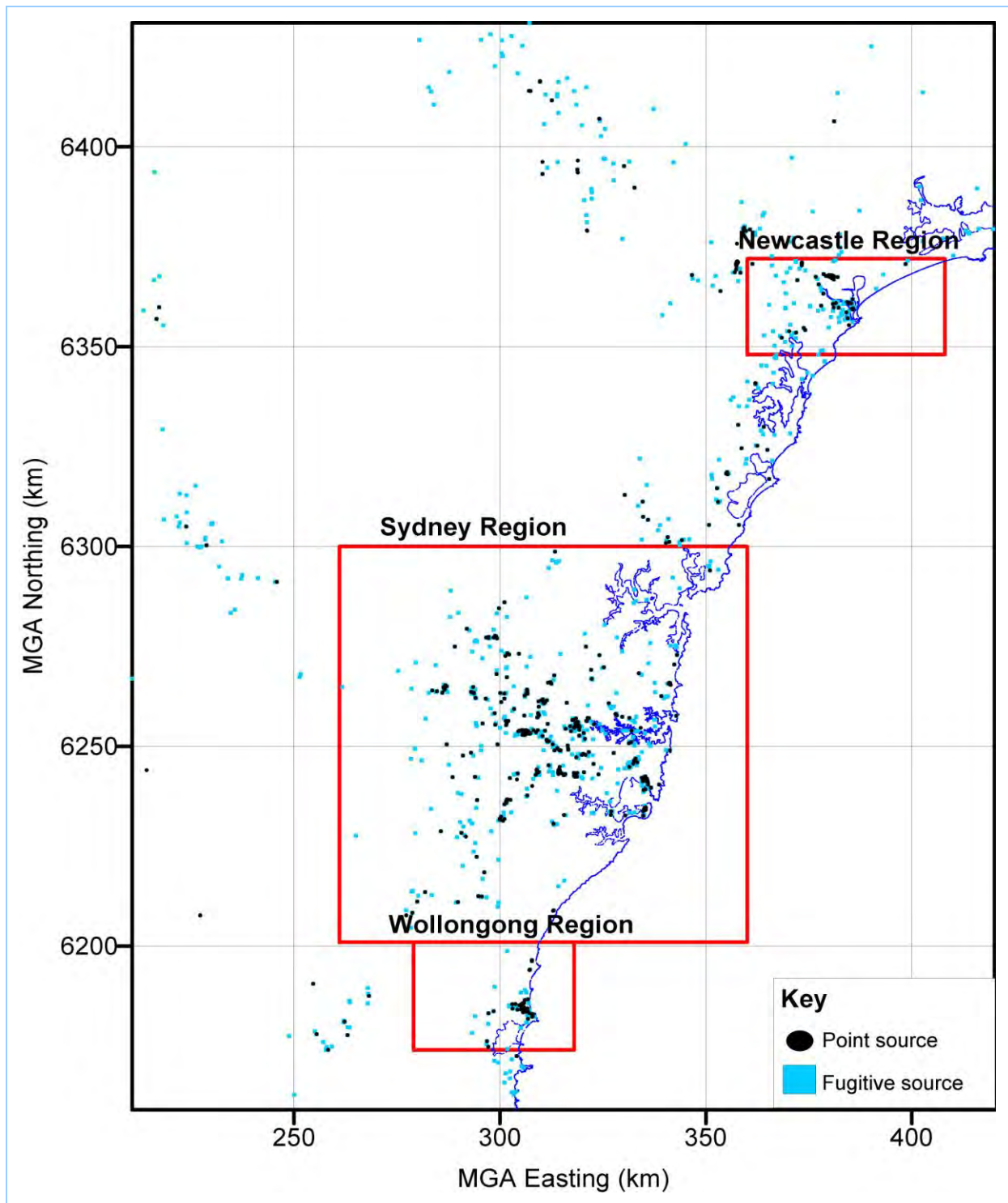


Figure ES-2: Industrial emission sources in the GMR

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 $\leq 10 \mu\text{m}$	6,210	3,740	2,100	61,200	73,200
PARTICULATE MATTER $\leq 2.5 \mu\text{m}$	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.

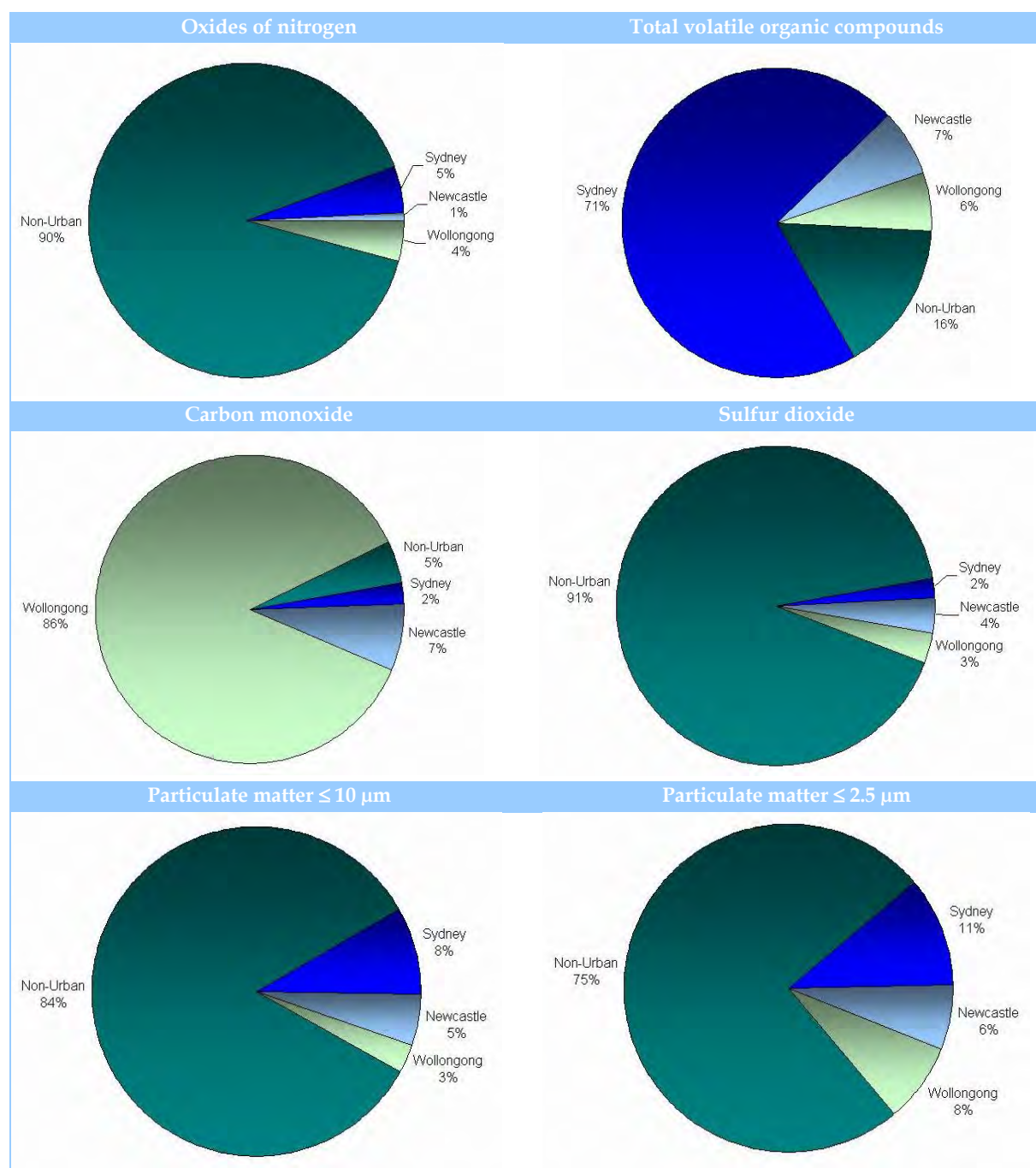


Figure ES-3: Proportion of total estimated annual emissions from industrial sources in each region

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

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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.

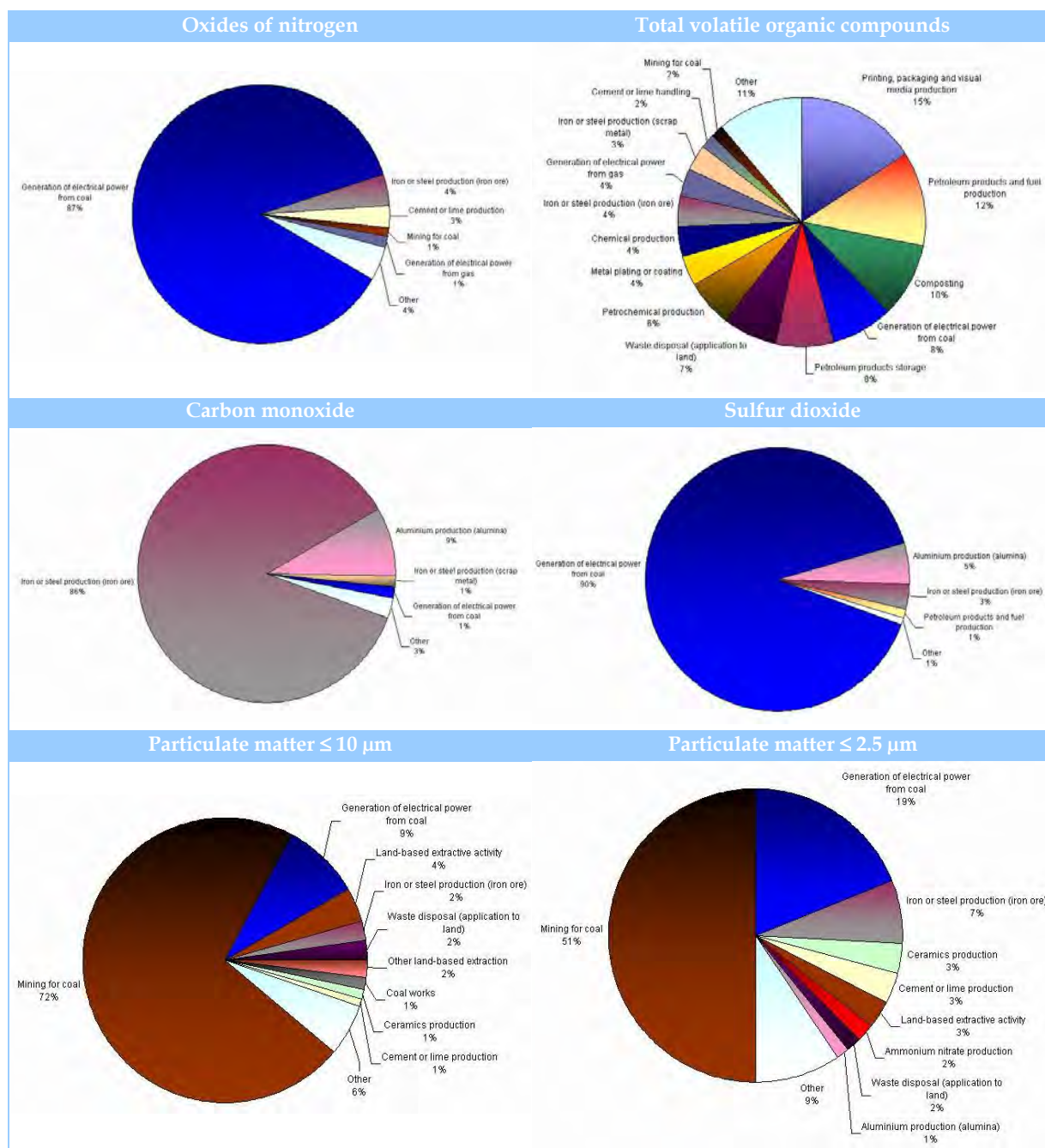


Figure ES-4: Proportion of total emissions by industry source type in the GMR

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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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.

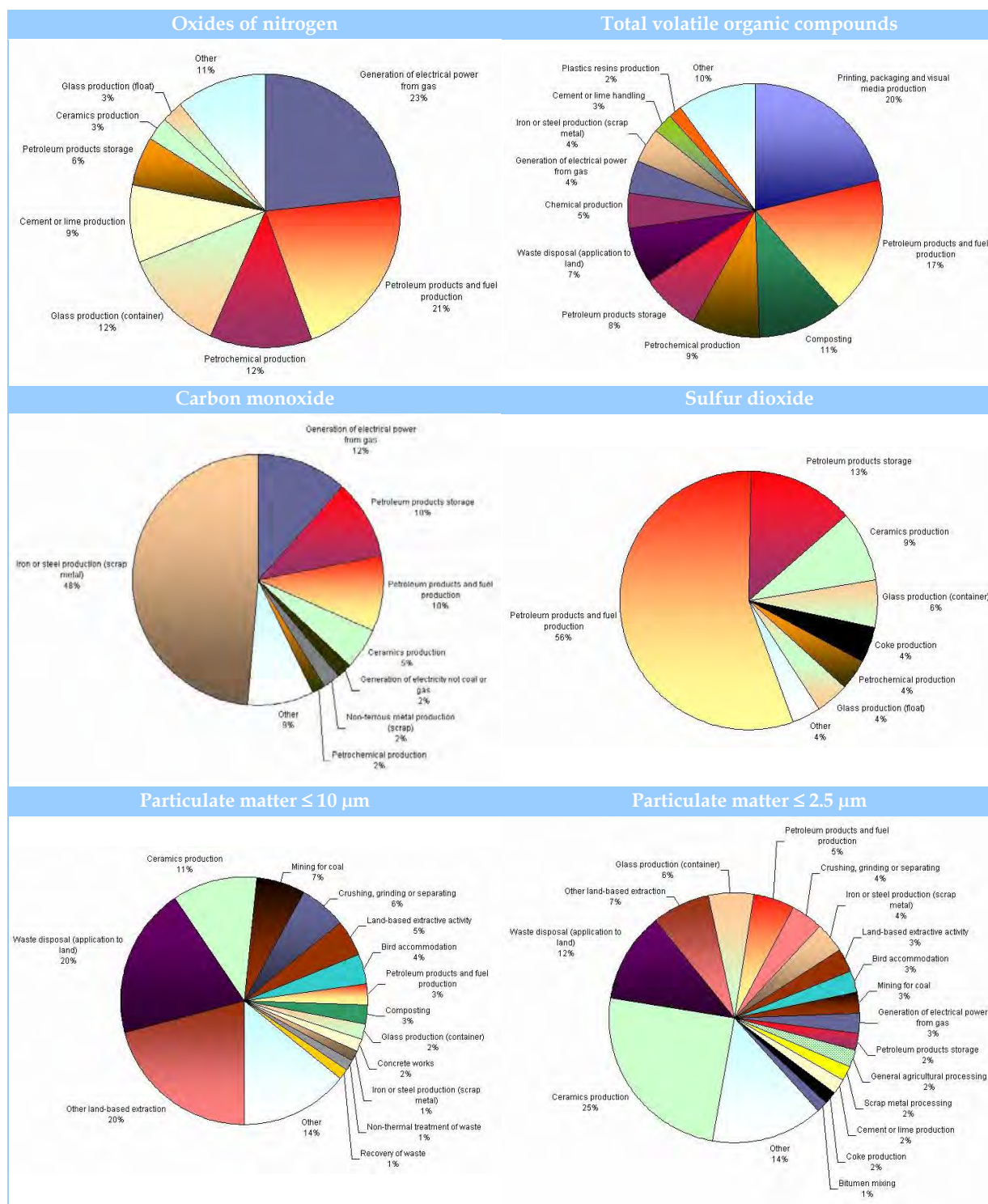


Figure ES-5: Proportion of total emissions by industry source type in the Sydney region

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GLOSSARY/ABBREVIATIONS

Acronym	Definition
µm	micrometre (1 x 10 ⁻⁶ metre)
ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
ADF	Australian diesel fuel
Ambient Air Quality NEPM	National Environment Protection (Ambient Air) Measure
ANFO	Ammonium nitrate/fuel oil
ANZSIC	Australian and New Zealand Standard Industrial Classification, 1993
ARB	Air Resources Board
AVGAS	Aviation gasoline
AVTUR	Aviation turbine fuel
BOD	Biological oxygen demand
Boiler - WB-TF	Boiler - wet bottom - tangentially fired
Boiler - WB-WF	Boiler - wet bottom - wall fired
Boiler - DB-TF	Boiler - dry bottom - tangentially fired
BoM	Bureau of Meteorology
BP	British Petroleum
C/O	Care of
CA	California
CA	Continuous annealing
CARB	California Air Resources Board
CAS	Continuous annealing stack
CCU	Catalytic cracking unit
CDU	Crude distillation unit
CE-CERT	Center for Environmental Research and Technology
CEIDARS	California emission inventory and reporting system
chromium VI	Hexavalent chromium (i.e. Cr ⁶⁺)
Cl ₂	Chlorine
CLO	Caltex lubricating oil
CLOR	Caltex lubricating oil refinery
CO	Carbon monoxide
CO ₂	Carbon dioxide
COG	Coke ovens gas
Combustion products	CO, NO _x , TSP, PM ₁₀ , PM _{2.5} , particulate matter, VOC, SO ₂ , SO ₃ , H ₂ SO ₄ , speciated metals, speciated organics, greenhouse gases, ammonia
CSIRO	Commonwealth Scientific and Industrial Research Organisation
csm	Coal seam methane
DA	Development application
DCC	Australian Commonwealth Department of Climate Change
DCCEE	Australian Commonwealth Department of Climate Change and Energy Efficiency
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
DECCW	Department of Environment, Climate Change and Water (NSW)
DEH	Australian Commonwealth Department of Environment and Heritage
DEW	Australian Commonwealth Department of Environment and Water
DEWHA	Australian Commonwealth Department of Environment, Water, Heritage and the Arts
DSEWPC	Australian Commonwealth Department of Sustainability, Environment, Water,

Acronym	Definition
	Population and Communities
EA	Environment Australia
EBF	Exhaust bag filter
EET	Emission estimation technique
EFRT	External floating roof tank
EI	Emissions inventory
EIIP	Emission Inventory Improvement Program
EP&A	Environmental Planning and Assessment
EPA	Environment Protection Authority
EPAV	Environment Protection Authority Victoria
EPL	Environmental Protection Licence
ERG	Eastern Research Group
ESP	Electrostatic precipitators
FBC	Fluidised bed combustion
FCCU	Fluid catalytic cracking unit
FF	Fabric filters
GDA	Geocentric Datum of Australia
GJ	Gigajoule (1 x 10 ⁹ joule)
GMR	Greater Metropolitan Region
GPO	Government Post Office
GWh	Gigawatt hour (1 x10 ⁹ watt hour)
H ₂ S	Hydrogen sulfide
ha	Hectare (one hectare equals 10,000 m ²)
HC	Hydrocarbons
HCl	Hydrochloric acid
HFRT	Horizontal fixed roof tank
HNN	High normal naphtha
HP	Horsepower
HSR	Heavy straight run naphtha
HTU	Hydro treating unit
HVI	High viscosity index
I.C.	Internal combustion
ICSM	Intergovernmental Committee on Surveying and Mapping
ID	Identification number
IFRT	Internal floating roof tanks
IPCC	Intergovernmental Panel on Climate Change
ISBN	International Standard Book Number
K	Kelvin
kg	kilogram (1,000 gram)
kL	kilolitre (1,000 litre)
km	kilometre (1,000 metre)
kW	kilowatt (1,000 watt)
L	Litre
lb	Pound (avdp) (Avoirdupois)
LBL	Load based licensing
lfg	Landfill gas
LPG	Liquefied Petroleum Gas
LSR	Light straight run naphtha
Ltd	Limited
LVI	Low viscosity index
m	metre

Acronym	Definition
M	Moisture content
m/s	metre per second
m ²	Square metre
m ³	Cubic metre
MGA	Map Grid of Australia based on the Geocentric Datum of Australia 1994 (GDA94)
MJ	Megajoule (1,000,000 joule)
ML	Megalitre (1,000,000 litre)
mm	millimetre (1,000 th of a metre or 1x10 ⁻³ metre)
MM	Munmorah
MPCA	Minnesota Pollution Control Agency
Mt	Megatonne (1,000,000 tonne)
MW	Megawatt (1,000,000 watt)
MWh	Megawatt hour (one million watt hour)
N ₂ O	Nitrous oxide
NA	Not applicable
NaOH	Sodium hydroxide
NC	North Carolina
ND	No data
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NGA	National Greenhouse Accounts
NGGIC	National Greenhouse Gas Inventory Committee
NO	Nitric oxide
No.	Number
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen (sum of nitric oxide and nitrogen dioxide expressed as nitrogen dioxide equivalent)
NPI	National Pollutant Inventory
NPI NEPM	National Environment Protection (National Pollutant Inventory) Measure
NSW	New South Wales
OEH	Office of Environment and Heritage (NSW)
OEHHA	Office of Environmental Health Hazard Assessment
P	Power
PAE	Pacific Air & Environment
PAH	Polycyclic aromatic hydrocarbons
PCA	Pollution control approval
PCB	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxins
PCDD/F	Polychlorinated dibenzo-p-dioxins & polychlorinated dibenzo-p-furans (polychlorinated dioxins and furans)
PCDD/PCDF	Polychlorinated dibenzo-p-dioxins & polychlorinated dibenzo-p-furans (polychlorinated dioxins and furans)
PCDF	Polychlorinated dibenzo-p-furans
PCO	Parliamentary Counsel Office (New South Wales)
PDU	Propane deasphalting unit
PM	Particulate matter (included in the air emissions inventory as TSP, PM ₁₀ and PM _{2.5})
PM ₁₀	Particulate matter with an aerodynamic diameter of less than or equal to 10 micrometres
PM _{2.5}	Particulate matter with an aerodynamic diameter of less than or equal to 2.5 micrometres
PO	Post Office
POEO	Protection of the Environment Operations

Acronym	Definition
pp	pages
ppm	Parts per million (in mass) (e.g. gram/tonne)
Pty	Proprietary
PULP	Premium unleaded petrol
Qld	Queensland
RAAF	Royal Australian Air Force
ROM	Run of mine
RTA	Road and Traffic Authority
SAPRC	Statewide Air Pollution Research Center
SO ₂	Sulfur dioxide
SO ₃	Sulfur trioxide
SPULP	Super premium unleaded petrol
Stat	Stationary
STP	Sewage treatment plant
Syngas	Synthetic gas (e.g. refinery gas)
t	tonne (1,000 kilogram)
TAPM	The Air Pollution Model
TEF	Toxic Equivalency Factors
TJ	Terajoule (1x 10 ¹² joule)
TSA	Toluenesulfonic Acid
TSP	Total suspended particulate matter
TTY	Text Telephone, Telephone typewriter, or telecommunication device for the Deaf
ULP	Unleaded petrol
UNEP	United Nations Environment Programme
USA	United States of America
USEPA	United States Environmental Protection Agency
VA	Virginia
VDU	Vacuum distillation unit
VFRT	Vertical fixed roof tanks
Vic	Victoria
VOC	Total volatile organic compounds
VP	Vales Point
WEBFIRE	Internet based factor information retrieval (FIRE)
WFO	Waste fuel oil
wo	without
WW	Wallerawang
XSA	Xylenesulfonic acid

1 INTRODUCTION

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 purpose of this document is to present the emission estimation methodologies and results of the industrial air emissions inventory. The information is structured as follows:

- A description of the industrial air emissions inventory specification (Section 2) including:
 - The inventory year (Section 2.1);
 - A description of the inventory region (Section 2.2);
 - A description of the grid coordinate system (Section 2.3);
 - A description of emission sources considered (Section 2.4);
 - A description of the pollutants evaluated (Section 2.5); and
 - A broad discussion of the methodology (Section 2.6).
- The emission estimation methodology presented by industrial source type for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions (Section 3).
- An emission summary for selected substances presented by industrial source type for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions (Section 3).
- An emissions summary for selected substances presented for all industrial sources for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions (Section 4).
- A summary of data quality assurance procedures used for estimated emissions (Section 5)
- A complete list of references (Section 6).
- Total industrial emissions of all substances emitted in the GMR, Sydney, Newcastle, Wollongong and Non Urban regions (Appendix A).

2 INVENTORY SPECIFICATIONS

2.1 The Inventory Year

The industrial air emissions inventory results presented in this report are based on activities that took place in the 2008 calendar year.

2.2 The Inventory Region

The inventory region defined as the GMR measures 210 km (east-west) by 273 km (north-south). The inventory region is defined in Table 2-1 and shown in Figure 2-2.

Table 2-1: 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).

2.3 Grid Coordinate System

The grid coordinate system used for the industrial air emissions inventory uses 1 km by 1 km grid cells. The grid coordinates start from the bottom left corner having index number with Easting (km) in the horizontal and Northing (km) in the vertical direction. The grid coordinate system is illustrated in Figure 2-1.

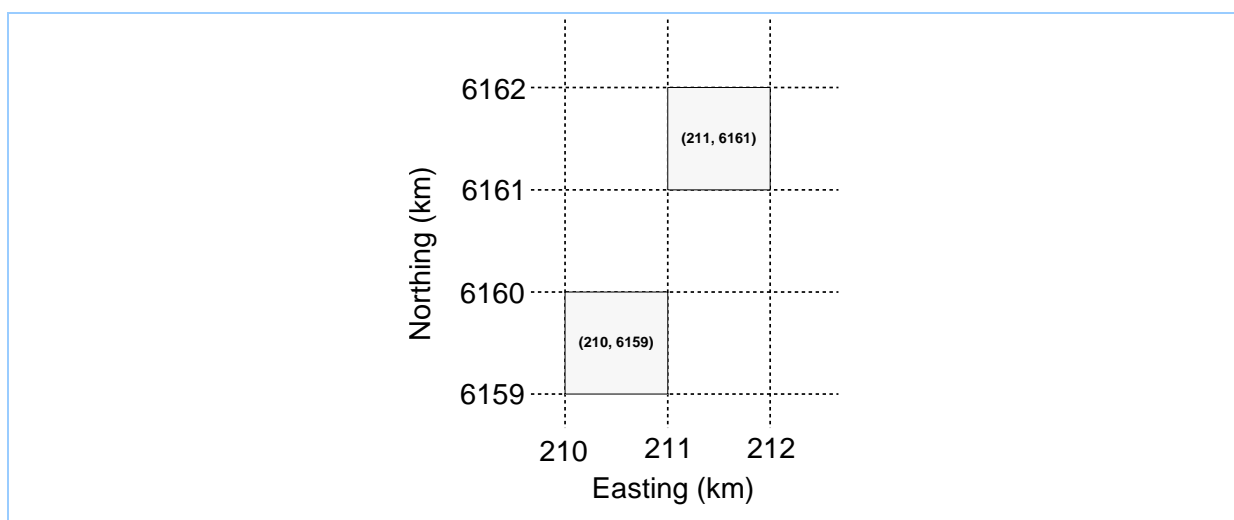


Figure 2-1: Grid coordinate system

2. Inventory Specifications



Figure 2-2: Definition of Greater Metropolitan, Sydney, Newcastle and Wollongong regions

2.4 Emission Sources Considered

Industrial facilities include all NSW Activity Types with the potential for air emissions in the GMR that hold a licence to operate under the Protection of the Environment Operations Act 1997. The industrial emissions inventory for 2008 includes sources from 1,092 facilities.

2. Inventory Specifications

The industrial categories* included in the 2008 air emissions inventory and the number of facilities included in each category are provided in Table 2-2.

Table 2-2: Industrial categories included in the 2008 air emissions inventory

Activity	NSW Activity Code	Number of Facilities
Agricultural fertiliser (phosphate) production	14B	2
Aluminium production (alumina)	57	2
Aluminium production (scrap metal)	58	3
Ammonium nitrate production	14A	1
Animal accommodation	44	3
Battery production	15	3
Bird accommodation	43	7
Bitumen mixing	8	17
Boat construction/maintenance (dry/float)	53	3
Boat construction/maintenance (general)	54	21
Boat mooring and storage	52	14
Brewing and distilling	9	2
Cement or lime handling	11	13
Cement or lime production	10	5
Ceramics production	13	11
Chemical production	24	44
Chemical storage	25	2
Coal washery reject or slag landfilling	78	4
Coal works	28	9
Coke production	27	2
Composting	29	29
Concrete works	30	163
Container reconditioning	33	8
Contaminated soil treatment	31	6
Crushing, grinding or separating	32	22
Dairy animal accommodation	40	2
Dairy processing	1	6
Explosives production	16	3
General agricultural processing	3	13
General animal products production	50	8
General chemicals storage	25A	11
Generation of electrical power from coal	34A	8
Generation of electrical power from gas	34B	13
Generation of electricity not coal or gas	34C	4
Glass production (container)	12A	1
Glass production (float)	12B	2
Hazardous, industrial or group A waste disposal	75A	2
Hazardous, industrial or group A waste generation	73	2
Helicopter-related activity	4	7

* Schedule 1 of the Protection of the Environment Operations Act 1997 is used to identify industrial facility groups

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

2. Inventory Specifications

Activity	NSW Activity Code	Number of Facilities
Inert waste landfilling	77	3
Iron or steel production (iron ore)	55	1
Iron or steel production (scrap metal)	56	4
Land-based extractive activity	36	60
Metal plating or coating	61	38
Metal processing	63	8
Mining for coal	26	65
Mining for minerals	64	4
Miscellaneous licensed discharges to waters (at any time)	91	20
Miscellaneous licensed discharges to waters (wet weather only)	90	1
Non-ferrous metal production (scrap)	60	1
Non-thermal treatment of waste	92	63
Other land-based extraction	37	10
Paints/polishes/adhesives production	17	13
Paper or pulp production	67	2
Paper production using recycle materials	66	1
Pesticides and related products production	19	5
Petrochemical production	18	3
Petroleum products and fuel production	68	11
Petroleum products storage	25B	20
Pharmaceutical and veterinary products production	20	19
Pig accommodation	42	2
Plastics resins production	21	6
Printing, packaging and visual media production	94	8
Railway systems activities	70	6
Recovery of waste	75	13
Recovery of waste oil	69	4
Recovery of waste tyres	76	1
Rendering or fat extraction	47	4
Road construction	38	6
Rubber products/tyre production	22	1
Scrap metal processing	62	10
Sewage treatment - large plants	71B	19
Sewage treatment - small plants	71A	58
Shipping in bulk	72	19
Slaughtering or processing of animals	45	13
Soap and detergent production	23	3
Solid waste landfilling	79	3
Sterilisation activities	74	2
Waste disposal (application to land)	7	47
Waste storage	84	22
Water-based extractive activity	35	11
Wood or timber milling or processing	86	3
Wood preservation	87	1
Grand Total		1,092

2.5 Pollutants Evaluated

The following pollutants have been considered:

- Substances included in the National Environment Protection (National Pollutant Inventory (NPI)) Measure (NEPC, 2008);
- Pollutants included in the National Environment Protection (Ambient Air Quality) Measure (NEPC, 2003);
- Pollutants included in the National Environment Protection (Air Toxics) Measure (NEPC, 2004);
- Pollutants associated with the Protection of the Environment Operations (Clean Air) Regulation 2010 (PCO, 2011);
- Air pollutants associated with the Protection of the Environment Operations (General) Regulation 2009 (PCO, 2010);
- Speciation of oxides of nitrogen (i.e. NO and NO₂) for photochemical modelling (USEPA, 1995a)†;
- Speciated organic compounds for photochemical modelling sourced from Carter (2010);
- Speciated particulate emissions (i.e. TSP (total suspended particulate), PM₁₀ (particulate matter with an aerodynamic diameter ≤ 10 µm) and PM_{2.5} (particulate matter with an aerodynamic diameter ≤ 2.5 µm));
- Environment Protection Authority of Victoria air toxic pollutants sourced from Hazardous Air Pollutants - A Review of Studies Performed in Australia and New Zealand (EPAV, 1999);
- Commonwealth Government Air Toxics Program Technical Advisory Group (13 March 2000) priority air pollutants (EA, 2001b);
- U.S. Environmental Protection Agency list of 189 Hazardous Air Pollutants (USEPA, 2010);
- Air pollutants included in the Office of Environmental Human Health Assessment (OEHHA)/ Air Resources Board (ARB) 'hot spots' list (CARB, 2011);
- EPA regulated pollutants with design ground level concentrations (DEC, 2005);
- USEPA 16 priority polycyclic aromatic hydrocarbons (PAH) (Keith et. al., 1979);
- WHO97 polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofurans (PCDF) and polychlorinated biphenyls (PCB) (Van den Berg et. al., 1998); and
- Greenhouse gases (i.e. carbon dioxide, methane and nitrous oxide) included in the National Greenhouse Accounts (NGA) Factors (DCCEE, 2010).

2.6 Methodology Overview

This section contains a broad overview of the methodology used to develop the industrial air emissions inventory, while specific details are provided in Section 3.

† The default NO_x speciation profile used in the inventory is 95% NO and 5% NO₂.

2. Inventory Specifications

The methodology used to develop the industrial air emissions inventory involves the following steps:

2.6.1 Industrial Facility Identification

Industrial facilities in this project include all facilities with the potential for air emissions in the GMR that hold a licence to operate under the Protection of the Environment Operations Act 1997. Facility addresses have been geocoded to obtain a spatial location for each facility. The geocoding process queried calibrated street map layers to search for the postcode, suburb, street name and street number in order to return the most accurate MGA (Map Grid of Australia) coordinates for the facility (the datum used is GDA94). Where the street number could not be located the street centroid coordinate was returned. Where the street name could not be found the suburb centroid was returned. The statistics from the geocoding process are presented in Table 2-3.

Table 2-3: Results from geocoding process

Geocoding Accuracy	Number of facilities
Accurate to facility street number	642
Accurate to facility street	436
Accurate to facility suburb	14
Total	1,092

The coordinates have been used to spatially allocate facility emission sources unless more accurate data have been provided. Where industrial facilities provided specific coordinates for emission sources, the default coordinates generated from geocoding have been overwritten.

2.6.2 Emission Source Identification

Once all facilities were located, all possible emission sources from each industry type (separated into NSW POEO Scheduled activities) and the substances emitted from each emission source were identified.

2.6.3 Emission Estimation Technique Design

All emissions are calculated within a specifically designed database which stores facility details and emission sources and uses CARB, NPI and USEPA emission factors to estimate emission loads. In this project, source emission test data have been used to estimate emissions to air in preference to default methodologies that utilise emission factors.

In general, emissions have been estimated using Equation 1.

$$E_{i,j} = A_j \times EF_{i,j} \times CF_{i,j} \quad \text{Equation 1}$$

where:

$E_{i,j}$	=	Emissions of substance i from process j	(kg/year)
$EF_{i,j}$	=	Emission factor for substance i from process j	(kg/activity unit)
A_j	=	Rate of activity for process j	(activity unit/year)
$CF_{i,j}$	=	Control factor for substance i for process j	(-)

2.6.4 Identification of Required Data to Estimate Emissions

Based on the designed emission estimation techniques the required data to estimate emissions from each source were identified.

2.6.5 Data Acquisition

Industrial questionnaires have been designed for each industrial category to obtain detailed information on manufacturing processes, speciated emissions from stacks and fugitive sources, and temporal operational details. Each industrial facility received one questionnaire for each Schedule 1 activity listed on their licence.

A total of 1,108 facilities were mailed questionnaires on 29 September 2009. The industrial questionnaires were sent out under a NSW EPA notice to provide information and/or records under section 191 of the Protection of the Environment Operations Act 1997. Questionnaires were requested to be returned to the NSW EPA by 10 November 2009, after which follow up emails and phone calls were made to premises that had failed to return questionnaires. Although emissions have only been provided for 1,092 facilities, emissions from 16 facilities were not estimated as they either surrendered their licence, ceased operations or were subsequently found to be outside the GMR.

All industrial facilities responded to the inventory questionnaire.

The general objective for industrial source surveys was to obtain as much site-specific information as possible. To this end, source test data and site specific emission factors (often derived for regulatory reporting) were requested in the surveys for each type of emission source at the facility. All surveyed facilities were requested to identify every unit process with releases to air and provide site specific source test data, emissions estimates and a basis for these estimates using activity data (e.g. fuel consumed by the process unit).

Facilities were asked a number of questions in the surveys in order to characterise variation in operating hours. Production has been assumed to vary with operating hours for most facilities. This was to simplify the survey (i.e. by not requesting variation of emissions for each source at each facility). Generic temporal profiles have been developed for emission sources where it is clear that emissions are not related to production or operating hours (e.g. tank breathing loss).

Facilities were requested to provide unit process specific emission estimates and data used to estimate emissions. If facility specific, unit process specific emission estimates were not available, or were unreliable, other data, such as production data collected in the survey have been used to estimate emissions. Facilities that submitted insufficient data in the survey were contacted separately to the survey in order to collect the required information.

Sample questionnaires are presented in Appendix B.

2.6.6 Data Analysis and Validation

Survey results have been validated with known realistic values (based on experience) and cross-checked with calculations based on responses from other facilities. Emissions from facilities that report to the NPI have been cross-checked with inventory estimates as a validation step.

2. Inventory Specifications

2.6.7 Deriving Industry Type Specific Projection Factors

Projection factors have been derived based on energy (primary or final) projections published by ABARE (Australian Bureau of Agricultural and Resource Economics) national or state projection data (e.g. Australian Energy, National and State Projections to 2029/2030, ABARE, 2006).

Projection factors have been developed for every year from 2009 to 2036 (emissions for the base year 2008 are based on responses to the inventory questionnaire and emission estimation techniques).

The projection factors for each source are used to estimate emissions in future annual periods using Equation 2:

$E_{i,j,k,n} = E_{i,j,k,2008} \times PF_{j,k,n}$	Equation 2
--	-------------------

where:

$E_{i,j,k,n}$	= Emission of substance i from location j for source type k for year n	(kg/year)
$E_{i,j,k,2008}$	= Emission of substance i from location j for source type k for the base year, 2008	(kg/year)
$PF_{j,k,n}$	= Projection factor for location j for source type k for year n (relative to the base year)	(-)

The methodology followed to assign projection factors to each industrial activity was as follows:

- NSW Schedule 1 Activities were assigned equivalent ANZSIC93 categories (ABS, 1993);
- ABARE energy projection data for ANZSIC categories were obtained for 2004/2005 to 2030/2031 for primary and final energy consumption for NSW and by energy type (ABARE, 2006);
- Energy usage for 2031/2032 to 2036/2037 were forecast based on ABARE data using linear regression (i.e. assuming linear growth rates out to 2036/2037);
- Calendar year energy usage was estimated based on the average of the two corresponding financial years (e.g. 2008 is the average energy usage from 2007/2008 and 2008/2009);
- ABARE energy projections were matched up with NSW Schedule 1 activities based on ANZSIC93 class generally. Some exceptions from this approach were forced in certain instances (e.g. Petroleum Wholesaling is matched with petroleum refining); and
- Generally, either total primary or final energy consumption was chosen as the projection surrogate based on judgement for each Schedule 1 activity.

Some deviations from this approach occurred on a selected basis (e.g. electricity generation from coal is matched with total primary black coal consumption in NSW from the electricity generation ANSZIC class and not the total).

The basis for each industry specific projection factors are provided in Table 2-4.

2. Inventory Specifications

Table 2-4: Basis for industry specific projection factors

ABARE Energy Category	ABARE Category	ABARE ANZSIC Basis	NSW Scheduled Activity	Assigned ANZSIC93 Category
Final Energy Consumption	Agriculture (Section 3.1.5)	Division A	Animal accommodation	Division A
			Bird accommodation	Division A
			Dairy animal accommodation	Division A
			Dairy processing	Division C, Group 212
			General agricultural processing	Division A
			General animal products production	Division C, Group 211
			Pig accommodation	Division A
			Rendering or fat extraction	Division C, Group 211
			Slaughtering or processing of animals	Division C, Group 211
	Basic chemicals (Section 3.24.5)	Group 253	Agricultural fertiliser (phosphate) production	Division C, Class 2531
			Ammonium nitrate production	Division C, Class 2531
			Chemical production	Division C, Group 253 and Group 254
			Chemical storage	Division I, Class 6709
			General chemicals storage	Division I, Class 6709
			Plastics resins production	Division C, Group 256
	Basic non-ferrous metals products (Section 3.38.5)	Group 272 and Group 273	Metal processing	Division C, Subdivision 27
			Non-ferrous metal production (scrap)	Division C, Group 273
	Commercial and services (Section 3.16.5)	Sectors 37, 66 and 67; Divisions F, G, H, J, K, L, M, N, O, P and Q	Composting	Division Q, Class 9634
			Container reconditioning	Division Q, Class 9634
			Contaminated soil treatment	Division Q, Class 9634
			Inert waste landfilling	Division Q, Class 9634
			Miscellaneous licensed discharges to waters (at any time)	Division D, Subdivision 37
			Miscellaneous licensed discharges to waters (wet weather only)	Division D, Subdivision 37
			Non-thermal treatment of waste	Division Q, Class 9634
			Recovery of waste	Division Q, Class 9634
			Recovery of waste oil	Division Q, Class 9634
			Recovery of waste tyres	Division Q, Class 9634
			Sewage treatment - large plants	Division D, Subdivision 37
			Sewage treatment - small	Division D, Subdivision 37

2. Inventory Specifications

ABARE Energy Category	ABARE Category	ABARE ANZSIC Basis	NSW Scheduled Activity	Assigned ANZSIC93 Category
			plants	
			Solid waste landfilling	Division Q, Class 9634
			Sterilisation activities	Division Q, Class 9634
			Waste disposal (application to land)	Division Q, Class 9634
			Waste storage	Division Q, Class 9634
	Domestic water transport (Section 3.5.5)	Class 6302 and Class 6303	Boat construction/maintenance (dry/float)	Division C, Class 2822
			Boat construction/maintenance (general)	Division C, Class 2822
			Boat mooring and storage	Division I, Class 6709
	Mining (Section 3.14.5)	Division B	Coal washery reject or slag landfilling	Division Q, Class 9634
			Coal works	Division B
			Coke production	Division C, Class 2520
			Crushing, grinding or separating	Division B
			Land-based extractive activity	Division B
			Mining for coal	Division B
			Mining for minerals	Division B
			Other land-based extraction	Division B
	Non-metallic minerals (Section 3.9.5)	Subdivision 26	Cement or lime handling	Division C, Class 2631 (as a surrogate)
			Cement or lime production	Division C, Class 2631
			Ceramics production	Division C, Group 262
			Concrete works	Division C, Class 2633
			Glass production (container)	Division C, Class 2610
	Other basic non ferrous metals (Section 3.39.5)	Classes 2720–2721, 2723–2729	Aluminium production (alumina)	Division C, Class 2721
			Aluminium production (scrap metal)	Division C, Class 2729
			Bitumen mixing	Division C, Class 2720
			Scrap metal processing	Division C, Class 2769
	Other industry (Section 3.2.5)	NA (but other industry within Division C)	Battery production	Division C, Class 2853
			Brewing and distilling	Division C, Group 218
			Explosives production	Division C, Class 2541
Hazardous, industrial or group A waste disposal			Division Q, Class 9634	
Hazardous, industrial or group A waste generation			Division Q, Class 9634	
Metal plating or coating			Division C, Class 2764	
Paints/polishes/adhesives			Division C, Group 254	

2. Inventory Specifications

ABARE Energy Category	ABARE Category	ABARE ANZSIC Basis	NSW Scheduled Activity	Assigned ANZSIC93 Category	
			production		
			Pesticides and related products production	Division C, Class 2544	
			Pharmaceutical and veterinary products production	Division C, Class 2543	
			Rubber products/tyre production	Division C, Group 255	
			Soap and detergent production	Division C, Class 2545	
	Rail transport (Section 3.56)	Subdivision 62		Railway systems activities	Division I, Class 6649
	Road transport (Section 3.59.5)	Subdivision 61		Road construction	Division I, Class 6619
	Wood, paper (Section 3.47.5)	Subdivision 23 & Subdivision 24		Paper or pulp production	Division C, Group 233
				Paper production using recycle materials	Division C, Class 2339
				Printing, packaging and visual media production	Division C, Subdivision 24
				Wood or timber milling or processing	Division C, Group 231
				Wood preservation	Division C, Subdivision 23
	Primary Energy Consumption	Domestic air transport (Section 3.34.5)	NA (but a subsector of Subdivision 64)	Helicopter-related activity	Division I, Class 6402
		Electricity generation (Section 3.28.5)	Group 361	Generation of electrical power from coal	Division D, Class 3610
				Generation of electrical power from gas	Division D, Class 3610
Generation of electricity not coal or gas				Division D, Class 3610	
International water transport (Section 3.64.5)		Class 6301		Shipping in bulk	Division I, Subdivision 63
Iron and steel (Section 3.39.5)		Group 271		Iron or steel production (iron ore)	Division C, Group 271
				Iron or steel production (scrap metal)	Division C, Group 271
Petroleum refining (Section 3.49.5)		Group 251		Petrochemical production	Division C, Group 252
				Petroleum products and fuel production	Division C, Group 252
			Petroleum products storage	Division F, Class 4521	

2. Inventory Specifications

2.6.8 Emissions Estimation

Emissions have been estimated using data supplied in the industrial questionnaires. Where available, source test data has been used in preference to default emission estimation techniques. Generally emissions have been estimated using emission factors sourced from references provided in Table 2-5.

Table 2-5: Typical reference sources for emission factors

Substance	Emission Factor Source
CO, NO _x ¹ , SO ₂ & VOC	<ul style="list-style-type: none"> - USEPA AP42 Compilation of Air Pollutant Emission Factors (USEPA, 2011b) - NPI Emission Estimation Technique Manuals (DSEWPC, 2011) - USEPA TANKS 4.09D software (USEPA, 2006e). A detailed description of tank emission estimates is presented in Appendix C.
PM _{2.5} , PM ₁₀ & TSP	<ul style="list-style-type: none"> - USEPA AP42 Compilation of Air Pollutant Emission Factors (USEPA, 2011b) - NPI Emission Estimation Technique Manuals (DSEWPC, 2011) - California Emissions Inventory and Reporting System (CEIDARS) Particulate Matter Size Profiles (CARB, 2008) - USEPA AP42 <i>Chapter 13.2.1 Paved Roads & Chapter 13.2.2 Unpaved Roads</i> (USEPA, 2006c; 2011a). A detailed description of wheel generated dust emission estimates is presented in Appendix D.
Organic air toxics	<ul style="list-style-type: none"> - USEPA SPECIATE v4.2 software (USEPA, 2008e) - California Emissions Inventory and Reporting System Organic Speciation Profiles (CARB, 2005)
Metal air toxics	<ul style="list-style-type: none"> - California Emissions Inventory and Reporting System Particulate Matter Speciation Profiles (CARB, 2007) - USEPA SPECIATE v4.2 software (USEPA, 2008e)
Ammonia	<ul style="list-style-type: none"> - Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	<ul style="list-style-type: none"> - USEPA AP42 Compilation of Air Pollutant Emission Factors (USEPA, 2011b) - NPI Emission Estimation Technique Manuals (DSEWPC, 2011) - Mass balance - Raoult's law (Raoult, M, 1882a; 1882b, 1887a; 1887b), using chemical properties from Perry and Green (1997)
PAH	<ul style="list-style-type: none"> - USEPA AP42 Compilation of Air Pollutant Emission Factors (USEPA, 2011b) - USEPA SPECIATE v4.2 software (USEPA, 2008e) - NPI Emission Estimation Technique Manuals (DSEWPC, 2011)
PCDD/PCDF	<ul style="list-style-type: none"> - Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004) - Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP, 2005)
Speciated VOC & Methane	<ul style="list-style-type: none"> - USEPA SPECIATE v4.2 software (USEPA, 2008e) - California Emissions Inventory and Reporting System Organic Speciation Profiles (CARB, 2005) - USEPA TANKS 4.09D software (USEPA, 2006e)
Greenhouse gases (CO ₂ -and N ₂ O)	<ul style="list-style-type: none"> - National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

Industry specific, source specific emission estimation techniques are detailed in Section 3.

2.6.9 Data Storage

All emissions have been calculated within the Industrial Emissions Inventory Database, which is a Microsoft® Access™ 2000 relational database with a SQL server back-end. The Industrial Emissions Inventory Database was originally designed and configured for the 2003 NSW GMR air emissions inventory (PAE, 2007). The database facilitates the storage of all data required for estimating emissions to air from industrial sources, including: activity data; emission factors; volatile organic compound (VOC) speciation profiles; spatial allocation data; hourly, daily and monthly temporal variation data; and emission projection factors. The Industrial Emissions Inventory Database start-up form is shown in Figure 2-3.



Figure 2-3: Industrial emissions inventory database start-up form

2. Inventory Specifications

Users can enter and store facility details, including, facility name, address and accountable party details, as well as identified emission sources, locations of emission sources, and other facility details into the Facility Configuration Screen shown in Figure 2-4.

Facility Configuration

Facility Configuration

Jump to Licence:
 Jump to Facility:

Details | Address | AP Details
Does Not Exist

Facility:

LGA:

NSW License No: NPI reporter:

Annual Electricity Consumption: MWh

Other Info:

UTM Zone 56

Easting (km): Northing (km):

Centroid Accuracy

Unknown Site Street Suburb

Survey Recv'd

Sources | Contacts | Activities

Source	Point Type	Easting km	Northing km
▶ Turbine (natural gas, 200 MW, low NOx burners)	Point	220.652	6325.526
Fuel storage (petrol)	Fugitive	220.652	6325.526
Wheel generated dust (paved roads)	Fugitive	220.652	6325.526
* <enter source name>	<NOT SET>	220.652	6325.526

View Details:
View all:
Delete:

Record: of 3

Show Facility output:
Replicate Facility Sources:

Record: of 1093

Figure 2-4: Facility configuration screen

2. Inventory Specifications

Once emission sources have been identified, users can configure each emission source by selecting an appropriate EET from a library of techniques as well as select the most appropriate organic speciation profile using the Emission Source Configuration Screen shown in Figure 2-5. Users can also store source information such as stack parameters if required and temporal factors to describe how the emission source varies over time.

The screenshot displays the 'Source Configuration' window. At the top, the title 'Source Configuration' is prominently displayed. Below this, the 'Facility' is set to 'Example Facility'. The 'Source' dropdown menu is selected to 'Turbine (natural gas, 200 MW, low NOx burners)'. The 'EET' dropdown is set to 'Turbine (natural gas)' and the 'Speciation Profile' dropdown is set to 'Natural Gas Turbine'. The 'Details' tab is active, showing UTM coordinates (Easting: 220.652, Northing: 6325.526), Grid Cell information (011167 X 220.000 Y 6325.000), and Source Type set to 'Point'. Stack information includes Height (15 m), Diameter (0.1 m), Velocity (25 m/s), and Temperature (423 K). The 'Date Commissioned' is set to 2008. A 'Record' bar at the bottom indicates '1 of 3' records.

Figure 2-5: Emission source configuration screen

Emissions are estimated using the Emission Estimation Screen shown in Figure 2-6. Users are required to enter the required source activity data corresponding to the EET selected to estimate emissions. Substance specific emission control factors may be entered corresponding to site specific control technologies that may be in place.

EET Data Entry

EET Data Entry

Reset all:

For: Example Facility: Turbine (natural gas, 200 MW, low NOx burners): Turbine (natural gas)

Required Inputs:		Editable?
Amount of methane combusted	<input style="width: 95%;" type="text" value="15.200000000000000000"/>	Mm ³ /year <input checked="" type="checkbox"/>

Substance:	Measurement:	Editable?
ARSENIC & COMPOUNDS: Emission Factor	<input style="width: 95%;" type="text" value=".00330000000000000000"/>	kg/Mm ³ <input checked="" type="checkbox"/>
ARSENIC & COMPOUNDS: Control Factor	<input style="width: 95%;" type="text" value="1.000000000000000000"/>	factor <input checked="" type="checkbox"/>
BERYLLIUM & COMPOUNDS: Emission Factor	<input style="width: 95%;" type="text" value=".00020000000000000000"/>	kg/Mm ³ <input checked="" type="checkbox"/>
BERYLLIUM & COMPOUNDS: Control Factor	<input style="width: 95%;" type="text" value="1.000000000000000000"/>	factor <input checked="" type="checkbox"/>

Record: 3 of 46

Substance:	Estimated Emission:	Calculate
ARSENIC & COMPOUNDS	.05016000000000000000 kg/year	<input type="checkbox"/>
BERYLLIUM & COMPOUNDS	.00304000000000000000 kg/year	<input type="checkbox"/>
CADMIUM & COMPOUNDS	.27360000000000000000 kg/year	<input type="checkbox"/>
CARBON DIOXIDE	29806592.00000000000000000000 kg/year	<input type="checkbox"/>
CARBON MONOXIDE	20375.6000000000000000000000 kg/year	<input type="checkbox"/>
CHROMIUM (III) COMPOUNDS	.33440000000000000000000000 kg/year	<input type="checkbox"/>

Record: 4 of 25

Record: 1 of 1

Figure 2-6: Emission estimation screen

3 DATA SOURCES AND RESULTS

Emissions have been calculated based on information supplied in the returned questionnaires, other data available from industry personnel, CARB, NPI and USEPA emission factors for various engineering and combustion processes. Where monitoring data or stack test data were available, this was used in preference to literature emission rates. All emissions are calculated by a specifically designed database which stores facility details and emission sources and uses CARB, NPI and USEPA emission factors to estimate emission loads.

In this section the term “combustion products” is intended to include TSP, PM₁₀, PM_{2.5}, SO₂, CO, NO_x and VOC (total and speciated). The term “particulate matter” (PM) refers to TSP, PM₁₀ and PM_{2.5}.

In this section total emissions are presented for each ANZSIC class for the GMR, Sydney, Newcastle and Wollongong regions in all cases and emissions released in the “Non Urban” region for ANZSIC classes where emissions in this area are significant. The “Non Urban” region is defined as the area within the GMR that is not bounded by Sydney, Newcastle or Wollongong. Emissions are presented for the following pollutants only:

- 1,3-butadiene
- Acetaldehyde
- Benzene
- Carbon monoxide (CO)
- Formaldehyde
- Isomers of xylene
- Lead & compounds
- Oxides of nitrogen (NO_x)
- Particulate matter ≤ 10 µm (PM₁₀)
- Particulate matter ≤ 2.5 µm (PM_{2.5})
- Perchloroethylene
- Polycyclic aromatic hydrocarbons (PAH)
- Sulfur dioxide (SO₂)
- Toluene
- Total suspended particulate (TSP)
- Total volatile organic compounds (VOC)
- Trichloroethylene

These substances have been selected since they are:

- the most common air pollutants found in airsheds according to the National Pollutant Inventory NEPM (NEPC, 2008);

3. Data Sources and Results

- referred to in National Environment Protection Measures (NEPMs) for criteria pollutants (NEPC, 2003) and air toxics (NEPC, 2004); and
- have been classified as priority air pollutants (NEPC, 2006).

Emissions from all sources and substances considered in this study are presented in Appendix A.

Aspects common to all sectors are described here:

Emission Sources

Many commercial facilities include combustion, wastewater treatment, fuel and organic liquid storage and handling operations, process fugitives, wastewater treatment, fuel/solvent storage and surface coating operations. All surveys have been designed to collect this information and where indicated in returned surveys, emissions have been included in the inventory for each facility.

Activity Data and Assumptions

Data provided in the returned questionnaires allowed for the estimation of emissions from all sources. All emission factors are stored and referenced within the database.

If stack parameters have not been provided and could not be determined in consultation with each facility the following assumptions have been made:

Stack emissions of combustion products:

- Diameter = 0.5 m
- Temperature = 423 K
- Velocity = 10 m/s

Stack emissions of non-combustion products:

- Diameter = 0.5 m
- Temperature = 298 K
- Velocity = 10 m/s

Where stack height has not been provided, each facility was contacted and requested to provide an estimate.

Temporal Variation

Process emissions have been assumed to vary in direct proportion to the change in production rates over a typical year which was supplied in returned questionnaires. The temporal variation in emissions includes hourly, weekday, weekend day and monthly temporal factors. These data are stored in the industrial inventory database.

Temporal variations of evaporative emissions from fuel tanks have been calculated using the USEPA TANKS program (USEPA, 2006e).

3.1 Animal Accommodation 44

3.1.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-1.

Table 3-1: Animal accommodation facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
MAITLAND SALEYARDS	2463	52 KYLE STREET	RUTHERFORD	2320
MOSS VALE LIVESTOCK SELLING CENTRE	3699	BERRIMA ROAD	MOSS VALE	2577
SINGLETON REGIONAL LIVESTOCK MARKETS	12728	GRESFORD ROAD	SINGLETON	2330

The emission sources and associated releases to air from animal accommodation are presented in Table 3-2.

Table 3-2: Animal accommodation – emission sources

Source	Emissions to Air
Beef cattle feedlot	PM, ammonia
Beef cattle (fresh manure loss)	Ammonia
Beef cattle (manure on pad surface)	Ammonia
Beef cattle (manure stockpile)	Ammonia
Beef cattle (retention pond)	Ammonia
Internal combustion engine (diesel, P<450kW)	Combustion products
Fuel storage (diesel)	VOC
Wastewater treatment	VOC, ammonia

3.1.2 Activity Data

Summary activity data collected from the industrial questionnaires for animal accommodation is presented in Table 3-3.

Table 3-3: Summary activity data for animal accommodation

Parameter	Value	Unit
Number of animals housed	896	(-)
Total vehicle kilometres travelled	ND	km/year
Total diesel combusted	0.591	kL/year
Electricity consumed	0	MWh/year

3.1.3 Emission and Speciation Factors

The emission and speciation factors for all substances from animal accommodation sources are detailed in Table 3-4.

3. Data Sources and Results

Table 3-4: Emission and speciation factors for all substances from animal accommodation

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Beef cattle feedlot	NPI EET Manual for Intensive Livestock - beef cattle v3.1 (DEWHA, 2007a) and CEIDARS PM size profile 322 for livestock dust (CARB, 2008)
Speciated organics (including methane)	Internal combustion engine (diesel, P<450kW)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Internal combustion engine (diesel, P<450kW)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
Ammonia	Internal combustion engine (diesel, P<450kW)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Beef cattle feedlot	NPI EET Manual for Intensive Livestock - beef cattle v3.1 (DEW, 2007a)
	Beef cattle (fresh manure loss)	
	Beef cattle (manure on pad surface)	
	Beef cattle (manure stockpile)	
	Beef cattle (retention pond)	
Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)	
Sulfuric or hydrochloric acid	NA	NA
PAH	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	Internal combustion engine (diesel, P<450kW)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.1.4 Emission Estimates

Total estimated annual emissions (for selected substances) from animal accommodation for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-5. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-5: Total estimated annual emissions from animal accommodation in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0.25	0.25
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	0.28	0.28
CARBON MONOXIDE	0	0	0	9.22	9.22
FORMALDEHYDE	0	0	0	0.59	0.59
ISOMERS OF XYLENE	0	0	0	3.56	3.56
LEAD AND COMPOUNDS	0	0	0	0.01	0.01
OXIDES OF NITROGEN	0	0	0	42.8	42.8
PARTICULATE MATTER ≤ 10 µm	0	0	0	10,500	10,500
PARTICULATE MATTER ≤ 2.5 µm	0	0	0	1,350	1,350
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0.05	0.05
TETRACHLOROETHYLENE	0	0	0	4.14	4.14
TOLUENE	0	0	0	2.37	2.37
TOTAL SUSPENDED PARTICULATE	0	0	0	21,900	21,900
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	0	28.7	28.7
TRICHLOROETHYLENE	0	0	0	0.59	0.59

3.1.5 Emission Projection Methodology

Projection factors for animal accommodation have been derived based on final energy consumption projections for agriculture in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-6 and illustrated in Figure 3-1.

Table 3-6: Projection factors for agriculture related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0123	2023	1.1445
2010	1.0237	2024	1.1533
2011	1.0344	2025	1.1617
2012	1.0444	2026	1.1701
2013	1.0542	2027	1.1785
2014	1.0637	2028	1.1868
2015	1.0729	2029	1.1953
2016	1.0820	2030	1.2073
2017	1.0910	2031	1.2199
2018	1.1000	2032	1.2294
2019	1.1089	2033	1.2389
2020	1.1179	2034	1.2484
2021	1.1269	2035	1.2579
2022	1.1357	2036	1.2674

Source: ABARE (2006)

3. Data Sources and Results

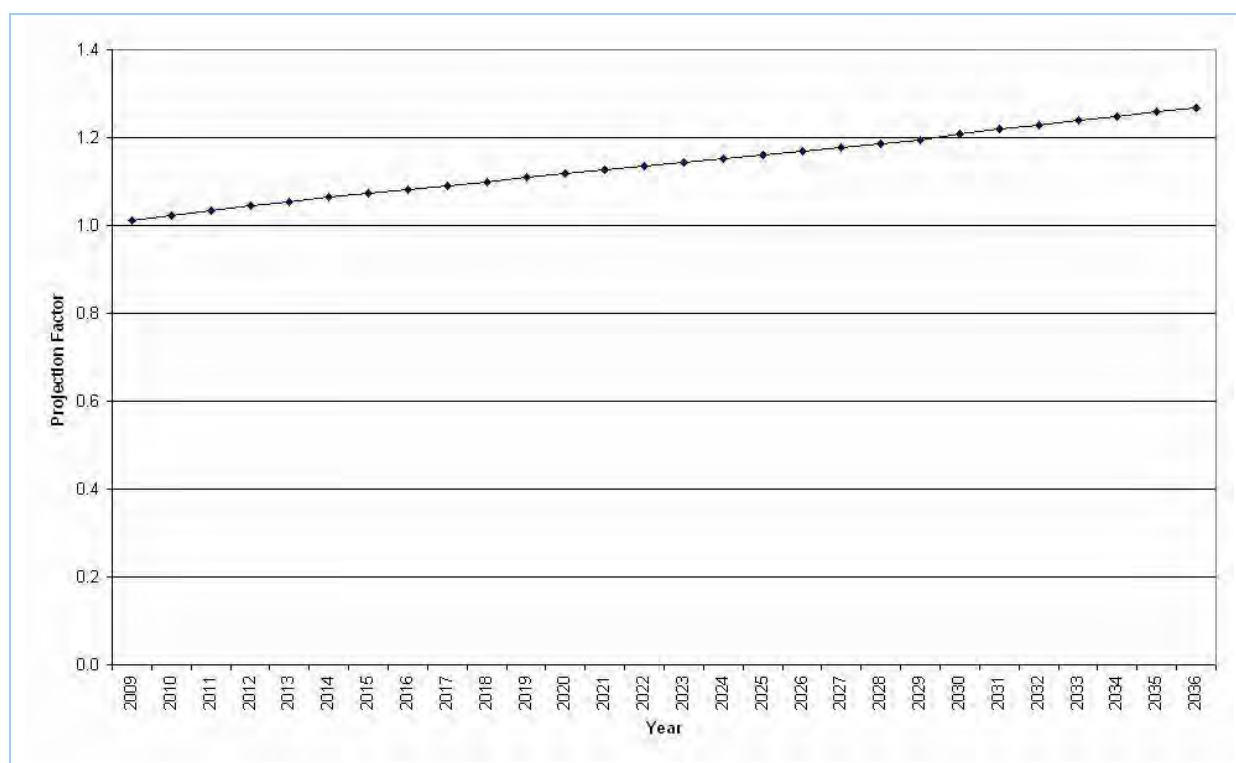


Figure 3-1: Projection factors for agriculture related sources

3.2 Battery Production 15

3.2.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-7.

Table 3-7: Battery production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
EXIDE TECHNOLOGIES	2088	55 BRYANT STREET	PADSTOW	2211
BATTERY ENERGY POWER SOLUTIONS PTY LTD	5803	92-96 FAIRFIELD STREET	FAIRFIELD	2165
SAFT	11896	UNIT 18 - 167 PROSPECT HIGHWAY	SEVEN HILLS	2147

The emission sources and associated releases to air from battery production are presented in Table 3-8.

Table 3-8: Battery production - emission sources

Source	Emissions to Air
Dry formation	Sulfuric acid, PM
Grid casting	PM
Lead oxide mill	PM
Lead reclaim furnace	PM
Paste mixing	PM
Small parts casting	PM

3. Data Sources and Results

Source	Emissions to Air
Three process operation	PM
Wheel generated dust (paved roads)	PM

3.2.2 Activity Data

Summary activity data collected from the industrial questionnaires for battery production is presented in Table 3-9.

Table 3-9: Summary activity data for battery production

Parameter	Value	Unit
Number of batteries produced	122,500	batteries/year
Total vehicle kilometres travelled	8,438	km/year
Electricity consumed	4,683	MWh/year

3.2.3 Emission and Speciation Factors

The emission and speciation factors for all substances from aluminium production (scrap metal) sources are detailed in Table 3-10.

Table 3-10: Emission and speciation factors for all substances from animal accommodation

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	NA	NA
PM _{2.5} , PM ₁₀ & TSP	Dry formation	Site specific emission estimates
	Grid casting	AP42 Chapter 12.15 Storage Battery Production (USEPA, 1995e)
	Lead oxide mill	
	Lead reclaim furnace	
	Paste mixing	
	Small parts casting	
	Three process operation	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	NA	NA
Speciated particulate matter	Dry formation	Site specific emission estimates
	Grid casting	AP42 Chapter 12.15 Storage Battery Production (USEPA, 1995e)
	Lead oxide mill	
	Lead reclaim furnace	
	Paste mixing	
	Small parts casting	
	Three process operation	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	NA	NA
Sulfuric or	Dry formation	AP42 Chapter 12.15 Storage Battery Production (USEPA,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
hydrochloric acid		1995e)
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.2.4 Emission Estimates

Total estimated annual emissions (for selected substances) from battery production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-11. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-11: Total estimated annual emissions from battery production in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	0	0
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0	0	0	0	0
LEAD AND COMPOUNDS	910	0	0	0	910
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	3,940	0	0	0	3,940
PARTICULATE MATTER ≤ 2.5 µm	3,940	0	0	0	3,940
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	0	0	0	0
TOTAL SUSPENDED PARTICULATE	3,950	0	0	0	3,950
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	0	0	0
TRICHLOROETHYLENE	0	0	0	0	0

3.2.5 Emission Projection Methodology

Projection factors for battery production have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

Table 3-12: Projection factors for other industry related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0054	2023	1.0921
2010	1.0111	2024	1.0981
2011	1.0177	2025	1.1038
2012	1.0242	2026	1.1096
2013	1.0306	2027	1.1153

3. Data Sources and Results

Year	Projection Factor	Year	Projection Factor
2014	1.0370	2028	1.1212
2015	1.0433	2029	1.1270
2016	1.0495	2030	1.1332
2017	1.0556	2031	1.1393
2018	1.0617	2032	1.1453
2019	1.0679	2033	1.1513
2020	1.0740	2034	1.1573
2021	1.0801	2035	1.1633
2022	1.0861	2036	1.1693

Source: ABARE (2006)

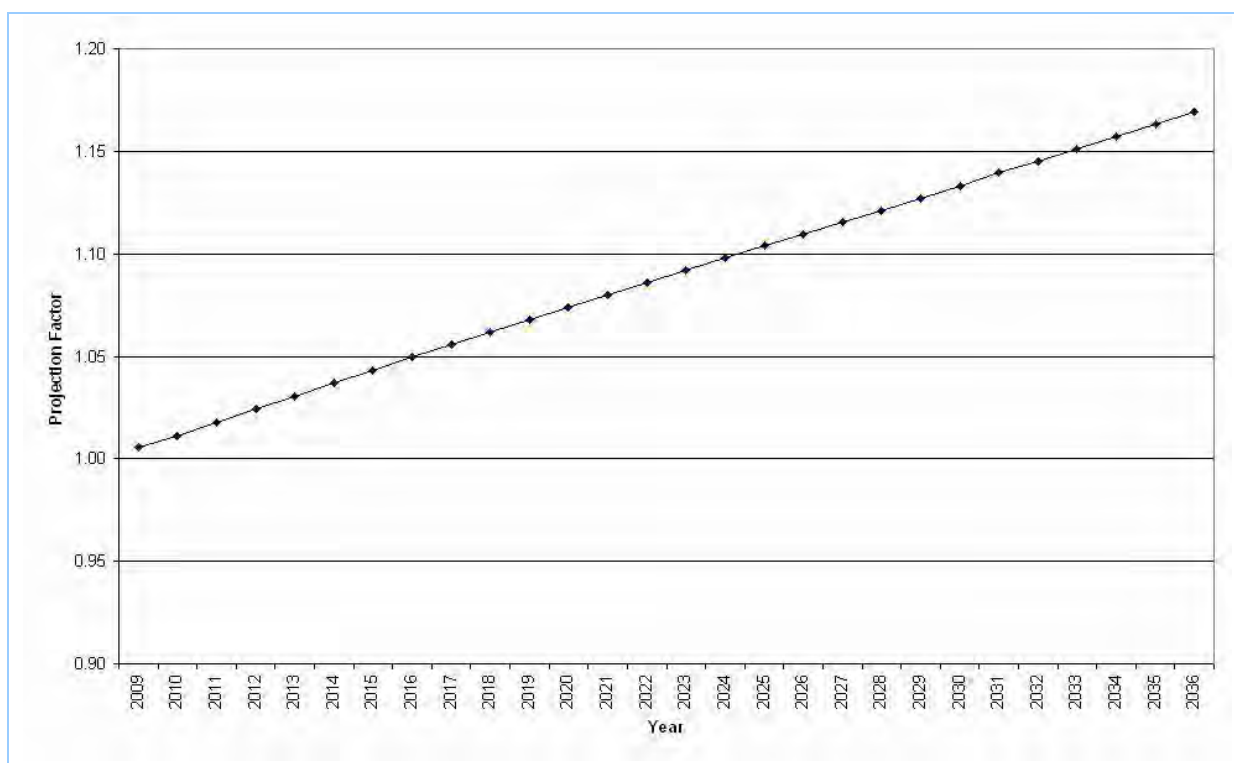


Figure 3-2: Projection factors for other industry related sources

3.3 Bird Accommodation 43

3.3.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-13.

Table 3-13: Bird accommodation facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
BREEDER FARMS	1254	LOT 23 BADGERYS CREEK ROAD	BADGERYS CREEK	2171
KARYATES ENTERPRISE PTY LIMITED	3275	108 DEEPFIELDS ROAD	CATHERINE FIELD	2171

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
LUDDENHAM BROILER FARM	10812	2907 THE NORTHERN ROAD	LUDDENHAM	2745
'PEATS RIDGE FARM'	10888	RMB 1435 - KILPA ROAD	PEATS RIDGE	2250
APPIN BROILER COMPLEX	11636	345 APPIN ROAD	APPIN	2560
GS & KL FRIPP POULTRY FARM	12265	1166 PEATS RIDGE ROAD	PEATS RIDGE	2250
KANTANDRA POULTRY FARM	12769	60 BUSHHELLS RIDGE	PEATS RIDGE	2250

The emission sources and associated releases to air from bird accommodation are presented in Table 3-14.

Table 3-14: Bird accommodation – emission sources

Source	Emissions to Air
Boiler (LPG, commercial)	Combustion products
Boiler (natural gas, residential)	Combustion products
Poultry raising (mother hens > 6 months)	PM, ammonia
Poultry raising (broilers)	PM, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC

3.3.2 Activity Data

Summary activity data collected from the industrial questionnaires for bird accommodation is presented in Table 3-15.

Table 3-15: Summary activity data for bird accommodation

Parameter	Value	Unit
Stock capacity (broilers)	2,635,481	birds
Stock capacity (mother hens)	222,248	birds
Number of birds produced (broilers)	17,071,832	birds/year
Total vehicle kilometres travelled	22,000	km/year
Total natural gas combusted	70,315	GJ/year
Total LPG combusted	1,158	m ³ /year
Electricity consumed	9,987	MWh/year

3.3.3 Emission and Speciation Factors

The emission and speciation factors for all substances from bird accommodation sources are detailed in Table 3-16.

Table 3-16: Emission and speciation factors for all substances from bird accommodation

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (LPG, commercial)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas, residential)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
PM _{2.5} , PM ₁₀ & TSP	Boiler (LPG, commercial)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas, residential)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Poultry raising (mother hens > 6 months)	Source testing presented in "Silverweir" Broiler Farm Development Approval Application Air Quality Assessment (Mirrabooka, 2002)
	Poultry raising (broilers)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
Speciated organics (including methane)	Boiler (LPG, commercial)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas, residential)	SPECIATE v4.2 software profile ID 0003 (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
Speciated particulate matter	Boiler (LPG, commercial)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas, residential)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 and after (CARB, 2007)
	Exposed area (wind erosion)	Appendix A NPI Manual for Mining v2.3 (based on EF = 0.4 kg/ha/hour for general exposed areas) and soil profile from Appendix B (EA, 2003b)
Ammonia	Boiler (LPG, commercial)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004) (assuming the same emissions per joule as natural gas)
	Boiler (natural gas, residential)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Poultry raising (mother hens > 6 months)	NPI EET Manual for Intensive Livestock - Poultry Raising v1.0 (EA, 2002a)
	Poultry raising (broilers)	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (LPG, commercial)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas, residential)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		1998b)
PCDD/PCDF	Boiler (LPG, commercial)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (natural gas, residential)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (LPG, commercial)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (natural gas, residential)	

3.3.4 Emission Estimates

Total estimated annual emissions (for selected substances) from battery production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-17. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-17: Total estimated annual emissions from bird accommodation in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	22.7	0	0	17.3	39.9
CARBON MONOXIDE	1,400	0	0	574	1,980
FORMALDEHYDE	45.4	0	0	34.5	79.9
ISOMERS OF XYLENE	0.17	0	0	0.05	0.22
LEAD AND COMPOUNDS	2.07	0	0	3.27	5.34
OXIDES OF NITROGEN	3,670	0	0	1,150	4,820
PARTICULATE MATTER ≤ 10 µm	238,000	0	0	81,000	319,000
PARTICULATE MATTER ≤ 2.5 µm	53,900	0	0	17,600	71,400
POLYCYCLIC AROMATIC HYDROCARBONS	0.02	0	0	0	0.03
SULFUR DIOXIDE	17.4	0	0	8.37	25.7
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	11.4	0	0	8.63	20
TOTAL SUSPENDED PARTICULATE	536,000	0	0	187,000	724,000
TOTAL VOLATILE ORGANIC COMPOUNDS	195	0	0	69.6	265
TRICHLOROETHYLENE	0	0	0	0	0

3.3.5 Emission Projection Methodology

Projection factors for bird accommodation have been derived based on final energy consumption projections for agriculture in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-6 and illustrated in Figure 3-1.

3.4 Bitumen Mixing 8

3.4.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-18.

Table 3-18: Bitumen mixing facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
BORAL ASPHALT	7	1 GROSS STREET	CARRINGTON	2294
PIONEER ROAD SERVICES PTY LTD	494	OLD WALLGROVE ROAD	EASTERN CREEK	2766
EMOLEUM	499	GATE 1 - UNWIN STREET	GRANVILLE	2142
PIONEER ROAD SERVICES	683	30 RIVULET CRES	ALBION PARK RAIL	2527
EMOLEUM	861	24 DAVIS STREET	WETHERILL PARK	2164
BORAL ASPHALT	952	LOT 1 COMSERV CLOSE	GOSFORD	2250
BORAL ASPHALT	1110	SPRINGHILL ROAD	PORT KEMBLA	2505
EMOLEUM	1321	RHONDDA ROAD	TERALBA	2284
RTA ILLAWARRA DISTRICT OFFICE	1530	YORK ROAD	BELLAMBI	2518
PIONEER ROAD SERVICES PTY LTD	2292	LOT 23 GARDINERS ROAD	RUTHERFORD	2320
BORAL ASPHALT	2566	LENAGHANS DRIVE	BLACK HILL	2322
FULTON HOGAN PTY LTD	3138	117 AIRDS ROAD	MINTO	2566
PIONEER ROAD SERVICES	3140	40-42 BURROWS ROAD	ALEXANDRIA	2015
PIONEER ROAD SERVICES PTY LTD	5002	2-4 DAVID STREET	DOYALSON	2262
STATE ASPHALTS NSW PTY LTD	11235	90 JEDDA ROAD	PRESTONS	2170
BORAL ASPHALT	11678	1-5 NORFOLK ROAD	GREENACRE	2190
TROPIC TOMAGO PTY LIMITED	12806	25-27 KENNINGTON DRIVE	TOMAGO	2322

The emission sources and associated releases to air from bitumen mixing are presented in Table 3-19.

Table 3-19: Bitumen mixing – emission sources

Source	Emissions to Air
Fuel storage (kerosene)	VOC
Chemical storage (bitumen)	VOC
Fuel storage (diesel)	VOC
Chemical storage (toluene)	VOC
Chemical storage (ethanol)	VOC
Asphalt manufacturing (batch mix, natural gas-fired dryer)	Combustion products
Asphalt manufacturing (drum mix, oil fired)	Combustion products
Aggregate transfer to conveyor	PM
Aggregate transfer to ground	PM
Sand transfer to conveyor	PM
Conveyor transfer of aggregate to elevated storage	PM
Conveyor transfer of sand to elevated storage	PM
Material transfer	PM
Screening	PM
Surface coating (degreaser)	VOC
Wastewater treatment (VOC vaporisation (petrochemical, synthetic resins and textiles))	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3. Data Sources and Results

3.4.2 Activity Data

Summary activity data collected from the industrial questionnaires for bitumen mixing is presented in Table 3-20.

Table 3-20: Summary activity data for bitumen mixing

Parameter	Value	Unit
Amount of hot-mix asphalt produced	1,740,206	tonne/year
Total vehicle kilometres travelled	6,428	km/year
Total natural gas combusted	367,530	GJ/year
Total LPG combusted	16	m ³ /year
Total diesel combusted	700	kL/year
Electricity consumed	8,615	MWh/year

3.4.3 Emission and Speciation Factors

The emission and speciation factors for all substances from bitumen mixing sources are detailed in Table 3-21.

Table 3-21: Emission and speciation factors for all substances from bitumen mixing

Substance	Emission Source	Emission Factor Source	
CO, NO _x , SO ₂ & VOC	Fuel storage (kerosene)	TANKS 4.09D software (USEPA, 2006e)	
	Chemical storage (bitumen)	TANKS 4.09D software (USEPA, 2006e) and AP42 Chapter 11.1 Hot Mix Asphalt Plants (USEPA, 1995b)	
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)	
	Chemical storage (toluene)		
	Chemical storage (ethanol)		
	Asphalt manufacturing (batch mix, natural gas-fired dryer)	AP42 Chapter 11.1 Hot Mix Asphalt Plants (USEPA, 1995b)	
	Asphalt manufacturing (drum mix, oil fired)		
	Surface coating (degreaser)	Mass balance	
	Wastewater treatment (VOC vaporisation (petrochemical, synthetic resins and textiles))	NGGIC Workbook for Waste (NGGIC, 1996)	
PM _{2.5} , PM ₁₀ & TSP	Asphalt manufacturing (batch mix, natural gas-fired dryer)	AP42 Chapter 11.1 Hot Mix Asphalt Plants (USEPA, 1995b)	
	Asphalt manufacturing (drum mix, oil fired)		
	Aggregate transfer to conveyor	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)	
	Aggregate transfer to ground		
	Sand transfer to conveyor		
	Conveyor transfer of aggregate to elevated storage		
	Conveyor transfer of sand to elevated storage		
	Material transfer		AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Screening		NPI EET Manual for Mining v2.3 (EA, 2003b)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wheel generated dust – paved roads	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust – unpaved roads	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Fuel storage (kerosene)	CEIDARS Organic Profile Jet fuel evaporation (jet a) (CARB, 2005)
	Chemical storage (bitumen)	CEIDARS Organic Profile 716 Medium cure asphalt (CARB, 2005)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Chemical storage (toluene)	Mass balance (100% toluene)
	Chemical storage (ethanol)	Mass balance (100% ethanol)
	Asphalt manufacturing (batch mix, natural gas-fired dryer)	AP42 Chapter 11.1 Hot Mix Asphalt Plants (USEPA, 1995b) and SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Asphalt manufacturing (drum mix, oil fired)	AP42 Chapter 11.1 Hot Mix Asphalt Plants (USEPA, 1995b) and SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Wastewater treatment (VOC vaporisation (petrochemical, synthetic resins and textiles))	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Asphalt manufacturing (batch mix, natural gas-fired dryer)	AP42 Chapter 11.1 Hot Mix Asphalt Plants (USEPA, 1995b)
	Asphalt manufacturing (drum mix, oil fired)	
	Material transfer	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust – paved roads	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust – unpaved roads	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 and after (CARB, 2007)
Ammonia	Wastewater treatment (VOC vaporisation (petrochemical, synthetic resins and textiles))	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Asphalt manufacturing (batch mix, natural gas-fired dryer)	AP42 Chapter 11.1 Hot Mix Asphalt Plants (USEPA, 1995b)
	Asphalt manufacturing (drum mix, oil fired)	
PCDD/PCDF	Asphalt manufacturing (drum mix, oil fired)	Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases, Prepared by UNEP Chemicals, Geneva, Switzerland (UNEP, 2005)
Greenhouse gases (CO ₂ and N ₂ O)	Asphalt manufacturing (batch mix, natural gas-fired dryer)	Site specific emission estimates
	Asphalt manufacturing (drum mix, oil fired)	

3. Data Sources and Results

3.4.4 Emission Estimates

Total estimated annual emissions (for selected substances) from bitumen mixing for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-22. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-22: Total estimated annual emissions from bitumen mixing in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	1,710	53.1	144	136	2,040
CARBON MONOXIDE	204,000	16,500	37,300	8,940	267,000
FORMALDEHYDE	3,440	1,740	304	281	5,770
ISOMERS OF XYLENE	179	130	105	61.7	476
LEAD AND COMPOUNDS	4.35	0.66	0.35	0.51	5.87
OXIDES OF NITROGEN	15,600	6,780	2,850	2,120	27,400
PARTICULATE MATTER ≤ 10 µm	59,300	9,030	10,800	12,300	91,400
PARTICULATE MATTER ≤ 2.5 µm	29,000	5,570	9,320	9,750	53,600
POLYCYCLIC AROMATIC HYDROCARBONS	75.7	21.7	13.8	5.47	117
SULFUR DIOXIDE	3,010	4,420	1,030	1,230	9,690
TETRACHLOROETHYLENE	174	138	114	68.4	495
TOLUENE	984	111	141	109	1,350
TOTAL SUSPENDED PARTICULATE	105,000	13,600	12,600	15,500	146,000
TOTAL VOLATILE ORGANIC COMPOUNDS	20,200	4,850	2,340	1,940	29,300
TRICHLOROETHYLENE	35.7	19.8	16.3	9.77	81.6

3.4.5 Emission Projection Methodology

Projection factors for bitumen mixing have been derived based on final energy consumption projections for other basic non-ferrous metals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-240 and illustrated in Figure 3-13.

3.5 Boat Construction/Maintenance (Dry/Float) 53

3.5.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-23.

Table 3-23: Boat construction/maintenance facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
THALES AUSTRALIA	4333	GARDEN ISLAND	POTTS POINT	2011
FORGACS DOCKYARD	6001	81 DENISON ST	CARRINGTON	2294
BALMAIN SHIPYARDS	6868	72 WATERVIEW STREET	BALMAIN	2041

3. Data Sources and Results

The emission sources and associated releases to air from boat construction/maintenance (dry/float) are presented in Table 3-24.

Table 3-24: Boat construction/maintenance – emission sources

Source	Emissions to Air
Abrasive blasting	PM
Fibreglass (filament winding)	VOC
Fibreglass (manual resin application (non-vapour suppressed))	VOC
Boiler (LPG, commercial)	Combustion products
Surface coating (marine - antifouling)	VOC
Surface coating (enamel)	VOC
Surface coating (primer)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (thinner)	VOC
Wastewater treatment (VOC vaporisation (municipal wastewater))	VOC, ammonia
Fuel storage (diesel)	VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.5.2 Activity Data

Summary activity data collected from the industrial questionnaires for boat construction/maintenance (dry float) is presented in Table 3-25.

Table 3-25: Summary activity data for boat construction/maintenance

Parameter	Value	Unit
Amount of surface coating used	32.6	kL/year
Total vehicle kilometres travelled	255,396	km/year
Total LPG combusted	22.3	m ³ /year
Electricity consumed	3,325	MWh/year

3.5.3 Emission and Speciation Factors

The emission and speciation factors for all substances from boat construction/maintenance (dry/float) sources are detailed in Table 3-26.

Table 3-26: Emission and speciation factors for all substances from boat construction/maintenance

Substance	Emission Source	Emission Factor Source
CO, NO _x ¹ , SO ₂ & VOC	Fibreglass (Filament Winding)	NPI EET Manual for Fibreglass Product Manufacturing (average for all resin types) (assuming all VOC are styrene) (EA, 1999c)
	Fibreglass (Manual Resin Application (non-vapour suppressed))	
	Boiler (LPG, Commercial)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Surface coating (marine - antifouling)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (enamel)	
Surface coating (primer)		

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Surface coating (paint - solvent based)	NGGIC Workbook for Waste (NGGIC, 1996)
	Surface coating (thinner)	
	Wastewater Treatment (VOC vaporisation (municipal wastewater))	
	Fuel storage (diesel)	
PM _{2.5} , PM ₁₀ & TSP	Abrasive blasting	NPI EET Manual for Surface Coating (EA, 1999h) and CEIDARS PM Size Speciation Profile for Steel Abrasive Blasting (CARB, 2005)
	Boiler (LPG, Commercial)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Fibreglass (Filament Winding)	Mass balance (100% styrene)
	Fibreglass (Manual Resin Application (non-vapour suppressed))	SPECIATEv4.2 (Profile ID=1005) (USEPA, 2008e)
	Boiler (LPG, Commercial)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Surface coating (marine - antifouling)	SPECIATEv4.2 (Profile ID=2414) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater Treatment (VOC vaporisation (municipal wastewater))	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
Speciated particulate matter	Abrasive blasting	NPI EET Manual for Surface Coating (assuming GMA garnet is used) (EA, 1999h)
	Boiler (LPG, Commercial)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (LPG, commercial)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (assuming the same emissions per joule as natural gas) (Pechan, 2004)
	Wastewater Treatment (VOC vaporisation (municipal wastewater))	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (LPG, commercial)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		as natural gas)
PCDD/PCDF	Boiler (LPG, commercial)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (LPG, commercial)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.5.4 Emission Estimates

Total estimated annual emissions (for selected substances) from battery production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-27. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-27: Total estimated annual emissions from boat construction/maintenance in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	18.1	0	0	0	18.1
ACETALDEHYDE	0	0	0	0	0
BENZENE	3.17	0.6	0	0	3.78
CARBON MONOXIDE	0	20.1	0	0	20.1
FORMALDEHYDE	1.95	1.21	0	0	3.15
ISOMERS OF XYLENE	365	2,650	0	0	3,020
LEAD AND COMPOUNDS	0.02	226	0	0	226
OXIDES OF NITROGEN	0	40.2	0	0	40.2
PARTICULATE MATTER ≤ 10 µm	31.7	57,300	0	0	57,300
PARTICULATE MATTER ≤ 2.5 µm	7.66	48,800	0	0	48,900
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0.29	0	0	0.29
TETRACHLOROETHYLENE	13.6	0	0	0	13.6
TOLUENE	1,330	1,610	0	0	2,940
TOTAL SUSPENDED PARTICULATE	165	84,100	0	0	84,300
TOTAL VOLATILE ORGANIC COMPOUNDS	4,540	12,200	0	0	16,700
TRICHLOROETHYLENE	1.95	0	0	0	1.95

3.5.5 Emission Projection Methodology

Projection factors for boat construction/maintenance (dry/float) have been derived based on final energy consumption projections for domestic water transport in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-28 and illustrated in Figure 3-3.

Table 3-28: Projection factors for domestic water transport related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0046	2023	1.0323
2010	1.0084	2024	1.0337
2011	1.0115	2025	1.0349
2012	1.0138	2026	1.0359

3. Data Sources and Results

Year	Projection Factor	Year	Projection Factor
2013	1.0159	2027	1.0369
2014	1.0180	2028	1.0380
2015	1.0198	2029	1.0392
2016	1.0215	2030	1.0434
2017	1.0232	2031	1.0481
2018	1.0248	2032	1.0501
2019	1.0264	2033	1.0522
2020	1.0279	2034	1.0542
2021	1.0295	2035	1.0562
2022	1.0309	2036	1.0583

Source: ABARE (2006)

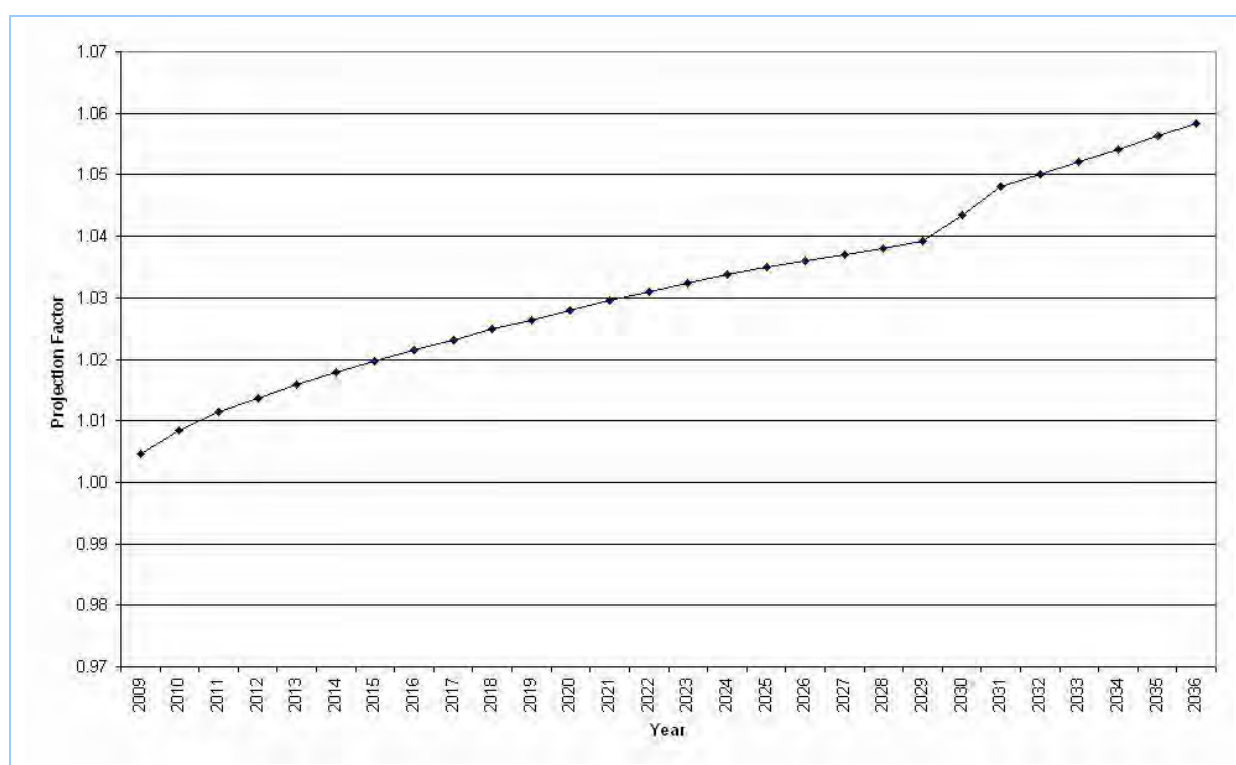


Figure 3-3: Projection factors for domestic water transport related sources

3.6 Boat Construction/Maintenance (General) 54

3.6.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-29.

Table 3-29: Boat construction/maintenance (general) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
EMPIRE MARINA BOBBIN HEAD	1940	BOBBIN HEAD ROAD	BOBBIN HEAD	2074
WOODLEYS (BERRYS BAY)	6322	1 BALLS HEAD ROAD	WAVERTON	2060

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
PTY LIMITED				
AZZURA MARINE (NEWCASTLE) PTY LTD	6609	50 FITZROY ST	CARRINGTON	2294
SHELL POINT MARINE	10816	2 MANGROVE LANE	TAREN POINT	2229
ROYAL MOTOR YACHT CLUB	10820	46 PRINCE ALFRED PARADE	NEWPORT	2106
RIVER QUAYS MARINA	10889	140 TENNYSON ROAD	MORTLAKE	2137
THE QUAYS MARINA	10890	1856 PITTWATER ROAD	CHURCH POINT	2105
MORTLAKE SLIPWAY	10892	HILLY STREET	MORTLAKE	2137
NOAKES BOATYARD	10893	6 JOHN STREET	NORTH SYDNEY	2060
FENWICKS MARINA	10894	31 BROOKLYN ROAD	BROOKLYN	2083
MARMONG COVE MARINA	11161	1 NANDA STREET	MARMONG POINT	2284
MARKS POINT MARINA	11162	19/21/23 EDITH STREET	MARKS POINT	2280
ROYAL PRINCE ALFRED YACHT CLUB	11202	16 MITALA STREET	NEWPORT	2106
LEWIS ANCHORAGES	11329	1 MANGROVE LANE	TAREN POINT	2229
SYDNEY SHIP REPAIR AND ENGINEERING PTY LTD	11517	GOAT ISLAND	SYDNEY	2000
ROYAL SYDNEY YACHT SQUADRON	11758	33 PEEL STREET	KIRRIBILLI	2061
WOLLONGONG SLIPWAY SERVICES	11847	BELMORE BASIN	WOLLONGONG	2500
NSW MARITIME	11919	JAMES CRAIG ROAD	ROZELLE	2039
HALVO'S BOAT SHED & MARINA	12532	20 WATERVIEW STREET	PUTNEY	2112
SYDNEY CITY MARINE	12651	JAMES CRAIG ROAD	ROZELLE	2039
WOOLWICH DOCK	12785	FRANKI AVE	HUNTERS HILL	2110

The emission sources and associated releases to air from boat construction/maintenance (general) are presented in Table 3-30.

Table 3-30: Boat construction/maintenance (general) – emission sources

Source	Emissions to Air
Abrasive blasting	PM
Direct entry - dust and fluoride	PM
Fibreglass (filament winding)	VOC
Fibreglass (gel coat application)	VOC
Fibreglass (manual resin application (non-vapour suppressed))	VOC
Fibreglass (mechanical resin application (non-vapour suppressed))	VOC
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Metal cutting (mild steel, 8 mm)	NO _x , magnesium oxide fume
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Surface coating (lacquer)	VOC
Surface coating (marine - antifouling)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (primer)	VOC

3. Data Sources and Results

Source	Emissions to Air
Surface coating (thinner)	VOC
Wastewater treatment	VOC, ammonia
Welding	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.6.2 Activity Data

Summary activity data collected from the industrial questionnaires for boat construction/maintenance (general) is presented in Table 3-31.

Table 3-31: Summary activity data for boat construction/maintenance (general)

Parameter	Value	Unit
Amount of surface coating used	68	kL/year
Total vehicle kilometres travelled	4,499	km/year
Electricity consumed	4,945	MWh/year

3.6.3 Emission and Speciation Factors

The emission and speciation factors for all substances from boat construction/maintenance (general) sources are detailed in Table 3-32.

Table 3-32: Emission and speciation factors for all substances from boat construction/maintenance (general)

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fibreglass (filament winding)	NPI EET Manual for Fibreglass Product Manufacturing (average for all resin types) (assuming all VOC are styrene) (EA, 1999c)
	Fibreglass (gel coat Application)	
	Fibreglass (manual resin application (non-vapour suppressed))	
	Fibreglass (mechanical resin application (non-vapour suppressed))	
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Metal cutting (mild steel, 8 mm)	NPI EET Manual for Structural and Fabricated Metal Product Manufacture (EA, 1999g)
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (lacquer)	NPI EET Manual for Aggregated Emissions from Motor Vehicle Refinishing (EA, 1999a) & VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (marine - antifouling)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	based)	
	Surface coating (primer)	
	Surface coating (thinner)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Abrasive blasting	NPI EET Manual for Surface Coating (EA, 1999h) and CEIDARS PM Size Speciation Profile for Steel Abrasive Blasting (CARB, 2005)
	Direct entry - dust and fluoride	Site specific emission estimates
	Welding	NPI EET Manual for Fugitive Emissions (assuming manual metal arc welding and electrode type 14Mn-4Cr) (EA, 1999d)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Fibreglass (filament winding)	Mass balance (100% styrene)
	Fibreglass (gel coat application)	SPECIATEv4.2 (Profile ID=1005) (USEPA, 2008e)
	Fibreglass (manual resin application (non-vapour suppressed))	
	Fibreglass (mechanical resin application (non-vapour suppressed))	
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (lacquer)	SPECIATEv4.2 (Profile ID=1017) (USEPA, 2008e)
	Surface coating (marine - antifouling)	SPECIATEv4.2 (Profile ID=2414) (USEPA, 2008e)
	Surface coating (paint - solvent based)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (primer)	
	Surface coating (thinner)	
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Abrasive blasting	NPI EET Manual for Surface Coating (assuming GMA garnet is used) (EA, 1999h)
	Welding	NPI EET Manual for Fugitive Emissions (assuming manual metal arc welding and electrode type 14Mn-4Cr) (EA, 1999d)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.6.4 Emission Estimates

Total estimated annual emissions (for selected substances) from battery production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-33. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-33: Total estimated annual emissions from boat construction/maintenance (general) in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	9.06	31.7	0	0	40.7
ACETALDEHYDE	0	0	0	0	0
BENZENE	16.7	5.99	0	0.76	23.5
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	1.15	0	0	0.12	1.27
ISOMERS OF XYLENE	5,000	694	0.07	239	5,930
LEAD AND COMPOUNDS	0.12	0.05	0	0	0.17
OXIDES OF NITROGEN	0	578	0	0	578
PARTICULATE MATTER ≤ 10 µm	12,600	256	0	0	12,800
PARTICULATE MATTER ≤ 2.5 µm	11,500	183	0	0	11,700
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	8.08	0	0	4.81	12.9
TOLUENE	4,520	2,400	0.02	243	7,170
TOTAL SUSPENDED PARTICULATE	14,800	610	0	0	15,400
TOTAL VOLATILE ORGANIC COMPOUNDS	30,800	8,310	0.72	1,560	40,700
TRICHLOROETHYLENE	1.15	0	0	11.5	12.7

3.6.5 Emission Projection Methodology

Projection factors for boat construction/maintenance (general) have been derived based on final energy consumption projections for domestic water transport in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-28 and illustrated in Figure 3-3.

3.7 Boat Mooring and Storage 52

3.7.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-34.

Table 3-34: Boat mooring and storage facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
D'ALBORA MARINAS - CABARITA POINT	10818	CABARITA PARK	CABARITA	2137
ST GEORGE MOTOR BOAT CLUB	11166	2 WELLINGTON STREET	SANS SOUCI	2219
D'ALBORA MARINAS - THE SPIT	11211	THE SPIT	MOSMAN	2088
D'ALBORA MARINAS - AKUNA BAY	11212	LIBERATOR GENERAL SAN MARTIN DRIVE	TERREY HILLS	2084
D'ALBORA MARINAS - NELSON BAY	11213	TERAMBY STREET	NELSON BAY	2315
D'ALBORA MARINAS - RUSHCUTTERS BAY	11214	1B NEW BEACH ROAD	RUSHCUTTERS BAY	2027
ANCHORAGE MARINA PORT STEPHENS	11228	CORLETTE POINT ROAD	CORLETTE	2315
LAKE MACQUARIE YACHT CLUB	11339	1 ADA STREET	BELMONT	2280
NEWCASTLE CRUISING YACHT CLUB LIMITED	11396	91 HANNELL STREET	WICKHAM	2293
PULPIT POINT HUNTERS HILL	10542	28 ST MALO AVENUE	HUNTERS HILL	2110
CRUISING YACHT CLUB OF AUSTRALIA	10822	NEW BEACH ROAD	DARLING POINT	2027
BIRKENHEAD POINT MARINA	11165	3 ROSEBY STREET	DRUMMOYNE	2047
SHELL COVE	12426	BASS POINT TOURIST ROAD	SHELL COVE	2529
SYDNEY BOATHOUSE	12781	JAMES CRAIG ROAD	ROZELLE	2039

The emission sources and associated releases to air from boat mooring and storage are presented in Table 3-35.

Table 3-35: Boat mooring and storage – emission sources

Source	Emissions to Air
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Surface coating (yacht - clear wood finish - sealer)	VOC
Surface coating (yacht - clear wood finish - varnish)	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM

3. Data Sources and Results

3.7.2 Activity Data

Summary activity data collected from the industrial questionnaires for boat mooring and storage is presented in Table 3-36.

Table 3-36: Summary activity data for boat mooring and storage

Parameter	Value	Unit
Total vehicle kilometres travelled	9,523	km/year
Electricity consumed	3,907	MWh/year

3.7.3 Emission and Speciation Factors

The emission and speciation factors for all substances from boat construction/maintenance (general) sources are detailed in Table 3-37.

Table 3-37: Emission and speciation factors for all substances from boat construction/maintenance (general)

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Surface coating (yacht - clear wood finish - sealer)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (yacht - clear wood finish - varnish)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Surface coating (yacht - clear wood finish - sealer)	SPECIATEv4.2 (Profile ID=1017) (USEPA, 2008e)
	Surface coating (yacht - clear wood finish - varnish)	SPECIATEv4.2 (Profile ID=0127) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.7.4 Emission Estimates

Total estimated annual emissions (for selected substances) from battery production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-38. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-38: Total estimated annual emissions from boat mooring and storage in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	13.5	0.17	0	3.56	17.3
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	38	0.13	0	2.76	40.9
LEAD AND COMPOUNDS	0.05	0	0	0.05	0.1
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	76	0	0	74.8	151
PARTICULATE MATTER ≤ 2.5 µm	18.4	0	0	18.1	36.5
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	332	0.42	0	8.74	341
TOTAL SUSPENDED PARTICULATE	396	0	0	390	785
TOTAL VOLATILE ORGANIC COMPOUNDS	2,600	21.3	0	444	3,060
TRICHLOROETHYLENE	0	0	0	0	0

3.7.5 Emission Projection Methodology

Projection factors for boat mooring and storage have been derived based on final energy consumption projections for domestic water transport in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-28 and illustrated in Figure 3-3.

3.8 Brewing and Distilling 9

3.8.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-39.

Table 3-39: Brewing and distilling facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
TOOHEYS PTY LTD	1167	29 NYRANG STREET	LIDCOMBE	2141
BLUETONGUE BREWERY	13026	16 BURNET ROAD	WARNERVALE	2259

3. Data Sources and Results

The emission sources and associated releases to air from brewing and distilling are presented in Table 3-40.

Table 3-40: Brewing and distilling – emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Beer production (brew kettle)	PM, VOC
Beer production (lauter tun)	VOC
Beer production (mash tun)	VOC
Beer production (fermenter venting: closed fermenter)	VOC, H ₂ S, CO ₂
Fugitive emissions	VOC, ammonia
Wheel generated dust (paved roads)	PM

3.8.2 Activity Data

Summary activity data collected from the industrial questionnaires for brewing and distilling is presented in Table 3-41.

Table 3-41: Summary activity data for brewing and distilling

Parameter	Value	Unit
Amount of beer produced	310,330	kL/year
Total vehicle kilometres travelled	609,926	km/year
Total natural gas combusted	235,000	GJ/year
Electricity consumed	33,300	MWh/year

3.8.3 Emission and Speciation Factors

The emission and speciation factors for all substances from brewing and distilling sources are detailed in Table 3-42.

Table 3-42: Emission and speciation factors for all substances from brewing and distilling

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Beer production (brew kettle)	AP42 Chapter 9.12.1 Malt Beverages (USEPA, 1996b)
	Beer production (lauter tun)	
	Beer production (mash tun)	
	Beer production (fermenter venting: closed fermenter)	
	Fugitive emissions	Site specific emission estimates
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Beer production (brew kettle)	AP42 Chapter 9.12.1 Malt Beverages (USEPA, 1996b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Beer production (brew kettle)	SPECIATEv4.2 (Profile ID=1188) (USEPA, 2008e)
	Beer production (lauter tun)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
methane)	Beer production (mash tun)	
	Beer production (fermenter venting: closed fermenter)	
	Fugitive emissions	
Speciated particulate matter	Boilers (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust - paved roads	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Fugitive emissions	Site specific emission estimates
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Beer production (fermenter venting: closed fermenter)	AP42 Chapter 9.12.1 Malt Beverages (USEPA, 1996b)

3.8.4 Emission Estimates

Total estimated annual emissions (for selected substances) from brewing and distilling for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-43. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-43: Total estimated annual emissions from brewing and distilling in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	49.1	0	0	0	49.1
CARBON MONOXIDE	8,220	0	0	0	8,220
FORMALDEHYDE	98.1	0	0	0	98.1
ISOMERS OF XYLENE	0	0	0	0	0
LEAD AND COMPOUNDS	0.14	0	0	0	0.14
OXIDES OF NITROGEN	18,600	0	0	0	18,600
PARTICULATE MATTER ≤ 10 µm	1,240	0	0	0	1,240
PARTICULATE MATTER ≤ 2.5 µm	1,140	0	0	0	1,140
POLYCYCLIC AROMATIC HYDROCARBONS	0.07	0	0	0	0.07
SULFUR DIOXIDE	51.3	0	0	0	51.3
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	24.5	0	0	0	24.5
TOTAL SUSPENDED PARTICULATE	1,820	0	0	0	1,820
TOTAL VOLATILE ORGANIC COMPOUNDS	18,800	0	0	0	18,800
TRICHLOROETHYLENE	0	0	0	0	0

3.8.5 Emission Projection Methodology

Projection factors for brewing and distilling have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

3.9 Cement or Lime Handling 11

3.9.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-44.

Table 3-44: Cement or lime handling facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
CSR BUILDING PRODUCTS - WETHERILL PARK	457	376 VICTORIA STREET	WETHERILL PARK	2164
JAMES HARDIE BUILDING PRODUCTS	602	10 COLQUHOUN STREET	ROSEHILL	2142
BLUE CIRCLE SOUTHERN CEMENT LTD	865	RAILWAY SIDING	VILLAWOOD	2163
BLUE CIRCLE SOUTHERN CEMENT LTD	947	PARRAMATTA ROAD	AUBURN	2144
CEMENT AUSTRALIA PTY LIMITED	1069	HIGHGATE STREET	AUBURN	2144
BLUE CIRCLE SOUTHERN CEMENT	1094	100 CORMORANT ROAD	KOORAGANG	2304
AUSTRALIAN CEMENT HOLDINGS	3694	CNR RAWSON ROAD AND HIGHGATE STREET	AUBURN	2144
FLYASH AUSTRALIA PTY LIMITED	3780	CNR CROSS STREET AND CONTRACTORS ROAD	DORA CREEK	2264
KOORANGANG ISLAND CEMENT TERMINAL	4193	NO.2 BERTH - HERON ROAD	KOORAGANG	2304
GLEBE ISLAND CEMENT TERMINAL	4310	SOMMERVILLE ROAD	SYDNEY	2000
MORGAN ASH	5148	CONSTRUCTION ROAD	MANNERING PARK	2259
HYROCK BLENDING PLANT	11332	LOT 1 OLD PORT ROAD	PORT KEMBLA	2505
MORGAN CEMENT INTERNATIONAL PTY LTD	12294	200 - 202 POWER STREET	GLENDEENING	2761

The emission sources and associated releases to air from cement or lime handling are presented in Table 3-45.

Table 3-45: Cement or lime handling – emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Cement or lime production (finished cement grinding)	PM
Aggregate transfer to conveyor	PM
Aggregate transfer to ground	PM
Cement unloading	PM
Fly ash transfer (cement supplement)	PM
Mixer loading (central mix)	PM
Sand transfer to conveyor	PM
Sand transfer to ground	PM
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Plaster product manufacturing (gypsum processing plant)	Combustion products
Surface coating (degreaser)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM

3.9.2 Activity Data

Summary activity data collected from the industrial questionnaires for cement or lime handling is presented in Table 3-46.

Table 3-46: Summary activity data for cement or lime handling

Parameter	Value	Unit
Total vehicle kilometres travelled	341,314	km/year
Total natural gas combusted	136,438	GJ/year
Electricity consumed	48,564	MWh/year

3.9.3 Emission and Speciation Factors

The emission and speciation factors for all substances from cement or lime handling sources are detailed in Table 3-47.

Table 3-47: Emission and speciation factors for all substances from cement or lime handling

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Plaster product manufacturing (gypsum processing plant)	NPI EET Manual for Plasterboard and Plaster Manufacturing v1.2 (DEH, 2004b)
	Surface coating (degreaser)	Mass balance
	Surface coating (paint - solvent)	VOCs from Surface Coatings Final Report (ENVIRON,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	based)	2009)
	Surface coating (primer)	
	Surface coating (thinner)	
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Cement or lime production (finished cement grinding)	NPI EET Manual for Cement Manufacturing v1.2 (EA, 2003a)
	Aggregate transfer to conveyor	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Aggregate transfer to ground	
	Cement unloading	
	Fly ash transfer (cement supplement)	
	Mixer loading (central mix)	
	Sand transfer to conveyor	
	Sand transfer to ground	
	Plaster product manufacturing (gypsum processing plant)	NPI EET Manual for Plasterboard and Plaster Manufacturing v1.2 (DEH, 2004b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (overburden)	NPI Manual for Mining v2.3 (EA, 2003)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Plaster product manufacturing (gypsum processing plant)	
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Mixer loading (central mix)	
	Plaster product manufacturing (gypsum processing plant)	NPI EET Manual for Plasterboard and Plaster Manufacturing v1.2 (DEH, 2004b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B NPI Manual for Mining v2.3 (EA, 2003)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Plaster product manufacturing (Gypsum processing plant)	NPI EET Manual for Plasterboard and Plaster Manufacturing v1.2 (DEH, 2004b)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)

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Substance	Emission Source	Emission Factor Source
	Plaster product manufacturing (gypsum processing plant)	NPI EET Manual for Plasterboard and Plaster Manufacturing v1.2 (DEH, 2004b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Plaster product manufacturing (gypsum processing plant)	NPI EET Manual for Plasterboard and Plaster Manufacturing v1.2 (DEH, 2004b)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Plaster product manufacturing (gypsum processing plant)	Derived based on Table 2, National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b) and site specific mass balance calculations

3.9.4 Emission Estimates

Total estimated annual emissions (for selected substances) from cement or lime handling for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-48. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-48: Total estimated annual emissions from cement or lime handling in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	80.8	3.03	0.22	0	84.1
CARBON MONOXIDE	97,200	353	0	0	97,600
FORMALDEHYDE	162	4.21	0	0	166
ISOMERS OF XYLENE	13,000	0.69	3.24	0	13,000
LEAD AND COMPOUNDS	12.5	0	0.4	0	13
OXIDES OF NITROGEN	23,100	421	0	0	23,600
PARTICULATE MATTER ≤ 10 µm	49,000	2,380	992	5,710	58,100
PARTICULATE MATTER ≤ 2.5 µm	12,300	547	116	856	13,800
POLYCYCLIC AROMATIC HYDROCARBONS	7.65	0	0	0	7.65
SULFUR DIOXIDE	2,520	2.2	0	0	2,520
TETRACHLOROETHYLENE	0	0	1.6	0	1.6
TOLUENE	87,100	3.32	13.2	0	87,100
TOTAL SUSPENDED PARTICULATE	100,000	4,160	3,370	13,700	122,000
TOTAL VOLATILE ORGANIC COMPOUNDS	213,000	138	56.1	0	213,000
TRICHLOROETHYLENE	0	0	4.56	0	4.56

3.9.5 Emission Projection Methodology

Projection factors for cement or lime handling have been derived based on final energy consumption projections for non-metallic minerals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-49 and illustrated in Figure 3-4.

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Table 3-49: Projection factors for non-metallic minerals related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0108	2023	1.1119
2010	1.0210	2024	1.1193
2011	1.0282	2025	1.1265
2012	1.0337	2026	1.1335
2013	1.0400	2027	1.1407
2014	1.0464	2028	1.1479
2015	1.0527	2029	1.1552
2016	1.0595	2030	1.1633
2017	1.0670	2031	1.1716
2018	1.0745	2032	1.1790
2019	1.0819	2033	1.1865
2020	1.0895	2034	1.1940
2021	1.0970	2035	1.2014
2022	1.1045	2036	1.2089

Source: ABARE (2006)

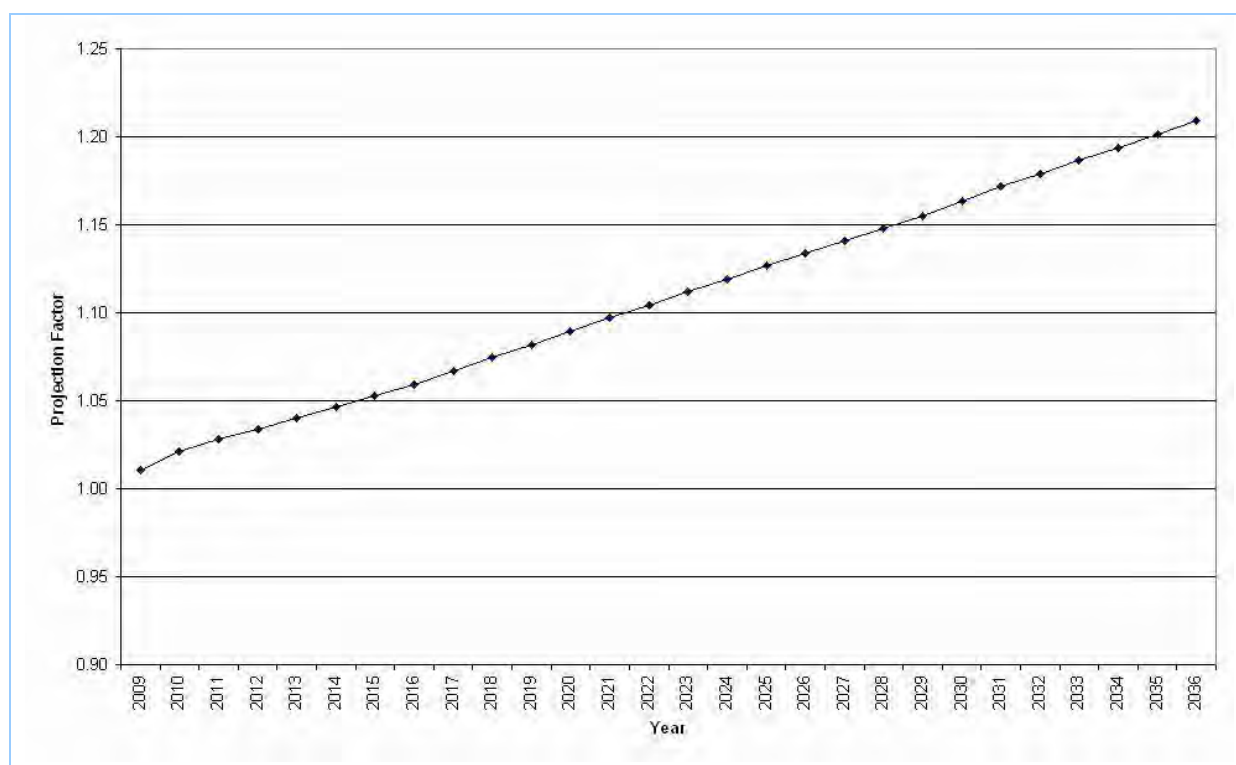


Figure 3-4: Projection factors for non-metallic minerals related sources

3.10 Cement or Lime Production 10

3.10.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-50.

Table 3-50: Cement or lime production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
BLUE CIRCLE SOUTHERN CEMENT LTD	212	40 MALDON BRIDGE ROAD	MALDON	2571
BERRIMA CEMENT WORKS	1698	TAYLOR AVENUE	NEW BERRIMA	2577
AUSTRALIAN CEMENT HOLDINGS PTY LTD	2042	JAMIESON STREET	KANDOS	2848
HYROCK CHARBON WORKS	5412	CHARBON ROAD	CHARBON	2848
ORICA SITE - BROADFIELDS AREA	12643	GATE 7 FORESHORE ROAD	PORT KEMBLA	2505

The emission sources and associated releases to air from cement or lime production are presented in Table 3-51.

Table 3-51: Cement or lime production – emission sources

Source	Emissions to Air
Cement handling	PM
Cement kiln	Combustion products
Cement mill	PM
Cement or lime production (raw material crushing)	PM
Cement unloading	PM
Cooler	PM
Fly ash transfer (cement supplement)	PM
Fuel storage (diesel)	VOC
Fuel storage (waste oil)	VOC
Lime kiln	Combustion products
Limestone manufacturing (limestone crushing with fabric filter)	PM
Loaders (coal)	PM
Other fugitive releases	PM
Slag dryer	Combustion products
Trucks (dumping coal)	PM
Trucks (dumping sandstone)	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (coal)	PM

3.10.2 Activity Data

Summary activity data collected from the industrial questionnaires for cement or lime production is presented in Table 3-52.

Table 3-52: Summary activity data for cement or lime production

Parameter	Value	Unit
Amount of cement produced	1,537,725	tonne/year
Total coal combusted	416,125	tonne/year
Amount of diesel combusted	73	kL/year
Amount of LPG combusted	454	m ³ /year
Amount of fuel oil/waste oil combusted	208	kL/year

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Parameter	Value	Unit
Total vehicle kilometres travelled	90,468	km/year
Electricity consumed	106,516	MWh/year

3.10.3 Emission and Speciation Factors

The emission and speciation factors for all substances from cement or lime production sources are detailed in Table 3-53.

Table 3-53: Emission and speciation factors for all substances from cement or lime production

Substance	Emission Source	Emission Factor Source	
CO, NO _x , SO ₂ & VOC	Cement kiln	Site specific emission estimates and NPI EET Manual for Cement Manufacturing v2.1 (DEWHA, 2008a)	
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)	
	Fuel storage (waste oil)		
	Lime kiln	Site specific emission estimates	
	Slag dryer	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)	
PM _{2.5} , PM ₁₀ & TSP	Cement handling	Site specific emission estimates	
	Cement kiln	Site specific emission estimates and NPI EET Manual for Cement Manufacturing v2.1 (DEWHA, 2008a)	
	Cement mill	Site specific emission estimates	
	Cement or lime production (raw material crushing)	NPI EET Manual for Cement Manufacturing v1.2 (EA, 2003a)	
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)	
	Cooler	Site specific emission estimates	
	Fly ash transfer (cement supplement)	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)	
	Lime kiln	Site specific emission estimates	
	Limestone manufacturing (limestone crushing with fabric filter)	NPI EET Manual for Lime and Dolomite Mfg (DEH, 2003)	
	Loaders (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Other fugitive releases	Site specific emission estimates	
	Slag dryer		
	Trucks (dumping coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Trucks (dumping sandstone)		
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)	
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)	
	Wind erosion (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Speciated organics (including methane)	Cement kiln	SPECIATEv4.2 (Profile ID=1178) (USEPA, 2008e)
		Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
Fuel storage (waste oil)		SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)	
Lime kiln		SPECIATEv4.2 (Profile ID=1178) (USEPA, 2008e)	
Slag dryer		AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)	
Speciated particulate matter	Cement handling	Site specific emission estimates	
	Cement kiln	Site specific emission estimates and NPI EET Manual for Cement Manufacturing v2.1 (DEWHA, 2008a)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Cement mill	Site specific emission estimates
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Cooler	Site specific emission estimates
	Lime kiln	SPECIATEv4.2 Profile 2720330 - cement kiln (coal fired) with ESP control (USEPA, 2008e)
	Loaders (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Other fugitive releases	Site specific emission estimates
	Slag dryer	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Trucks (dumping coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping sandstone)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	Cement kiln	Site specific emission estimates and NPI EET Manual for Cement Manufacturing v2.1 (DEWHA, 2008a)
	Lime kiln	NPI EET Manual for Cement Manufacturing v2.1 (DEWHA, 2008a)
	Slag dryer	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (assuming the same emissions per joule as natural gas) (Pechan, 2004)
Sulfuric or hydrochloric acid	Cement kiln	Site specific emission estimates and NPI EET Manual for Cement Manufacturing v2.1 (DEWHA, 2008a)
	Lime kiln	Site specific emission estimates
PAH	Cement kiln	Site specific emission estimates and AP42 Chapter 11.6 Portland Cement Manufacturing (USEPA, 1995h)
	Lime kiln	Site specific emission estimates
PCDD/PCDF	Cement kiln	Site specific emission estimates and Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al , 2004)
	Lime kiln	Site specific emission estimates
Greenhouse gases (CO ₂ and N ₂ O)	Cement kiln	Mass balance and National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Lime kiln	

3.10.4 Emission Estimates

Total estimated annual emissions (for selected substances) from cement or lime handling for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-54. Total estimated annual emissions of all substances are presented in Appendix A

Table 3-54: Total estimated annual emissions from cement or lime production in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
BENZENE	12.3	0	0	0	12.3
CARBON MONOXIDE	47,200	0	0	1,620,000	1,670,000
FORMALDEHYDE	24.5	0	0	0	24.5
ISOMERS OF XYLENE	588	0	0	2,660	3,250
LEAD AND COMPOUNDS	42.4	0	0	12,100	12,200
OXIDES OF NITROGEN	808,000	0	0	4,210,000	5,020,000
PARTICULATE MATTER ≤ 10 µm	40,800	0	1,370	637,000	679,000
PARTICULATE MATTER ≤ 2.5 µm	37,700	0	225	544,000	582,000
POLYCYCLIC AROMATIC HYDROCARBONS	153	0	0	476	629
SULFUR DIOXIDE	8,190	0	0	371,000	379,000
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	75.2	0	0	313	388
TOTAL SUSPENDED PARTICULATE	51,900	0	2,240	1,180,000	1,240,000
TOTAL VOLATILE ORGANIC COMPOUNDS	1,280	0	0	5,560	6,840
TRICHLOROETHYLENE	0	0	0	0	0

3.10.5 Emission Projection Methodology

Projection factors for cement or lime production have been derived based on final energy consumption projections for non-metallic minerals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-49 and illustrated in Figure 3-4.

3.11 Ceramics Production 13

3.11.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-55.

Table 3-55: Ceramics production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
CSR BUILDING PRODUCTS - HORSLEY PARK	123	OLD WALLGROVE ROAD	HORSLEY PARK	2164
AUSTRAL BRICK - PLANTS 1 - 2 & 3.	546	WALLGROVE ROAD	HORSLEY PARK	2164
BORAL BRICKS PTY LTD	684	235 MARTIN ROAD	BADGERYS CREEK	2171
CSR BUILDING PRODUCTS - CECIL PARK	1027	LOT 7 CECIL ROAD	CECIL PARK	2171
BORAL BRICKS PTY LTD	1808	LOT 2 GREENDALE ROAD	BRINGELLY	2171
CSR BUILDING PRODUCTS - SCHOFIELDS	2014	75 TOWNSON ROAD	SCHOFIELDS	2762
THE AUSTRAL BRICK CO PTY LTD	2073	KIAMA STREET	BOWRAL	2576
CSR BUILDING PRODUCTS - METFORD	2189	METFORD ROAD	EAST MAITLAND	2323

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
AUSTRAL TILES	2240	62 BELMORE ROAD	PUNCHBOWL	2196
BORAL MONTORO PTY LTD	2702	TOOHEYS ROAD EAST	BUSHELLS RIDGE	2259
NATIONAL CERAMIC INDUSTRIES AUSTRALIA PTY LTD	11956	RACECOURSE ROAD	RUTHERFORD	2320

The emission sources and associated releases to air from ceramics production are presented in Table 3-56.

Table 3-56: Ceramics production - emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Brick - dryer with supplement gas burner	Combustion products
Brick - grinding and screening	PM
Brick - kiln - natural gas	Combustion products
Brick - primary crusher - fabric filter	PM
Bulldozers (overburden)	PM
Ceramic - ceramic glaze spray booth - wet scrubber	PM
Ceramic - dryer	PM
Ceramic - firing-natural gas fired kiln	Combustion products
Ceramic - raw material crushing and screening - fabric filter	PM
Direct entry - dust and fluoride	PM
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Loaders (overburden)	PM
Material transfer (overburden)	PM
Primary crushing (M < 4%)	PM
Surface coating (paint - solvent based)	VOC
Trucks (dumping overburden)	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM

3.11.2 Activity Data

Summary activity data collected from the industrial questionnaires for ceramics production is presented in Table 3-57.

Table 3-57: Summary activity data for ceramics production

Parameter	Value	Unit
Amount of brick produced	1,644,807	tonne/year
Amount of ceramic produced	145,218	tonne/year
Total natural gas combusted	2,715,803	GJ/year
Total vehicle kilometres travelled	1,048,830	km/year
Electricity consumed	85,014	MWh/year

3. Data Sources and Results

3.11.3 Emission and Speciation Factors

The emission and speciation factors for all substances from ceramics production sources are detailed in Table 3-58.

Table 3-58: Emission and speciation factors for all substances from ceramics production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Brick - dryer with supplement gas burner	NPI EET Manual for Bricks, Ceramics and Clay Product Manufacturing (EA, 1998)
	Brick - kiln - natural gas	
	Ceramic - firing-natural gas fired kiln	
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Surface coating (paint - solvent based)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Brick - dryer with supplement gas burner	NPI EET Manual for Bricks, Ceramics and Clay Manufacturing (EA, 1998)
	Brick - grinding and screening	NPI EET Manual for Bricks, Ceramics and Clay Manufacturing (EA, 1998) and CEIDARS Speciation profile 346 Clay and related products manufacturing (CARB, 2008)
	Brick - kiln - natural gas	
	Brick - primary crusher - fabric filter	
	Bulldozers (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Ceramic - ceramic glaze spray booth - wet scrubber	NPI EET Manual for Bricks, Ceramics and Clay Manufacturing (EA, 1998) and CEIDARS Speciation profile 346 Clay and related products manufacturing (CARB, 2008)
	Ceramic - dryer	
	Ceramic - firing-natural gas fired kiln	
	Ceramic - raw material crushing and screening - fabric filter	
	Direct entry - dust and fluoride	Site specific emission estimates
	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Loaders (overburden)	
	Material transfer (overburden)	
	Primary crushing (M < 4%)	
	Trucks (dumping overburden)	
	Wheel generated dust (paved roads)	
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Speciated organics (including methane)	Boiler (natural gas)
Brick - dryer with supplement gas burner		
Brick - kiln - natural gas		
Ceramic - firing-natural gas		

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	fired kiln	
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Brick - kiln - natural gas	NPI EET Manual for Bricks, Ceramics and Clay Product Manufacturing (EA, 1998)
	Bulldozers (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Ceramic - firing-natural gas fired kiln	NPI EET Manual for Bricks, Ceramics and Clay Product Manufacturing (EA, 1998)
	Direct entry - dust and fluoride	Site specific emission estimates
	Exposed area (wind erosion)	Appendix A NPI Manual for Mining v2.3 (based on EF = 0.4 kg/ha/hour for general exposed areas) and soil profile from Appendix B (EA, 2003)
	Loaders (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (overburden)	
	Primary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Trucks (dumping overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	Brick - kiln - Natural gas	NPI EET Manual for Bricks, Ceramics and Clay Product Manufacturing (EA, 1998)
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, (Bawden et al, 2004)
	Brick - kiln - natural gas	
	Ceramic - firing-natural gas fired kiln	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b).
	Brick - kiln - natural gas	
	Ceramic - firing-natural gas fired kiln	

3.11.4 Emission Estimates

Total estimated annual emissions (for selected substances) from ceramics production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-59. Total estimated annual emissions of all substances are presented in Appendix A.

3. Data Sources and Results

Table 3-59: Total estimated annual emissions from ceramics production in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	2,620	0	0	274	2,900
CARBON MONOXIDE	767,000	0	0	168,000	935,000
FORMALDEHYDE	5,240	0	0	549	5,790
ISOMERS OF XYLENE	55.6	0	0	0.11	55.7
LEAD AND COMPOUNDS	40.6	0	0	26.6	67.2
OXIDES OF NITROGEN	227,000	0	0	68,800	296,000
PARTICULATE MATTER ≤ 10 µm	681,000	0	0	174,000	855,000
PARTICULATE MATTER ≤ 2.5 µm	478,000	0	0	115,000	593,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0.11	0.11
SULFUR DIOXIDE	505,000	0	0	76,500	581,000
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	1,560	0	0	137	1,700
TOTAL SUSPENDED PARTICULATE	1,410,000	0	0	390,000	1,800,000
TOTAL VOLATILE ORGANIC COMPOUNDS	29,500	0	0	3,020	32,500
TRICHLOROETHYLENE	0	0	0	0	0

3.11.5 Emission Projection Methodology

Projection factors for ceramics production have been derived based on final energy consumption projections for non-metallic minerals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-49 and illustrated in Figure 3-4.

3.12 Chemical Production 24**3.12.1 Emission Sources and Associated Releases to Air**

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-60.

Table 3-60: Chemical production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
HARDMAN AUSTRALIA PTY LIMITED	141	11 BODEN ROAD	SEVEN HILLS	2147
ECOLAB	512	30-32 MARIGOLD STREET	REVESBY	2212
THE LINCOLN ELECTRIC CO (AUSTRALIA) PTY LTD	866	35 BRYANT ST	PADSTOW	2211
NUPLEX INDUSTRIES (AUST) PTY LTD	993	49-61 STEPHEN ROAD	BOTANY	2019
SOLVAY INTEROX PTY LTD	1255	20-22 MCPHERSON ST	BANKSMEADOW	2019
NALCO AUSTRALIA PTY LTD	2086	3-5 ANDERSON STREET	BANKSMEADOW	2019
FOSECO PTY LIMITED	2130	7 STUART STREET	PADSTOW	2211

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3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ORICA AUSTRALIA PTY LTD	2148	16-20 BEAUCHAMP ROAD	MATRAVILLE	2036
KOPPERS CARBON MATERIALS & CHEMICALS PTY LTD	2156	WOODSTOCK STREET	MAYFIELD	2304
RECKITT BENCKISER	2196	44 WHARF ROAD	WEST RYDE	2114
S.C.JOHNSON	2248	160 EPPING ROAD	LANE COVE	2066
CHEMPROD NOMINEES PROPRIETARY LIMITED	2491	109 ENTERPRISE DRIVE	TOMAGO	2322
MIROTONE PTY LTD	2586	21 MARIGOLD STREET	REVESBY	2212
JALCO HOUSEHOLD AND FABRIC CARE	2746	277-303 WOODPARK ROAD	SMITHFIELD	2164
ELI LILLY AUSTRALIA PTY LTD	2762	112 WHARF ROAD	WEST RYDE	2114
PIONEER ROAD SERVICES PTY LTD	3269	25 GROVES AVE	MCGRATHS HILL	2756
PAX AUSTRALIA	3530	9 WILLIAMSON ROAD	INGLEBURN	2565
UNILEVER AUSTRALASIA	3740	219 NORTH ROCKS ROAD	NORTH ROCKS	2151
MEMCOR AUSTRALIA PTY LTD	5961	1 MEMTEC PARKWAY	SOUTH WINDSOR	2756
GE BETZ PTY LTD	5966	69 - 77 WILLIAMSON ROAD	INGLEBURN	2565
MINMET OPERATIONS PTY LTD	5986	25 SCHOOL DRIVE	TOMAGO	2322
DU PONT PERFORMANCE COATINGS	6070	15-23 MELBOURNE ROAD	RIVERSTONE	2765
MULTI-FILL PTY LTD	6254	14 GARLING ROAD	KINGS PARK	2148
MOOREBANK AEROSOL FILLERS	6382	11 CUNNINGHAM STREET	MOOREBANK	2170
SYDNEY OPERATIONS CENTRE	6679	428-440 VICTORIA STREET	WETHERILL PARK	2164
CAMPBELL BROTHERS LIMITED	6700	144 GILBA ROAD	GIRRAWEE	2145
QANTAS COMPONENT MAINTENANCE BANKSTOWN	6855	361 MILPERRA ROAD	BANKSTOWN	2200
NUPLEX SPECIALTY PRODUCTS	6980	8 ABBOTT ROAD	SEVEN HILLS	2147
HAWKER DE HAVILLAND	7127	361 MILPERRA ROAD	BANKSTOWN	2200
BOC LIMITED	10095	147 FIVE ISLANDS ROAD	CRINGILA	2502
FUCHS LUBRICANTS (AUSTRALASIA) PTY LTD	10181	2 HOLLAND STREET	WICKHAM	2293
ORICA AUSTRALIA PTY LTD	11220	PIKES GULLY ROAD	RAVENSWORTH	2330
CRC INDUSTRIES (AUST) PTY LIMITED	11895	9 GLADSTONE ROAD	CASTLE HILL	2154
SCHERING-PLOUGH ANIMAL HEALTH	11626	26 ARTISAN ROAD	SEVEN HILLS	2147
BHP BILLITON INNOVATION PTY LTD	12054	OFF VALE STREET	SHORTLAND	2307
DYNO NOBEL WARKWORTH PLANT	12158	186 LONG POINT ROAD	WARKWORTH	2330

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
TENIXTOLL DEFENCE LOGISTICS	12233	MOOREBANK AVENUE	MOOREBANK	2170
COREGAS PTY LTD	12259	66 LOFTUS ROAD	YENNORA	2161
AUSTRALIAN BIODIESEL GROUP	12271	15 APPRENTICE DRIVE	BERKELEY VALE	2261
DOWNER EDI MINING BLASTING SERVICES	12325	8 MELVA PLACE	SINGLETON	2330
DEGUSSA ORGANIC PEROXIDE PLANT	12485	20-22 MCPHERSON STREET	BANKSMEDOW	2019
COSMETIC PRODUCTS PTY LTD	12697	1 WELLA WAY	SOMERSBY	2250
PARCHEM CONSTRUCTION SUPPLIES PTY LTD	12724	7 LUCCA ROAD	WYONG	2259
AUSTPAC RESOURCES DEMONSTRATION PLANT	12876	240 HERRON ROAD (CORMORANT ROAD)	KOORAGANG	2304

The emission sources and associated releases to air from chemical production are presented in Table 3-61.

Table 3-61: Chemical production - emission sources

Source	Emissions to Air
Material transfer	PM
Ammonium nitrate - coolers and dryers (high density prill coolers)	PM
Boiler (coal)	Combustion products
Boiler (diesel)	Combustion products
Boiler (LPG)	Combustion products
Boiler (natural gas)	Combustion products
Chemical storage (acetone)	VOC
Chemical storage (bitumen)	VOC
Chemical storage (diisobutyl ketone)	VOC
Chemical storage (dimethyl ether)	VOC
Chemical storage (ethanol)	VOC
Chemical storage (heptane)	VOC
Chemical storage (iso-butanol)	VOC
Chemical storage (methyl ethyl ketone)	VOC
Chemical storage (n-butyl acetate)	VOC
Chemical storage (toluene)	VOC
Chemical storage (xylene)	VOC
Coal crushing (controlled wet suppression)	PM
Coke production (coal preheating)	PM
Coke production (oven charging (larry car))	Combustion products
Coke production (oven door leaks)	Combustion products
Coke production (oven pushing)	PM
Coke production (quenching)	PM
Concrete batching (cement unloading)	PM
Concrete batching (sand transfer to ground)	PM
Exposed area (wind erosion)	PM
Fuel storage (AVTUR)	VOC

3. Data Sources and Results

Source	Emissions to Air
Fuel storage (diesel)	VOC
Fuel storage (fuel oil)	VOC
Fuel storage (petrol)	VOC
Internal combustion engine (petrol)	Combustion products
Iron and steel production (ore handling)	PM
Iron and steel production (sinter/pellet making)	CO, PM, PCDD/F
Material transfer (coal)	PM
Process emissions/reaction vessels	Acids, SO ₃ , chlorine, ammonia, VOC, PM
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Surface coating (lacquer)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (paint - water based)	VOC
Surface coating (thinner)	VOC
Surface coating (yacht - clear wood finish - varnish)	VOC
Wastewater treatment	VOC
Welding	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.12.2 Activity Data

Summary activity data collected from the industrial questionnaires for chemical production is presented in Table 3-62.

Table 3-62: Summary activity data for chemical production

Parameter	Value	Unit
Amount of coal combusted	220	tonne/year
Amount of natural gas combusted	1,535,180	GJ/year
Amount of diesel combusted	732	kL/year
Total vehicle kilometres travelled	2,230,886	km/year
Electricity consumed	400,305	MWh/year

3.12.3 Emission and Speciation Factors

The emission and speciation factors for all substances from chemical production sources are detailed in Table 3-63.

Table 3-63: Emission and speciation factors for all substances from chemical production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (coal)	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a)
	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Chemical storage (acetone)	TANKS 4.09D software (USEPA, 2006e)
	Chemical storage (bitumen)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Chemical storage (diisobutyl ketone)	
	Chemical storage (dimethyl ether)	
	Chemical storage (ethanol)	
	Chemical storage (heptane)	
	Chemical storage (iso-butanol)	
	Chemical storage (methyl ethyl ketone)	
	Chemical storage (n-butyl acetate)	
	Chemical storage (toluene)	
	Chemical storage (xylene)	
	Coke production (oven charging (larry car))	
	Coke production (oven door leaks)	
	Fuel storage (AVTUR)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (diesel)	
	Fuel storage (fuel oil)	
	Fuel storage (petrol)	
	Internal combustion engine (Petrol)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Iron and steel production (sinter/pellet making)	NPI EET Manual for Iron and Steel Production (EA, 1999e)
	Process emissions/reaction vessels	Site specific emission estimates
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (lacquer)	NPI EET Manual for Aggregated Emissions from Motor Vehicle Refinishing (EA, 1999a) & VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent based)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - water based)	
Surface coating (thinner)		
Surface coating (yacht - clear wood finish - varnish)		
Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)	
PM _{2.5} , PM ₁₀ & TSP	Material transfer	AP42 Chapter 8.2 Ammonium Nitrate (USEPA, 1993a)
	Ammonium nitrate - coolers and dryers (high density prill coolers)	
	Boiler (coal)	AP42 Chapter 1.1 Bituminous And Subbituminous Coal Combustion (USEPA, 1998a) and CEIDARS profile ID131 Coal/Coke combustion (CARB, 2008)
	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Coal crushing (controlled wet suppression)	Table 11.19.2-1 USEPA AP42 (USEPA, 2004). Assuming emission factor for coal crushing controlled by wet suppression can be estimated with emission factors from this manual (see AP42 Chapter 12.2 USEPA, 2008d).
	Coke production (coal preheating)	AP42 Chapter 12.2 Coke Production (USEPA, 2008d)
	Coke production (oven charging (larry car))	
	Coke production (oven door leaks)	
	Coke production (oven pushing)	
	Coke production (quenching)	
	Cement unloading	
	Sand transfer to ground	
	Internal combustion engine (petrol)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Iron and steel production (ore handling)	NPI EET Manual for Iron and Steel Production (EA, 1999e)
	Iron and steel production (sinter/pellet making)	
	Material transfer (coal)	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Process emissions/reaction vessels	Site specific emission estimates
	Welding	NPI EET Manual for Fugitive Emissions (assuming manual metal arc welding and electrode type 14Mn-4Cr) (EA, 1999d)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (coal)	SPECIATEv4.2 (Profile ID=1178) (USEPA, 2008e)
	Boiler (diesel)	SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Chemical storage (acetone)	Mass balance (100% acetone)
	Chemical storage (bitumen)	CEIDARS Organic profile 716 (CARB, 2005)
	Chemical storage (diisobutyl ketone)	Mass balance (100% diisobutyl ether)
	Chemical storage (dimethyl ether)	Mass balance (100% dimethyl ether)
	Chemical storage (ethanol)	Mass balance (100% ethanol)
	Chemical storage (heptane)	Mass balance (100% heptane)
	Chemical storage (iso-butanol)	Mass balance (100% iso-butanol)
	Chemical storage (methyl ethyl ketone)	Mass balance (100% methyl ethyl ketone)
	Chemical storage (n-butyl	Mass balance (100% n-butyl acetate)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	acetate)	
	Chemical storage (toluene)	Mass balance (100% toluene)
	Chemical storage (xylene)	Mass balance (100% xylene)
	Coke production (oven charging (larry car))	SPECIATEv4.2 (Profile ID=0011) (USEPA, 2008e)
	Coke production (oven door leaks)	
	Fuel storage (AVTUR)	CEIDARS Organic speciation profile jet fuel evaporation (jet a) (CARB, 2005)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (fuel oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Internal combustion engine (petrol)	SPECIATEv4.2 Profile ID 1186 (USEPA, 2008e)
	Process emissions/reaction vessels	Site specific emission estimates
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (lacquer)	SPECIATEv4.2 (Profile ID=1017) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (paint - water based)	SPECIATEv4.2 (Profile ID=1013) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Surface coating (yacht - clear wood finish - varnish)	SPECIATEv4.2 (Profile ID=0127) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (coal)	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a)
	Boiler (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Coal crushing (controlled wet suppression)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Coke production (coal preheating)	
	Coke production (quenching)	
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Process emissions/reaction vessels	Site specific emission estimates
	Material transfer (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (paved	California Emissions Inventory and Reporting System -

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	roads)	Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (coal)	NPI EET Manual for Fossil Fuel Electric Power Generation v2.4 (DEH, 2005)
	Boiler (diesel)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (LPG)	
	Boiler (natural gas)	
	Coke production (oven charging (larry car))	AP42 Chapter 12.2 Coke Production (USEPA, 2008d)
	Coke production (oven door leaks)	
	Process emissions/reaction vessels	Site specific emission estimates
	Internal combustion engine (petrol)	WebFIRE - Ammonia emission factor for Mobile Sources, Highway vehicles - gasoline travelling on all road types. Assumed to be similar to emissions from stationary reciprocating engines (USEPA, 2008)
Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)	
Sulfuric or hydrochloric acid	Process emissions/reaction vessels	Site specific emission estimates
	Acid storage	Raoult's law (Raoult, M, 1882a; 1882b, 1887a; 1887b), using chemical properties from Perry and Green (1997)
	Boiler (coal)	NPI EET Manual for Fossil Fuel Electric Power Generation v2.4 (DEH, 2005)
PAH	Boiler (coal)	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a)
	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Process emissions/reaction vessels	Site specific emission estimates
PCDD/PCDF	Boiler (coal)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden, K et al, 2004)
	Boiler (diesel)	
	Boiler (LPG)	
	Boiler (natural gas)	
	Iron and steel production (sinter/pellet making)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (coal)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (diesel)	
	Boiler (LPG)	
	Boiler (natural gas)	
	Process emissions/reaction vessels	Site specific emission estimates
	Internal Combustion Engine	National Greenhouse Accounts (NGA) Factors June 2009,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	(petrol)	(DCC, 2009b)

3.12.4 Emission Estimates

Total estimated annual emissions (for selected substances) from chemical production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-64. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-64: Total estimated annual emissions from chemical production in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	1.92	0	0	1.92
ACETALDEHYDE	272	0	0	0	272
BENZENE	1,470	17,700	6.92	109	19,200
CARBON MONOXIDE	49,400	38,300	1,160	758	89,600
FORMALDEHYDE	593	204	13.8	31.1	842
ISOMERS OF XYLENE	13,100	9,600	0.16	88.9	22,800
LEAD AND COMPOUNDS	7.82	0.35	0.01	3.77	11.9
OXIDES OF NITROGEN	69,500	147,000	1,380	2,310	221,000
PARTICULATE MATTER ≤ 10 µm	12,500	4,110	105	12,600	29,300
PARTICULATE MATTER ≤ 2.5 µm	4,390	3,800	105	2,910	11,200
POLYCYCLIC AROMATIC HYDROCARBONS	0.29	103	0.01	0.01	103
SULFUR DIOXIDE	920	64,500	7.23	63.9	65,500
TETRACHLOROETHYLENE	1,160	4.58	0	32	1,190
TOLUENE	23,400	10,900	3.51	276	34,600
TOTAL SUSPENDED PARTICULATE	39,200	5,080	106	36,900	81,200
TOTAL VOLATILE ORGANIC COMPOUNDS	370,000	68,000	1,540	12,500	452,000
TRICHLOROETHYLENE	8,040	0.65	1,460	91.1	9,590

3.12.5 Emission Projection Methodology

Projection factors for ammonium nitrate production have been derived based on final energy consumption projections for basic chemicals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-135 and illustrated in Figure 3-7.

3.13 Chemical Storage 25

3.13.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-65.

Table 3-65: Chemical storage facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
JALCO COSMETICS PTY. LIMITED	2848	45 KING ROAD	HORNSBY	2077
TOX FREE (NEW SOUTH WALES) PTY LTD	12943	66 LINKS ROAD	ST MARYS	2760

The emission sources and associated releases to air from chemical storage are presented in Table 3-66.

Table 3-66: Chemical storage – emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Wastewater treatment	VOC, ammonia
Wheel generated dust – paved roads	PM
Wheel generated dust – unpaved roads	PM

3.13.2 Activity Data

Summary activity data collected from the industrial questionnaires for chemical storage is presented in Table 3-67.

Table 3-67: Summary activity data for chemical storage

Parameter	Value	Unit
Total vehicle kilometres travelled	22,810	km/year
Total natural gas combusted	3,639	GJ/year
Electricity consumed	1,424	MWh/year

3.13.3 Emission and Speciation Factors

The emission and speciation factors for all substances from chemical storage sources are detailed in Table 3-68.

Table 3-68: Emission and speciation factors for all substances from chemical storage

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Wastewater treatment	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.13.4 Emission Estimates

Total estimated annual emissions (for selected substances) from chemical storage for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-69. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-69: Total estimated annual emissions from chemical storage in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0.76	0	0	0	0.76
CARBON MONOXIDE	128	0	0	0	128
FORMALDEHYDE	1.87	0	0	0	1.87
ISOMERS OF XYLENE	2.09	0	0	0	2.09
LEAD AND COMPOUNDS	0	0	0	0	0
OXIDES OF NITROGEN	152	0	0	0	152
PARTICULATE MATTER ≤ 10 µm	17.6	0	0	0	17.6
PARTICULATE MATTER ≤ 2.5 µm	12.9	0	0	0	12.9
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0.79	0	0	0	0.79
TETRACHLOROETHYLENE	2.44	0	0	0	2.44
TOLUENE	1.78	0	0	0	1.78
TOTAL SUSPENDED PARTICULATE	41.4	0	0	0	41.4
TOTAL VOLATILE ORGANIC COMPOUNDS	23.4	0	0	0	23.4
TRICHLOROETHYLENE	0.35	0	0	0	0.35

3.13.5 Emission Projection Methodology

Projection factors for ammonium nitrate production have been derived based on final energy consumption projections for basic chemicals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-135 and illustrated in Figure 3-7.

3.14 Coal Washery Reject or Slag Landfilling 78

3.14.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-70.

Table 3-70: Coal washery reject or slag landfilling facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
KORRONGULLA	2509	PRIMBEE BY PASS	PRIMBEE	2502
NRE WONGAWILLI WASTE EMPLACEMENT	2575	JERSEY FARM ROAD	WONGAWILLI	2530
NORTHERN (RHONDDA) COLLIERY	3139	RHONDDA ROAD	WAKEFIELD	2278
HAYWARDS BAY PROJECT	7324	PRINCES HIGHWAY	YALLAH	2530

The emission sources and associated releases to air from coal washery or slag landfilling are presented in Table 3-71.

Table 3-71: Coal washery or slag landfilling - emission sources

Source	Emissions to Air
Exposed area (wind erosion)	PM
Wheel generated dust - unpaved roads	PM

3.14.2 Activity Data

Summary activity data collected from the industrial questionnaires for coal washery or slag landfilling is presented in Table 3-72 .

Table 3-72: Summary activity data for coal washery or slag landfilling

Parameter	Value	Unit
Total vehicle kilometres travelled	1,000	km/year
Total area exposed to wind erosion	9.3	ha
Electricity consumed	20	MWh/year

3.14.3 Emission and Speciation Factors

The emission and speciation factors for all substances from coal washery reject or slag landfilling sources are detailed in Table 3-63.

3. Data Sources and Results

Table 3-73: Emission and speciation factors for all substances from coal washery reject or slag landfilling

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	NA	NA
PM _{2.5} , PM ₁₀ & TSP	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	NA	NA
Speciated particulate matter	Exposed area (wind erosion)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	NA	NA
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.14.4 Emission Estimates

Total estimated annual emissions (for selected substances) from coal washery reject or slag landfilling for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-74. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-74: Total estimated annual emissions from coal washery reject or slag landfilling in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	0	0
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0	0	0	0	0
LEAD AND COMPOUNDS	0	0	1.26	0	1.26
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	0	0	16,600	0	16,600
PARTICULATE MATTER ≤ 2.5 µm	0	0	3,290	0	3,290
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	0	0	0	0
TOTAL SUSPENDED PARTICULATE	0	0	33,700	0	33,700
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	0	0	0
TRICHLOROETHYLENE	0	0	0	0	0

3.14.5 Emission Projection Methodology

Projection factors for coal washery reject or slag landfilling have been derived based on final energy consumption projections for mining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-75 and illustrated in Figure 3-5.

Table 3-75: Projection factors for mining related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0415	2023	1.6258
2010	1.0819	2024	1.6735
2011	1.1216	2025	1.7215
2012	1.1602	2026	1.7703
2013	1.1990	2027	1.8202
2014	1.2383	2028	1.8716
2015	1.2780	2029	1.9243
2016	1.3181	2030	1.9535
2017	1.3591	2031	1.9773
2018	1.4008	2032	2.0200
2019	1.4437	2033	2.0628
2020	1.4878	2034	2.1056
2021	1.5330	2035	2.1484
2022	1.5789	2036	2.1912

Source: ABARE (2006)

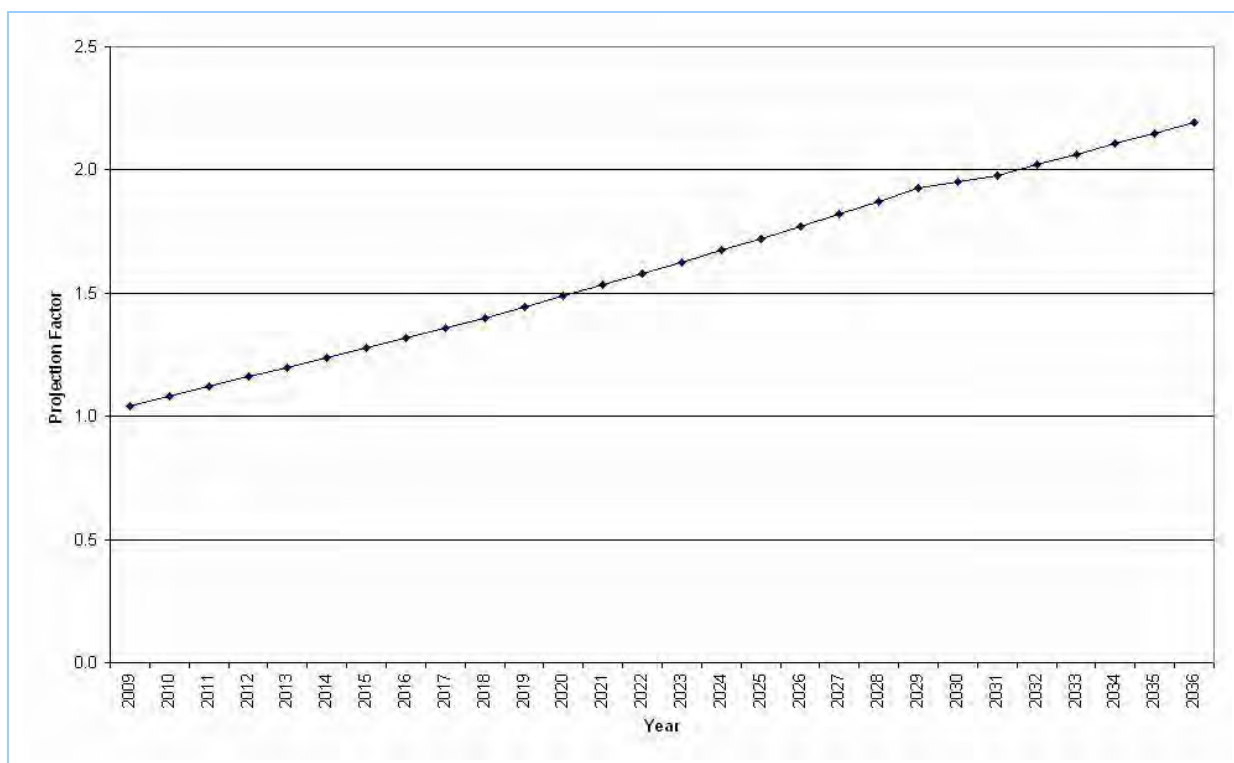


Figure 3-5: Projection factors for mining related sources

3.15 Coal Works and Coke Production 28, 27

3.15.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR included in the emissions inventory under the category coal works are outlined in Table 3-76.

Table 3-76: Coal works facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
MOUNT THORLEY COAL LOADING LTD	24	MOUNT THORLEY ROAD - MOUNT THORLEY VIA	SINGLETON	2330
PWCS CARRINGTON COAL TERMINAL	601	PORT WARATAH DRIVE	CARRINGTON	2294
PWCS - KOORAGANG COAL TERMINAL	1552	CURLEW STREET	KOORAGANG	2304
PORT KEMBLA COAL TERMINAL LIMITED	1625	PORT KEMBLA ROAD	WOLLONGONG	2500
ERARING COAL DELIVERY FACILITY - ERARING POWER STATION	4297	CONSTRUCTION ROAD	DORA CREEK	2264
LIDSDALE COAL LOADING FACILITY	5129	MAIN STREET	WALLERAWANG	2845
RAVENSWORTH COAL TERMINAL	5585	LIDDELL STATION ROAD	RAVENSWORTH	2330
HUNTLEY COLLIERY	10997	AVONDALE ROAD	AVONDALE	2530
NEWCASTLE COAL INFRASTRUCTURE GROUP	12693	CORMORANT ROAD	KOORAGANG	2304

Industrial facilities within the GMR included in the emissions inventory under the category coke production are outlined in Table 3-77.

Table 3-77: Coke production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
CORRIMAL COKE WORKS	125	27 RAILWAY STREET	CORRIMAL	2518
ILLAWARRA COKE WORKS	2150	LAWRENCE HARGRAVE DRIVE	COALCLIFF	2508

The emission sources and associated releases to air from coal works are presented in Table 3-78.

Table 3-78: Coal works – emission sources

Source	Emissions to Air
Bulldozers (coal)	PM
Bulldozers (overburden)	PM
Coal crushing (controlled wet suppression)	PM
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC

3. Data Sources and Results

Source	Emissions to Air
Graders	PM
Internal combustion engine (diesel, P<450 kW)	Combustion products
Loaders (overburden)	PM
Loading stockpiles (coal)	PM
Loading trains (coal)	PM
Material transfer (coal)	PM
Surface coating (degreaser)	VOC
Trucks (dumping coal)	PM
Unloading from stockpiles (coal)	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (coal)	PM

The emission sources and associated releases to air from coke production are presented in Table 3-79.

Table 3-79: Coke production – emission sources

Source	Emissions to Air
Coke manufacturing (combustion emissions)	Combustion products
Coke manufacturing (quench tower)	PM
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Surface coating (degreaser)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (primer)	VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (coal)	PM

3.15.2 Activity Data

Summary activity data collected from the industrial questionnaires for coal works and coke production is presented in Table 3-80.

Table 3-80: Summary activity data for coal works and coke production

Parameter	Value	Unit
Total coal handled/exported	117.1	Mt/year
Total vehicle kilometres travelled	802,596	km/year
Amount of diesel combusted ^a	0.02	kL/year
Electricity consumed	2,353	MWh/year

^a Includes only activity from stationary combustion sources

3.15.3 Emission and Speciation Factors

The emission and speciation factors for all substances from coal works sources are detailed in Table 3-81.

3. Data Sources and Results

Table 3-81: Emission and speciation factors for all substances from coal works

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Internal combustion engine (diesel, P<450 kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Surface coating (degreaser)	Mass balance
PM _{2.5} , PM ₁₀ & TSP	Bulldozers (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Bulldozers (overburden)	
	Coal crushing (controlled wet suppression)	Table 11.19.2-1 USEPA AP42 (USEPA, 2004). Assuming emission factor for coal crushing controlled by wet suppression can be estimated with emission factors from this manual (see AP42 Chapter 12.2 USEPA, 2008d).
	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Graders	
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Loaders (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Loading stockpiles (coal)	
	Loading trains (coal)	
	Material transfer (coal)	
	Trucks (dumping coal)	
	Unloading from stockpiles (coal)	
	Wheel generated dust (paved roads)	
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Wind erosion (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Internal combustion engine (diesel, P<450kW)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
Speciated particulate matter	Bulldozers (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Bulldozers (overburden)	
	Coal crushing (controlled wet suppression)	
	Exposed area (wind erosion)	
	Graders	
	Internal Combustion Engine (Diesel, P<450kW)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Loaders (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Loading stockpiles (coal)	
	Loading trains (coal)	
	Material transfer (coal)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source	
	Trucks (dumping coal)		
	Unloading from stockpiles (coal)		
	Wheel generated dust (paved roads)		California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)		California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (coal)		Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	Internal combustion engine (diesel, P<450kW)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)	
Sulfuric or hydrochloric acid	NA	NA	
PAH	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)	
PCDD/PCDF	NA	NA	
Greenhouse gases (CO ₂ and N ₂ O)	Internal combustion engine (diesel, P<450kW)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)	

The emission and speciation factors for all substances from coke production sources are detailed in Table 3-82.

Table 3-82: Emission and speciation factors for all substances from coke production

Substance	Emission Source	Emission Factor Source
CO, NO _x ¹ , SO ₂ & VOC	Coke manufacturing (combustion emissions)	Site specific emission estimates
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Surface coating (degreaser)	Mass balance
	Surface coating (paint - solvent based)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (primer)	
PM _{2.5} , PM ₁₀ & TSP	Coke manufacturing (combustion emissions)	Site specific emission estimates
	Coke manufacturing (quench tower)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)
Speciated organics (including methane)	Coke manufacturing (combustion emissions)	SPECIATEv4.2 (Profile ID=0217) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
Speciated particulate matter	Coke manufacturing (combustion emissions)	Site specific emission estimates
	Coke manufacturing (quench tower)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	Coke manufacturing (combustion emissions)	Estimating Ammonia Emissions from Anthropogenic Non-Agricultural Sources Draft Final Report July 2004 (Pechan, 2004)
Sulfuric or hydrochloric acid	Coke manufacturing (combustion emissions)	Site specific emission estimates
PAH	Coke manufacturing (combustion emissions)	
PCDD/PCDF	Coke manufacturing (combustion emissions)	
Greenhouse gases (CO ₂ and N ₂ O)	Coke manufacturing (combustion emissions)	Table 4.1, Chapter 4 - Metal Industry, 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006)

3.15.4 Emission Estimates

Total estimated annual emissions (for selected substances) from coal works for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-83. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-83: Total estimated annual emissions from coal works in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0.01	0.01
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0.89	0.25	2.6	3.74
CARBON MONOXIDE	0	0	0	0.31	0.31
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0	0.68	0.22	10	10.9
LEAD AND COMPOUNDS	0	238	5.56	27.4	271
OXIDES OF NITROGEN	0	0	0	1.45	1.45
PARTICULATE MATTER ≤ 10 µm	0	753,000	73,700	173,000	1,000,000
PARTICULATE MATTER ≤ 2.5 µm	0	93,400	11,400	21,500	126,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	19.2	19.2
TOLUENE	0	2.18	0.62	21.5	24.3
TOTAL SUSPENDED PARTICULATE	0	2,320,000	173,000	478,000	2,970,000
TOTAL VOLATILE ORGANIC COMPOUNDS	0	111	31.2	261	403

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
TRICHLOROETHYLENE	0	0	0	54.7	54.7

Total estimated annual emissions (for selected substances) from coke production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-84. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-84: Total estimated annual emissions from coke production in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	165	0	147	0	312
CARBON MONOXIDE	3,450	0	3,100	0	6,550
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0.05	0	6.1	0	6.15
LEAD AND COMPOUNDS	1,550	0	418	0	1,970
OXIDES OF NITROGEN	12,800	0	11,800	0	24,700
PARTICULATE MATTER $\leq 10 \mu\text{m}$	43,100	0	28,400	0	71,600
PARTICULATE MATTER $\leq 2.5 \mu\text{m}$	31,900	0	27,600	0	59,500
POLYCYCLIC AROMATIC HYDROCARBONS	19.7	0	16.4	0	36.1
SULFUR DIOXIDE	237,000	0	219,000	0	455,000
TETRACHLOROETHYLENE	0	0	9.59	0	9.59
TOLUENE	0.02	0	19.3	0	19.3
TOTAL SUSPENDED PARTICULATE	109,000	0	54,000	0	163,000
TOTAL VOLATILE ORGANIC COMPOUNDS	227	0	351	0	578
TRICHLOROETHYLENE	0	0	27.3	0	27.3

3.15.5 Emission Projection Methodology

Projection factors for coal works and coke production have been derived based on final energy consumption projections for mining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-75 and illustrated in Figure 3-5.

3.16 Composting 29

3.16.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-85.

3. Data Sources and Results

Table 3-85: Composting facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
WOODGRAND	4093	110 SPRINGS ROAD	SPRING FARM	2570
RYDE WASTE & RECYCLING CENTRE	4527	WICKS ROAD	NORTH RYDE	2113
AUSTRALIAN NATIVE LANDSCAPES PTY LTD	4625	210 MARTIN ROAD	BADGERYS CREEK	2171
ARTARMON WASTE & RECYCLING CENTRE	4922	LANCELEY PLACE	ARTARMON	2064
RIVERLANDS	5066	AULD AVENUE	MILPERRA	2214
DEBCO PTY LTD	5190	62 ST MARYS ROAD	BERKSHIRE PARK	2765
BETTERGROW PTY LTD	5487	48 INDUSTRY ROAD	VINEYARD	2765
CAMDEN SOIL MIX	5647	GLENLEE ROAD	CAMPBELLTOWN	2560
CHULLORA RECYCLING PARK	5893	MUIR ROAD	CHULLORA	2190
MINNAMURRA WASTE DISPOSAL & RECYCLING FACILITY	5958	PRINCES HIGHWAY	MINNAMURRA	2533
ELF FARM SUPPLIES PTY LTD	6229	108 MULGRAVE ROAD	MULGRAVE	2756
BUTTONDERRY COMPOSTING FACILITY	7349	HUE HUE ROAD	WARNERVALE	2259
RAVENSWORTH	7654	NEW ENGLAND HIGHWAY	MUSWELLBROOK	2333
RESOURCE RECOVERY CENTRE	10300	BERRIMA ROAD	MOSS VALE	2577
MUSHROOM COMPOSTERS PTY LTD	10620	BROKE RD	SINGLETON	2330
HALLINANS PTY LTD	11233	761 THE NORTHERN ROAD	BRINGELLY	2171
AUSTRALIAN NATIVE LANDSCAPES	11324	60 CRAWFORD ROAD	COORANBONG	2265
VOLK HOLDINGS PTY LTD	11539	765 THE NORTHERN ROAD	BRINGELLY	2171
BACK TO EARTH MULCH MAKERS	11620	132 BURFITT ROAD	RIVERSTONE	2765
UR-3R FACILITY	11798	WALLGROVE ROAD	EASTERN CREEK	2766
EASTERN CREEK WASTE & RECYCLING CENTRE	12517	WALLGROVE ROAD	EASTERN CREEK	2766
LUCAS HEIGHTS WASTE AND RECYCLING CENTRE	12520	NEW ILLAWARRA ROAD	LUCAS HEIGHTS	2234
BEDMINSTER FACILITY	12556	330 NEWLINE ROAD	RAYMOND TERRACE	2324
ECOLIBRIUM MIXED WASTE AND ORGANICS FACILITY	12588	RICHARDSON ROAD	SPRING FARM	2570
KIMBRIKI RECYCLING & WASTE DISPOSAL CENTRE	12615	KIMBRIKI ROAD	TERREY HILLS	2084
BRANDOWN RECYCLING YARD	12618	ELIZABETH DRIVE	KEMPS CREEK	2171
KELSO WASTE - STORAGE	12752	BRANSGROVE ROAD	MILPERRA	2214

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
AND TRANSFER FACILITY				
SITA ADVANCED WASTE TREATMENT FACILITY	12889	1725 ELIZABETH DRIVE	KEMPS CREEK	2171
DUNMORE RECYCLING DEPOT	12903	BUCKLEYS ROAD	DUNMORE	2529

The emission sources and associated releases to air from composting are presented in Table 3-86.

Table 3-86: Composting - emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Bulldozers (overburden)	PM
Composting	VOC, ammonia
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Grinding (wo air classification)	PM
Internal combustion engine (natural gas, 4-stroke lean-burn)	Combustion products
Material transfer (overburden)	PM
Material transfer (sandstone)	PM
Primary crushing (M < 4%)	PM
Screening	PM
Surface coating (degreaser)	VOC
Trucks (dumping overburden)	PM
Trucks (dumping sandstone)	PM
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM
Wind erosion (sandstone)	PM

3.16.2 Activity Data

Summary activity data collected from the industrial questionnaires for composting are presented in Table 3-87.

Table 3-87: Summary activity data for composting

Parameter	Value	Unit
Amount of compost produced	1,331,045	tonne/year
Amount of natural gas combusted	1,080	GJ/year
Amount of biogas combusted	177,337	GJ/year
Total vehicle kilometres travelled	216,577	km/year
Electricity consumed	13,594	MWh/year

3.16.3 Emission and Speciation Factors

The emission and speciation factors for all substances from composting sources are detailed in Table 3-88.

3. Data Sources and Results

Table 3-88: Emission and speciation factors for all substances from composting

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Composting	Estimating Ammonia Emissions from Non-Agricultural Sources – Draft Final Report (Pechan, 2004)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Internal combustion engine (natural gas)	NPI EET Manual for Combustion Engines v3.0 (DEWHA, 2008b)
	Surface coating (degreaser)	Mass balance
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Bulldozers (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	
	Grinding (wo air classification)	
	Internal combustion engine (natural gas)	NPI EET Manual for Combustion Engines v3.0 (DEWHA, 2008b)
	Material transfer (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (sandstone)	
	Primary crushing (M < 4%)	
	Screening	
	Trucks (dumping overburden)	
	Trucks (dumping sandstone)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
Wind erosion (sandstone)		
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Composting	Site specific emission test reports
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Internal combustion engine (natural gas)	SPECIATEv4.2 (Profile ID=1001) (USEPA, 2008e)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Bulldozers (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	
	Material transfer (overburden)	
	Material transfer (sandstone)	
	Primary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Screening	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock screening (CARB, 2007)
	Internal combustion engine (natural gas)	CEIDARS Particulate Matter (PM) Speciation Profiles - Stat I.C engine - gas (CARB, 2007)
	Trucks (dumping overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping sandstone)	
	Wheel generated dust (paved)	California Emissions Inventory and Reporting System -

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	roads)	Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wind erosion (sandstone)	
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Composting	
	Internal combustion engine (natural gas)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (natural gas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Internal combustion engine (natural gas)	

3.16.4 Emission Estimates

Total estimated annual emissions (for selected substances) from composting for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-89. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-89: Total estimated annual emissions from composting in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	11.8	0	0	0	11.8
BENZENE	59.7	0	0	0	59.7
CARBON MONOXIDE	24,600	0	0	0	24,600
FORMALDEHYDE	325	0	0	0	325
ISOMERS OF XYLENE	112	0	0	0.44	112
LEAD AND COMPOUNDS	27.7	0	0	2.98	30.7
OXIDES OF NITROGEN	39,300	0	0	0	39,300
PARTICULATE MATTER ≤ 10 µm	156,000	0	0	20,000	176,000
PARTICULATE MATTER ≤ 2.5 µm	28,200	0	0	3,580	31,700
POLYCYCLIC AROMATIC HYDROCARBONS	2.04	0	0	0	2.04
SULFUR DIOXIDE	45.8	0	0	0	45.8
TETRACHLOROETHYLENE	158	0	0	0	158
TOLUENE	172	0	0	0.13	173
TOTAL SUSPENDED PARTICULATE	420,000	0	0	46,500	466,000
TOTAL VOLATILE ORGANIC COMPOUNDS	900,000	0	0	220,000	1,120,000
TRICHLOROETHYLENE	347	0	0	0	347

3. Data Sources and Results

3.16.5 Emission Projection Methodology

Projection factors for composting have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

Table 3-90: Projection factors for commercial and services related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0239	2023	1.3455
2010	1.0474	2024	1.3695
2011	1.0708	2025	1.3935
2012	1.0931	2026	1.4175
2013	1.1154	2027	1.4419
2014	1.1377	2028	1.4667
2015	1.1599	2029	1.4919
2016	1.1822	2030	1.5126
2017	1.2047	2031	1.5322
2018	1.2275	2032	1.5553
2019	1.2505	2033	1.5784
2020	1.2740	2034	1.6016
2021	1.2976	2035	1.6247
2022	1.3214	2036	1.6479

Source: ABARE (2006)

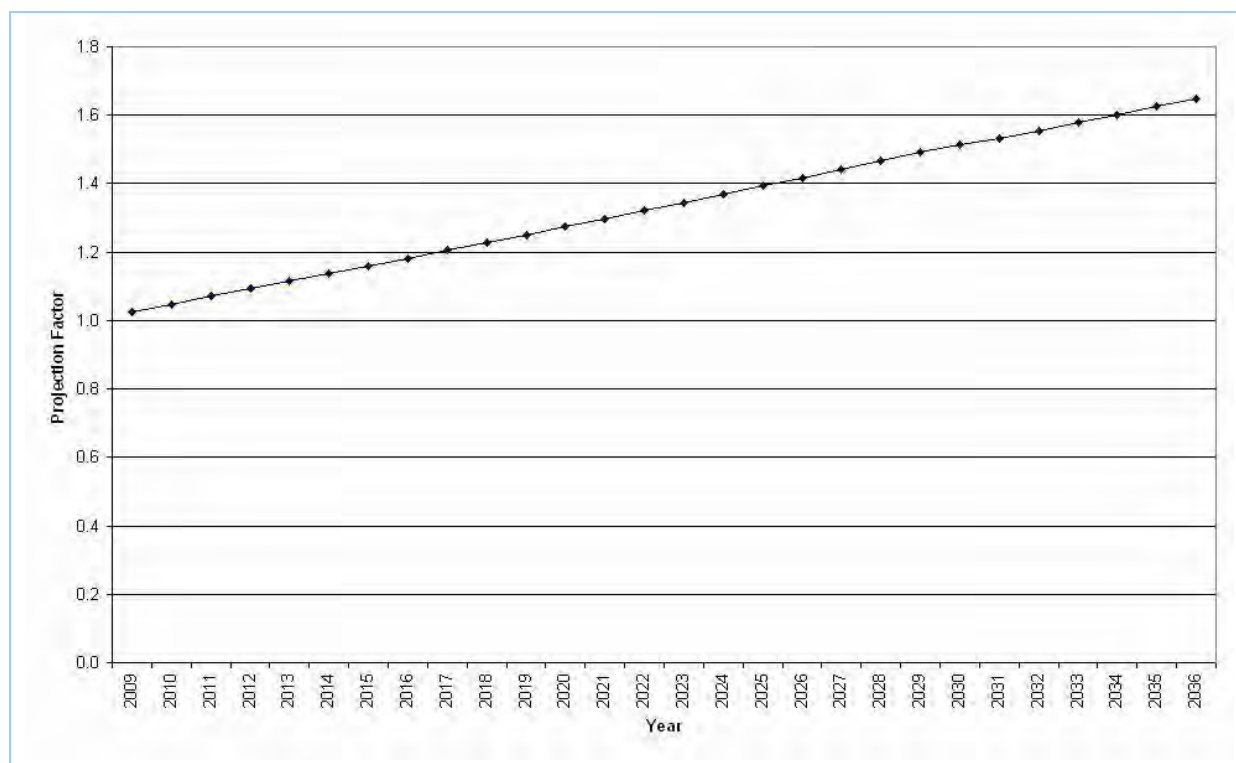


Figure 3-6: Projection factors for commercial and services related sources

3.17 Concrete Works 30**3.17.1 Emission Sources and Associated Releases to Air**

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-91.

Table 3-91: Concrete works facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
PREMIER CONCRETE (NSW) PTY LTD	10	5 CARBINE CLOSE	WALLSEND	2287
HEATHERBRAE CONCRETE	29	345 PACIFIC HIGHWAY	HEATHERBRAE	2324
HANSON CONSTRUCTION MATERIALS PTY LTD	42	85 BRIDGE STREET	PICTON	2571
METROMIX WETHERILL PARK	81	136 HASSALL STREET	WETHERILL PARK	2164
METROMIX CONCRETE SILVERWATER	109	24 STANLEY ST	SILVERWATER	2141
HYMIX AUSTRALIA PTY LTD	111	CNR. TOURLE STREET & INDUSTRIAL DRIVE	MAYFIELD	2304
BORAL CONCRETE	121	7 - 11 ESSEX STREET	MINTO	2566
BAINES MASONRY BLOCKS PTY LTD	126	900 WILTON ROAD	APPIN	2560
NARELLAN CONCRETE PLANT	146	9 GRAHAMS HILL ROAD	NARELLAN	2567
BORAL CONCRETE	247	PEACHTREE ROAD	PENRITH	2750
HANSON CONSTRUCTION MATERIALS PTY LTD	280	LOT 222 LAWSON ROAD	SPRINGWOOD	2777
LITHGOW CONCRETE	304	174 BELLS ROAD	LITHGOW	2790
BORAL ROOFING	315	MACKELLAR ST	EMU PLAINS	2750
BORAL CONCRETE	475	8 HEREFORD STREET	BERKELEY VALE	2261
CONCRITE PTY LIMITED	513	444 THE BOULEVARDE	KIRRAWEE	2232
HANSON PRECAST PTY LTD	542	63 RAILWAY ROAD NORTH	MULGRAVE	2756
METROMIX CONCRETE	622	158 SOUTH CREEK ROAD	DEE WHY	2099
WINDSOR CONCRETE	623	LOT 10 (115) FAIREY ROAD	SOUTH WINDSOR	2756
HANSON CONSTRUCTION MATERIALS PTY LTD	651	16-18 PORT STEPHENS STREET	RAYMOND TERRACE	2324
HANSON CONSTRUCTION MATERIALS PTY LTD	678	230 MANDALONG ROAD	MORISSET	2264
HANSON CONSTRUCTION MATERIALS PTY LTD	681	MAISON DIEU ROAD	SINGLETON	2330
SCE PREMIX - WOLLONGONG PLANT	686	101 MONTAGUE STREET	WOLLONGONG NORTH	2500
HYMIX AUSTRALIA PTY LTD	694	173-179 COWPASTURE ROAD	WETHERILL PARK	2164
HANSON CONSTRUCTION MATERIALS PTY LTD	699	328 SOLDIERS POINT ROAD	SALAMANDER BAY	2317
SCE PREMIX - DAPTO PLANT	700	32 MARSHALL STREET	DAPTO	2530
BORAL CONCRETE	703	1-5 NORFOLK RD	CHULLORA	2190

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
HYMIX AUSTRALIA PTY LTD	714	34 KALAROO ROAD	REDHEAD	2290
HANSON CONSTRUCTION MATERIALS PTY LTD	850	6 LANCELEY PLACE	ARTARMON	2064
HANSON CONSTRUCTION MATERIALS PTY LTD	929	46 RIDGE STREET	LAWSON	2783
BORAL CONCRETE	954	WALLARAH ROAD	MUSWELLBROOK	2333
CITY CONCRETE	979	122-132 EUSTON ROAD	ALEXANDRIA	2015
CARINGBAH CONCRETE	981	LOT 5 PARRAWEENA ROAD	CARINGBAH	2229
HURSTVILLE CONCRETE	982	156 BELLEVUE PARADE	HURSTVILLE	2220
BLACKTOWN CONCRETE	983	LOT 7 TATTERSALL ROAD	KINGS PARK	2148
BORAL CONCRETE	994	65 SEVENTH ST	BOOLAROO	2284
BORAL (COUNTRY) CONCRETE	995	MORDUE PARADE	JESMOND	2299
METROMIX ALEXANDRIA	1005	169 EUSTON ROAD	ALEXANDRIA	2015
METROMIX SEVEN HILLS	1007	POWERS ROAD	SEVEN HILLS	2147
PENDLE HILL CONCRETE	1014	154A BUNGAREE ROAD	PENDLE HILL	2145
SALAMANDER BAY CONCRETE	1015	334 SOLDIERS POINT ROAD	SALAMANDER BAY	2317
TIGHES HILL CONCRETE	1017	340 INDUSTRIAL DRIVE	TIGHES HILL	2297
CONCRITE PTY LTD	1065	NEW ILLAWARRA ROAD	LUCAS HEIGHTS	2234
LITHGOW CONCRETE PLANT	1081	144 INCH STREET	LITHGOW	2790
HANSON CONSTRUCTION MATERIALS PTY LTD	1082	ANSTEY STREET	CESSNOCK	2325
HANSON CONSTRUCTION MATERIALS PTY LTD	1083	59 PACIFIC HIGHWAY	BENNETTS GREEN	2290
HORNSBY CONCRETE	1084	12 CHILVERS ROAD	THORNLEIGH	2120
BROOKVALE CONCRETE	1085	18 WILLIAM STREET	BROOKVALE	2100
ABLE ALEXANDRIA	1107	131 WYNDHAM STREET	ALEXANDRIA	2015
HYMIX AUSTRALIA PTY LTD	1127	361 AWABA ROAD	TORONTO	2283
BORAL CONCRETE	1139	LONG ROAD	SMITHFIELD	2164
ROCLA PIPELINE PRODUCTS	1161	OLD BATHURST ROAD	EMU PLAINS	2750
BORAL CONCRETE	1176	136 CHRISTIE STREET	ST MARYS	2760
BORAL CONCRETE	1177	52 BAY ROAD	TAREN POINT	2229
BORAL CONCRETE	1178	MORT STREET	GRANVILLE	2142
BORAL CONCRETE	1179	5 GREENHILLS AVE	MOOREBANK	2170
BORAL CONCRETE	1180	CORNER BAKER AND ANDERSON STREETS	BOTANY	2019
BORAL CONCRETE	1182	FOURTH AVE	BLACKTOWN	2148
BORAL CONCRETE	1183	25 BURROWS ROAD SOUTH	ST PETERS	2044
C&M MASONRY PRODUCTS PTY LTD	1199	20 KELSO CRES	MOOREBANK	2170
HANSON CONSTRUCTION MATERIALS PTY LTD	1206	LOT 7 MARKLEA CLOSE	WYONG	2259
BCP PRECAST	1207	2 FIELD CLOSE	MOOREBANK	2170
HANSON CONSTRUCTION MATERIALS PTY LTD	1216	4 - 10 FISHER STREET	AUBURN	2144
HANSON CONSTRUCTION	1217	LOT 48 MELBOURNE	RIVERSTONE	2765

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Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
MATERIALS PTY LTD		ROAD		
BORAL CONCRETE	1233	2-10 ADA AVE	BROOKVALE	2100
BORAL CONCRETE	1236	88 RESERVE ROAD	ARTARMON	2064
BORAL CONCRETE	1237	23 SEFTON ROAD	THORNLEIGH	2120
DENMAN QUARRIES PTY LIMITED	1245	JERDEN STREET	DENMAN	2328
HYMIX AUSTRALIA PTY LTD	1251	192 HARBORD ROAD	BROOKVALE	2100
HYMIX AUSTRALIA PTY LTD	1253	41-45 BANK STREET	PYRMONT	2009
HANSON CONSTRUCTION MATERIALS PTY LTD	1259	29 CARBINE CLOSE	WALLSEND	2287
HANSON CONSTRUCTION MATERIALS PTY LTD	1261	CNR FLETCHER & GOW STREETS	ADAMSTOWN	2289
UNANDERRA CONCRETE	1263	4-6 GLASTONBURY AVENUE	UNANDERRA	2526
BORAL MASONRY LTD	1303	231 WISEMANS FERRY ROAD	SOMERSBY	2250
HUMES BLACKTOWN	1310	LOT1 WOODSTOCK AVE	ROOTY HILL	2766
HANSON CONSTRUCTION MATERIALS PTY LTD	1336	3 PIONEER AVE	THORNLEIGH	2120
HANSON CONSTRUCTION MATERIALS PTY LTD	1337	225 WENTWORTH AVE	PENDLE HILL	2145
HANSON CONSTRUCTION MATERIALS PTY LTD	1339	46 ORCHARD ROAD	BROOKVALE	2100
HANSON CONSTRUCTION MATERIALS PTY LTD	1341	66 BLAXLAND ROAD	CAMPBELLTOWN	2560
HANSON CONSTRUCTION MATERIALS PTY LTD	1342	10 DUNLOP STREET	STRATHFIELD SOUTH	2136
HANSON CONSTRUCTION MATERIALS PTY LTD	1344	3 ERSKINE ROAD	CARINGBAH	2229
HANDYCRETE CONCRETE PTY LTD	1345	5 / 423 THE BOULEVARDE	KIRRAWEE	2232
MAITLAND READY MIXED CONCRETE	1348	LOT 91 NEW ENGLAND HIGHWAY	RUTHERFORD	2320
CLEARY BROS CONCRETE	1355	8 JOHN CLEARY PLACE	CONISTON	2500
CONCRITE PTY LTD	1358	322 FIVE ISLAND ROAD	UNANDERRA	2526
BAINES CONCRETE	1381	YORK ROAD	WOONONA	2517
HANSON CONSTRUCTION MATERIALS PTY LTD	1428	7 KERTA ROAD	KINCUMBER	2251
METROMIX CONCRETE	1436	19 TWYNHAM STREET	KATOOMBA	2780
HUNTER READYMIXED CONCRETE PTY LTD	1463	8 NEVIN CLOSE	GATESHEAD	2290
BORAL CONCRETE	1501	DARLINGTON ROAD	SINGLETON	2330
BORAL CONCRETE	1855	GRAHAM HILL ROAD	NARELLAN	2567
WESCO READY MIXED CONCRETE (NSW) PTY LTD	1881	70 SARGENTS ROAD	MINCHINBURY	2770
HYMIX AUSTRALIA PTY LTD	1905	19 TATHRA STREET	GOSFORD WEST	2250
CSR READYMIX	1909	24 BOWRAL STREET	BOWRAL	2576
CLEARY BROS CONCRETE	1916	LOT 97 PRINCES HIGHWAY	BOMBO	2533

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Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
BORAL CONCRETE	1917	LOT 9 GRIEVE CLOSE	GOSFORD WEST	2250
HANSON CONSTRUCTION MATERIALS PTY LTD	1926	LOT 30 CARRAMERE ROAD	MUSWELLBROOK	2333
WYONG CONCRETE PLANT	1950	18 PAVITT CRESCENT	WYONG	2259
MONIER PGH HOLDINGS LTD	2007	10 GRAND AVE	ROSEHILL	2142
BORAL CONCRETE	2061	BUDGEWOI ROAD	DOYALSON	2262
BORAL CONCRETE	2063	35 OAKDALE ROAD	GATESHEAD	2290
BORAL CONCRETE	2070	71 ABERGLASSLYN ROAD	RUTHERFORD	2320
BORAL CONCRETE	2071	JOHNSON AVE	WESTON	2326
TERALBA CONCRETE	2103	CNR. PITT & WILLIAM STREETS	TERALBA	2284
BORAL CONCRETE	2141	14 MOTTO LANE	HEATHERBRAE	2324
HYMIX AUSTRALIA PTY LTD	2146	3 ARIZONA ROAD	CHARMHAVEN	2263
HANSON CONSTRUCTION MATERIALS PTY LTD	2190	LOT 1 PACIFIC HIGHWAY	DOYALSON	2262
HANSON CONSTRUCTION MATERIALS PTY LTD	2192	CNR KIRRAWEE ROAD & GLENNIE STREET	NORTH GOSFORD	2250
BORAL CONCRETE	2318	LOT 335 DARRAMBAL CLOSE	RATHMINES	2283
LIVERPOOL CONCRETE	2356	28 REGENT CRESCENT	MOOREBANK	2170
WESCO READY MIXED CONCRETE (NSW) PTY LTD	2549	71 STEPHEN ROAD	BOTANY	2019
HANSON CONSTRUCTION MATERIALS PTY LTD	2597	10 METFORD ROAD	EAST MAITLAND	2323
PEBBLECRETE INSITU PTY LTD	2630	238 WOODPARK ROAD	SMITHFIELD	2164
HYMIX AUSTRALIA PTY LTD	2658	9-10 COCHRANE STREET	KINCUMBER	2251
HYMIX AUSTRALIA PTY LTD	2701	55 MELBOURNE ROAD	RIVERSTONE	2765
CONCRITE PTY LTD	2712	26 SETON ROAD	MOOREBANK	2170
ABLE HORNSBY	3156	11 SALISBURY ROAD	HORNSBY	2077
CONCRITE PTY LIMITED	3177	178 BERRIMA ROAD	MOSS VALE	2577
HY-TEC INDUSTRIES PTY LTD	3317	LOT 16 SHAW ROAD	INGLEBURN	2565
BORAL CONCRETE	3327	16-17 GEORGE ROAD	SALAMANDER BAY	2317
CONCRITE PTY LIMITED	3350	DRAPERS ROAD	MITTAGONG	2575
CSR BUILDING PRODUCTS - HEBEL - SOMERSBY	3427	112 WISEMANS FERRY ROAD	SOMERSBY	2250
CONCRITE PTY LIMITED	3428	25 MANDIBLE STREET	ALEXANDRIA	2015
HY-TEC INDUSTRIES PTY LTD	3445	12 LINKS ROAD	ST MARYS	2760
PF CONCRETE (NSW) PTY LTD	3498	KITE STREET	EMU PLAINS	2750
HY-TEC INDUSTRIES PTY LTD	3539	10 BEARING ROAD	SEVEN HILLS	2147
HY-TEC INDUSTRIES PTY LTD	3680	LOT8 HUDSON PLACE	MULGRAVE	2756
BORAL RESOURCES (COUNTRY) PTY LTD	3754	PRT LOTS 1 & 19 FIVE ISLANDS ROAD	PORT KEMBLA	2505
HANSON CONSTRUCTION MATERIALS PTY LTD	3801	BRIDGE ROAD	GLEBE	2037
CONCRITE PTY LTD	4076	169 HARTLEY ROAD	SMEATON GRANGE	2567
HANSON CONSTRUCTION MATERIALS PTY LTD	4185	SHELLHARBOUR ROAD	SHELLHARBOUR	2529
BORAL CONCRETE	4375	LOTS 19 + 20 SPEEDWELL	WINDSOR	2756

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Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
		PLACE		
ROCLA PTY LIMITED	4455	11-15 DRAPERS ROAD	MITTAGONG	2575
BORAL MASONRY LIMITED	4664	CLUNIES ROSS STREET	PROSPECT	2148
BAINES TRANSPORT PTY LTD	4705	900 WILTON ROAD	APPIN	2560
CONCRITE PTY LIMITED	4933	CNR SHORT AND DUCK STREETS	AUBURN	2144
MITTAGONG CONCRETE PRODUCTS PTY LTD	4976	3-11 CARDIGAN STREET	MITTAGONG	2575
HYMIX AUSTRALIA PTY LTD	5063	14 GRAND AVE	CAMELLIA	2142
TORNBOS HOLDINGS PTY LTD	5197	14 CULLEN PLACE	SMITHFIELD	2164
COASTWIDE READYMIX CONCRETE	5238	4 APOLLO CLOSE	WEST GOSFORD	2250
LIDCOMBE CONCRETE	5604	LOT 2 BIRNIE AVENUE	LIDCOMBE	2141
ARTARMON CONCRETE	5609	8 MARDEN STREET	ARTARMON	2064
HANSON CONSTRUCTION MATERIALS PTY LTD	5641	54 JEDDA ROAD	PRESTONS	2170
HUNTER READYMIXED CONCRETE PTY LTD	6587	54 GLENWOOD DRIVE	THORNTON	2322
HY-TEC INDUSTRIES PTY LTD	7271	155-157 ADDERLEY ST	AUBURN	2144
HYMIX AUSTRALIA PTY LTD	7559	12 APPRENTICE DRIVE	BERKELEY VALE	2261
HYMIX AUSTRALIA PTY LTD	7575	15 KYLE ST	RUTHERFORD	2320
CONCRITE PTY LTD	7588	LOT 11 REDBANK PLACE	PICTON	2571
HY-TEC CONCRETE	11000	202 POWER STREET	GLENDENNING	2761
HYTEC	11112	100 JEDDA ROAD	PRESTONS	2170
TOTAL CONCRETE SOLUTIONS PTY LTD	11461	261 COOMBES DRIVE	PENRITH	2750
BORAL RESOURCES (COUNTRY) PTY LTD	11578	2 KERTA ROAD	KINCUMBER	2251
HY-TEC INDUSTRIES PTY LTD	11844	296 COWARD STREET	MASCOT	2020
REDICRETE PTY LTD	12064	7 STENHOUSE DRIVE	CAMERON PARK	2285
BORAL CONCRETE	12143	10-12 BERNERA RD	PRESTONS	2170
HUNTER READYMIXED CONCRETE PTY LTD	12224	8 BURNET ROAD	WARNERVALE	2259
CONCRITE BLACKTOWN	12327	77A TATTERSAL ROAD	KINGS PARK	2148
ADAMSTOWN READYMIX (NON CMG CONCRETE)	12331	118 GARDEN GROVE PARADE	ADAMSTOWN	2289
BORAL THORTON CONTRETE PLANT	12497	72 ENTERPRISE DRIVE	BERESFIELD	2322
WESCO READY MIXED CONCRETE (NSW) PTY LTD	12564	22 VICTORIA STREET	SMITHFIELD	2164
BRICK & BLOCK COMPANY	12608	FORESHORE ROAD	PORT KEMBLA	2505
REDICRETE BERKELEY VALE PLANT	12666	3 CORELLA CLOSE	BERKELEY VALE	2261
ROLLERS AUSTRALIA PTY LIMITED	12672	8-10 SEDGWICK STREET	SMEATON GRANGE	2567
PORT BOTANY CONTAINER TERMINAL	12975	PENRHYN ROAD	BANKSMEADOW	2019

3. Data Sources and Results

The emission sources and associated releases to air from concrete works are presented in Table 3-92.

Table 3-92: Concrete works – emission sources

Source	Emissions to Air
Aggregate transfer to conveyor	PM
Aggregate transfer to ground	PM
Boiler (LPG)	Combustion products
Boiler (natural gas)	Combustion products
Cement unloading	PM
Conveyor transfer of aggregate to elevated storage	PM
Conveyor transfer of sand to elevated storage	PM
Fly ash transfer (cement supplement)	PM
Fuel storage (diesel)	VOC
Mixer loading (central mix)	PM
Mixer loading (truck mix)	PM
Primary crushing (M < 4%)	PM
Primary crushing (M > 4%)	PM
Sand transfer to conveyor	PM
Sand transfer to ground	PM
Surface coating (degreaser)	VOC
Surface coating (paint - water based)	VOC
Surface coating (thinner)	VOC
Wastewater treatment	VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.17.2 Activity Data

Summary activity data collected from the industrial questionnaires for concrete works is presented in Table 3-93.

Table 3-93: Summary activity data for concrete works

Parameter	Value	Unit
Amount of concrete produced	12,394,654	tonne/year
Amount of natural gas combusted	215,476	GJ/year
Amount of LPG combusted	183	m ³ /year
Total vehicle kilometres travelled	476,598	km/year
Electricity consumed	27,777	MWh/year

3.17.3 Emission and Speciation Factors

The emission and speciation factors for all substances from concrete works sources are detailed in Table 3-94.

Table 3-94: Emission and speciation factors for all substances from concrete works

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Surface coating (degreaser)	Mass balance
	Surface coating (paint - water based)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (thinner)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Aggregate transfer to conveyor	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Aggregate transfer to ground	
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Conveyor transfer of aggregate to elevated storage	
	Conveyor transfer of sand to elevated storage	
	Fly ash transfer (cement supplement)	
	Mixer loading (central mix)	
	Mixer loading (truck mix)	
	Primary crushing (M < 4%)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Primary crushing (M > 4%)	
	Sand transfer to conveyor	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Sand transfer to ground	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)	
Speciated organics (including methane)	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (paint - water based)	SPECIATEv4.2 (Profile ID=1013) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Mixer loading (central mix)	CEIDARS Particulate Matter (PM) Speciation Profile - Rock crushing (USEPA, 2005)
	Mixer loading (truck mix)	
	Primary crushing (M < 4%)	
	Primary crushing (M > 4%)	
	Wheel generated dust (paved roads)	
	Wheel generated dust (unpaved roads)	
Ammonia	Boiler (LPG)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (assuming the same emissions per joule as natural gas) (Pechan, 2004)
	Boiler (natural gas)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (LPG)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (natural gas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (LPG)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (natural gas)	

3.17.4 Emission Estimates

Total estimated annual emissions (for selected substances) from concrete works for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-95. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-95: Total estimated annual emissions from concrete works in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	48.1	5.29	1.3	26.8	81.5
CARBON MONOXIDE	4620	0	0	3,100	7,730
FORMALDEHYDE	63	0	0	37	100
ISOMERS OF XYLENE	2.01	20.4	7.96	14.2	44.6
LEAD AND COMPOUNDS	15.8	0.1	0.01	4.23	20.1
OXIDES OF NITROGEN	5,640	0	0	3,700	9,330
PARTICULATE MATTER ≤ 10 µm	100,000	6,710	3,290	19,100	129,000
PARTICULATE MATTER ≤ 2.5 µm	17,000	1,040	506	3,450	22,000
POLYCYCLIC AROMATIC HYDROCARBONS	0.04	0	0	0.03	0.06
SULFUR DIOXIDE	30.1	0	0	19.3	49.4
TETRACHLOROETHYLENE	0.44	39.2	9.59	0	49.2
TOLUENE	16.5	44	25.8	38.8	125
TOTAL SUSPENDED PARTICULATE	310,000	16,700	8,070	61,500	396,000

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
TOTAL VOLATILE ORGANIC COMPOUNDS	4,940	533	230	2,930	8,640
TRICHLOROETHYLENE	0.06	112	27.3	0	139

3.17.5 Emission Projection Methodology

Projection factors for concrete works have been derived based on final energy consumption projections for non-metallic minerals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-49 and illustrated in Figure 3-4.

3.18 Container Reconditioning 33**3.18.1 Emission Sources and Associated Releases to Air**

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-96.

Table 3-96: Container reconditioning facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ABIOKA PTY LTD	124	30-32 POWERS ROAD	SEVEN HILLS	2147
MACQUARIE DRUMS	6835	12-14 BOX AVENUE	WILBERFORCE	2756
BRAZIER DRUM RECYCLERS	7082	32 BENT STREET	ST MARYS	2760
DRUM MASTER WOLLONGONG PTY LTD	11788	UNIT 11 - LOT 1 YORK ROAD	WOONONA	2517
TANK MANAGEMENT SERVICES	11877	89 REDFERN STREET	WETHERILL PARK	2164
CROSSROAD DRUM COMPANY	11977	UNIT 3 NO. 13 YORK ROAD	INGLEBURN	2565
VIP PACKAGING	12106	182-184 ANDREWS ROAD	PENRITH	2750
SYDNEY DRUM MACHINERY PTY LTD	12893	75 CHRISTIE ST	ST MARYS	2760

The emission sources and associated releases to air from container reconditioning are presented in Table 3-97.

Table 3-97: Container reconditioning - emission sources

Source	Emissions to Air
Boiler (diesel)	Combustion products
Boiler (LPG)	Combustion products
Boiler (natural gas)	Combustion products
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Surface coating (enamel)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (thinner)	VOC

3. Data Sources and Results

Source	Emissions to Air
Wastewater treatment	VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.18.2 Activity Data

Summary activity data collected from the industrial questionnaires for container reconditioning is presented in Table 3-98.

Table 3-98: Summary activity data for container reconditioning

Parameter	Value	Unit
Amount of natural gas combusted	48,181	GJ/year
Amount of LPG combusted	100	m ³ /year
Amount of diesel combusted	14	kL/year
Total vehicle kilometres travelled	21,745	km/year
Amount of electricity consumed	1,229	MWh/year

3.18.3 Emission and Speciation Factors

The emission and speciation factors for all substances from container reconditioning sources are detailed in Table 3-99.

Table 3-99: Emission and speciation factors for all substances from container reconditioning

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent based)	
	Surface coating (thinner)	
Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)	
PM _{2.5} , PM ₁₀ & TSP	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (diesel)	SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (diesel)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (LPG)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (assuming the same emissions per joule as natural gas) (Pechan, 2004)
	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (diesel)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (LPG)	
	Boiler (natural gas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (diesel)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (LPG, commercial)	
	Boiler (natural gas)	

3.18.4 Emission Estimates

Total estimated annual emissions (for selected substances) from container reconditioning for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-100. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-100: Total estimated annual emissions from container reconditioning in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	11.1	0	0	0	11.1
CARBON MONOXIDE	1,720	0	1.92	0	1,720
FORMALDEHYDE	22.8	0	0.06	0	22.9
ISOMERS OF XYLENE	8,730	0	231	0	8,960
LEAD AND COMPOUNDS	0.51	0	0.01	0	0.52
OXIDES OF NITROGEN	2,210	0	7.68	0	2,220
PARTICULATE MATTER ≤ 10 µm	1,210	0	18.2	0	1,230
PARTICULATE MATTER ≤ 2.5 µm	278	0	4.72	0	283
POLYCYCLIC AROMATIC HYDROCARBONS	0.01	0	0	0	0.01
SULFUR DIOXIDE	11.5	0	0.27	0	11.7
TETRACHLOROETHYLENE	2.49	0	0	0	2.49
TOLUENE	14,000	0	1,100	0	15,100
TOTAL SUSPENDED PARTICULATE	4,010	0	93.2	0	4,110
TOTAL VOLATILE ORGANIC COMPOUNDS	69,500	0	3,590	0	73,100
TRICHLOROETHYLENE	0.36	0	0	0	0.36

3.18.5 Emission Projection Methodology

Projection factors for container reconditioning have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.19 Contaminated Soil Treatment 31

3.19.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-101.

Table 3-101: Contaminated soil treatment facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
BHP BILLITON	1708	INDUSTRIAL DRIVE	MAYFIELD	2304
ORICA AUSTRALIA PTY LTD	2149	GATE 1 - 2 CHRISTINA ROAD	VILLAWOOD	2163
TRANSPACIFIC TECHNICAL SERVICES	6124	19 EGRET STREET	KOORAGANG	2304
VEOLIA ENVIRONMENTAL SERVICES (AUSTRALIA) PTY LTD	10251	9 WAYNOTE PLACE	UNANDERRA	2526
FORMER UNION CARBIDE	12146	40 WALKER STREET	RHODES	2138

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
FORMER UNION CARBIDE SITE & PART OF THE BED OF HOMEBUSH BAY	12146	40 WALKER STREET	RHODES	2138
FORMER ALLIED FEEDS SITE	12366	42 WALKER STREET	RHODES	2138

The emission sources and associated releases to air from contaminated soil treatment are presented in Table 3-102.

Table 3-102: Contaminated soil treatment – emission sources

Source	Emissions to Air
Aggregate transfer to ground	PM
Boiler (natural gas)	Combustion products
Bulldozers (overburden)	PM
Cement unloading	PM
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Graders	PM
Internal combustion engine (diesel, P<450kW)	Combustion products
Loaders (overburden)	PM
Material transfer (overburden)	PM
Trucks (dumping overburden)	PM
Wastewater treatment	VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM

3.19.2 Activity Data

Summary activity data collected from the industrial questionnaires for contaminated soil treatment is presented in Table 3-103.

Table 3-103: Summary activity data for contaminated soil treatment

Parameter	Value	Unit
Amount of natural gas combusted	506,441	GJ/year
Total vehicle kilometres travelled	33,633	km/year
Amount of electricity consumed	1,806	MWh/year

3.19.3 Emission and Speciation Factors

The emission and speciation factors for all substances from container reconditioning sources are detailed in Table 3-104.

Table 3-104: Emission and speciation factors for all substances from container reconditioning

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Aggregate transfer to ground	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Bulldozers (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Graders	
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Loaders (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (overburden)	
	Trucks (dumping overburden)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Internal combustion engine (diesel, P<450kW)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Bulldozers (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Exposed area (wind erosion)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Graders	
	Internal combustion engine (diesel, P<450kW)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Loaders (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (overburden)	
	Trucks (dumping overburden)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)	
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Internal combustion engine (diesel, P<450kW)	
	Wastewater treatment	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Internal combustion engine (diesel)	

3.19.4 Emission Estimates

Total estimated annual emissions (for selected substances) from contaminated soil treatment for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-105. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-105: Total estimated annual emissions from contaminated soil treatment in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0.21	0	0	0.21
ACETALDEHYDE	0	0	0	0	0
BENZENE	106	0.24	0	0	106
CARBON MONOXIDE	17,700	7.8	0	0	17,700
FORMALDEHYDE	212	0.19	0.25	0	213
ISOMERS OF XYLENE	5.41	1.16	1.51	0	8.07
LEAD AND COMPOUNDS	2.35	1.75	0.01	0	4.1
OXIDES OF NITROGEN	40,200	36.3	0	0	40,200
PARTICULATE MATTER ≤ 10 µm	8,550	7,800	59.4	0	16,400
PARTICULATE MATTER ≤ 2.5 µm	2,430	1,280	11.4	0	3,720
POLYCYCLIC AROMATIC HYDROCARBONS	0.15	0	0	0	0.15
SULFUR DIOXIDE	111	0.04	0	0	111
TETRACHLOROETHYLENE	6.02	1.35	1.76	0	9.12
TOLUENE	56.4	0.77	1	0	58.2
TOTAL SUSPENDED PARTICULATE	23,600	20,800	133	0	44,500
TOTAL VOLATILE ORGANIC COMPOUNDS	1,200	10.9	10.8	0	1,230
TRICHLOROETHYLENE	0.86	0.19	0.25	0	1.3

3.19.5 Emission Projection Methodology

Projection factors for contaminated soil treatment have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3. Data Sources and Results

3.20 Crushing, Grinding or Separating 32**3.20.1 Emission Sources and Associated Releases to Air**

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-106.

Table 3-106: Crushing, grinding or separating facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
EMOLEUM	306	12 GRAND AVENUE	CAMELLIA	2142
WOLLONDILLY COAL PREPARATION PLANT	641	BURRAGORANG ROAD	NATTAI	2570
SCE PROCESSING & SCE RECYCLING	1265	LOT1 SHELLHARBOUR ROAD	PORT KEMBLA	2505
UNIMIN AUSTRALIA LIMITED	1266	OLD MAITLAND ROAD	SANDGATE	2304
HI-QUALITY WALLACIA QUARRY	1462	NORTONS BASIN ROAD	WARRAGAMBA	2752
GLENLEE COAL PREPARATION PLANT	1596	1 GLENLEE ROAD - CNR SPRINGS AND RICHARDSON ROADS	NARELLAN	2567
SANDY POINT QUARRY	1924	HEATHCOTE ROAD	SANDY POINT	2171
UNIMIN AUSTRALIA LIMITED	2000	CNR UNWIN & SHIRLEY STREETS	GRANVILLE	2142
SOUTHERN LIMESTONE PTY LTD	2008	LACKEY ROAD	MOSS VALE	2577
BORAL AUSTRALIAN GYPSUM	2039	3 THACKERAY STREET	CAMELLIA	2142
BORAL EMU PLAINS QUARRY	2062	RAILWAY STREET	EMU PLAINS	2750
PACSONS QUARRIES PTY LTD	2223	BOXVALE ROAD	WELBY	2575
ABEL METAL SERVICES PTY LTD	2639	16-18 KELSO CRESCENT	MOOREBANK	2170
KNIGHT'S SYNDICATE PTY LTD	3504	LOT 4 - 105 SCHOFIELDS ROAD	ROUSE HILL	2155
LAFARGE PLASTERBOARD	3962	31 MILITARY ROAD	MATRAVILLE	2036
PENRITH QUARRY	4159	CNR SHEENS LANE & CASTLEREAGH ROAD	CASTLEREAGH	2749
PERMIAN RESOURCES PTY LTD	6456	PANAMA ST	BOMBO	2533
PEBBLECRETE INSITU PTY LTD	7567	LOT 1 & 2 PINTA ST	WALLERAWANG	2845
RESTORATION FILL SERVICES	7653	BUCKLEYS ROAD	DUNMORE	2529
BORAL RECYCLING PTY LTD	12418	VIA BURROWS ROAD SOUTH	ST PETERS	2044
STEELSTONE	12764	151 INGALL STREET	MAYFIELD	2304
ALLWORTH PARK QUARRY	12793	1642 BUCKETTS WAY	BOORAL	2425

The emission sources and associated releases to air from crushing, grinding or separating are presented in Table 3-107.

Table 3-107: Crushing, grinding or separating - emission sources

Source	Emissions to Air
Aggregate transfer to conveyor	PM
Aggregate transfer to ground	PM
Blasting	PM
Boiler (natural gas)	Combustion products
Bulldozers (coal)	PM
Bulldozers (overburden)	PM
Bulldozers (sandstone)	PM
Drilling	PM
Explosives (powergel gold, large)	CO
Exposed area (wind erosion)	PM
Flares (natural gas, csm, lfg)	Combustion products
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Graders	PM
Limestone manufacturing (limestone crushing with fabric filter)	PM
Loaders (overburden)	PM
Loading stockpiles (coal)	PM
Material transfer	PM
Plaster product manufacturing (boardline drier)	Combustion products
Plaster product manufacturing (cove drier)	Combustion products
Plaster product manufacturing (plaster mill drier)	Combustion products
Primary crushing (M < 4%)	PM
Screening	PM
Secondary crushing (M < 4%)	PM
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Tertiary crushing (M < 4%)	PM
Trucks (dumping overburden)	PM
Trucks (dumping sandstone)	PM
Unloading from stockpiles (coal)	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (coal)	PM
Wind erosion (overburden)	PM
Wind erosion (sandstone)	PM

3.20.2 Activity Data

Summary activity data collected from the industrial questionnaires for crushing grinding or separating is presented in Table 3-108.

Table 3-108: Summary activity data for crushing, grinding or separating

Parameter	Value	Unit
Amount of natural gas combusted	22,416	GJ/year
Total vehicle kilometres travelled	680,289	km/year
Amount of electricity consumed	28,904	MWh/year

3.20.3 Emission and Speciation Factors

The emission and speciation factors for all substances from crushing, grinding or separating sources are detailed in Table 3-109.

Table 3-109: Emission and speciation factors for all substances from crushing, grinding or separating

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Explosives (powergel gold, large)	NPI EET Manual for Explosives Detonation and Firing Ranges v2 (DEWHA, 2008c)
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Plaster product manufacturing (boardline drier)	Site specific emission estimates
	Plaster product manufacturing (cove drier)	
	Plaster product manufacturing (plaster mill drier)	
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent based)	
	Surface coating (primer)	
	Surface coating (thinner)	
	PM _{2.5} , PM ₁₀ & TSP	Aggregate transfer to conveyor
Aggregate transfer to ground		
Blasting		NPI EET Manual for Mining v2.3 (EA, 2003b)
Boiler (natural gas)		AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
Bulldozers (coal)		NPI EET Manual for Mining v2.3 (EA, 2003b)
Bulldozers (overburden)		
Bulldozers (sandstone)		
Drilling		
Exposed area (wind erosion)		
Flares (natural gas, csm, lfg)		AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
Graders		NPI EET Manual for Mining v2.3 (EA, 2003b)
Limestone manufacturing (limestone crushing with fabric)		NPI EET Manual for Lime and Dolomite Mfg (DEH, 2003)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source	
	filter)		
	Loaders (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Loading stockpiles (coal)		
	Material transfer	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)	
	Plaster product manufacturing (boardline drier)	Site specific emission estimates	
	Plaster product manufacturing (cove drier)		
	Plaster product manufacturing (plaster mill drier)		
	Primary crushing (M < 4%)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Screening		
	Secondary crushing (M < 4%)		
	Tertiary crushing (M < 4%)		
	Trucks (dumping overburden)		
	Trucks (dumping sandstone)		
	Unloading from stockpiles (coal)		
	Wheel generated dust (paved roads)		AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)		AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (coal)		NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wind erosion (overburden)		
	Wind erosion (sandstone)		
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)	
	Flares (natural gas, csm, lfg)	SPECIATEv4.2 (Profile ID=0051) (USEPA, 2008e)	
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)	
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)	
	Plaster product manufacturing (boardline drier)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)	
	Plaster product manufacturing (cove drier)		
	Plaster product manufacturing (plaster mill drier)		
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)	
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)	
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)	
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)	
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)	
Speciated particulate matter	Blasting	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)	
	Bulldozers (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Bulldozers (overburden)		
	Bulldozers (sandstone)		
	Drilling		

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Exposed area (wind erosion)	
	Flares (natural gas, csm, lfg)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Graders	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Loaders (overburden)	
	Loading stockpiles (coal)	
	Material transfer	
	Plaster product manufacturing (boardline drier)	
	Plaster product manufacturing (cove drier)	
	Plaster product manufacturing (plaster mill drier)	
	Primary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Screening	
	Secondary crushing (M < 4%)	
	Tertiary crushing (M < 4%)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping overburden)	
	Trucks (dumping sandstone)	
	Unloading from stockpiles (coal)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wind erosion (overburden)	
Wind erosion (sandstone)		
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Flares (natural gas, csm, lfg)	
	Plaster product manufacturing (boardline drier)	Site specific emission estimates
	Plaster product manufacturing (cove drier)	
	Plaster product manufacturing (plaster mill drier)	
Sulfuric or hydrochloric acid	Plaster product manufacturing (boardline drier)	Site specific emission estimates
	Plaster product manufacturing (cove drier)	
	Plaster product manufacturing (plaster mill drier)	
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	
	Plaster product manufacturing (boardline drier)	Site specific emission estimates
	Plaster product manufacturing (cove drier)	
	Plaster product manufacturing	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	(plaster mill drier)	
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Flares (natural gas, csm, lfg)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Plaster product manufacturing (boardline drier)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Plaster product manufacturing (cove drier)	
	Plaster product manufacturing (plaster mill drier)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Flares (natural gas, csm, lfg)	
	Plaster product manufacturing (boardline drier)	AP42 Chapter 11.16 Gypsum Manufacturing (USEPA, 1993d) and Table 2, National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Plaster product manufacturing (cove drier)	AP42 Chapter 11.16 Gypsum Manufacturing (USEPA, 1993d)
	Plaster product manufacturing (plaster mill drier)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.20.4 Emission Estimates

Total estimated annual emissions (for selected substances) from crushing, grinding or separating for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-110. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-110: Total estimated annual emissions from crushing, grinding or separating in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	371	0	0	2.48	373
CARBON MONOXIDE	221,000	0	0	417	222,000
FORMALDEHYDE	658	0	0	4.96	663
ISOMERS OF XYLENE	184	55	0	0.02	239
LEAD AND COMPOUNDS	102	0.63	0.14	4.1	107
OXIDES OF NITROGEN	37,400	0	0	496	37,900
PARTICULATE MATTER ≤ 10 µm	372,000	11,900	1,530	19,400	405,000
PARTICULATE MATTER ≤ 2.5 µm	80,600	2,350	268	3,380	86,600
POLYCYCLIC AROMATIC HYDROCARBONS	17.9	0	0	0	17.9
SULFUR DIOXIDE	5,880	0	0	2.59	5,880
TETRACHLOROETHYLENE	309	0	0	0	309
TOLUENE	625	254	0	1.25	881
TOTAL SUSPENDED PARTICULATE	1,450,000	34,600	6,070	65,500	1,560,000
TOTAL VOLATILE ORGANIC COMPOUNDS	8,330	664	0	27.5	9,030
TRICHLOROETHYLENE	880	0	0	0	880

3.20.5 Emission Projection Methodology

Projection factors for crushing, grinding or separating have been derived based on final energy consumption projections for mining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-75 and illustrated in Figure 3-5.

3.21 Dairy Animal Accommodation 40

3.21.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-111.

Table 3-111: Dairy animal accommodation facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
HAMBLEDON PARK	7374	TERRACE ROAD	NORTH RICHMOND	2754
LEPPINGTON PASTORAL COMPANY	11557	1675 THE NORTHERN ROAD	BRINGELLY	2171

The emission sources and associated releases to air from dairy animal accommodation are presented in Table 3-112.

Table 3-112: Dairy animal accommodation - emission sources

Source	Emissions to Air
Beef cattle feedlot	PM, ammonia
Beef cattle (fresh manure loss)	Ammonia
Beef cattle (manure on pad surface)	Ammonia
Beef cattle (manure stockpile)	Ammonia
Beef cattle (retention pond)	Ammonia
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC

3.21.2 Activity Data

Summary activity data collected from the industrial questionnaires for dairy animal accommodation is presented in Table 3-113.

Table 3-113: Summary activity data for dairy animal accommodation

Parameter	Value	Unit
Number of animals housed	2,000	(-)
Total vehicle kilometres travelled	ND	km/year
Electricity consumed	1,850	MWh/year

3.21.3 Emission and Speciation Factors

The emission and speciation factors for all substances from dairy animal accommodation sources are detailed in Table 3-114.

Table 3-114: Emission and speciation factors for all substances from dairy animal accommodation

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
PM _{2.5} , PM ₁₀ & TSP	Beef cattle feedlot	NPI EET Manual for Intensive Livestock - beef cattle v3.1 (DEW, 2007a) and CEIDARS PM size profile 322 for livestock dust (CARB, 2008)
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
Speciated particulate matter	NA	NA
Ammonia	Beef cattle feedlot	NPI EET Manual for Intensive Livestock - beef cattle v3.1 (DEW, 2007a)
	Beef cattle (fresh manure loss)	
	Beef cattle (manure on pad surface)	
	Beef cattle (manure stockpile)	
	Beef cattle (retention pond)	
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.21.4 Emission Estimates

Total estimated annual emissions (for selected substances) from dairy animal accommodation for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-115. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-115: Total estimated annual emissions from dairy animal accommodation in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0.17	0	0	0	0.17
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0.42	0	0	0	0.42
LEAD AND COMPOUNDS	0	0	0	0	0
OXIDES OF NITROGEN	0	0	0	0	0

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
PARTICULATE MATTER ≤ 10 µm	23,400	0	0	0	23,400
PARTICULATE MATTER ≤ 2.5 µm	3,000	0	0	0	3,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0.51	0	0	0	0.51
TOTAL SUSPENDED PARTICULATE	48,800	0	0	0	48,800
TOTAL VOLATILE ORGANIC COMPOUNDS	24.6	0	0	0	24.6
TRICHLOROETHYLENE	0	0	0	0	0

3.21.5 Emission Projection Methodology

Projection factors for dairy animal accommodation have been derived based on final energy consumption projections for agriculture in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-6 and illustrated in Figure 3-1.

3.22 Dairy Processing 1

3.22.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-116.

Table 3-116: Dairy processing facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
DAIRY FARMERS HEXHAM	816	189 MAITLAND ROAD	HEXHAM	2322
DAIRY FARMERS	2108	LOT 1 BIRNIE AVE	LIDCOMBE	2141
DAIRY FARMERS WETHERILL PARK	2803	433 VICTORIA ST	WETHERILL PARK	2164
NATIONAL FOODS MILK LIMITED	2869	2257 - 2265 CASTLEREAGH ROAD	PENRITH	2750
STREETS ICE CREAM	5851	401 PEMBROKE ROAD	MINTO	2566
PERFECTION DAIRIES PTY LTD	6744	7 GIBBON ROAD	BAULKHAM HILLS	2153

The emission sources and associated releases to air from dairy processing are presented in Table 3-117.

Table 3-117: Dairy processing - emission sources

Source	Emissions to Air
Fuel storage (diesel)	VOC
Boiler (natural gas)	Combustion products
Surface coating (degreaser)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (thinner)	VOC
Wastewater treatment	VOC
Wheel generated dust (paved roads)	PM

3.22.2 Activity Data

Summary activity data collected from the industrial questionnaires for dairy processing is presented in Table 3-118.

Table 3-118: Summary activity data for dairy processing

Parameter	Value	Unit
Amount of dairy products processed per annum ^a	740,000	kL/year
Amount of natural gas combusted	283,918	GJ/year
Total vehicle kilometres travelled	1,717,708	km/year
Amount of electricity consumed	71,615	MWh/year

^a includes: milk, cream, yogurt and ice cream

3.22.3 Emission and Speciation Factors

The emission and speciation factors for all substances from dairy processing sources are detailed in Table 3-119.

Table 3-119: Emission and speciation factors for all substances from dairy processing

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Surface coating (degreaser)	Mass balance
	Surface coating (paint - solvent based)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (thinner)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Wastewater treatment	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.22.4 Emission Estimates

Total estimated annual emissions (for selected substances) from dairy processing for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-120. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-120: Total estimated annual emissions from dairy processing in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	2.49	0.21	0	0	2.7
BENZENE	55.7	17.9	0	0	73.6
CARBON MONOXIDE	8,100	2,820	0	0	10,900
FORMALDEHYDE	133	41.9	0	0	175
ISOMERS OF XYLENE	383	68.7	0	0	452
LEAD AND COMPOUNDS	22.1	0.25	0	0	22.4
OXIDES OF NITROGEN	8,610	3,360	0	0	12,000
PARTICULATE MATTER ≤ 10 µm	34,900	616	0	0	35,600
PARTICULATE MATTER ≤ 2.5 µm	9,010	343	0	0	9,350
POLYCYCLIC AROMATIC HYDROCARBONS	0.07	0.02	0	0	0.09
SULFUR DIOXIDE	50.4	17.6	0	0	68
TETRACHLOROETHYLENE	255	61.5	0	0	317
TOLUENE	298	125	0	0	423
TOTAL SUSPENDED PARTICULATE	179,000	2,140	0	0	181,000
TOTAL VOLATILE ORGANIC COMPOUNDS	3,010	814	0	0	3,830
TRICHLOROETHYLENE	36.5	17.4	0	0	53.9

3.22.5 Emission Projection Methodology

Projection factors for dairy processing have been derived based on final energy consumption projections for agriculture in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-6 and illustrated in Figure 3-1.

3.23 Explosives Production 16

3.23.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-121.

Table 3-121: Explosives production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ORICA AUSTRALIA TECHNICAL CENTRE	4121	GEORGE BOOTH DRIVE	KURRI KURRI	2327
HOWARD & SONS PYROTECHNICS (MANUFACTURING) PTY LTD	11640	581 PORTLAND ROAD	WALLERAWANG	2845
DYNO NOBEL MT THORLEY TECHNICAL CENTRE	12159	5 WOODLANDS ROAD	MOUNT THORLEY	2330

The emission sources and associated releases to air from explosives production are presented in Table 3-122.

Table 3-122: Explosives production - emission sources

Source	Emissions to Air
Fuel storage (diesel)	VOC
Ammonium nitrate - bulk loading operations	PM
Boiler (diesel)	Combustion products
Process emissions	Combustion products
Explosives (black powder)	CO ₂ , N ₂ O, H ₂ S, CO
Surface coating (degreaser)	VOC
Surface coating (lacquer)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Wastewater treatment	VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.23.2 Activity Data

Summary activity data collected from the industrial questionnaires for explosives production is presented in Table 3-123.

Table 3-123: Summary activity data for explosives production

Parameter	Value	Unit
Total vehicle kilometres travelled	4,600	km/year
Amount of diesel combusted	2	kL/year
Amount of electricity consumed	167	MWh/year

3.23.3 Emission and Speciation Factors

The emission and speciation factors for all substances from explosives production sources are detailed in Table 3-124.

Table 3-124: Emission and speciation factors for all substances from dairy processing

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Process emissions	Site specific emission estimates
	Explosives (black powder)	NPI EET Manual for Explosives Detonation and Firing Ranges v2.0 (DEWHA, 2008c)
	Surface coating (degreaser)	Mass balance
	Surface coating (lacquer)	NPI EET Manual for Aggregated Emissions from Motor Vehicle Refinishing (EA, 1999a) & VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (primer)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (thinner)	
Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)	
PM _{2.5} , PM ₁₀ & TSP	Ammonium nitrate - bulk loading operations	AP42 Chapter 8.3 Ammonium Nitrate (USEPA, 1993a)
	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Process emissions	Site specific emission estimates
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Boiler (diesel)	SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)
	Process emissions	Site specific emission estimates
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (lacquer)	SPECIATEv4.2 (Profile ID=1017) (USEPA, 2008e)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)	
Speciated particulate matter	Boiler (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (diesel)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Wastewater treatment	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
PCDD/PCDF	Boiler (diesel)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (diesel)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Explosives (black powder)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b) (assuming similar carbon content as coke)

3.23.4 Emission Estimates

Total estimated annual emissions (for selected substances) from explosives production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-125. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-125: Total estimated annual emissions from explosives production in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	0.65	0.65
CARBON MONOXIDE	0	0	0	173	173
FORMALDEHYDE	0	0	0	0.06	0.06
ISOMERS OF XYLENE	0	0	0	5.11	5.11
LEAD AND COMPOUNDS	0	0	0	0.11	0.11
OXIDES OF NITROGEN	0	0	0	177	177
PARTICULATE MATTER ≤ 10 µm	0	0	0	199	199
PARTICULATE MATTER ≤ 2.5 µm	0	0	0	31.5	31.5
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0.17	0.17
TETRACHLOROETHYLENE	0	0	0	4.91	4.91
TOLUENE	0	0	0	35.2	35.2
TOTAL SUSPENDED PARTICULATE	0	0	0	834	834
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	0	161	161
TRICHLOROETHYLENE	0	0	0	13.7	13.7

3.23.5 Emission Projection Methodology

Projection factors for explosives production have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

3.24 Fertiliser Production (Phosphate and Ammonium Nitrate) 14B, 14A

3.24.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under agricultural fertiliser (phosphate) production category are outlined in Table 3-126.

3. Data Sources and Results

Table 3-126: Agricultural fertiliser (phosphate) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
INCITEC COCKLE CREEK WORKS	208	MAIN ROAD	BOOLAROO	2284
INCITEC PIVOT	11781	HERON ROAD	KOORAGANG	2304

Industrial facilities within the GMR that are included in the emissions inventory under ammonium nitrate production are outlined in Table 3-127.

Table 3-127: Ammonium nitrate production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ORICA AUSTRALIA PTY LTD	828	GREENLEAF ROAD	KOORAGANG	2304

The emission sources and associated releases to air from the production of phosphate fertiliser are outlined in Table 3-128.

Table 3-128: Agricultural fertiliser (phosphate) - emission sources

Source	Emissions to Air
Fuel storage	VOC
Acid storage	Sulfuric acid
Boiler (natural gas)	Combustion products
Milling	PM and fluoride
Phosphate rock unloading	PM
Curing building	PM and fluoride
Mixer and den	PM and fluoride
Rock feeding	PM and fluoride
Rock unloading	PM and fluoride
Wheel generated dust - paved roads	PM

The emission sources and associated releases to air from ammonium nitrate production are presented in Table 3-129.

Table 3-129: Ammonium nitrate production - emission sources

Source	Emissions to Air
Cooler	PM
Granulator	PM
Pre-dryer	PM
Prill tower	PM
Reformer	Combustion products
Nitric acid plant	Ammonia, CO, nitric acid, NO _x , VOC
Fuel storage (diesel)	VOC
Boiler (natural gas)	Combustion products
Surface coating	VOC
Fugitive process emissions	Ammonia, nitric acid
Wheel generated dust - paved roads	PM

3.24.2 Activity Data

Summary activity data collected from the industrial questionnaires for fertiliser production is presented in Table 3-130.

Table 3-130: Summary activity data for fertiliser production

Parameter	Value	Unit
Amount of fertiliser produced (super phosphate or ammonium nitrate)	490,000	tonne/year
Total natural gas combusted	4,240,691	GJ/year
Electricity consumed	97,210	MWh/year

3.24.3 Emission and Speciation Factors

The emission and speciation factors for all substances from agricultural fertiliser (phosphate) production sources are detailed in Table 3-131.

Table 3-131: Emission and speciation factors for all substances from agricultural fertiliser (phosphate) production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage	TANKS 4.09D software (USEPA, 2006e)
PM _{2.5} , PM ₁₀ & TSP	Milling	Site specific emission estimates and USEPA AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Phosphate rock unloading	AP42 Chapter 8.5.2 Triple Super phosphates (USEPA, 1993c)
	Curing building	AP42 Chapter 8.5.1 Normal Super phosphates (USEPA, 1993b)
	Mixer and den	
	Rock feeding	AP42 Chapter 8.5.2 Triple Super phosphates (USEPA, 1993c)
	Rock unloading	
Wheel generated dust – paved roads	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)	
Speciated organics (including methane)	Combustion (boilers) - natural gas	SPECIATE v4.2 software (USEPA, 2008e)
	Fuel storage	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
Speciated particulate matter	Combustion (boilers) - natural gas	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust – paved roads	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Combustion (boilers) - natural gas	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	Acid storage	Raoult's law (Raoult, M, 1882a; 1882b, 1887a; 1887b), using chemical properties from Perry and Green (1997)
PAH	Combustion (boilers) - natural gas	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Combustion (boilers) - natural gas	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Combustion (boilers) - natural gas	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3. Data Sources and Results

The emission and speciation factors for all substances from ammonium nitrate production sources are detailed in Table 3-132.

Table 3-132: Emission and speciation factors for all substances from ammonium nitrate production

Substance	Emission Source	Emission Factor Source
CO, NO _x ¹ , SO ₂ & VOC	Reformer	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler (natural gas)	
	Nitric acid plant	Site specific emission estimates
	Surface coating	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
PM _{2.5} , PM ₁₀ & TSP	Cooler	AP42 Chapter 8.3 Ammonium Nitrate (USEPA, 1993a)
	Granulator	
	Pre-dryer	
	Prill tower	
	Reformer	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler (natural gas)	
Wheel generated dust - paved roads	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)	
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Surface coating	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust - paved roads	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust - unpaved roads	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 and after (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Nitric acid plant	
	Fugitive process emissions	Site specific emission estimates
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.24.4 Emission Estimates

Total estimated annual emissions (for selected substances) from agricultural fertiliser (phosphate) production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-133. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-133: Total estimated annual emissions from agricultural fertiliser (phosphate) production in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	2.5	0	0	2.5
CARBON MONOXIDE	0	1,090	0	0	1,090
FORMALDEHYDE	0	5.01	0	0	5.01
ISOMERS OF XYLENE	0	0.11	0	0	0.11
LEAD AND COMPOUNDS	0	0.33	0	0	0.33
OXIDES OF NITROGEN	0	501	0	0	501
PARTICULATE MATTER ≤ 10 µm	0	40,000	0	0	40,000
PARTICULATE MATTER ≤ 2.5 µm	0	38,400	0	0	38,400
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	2.62	0	0	2.62
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	1.29	0	0	1.29
TOTAL SUSPENDED PARTICULATE	0	44,300	0	0	44,300
TOTAL VOLATILE ORGANIC COMPOUNDS	0	28.8	0	0	28.8
TRICHLOROETHYLENE	0	0	0	0	0

Total estimated annual emissions (for selected substances) from ammonium nitrate production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-134. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-134: Total estimated annual emissions from ammonium nitrate production in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	2,440	0	0	2,440
BENZENE	0	12,000	0	0	12,000
CARBON MONOXIDE	0	258,000	0	0	258,000
FORMALDEHYDE	0	1,810	0	0	1,810
ISOMERS OF XYLENE	0	682	0	0	682
LEAD AND COMPOUNDS	0	0.9	0	0	0.9
OXIDES OF NITROGEN	0	844,000	0	0	844,000
PARTICULATE MATTER < 10 µm	0	323,000	0	0	323,000
PARTICULATE MATTER < 2.5 µm	0	316,000	0	0	316,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	1.21	0	0	1.21
SULFUR DIOXIDE	0	923	0	0	923
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	2,970	0	0	2,970
TOTAL SUSPENDED PARTICULATE	0	337,000	0	0	337,000
TOTAL VOLATILE ORGANIC COMPOUNDS	0	132,000	0	0	132,000
TRICHLOROETHYLENE	0	0	0	0	0

3. Data Sources and Results

3.24.5 Emission Projection Methodology

Projection factors for fertiliser production (phosphate and ammonium nitrate) have been derived based on final energy consumption projections for basic chemicals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-135 and illustrated in Figure 3-7.

Table 3-135: Projection factors for basic chemicals related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0082	2023	1.1320
2010	1.0162	2024	1.1416
2011	1.0245	2025	1.1510
2012	1.0329	2026	1.1604
2013	1.0415	2027	1.1700
2014	1.0501	2028	1.1798
2015	1.0587	2029	1.1898
2016	1.0675	2030	1.1971
2017	1.0764	2031	1.2038
2018	1.0854	2032	1.2127
2019	1.0945	2033	1.2216
2020	1.1038	2034	1.2305
2021	1.1131	2035	1.2394
2022	1.1225	2036	1.2484

Source: ABARE (2006)

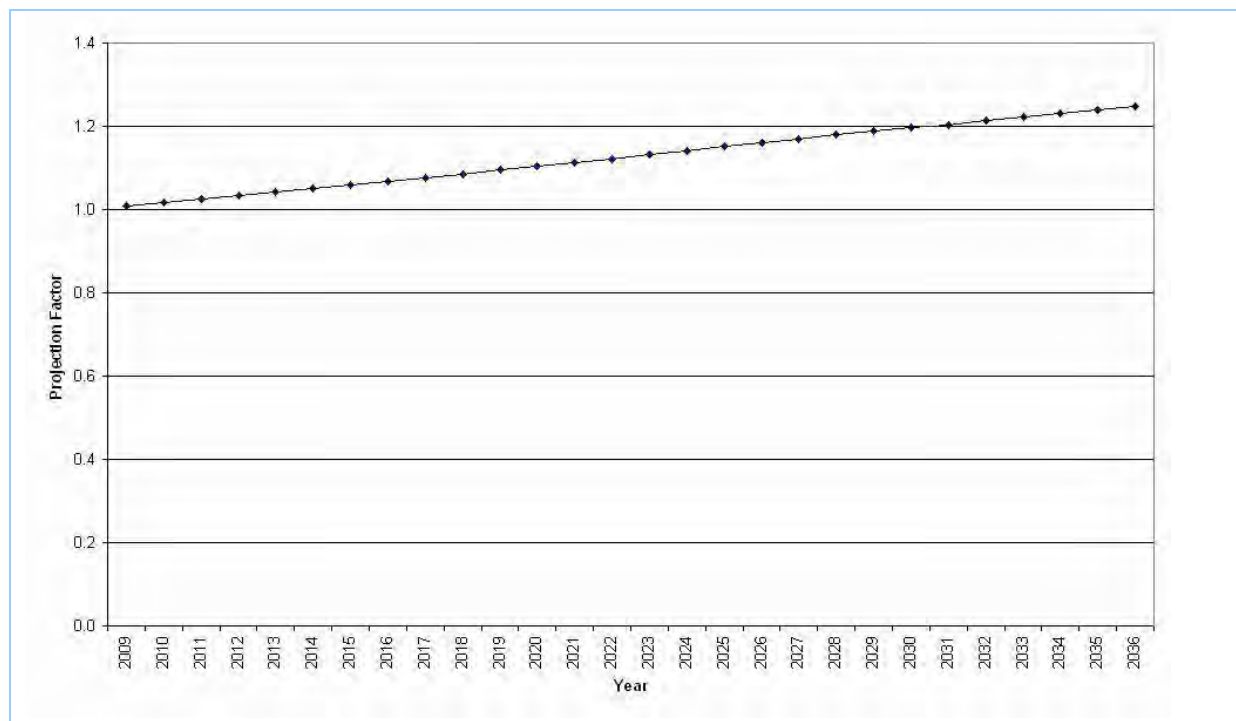


Figure 3-7: Projection factors for basic chemicals related sources

3.25 General Agricultural Processing 3

3.25.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-136.

Table 3-136: General agricultural processing facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
PENFORD AUSTRALIA LIMITED	518	170 EPPING ROAD	LANE COVE	2066
INGHAMS ENTERPRISES PTY. LIMITED	692	16 NELSON ROAD	CARDIFF	2285
KELLOGG (AUST) PTY LTD	823	SWINBOURNE STREET	BOTANY	2019
ALLIED MILLS PTY LTD	2024	2 SMITH STREET	SUMMER HILL	2130
GEORGE WESTON FOODS LIMITED T/A WESTON MILLING - WESTON TECHNOLOGIES AND WESTON ANIMAL NUTRITION	2160	1 BRAIDWOOD STREET	STRATHFIELD SOUTH	2136
PREMIER STOCKFEEDS AUST PTY LTD	2619	21 CURTIS RD	MCGRATHS HILL	2756
VELLA STOCK FEEDS	2882	96 GLENDENNING ROAD	PLUMPTON	2761
ATLANTIC PACIFIC FOODS	3426	LOT 9 AND 10 GARDINER STREET	RUTHERFORD	2320
SUGAR AUSTRALIA GLEBE ISLAND TERMINAL	4790	LOT 1 SOMMERVILLE ROAD	ROZELLE	2039
CARGILL AUSTRALIA LIMITED	5810	51 RAVEN STREET	NEWCASTLE	2300
BERRIMA FEEDMILL	11261	DOUGLAS ROAD	NEW BERRIMA	2577
MITAVITE	12185	3 PILE ROAD	SOMERSBY	2250
ALLIED MILLS	12498	330 PICTON ROAD	MALDON	2571

The emission sources and associated releases to air from general agricultural processing are presented in Table 3-137.

Table 3-137: General agricultural processing - emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Feed shipping	PM
Fuel storage (diesel)	VOC
Grain cleaning	PM
Grain milling	PM
Grain receiving	PM
Material transfer	PM
Pelletising	PM
Process emissions	Combustion products
Surface coating usage	VOC

3. Data Sources and Results

Source	Emissions to Air
Wastewater treatment	VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.25.2 Activity Data

Summary activity data collected from the industrial questionnaires for general agricultural processing is presented in Table 3-138.

Table 3-138: Summary activity data for general agricultural processing

Parameter	Value	Unit
Amount of grain processed	1,202,488	tonne/year
Amount of natural gas combusted	1,047,490	GJ/year
Total vehicle kilometres travelled	610,437	km/year
Amount of electricity consumed	142,458	MWh/year

3.25.3 Emission and Speciation Factors

The emission and speciation factors for all substances from general agricultural processing sources are detailed in Table 3-139.

Table 3-139: Emission and speciation factors for all substances from general agricultural processing

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Process emissions	Site specific emission estimates
	Surface coating usage	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Feed shipping	AP42 Chapter 9.9.1 Grain Elevators and Processes (USEPA, 2003c)
	Grain cleaning	
	Grain milling	
	Grain receiving	
	Material transfer	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Pelletising	AP42 Chapter 9.9.1 Grain Elevators and Processes (USEPA, 2003c)
	Process emissions	Site specific emission estimates
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
methane)	Process emissions	Site specific emission estimates
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Process emissions	Site specific emission estimates
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Process emissions	Site specific emission estimates
	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Process emissions	Site specific emission estimates
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.25.4 Emission Estimates

Total estimated annual emissions (for selected substances) from general agricultural processing for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-140. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-140: Total estimated annual emissions from general agricultural processing in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0.93	0	0	0.93
BENZENE	143	76.6	0	29.6	249
CARBON MONOXIDE	23,300	12,800	0	4,970	41,100
FORMALDEHYDE	294	152	0	59.9	506
ISOMERS OF XYLENE	93.2	0.71	0	4.5	98.4
LEAD AND COMPOUNDS	2.15	0.09	0	0.05	2.3
OXIDES OF NITROGEN	27,900	15,200	0	5,910	49,000
PARTICULATE MATTER ≤ 10 µm	85,800	9,170	0	5,690	101,000
PARTICULATE MATTER ≤ 2.5 µm	40,800	3,560	0	1,920	46,300
POLYCYCLIC AROMATIC HYDROCARBONS	0.19	0.1	0	0.04	0.34

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
SULFUR DIOXIDE	213	79.4	0	30.9	324
TETRACHLOROETHYLENE	30.6	0	0	5.23	35.8
TOLUENE	152	39.8	0	17.8	210
TOTAL SUSPENDED PARTICULATE	161,000	17,400	0	11,400	190,000
TOTAL VOLATILE ORGANIC COMPOUNDS	2,940	2,840	0	358	6,140
TRICHLOROETHYLENE	4.37	0	0	0.75	5.12

3.25.5 Emission Projection Methodology

Projection factors for general agricultural processing have been derived based on final energy consumption projections for agriculture in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-6 and illustrated in Figure 3-1.

3.26 General Animal Products Production 50

3.26.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-141.

Table 3-141: General animal products production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
INGHAMS ENTERPRISES PTY LIMITED	1556	470 WISEMANS FERRY ROAD	MANGROVE MOUNTAIN	2250
BUSHS PET FOODS PTY LTD	5061	12 WILLIAMSON ROAD	INGLEBURN	2565
PRIMO	6252	18 HUME HIGHWAY	CHULLORA	2190
BARTTER ENTERPRISES	6653	SOUTH STREET	MARSDEN PARK	2765
OSI INTERNATIONAL FOODS (AUSTRALIA) PTY LIMITED	7005	11 BESSEMER ST	BLACKTOWN	2148
HANS CONTINENTAL SMALL GOODS - BLACKTOWN	7404	25 BESSEMER STREET	BLACKTOWN	2148
INGLEBURN FURTHER PROCESSING PLANT	11525	6 BENSON ROAD	INGLEBURN	2565
INGHAMS LISAROW	12009	LOT 1 CUTROCK ROAD	LISAROW	2250

The emission sources and associated releases to air from general animal products production are presented in Table 3-142.

Table 3-142: General animal products production – emission sources

Source	Emissions to Air
Boiler (LPG)	Combustion products
Boiler (natural gas)	Combustion products
Fuel storage (diesel)	VOC
Fugitive process emissions	Ammonia
Surface coating (primer)	VOC
Wastewater treatment	VOC
Wheel generated dust (paved roads)	PM

3.26.2 Activity Data

Summary activity data collected from the industrial questionnaires for general animal products production is presented in Table 3-143.

Table 3-143: Summary activity data for general animal products production

Parameter	Value	Unit
Amount of processed meat produced	169,960	tonne/year
Amount of natural gas combusted	836,265	GJ/year
Total vehicle kilometres travelled	234,967	km/year
Amount of electricity consumed	68,301	MWh/year

3.26.3 Emission and Speciation Factors

The emission and speciation factors for all substances from general animal product production sources are detailed in Table 3-144.

Table 3-144: Emission and speciation factors for all substances from general animal products production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Surface coating (primer)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (LPG)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (assuming the same emissions per joule as natural gas) (Pechan, 2004)
	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Fugitive process emissions	Site specific emission estimates
	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler (natural gas)	
PCDD/PCDF	Boiler (LPG)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (natural gas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (LPG)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (natural gas)	

3.26.4 Emission Estimates

Total estimated annual emissions (for selected substances) from general animal products production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-145. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-145: Total estimated annual emissions from general animal products production in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	162	0	0	21.8	184
CARBON MONOXIDE	27,200	0	0	2,420	29,600
FORMALDEHYDE	342	0	0	45.3	388
ISOMERS OF XYLENE	108	0	0	10.5	119
LEAD AND COMPOUNDS	0.2	0	0	0.12	0.33
OXIDES OF NITROGEN	50,800	0	0	3,120	53,900

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
PARTICULATE MATTER ≤ 10 µm	2,530	0	0	386	2,910
PARTICULATE MATTER ≤ 2.5 µm	2,480	0	0	260	2,740
POLYCYCLIC AROMATIC HYDROCARBONS	0.22	0	0	0.02	0.24
SULFUR DIOXIDE	169	0	0	17.6	187
TETRACHLOROETHYLENE	126	0	0	12.3	138
TOLUENE	153	0	0	17.9	171
TOTAL SUSPENDED PARTICULATE	2,800	0	0	1,090	3,890
TOTAL VOLATILE ORGANIC COMPOUNDS	2,960	0	0	250	3,210
TRICHLOROETHYLENE	18	0	0	1.76	19.8

3.26.5 Emission Projection Methodology

Projection factors for general animal products production have been derived based on final energy consumption projections for agriculture in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-6 and illustrated in Figure 3-1.

3.27 General Chemicals Storage 25A

3.27.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-146.

Table 3-146: General chemicals storage facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
DULUX AUSTRALIA	131	15 GOW STREET	PADSTOW	2211
AIR LIQUIDE AUSTRALIA LIMITED	135	43 PINE ROAD	FAIRFIELD	2165
ORICA CHEMNET	549	GATE 1 - FORESHORE ROAD	PORT KEMBLA	2505
WATERCO LIMITED	2934	390 MARION STREET	BANKSTOWN	2200
CIBA SPECIALTY CHEMICALS PTY LIMITED	3553	6-8 DONALDSON STREET	WYONG	2259
HI-FERT PTY LTD	5430	LOT 107 GREENLEAF ROAD	KOORAGANG	2304
TOLL CHEMICAL LOGISTICS	6152	616 GREAT WESTERN HIGHWAY	ARNDELL PARK	2148
PATRICK PORT BOTANY CONTAINER TERMINAL	6962	PENRHYN ROAD	PORT BOTANY	2019
GOLDEN BROS. GROUP PTY LTD	10535	2 GREENFIELD STREET	BANKSMEADOW	2019
REDOX PTY LTD	12041	2 SWETTENHAM ROAD	MINTO	2566
MMP INDUSTRIAL PTY LTD	12677	3-5 HANNABUS PLACE	MULGRAVE	2756

3. Data Sources and Results

The emission sources and associated releases to air from general chemicals storage are presented in Table 3-147.

Table 3-147: General chemicals storage – emission sources

Source	Emissions to Air
Acid storage (sulfuric)	Sulfuric acid
Boiler (natural gas)	Combustion products
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Organic liquid storage (heptane)	VOC
Organic liquid storage (xylene)	VOC
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM

3.27.2 Activity Data

Summary activity data collected from the industrial questionnaires for general chemicals storage is presented in Table 3-148.

Table 3-148: Summary activity data for general chemicals storage

Parameter	Value	Unit
Amount of natural gas combusted	89,469	GJ/year
Total vehicle kilometres travelled	563,765	km/year
Amount of electricity consumed	22,098	MWh/year

3.27.3 Emission and Speciation Factors

The emission and speciation factors for all substances from general chemicals storage sources are detailed in Table 3-149.

Table 3-149: Emission and speciation factors for all substances from general chemicals storage

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Organic liquid storage (heptane)	
	Organic liquid storage (xylene)	
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	roads)	
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Organic liquid storage (heptane)	Mass balance (100% heptane)
	Organic liquid storage (xylene)	Mass balance (100% xylene)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Wastewater treatment	
Sulfuric or hydrochloric acid	Acid storage (sulfuric)	Raoult's law (Raoult, M, 1882a; 1882b, 1887a; 1887b), using chemical properties from Perry and Green (1997)
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.27.4 Emission Estimates

Total estimated annual emissions (for selected substances) from general chemicals storage for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-150. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-150: Total estimated annual emissions from general chemicals storage in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	3.86	0	21.2	0.1	25.2
CARBON MONOXIDE	0	0	3,120	17.5	3,140
FORMALDEHYDE	0.64	0	42.4	0.21	43.3
ISOMERS OF XYLENE	1,970	0.01	0	0	1,970
LEAD AND COMPOUNDS	8.1	0.08	0.03	0	8.21
OXIDES OF NITROGEN	0	0	3,840	20.8	3,860
PARTICULATE MATTER ≤ 10 µm	12,500	127	293	6.08	13,000
PARTICULATE MATTER ≤ 2.5 µm	3,030	30.7	285	2.67	3,350

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0.03	0	0.03
SULFUR DIOXIDE	0	0	31,200	0.11	31,200
TETRACHLOROETHYLENE	4.48	0	0	0	4.48
TOLUENE	1,100	0	10.6	0.05	1,110
TOTAL SUSPENDED PARTICULATE	65,300	660	339	25	66,300
TOTAL VOLATILE ORGANIC COMPOUNDS	8,590	0.1	233	1.14	8,830
TRICHLOROETHYLENE	0.64	0	0	0	0.64

3.27.5 Emission Projection Methodology

Projection factors for ammonium nitrate production have been derived based on final energy consumption projections for basic chemicals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-135 and illustrated in Figure 3-7.

3.28 Generation of Electrical Power from Coal 34A

3.28.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-151.

Table 3-151: Generation of electrical power from coal facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
MUNMORAH POWER STATION	759	OFF SCENIC DRIVE	DOYALSON	2262
VALES POINT POWER STATION AND COAL UNLOADER	761	OFF VALES POINT ROAD	MANNERING PARK	2259
WALLERAWANG POWER STATION	766	1 MAIN STREET	WALLERAWANG	2845
BAYSWATER POWER STATION	779	NEW ENGLAND HIGHWAY	MUSWELLBROOK	2333
ERARING POWER STATION	1429	3 & 28 ROCKY POINT ROAD AND 45 POINT PIPER ROAD	ERARING	2264
LIDDELL POWER STATION	2122	NEW ENGLAND HIGHWAY	LIDDELL	2333
REDBANK POWER STATION	11262	112 LONGPOINT ROAD	WARKWORTH	2330
MOUNT PIPER POWER STATION	13007	350 BOULDER ROAD	PORTLAND	2847

The emission sources and associated releases to air from generation of electrical power from coal are presented in Table 3-152.

3. Data Sources and Results

Table 3-152: Generation of electrical power from coal – emission sources

Source	Emissions to Air
Boiler (coal)	Combustion products
Boiler (oil)	Combustion products
Bulldozers (coal)	PM
Coal crushing (controlled wet suppression)	PM
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Fuel storage (petrol)	VOC
Internal combustion engine (diesel)	Combustion products
Loading stockpiles (coal)	PM
Material transfer (coal)	PM
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Trucks (dumping coal)	PM
Turbine (distillate)	Combustion products
Unloading from stockpiles (coal)	PM
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (coal)	PM

Detailed information on coal fired external combustion units included in the inventory is provided in Table 3-153.

Table 3-153: Detailed information on coal fired external combustion units included in the inventory

Facility EPL	Facility Name	Emission Source Name	Type of Combustion Device	Rated Capacity (MW)	Control Technology
759	MUNMORAH POWER STATION	MM Unit 3 Boiler	Boiler - WB-TF	300	FF
		MM Unit 4 Boiler	Boiler - WB-TF	300	FF
761	VALES POINT POWER STATION AND COAL UNLOADER	VP Unit 5 Boiler	Boiler - WB-TF	660	FF
		VP Unit 6 Boiler	Boiler - WB-TF	660	FF
766	WALLERAWANG POWER STATION	WW Unit 7 Boiler	Boiler-DB-TF	500	ESP
		WW Unit 8 Boiler	Boiler-DB-TF	500	ESP
779	BAYSWATER POWER STATION	Boiler Unit 1	Boiler - WB-WF	660	FF, low NO _x burners
		Boiler Unit 2	Boiler - WB-WF	660	FF, low NO _x burners
		Boiler Unit 3	Boiler - WB-WF	660	FF, low NO _x burners
		Boiler Unit 4	Boiler - WB-WF	660	FF, low NO _x burners
1429	ERARING	Boiler Unit 1	Boiler - WB-WF	660	FF, dual register

3. Data Sources and Results

Facility EPL	Facility Name	Emission Source Name	Type of Combustion Device	Rated Capacity (MW)	Control Technology
	POWER STATION				burners
		Boiler Unit 2	Boiler - WB-WF	660	FF, dual register burners
		Boiler Unit 3	Boiler - WB-WF	660	FF, dual register burners
		Boiler Unit 4	Boiler - WB-WF	660	FF, dual register burners
2122	LIDDELL POWER STATION	Boiler Unit 1	Boiler - WB-TF	500	FF
		Boiler Unit 2	Boiler - WB-TF	500	FF
		Boiler Unit 3	Boiler-DB-TF	500	FF
		Boiler Unit 4	Boiler-DB-TF	500	FF
11262	REDBANK POWER STATION	FBC - Unit 1	FBC	75	"High Efficiency" Cyclones
		FBC - Unit 2	FBC	75	"High Efficiency" Cyclones
13007	MOUNT PIPER POWER STATION	MP Unit 1 Boiler	Boiler - WB-WF	660	FF
		MP Unit 2 Boiler	Boiler - WB-WF	660	FF

Boiler - WB-TF: Boiler - wet bottom - tangentially fired

Boiler-DB-TF: Boiler - dry bottom - tangentially fired

Boiler - WB-WF: Boiler wet bottom - wall fired

FBC: Fluidised bed combustion

FF: Fabric filters

ESP: Electrostatic precipitators

3.28.2 Activity Data

Summary activity data collected from the industrial questionnaires for generation of electrical power from coal is presented in Table 3-154.

Table 3-154: Summary activity data for generation of electrical power from coal

Parameter	Value	Unit
Total amount of electricity generated	68,999	GWh/year
Total installed capacity	11,670	MW
Amount of coal combusted	30,077,089	tonne/year
Amount of distillate oil combusted	25,146	kL/year
Amount of heavy fuel oil combusted	404	kL/year
Total vehicle kilometres travelled	583,340	km/year
Amount of electricity consumed	3,772,653	MWh/year

3.28.3 Emission and Speciation Factors

The emission and speciation factors for all substances from generation of electrical power from coal sources are detailed in Table 3-155.

Table 3-155: Emission and speciation factors for all substances from generation of electrical power from coal

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (coal)	Site specific emission estimates & NPI EET Manual for Fossil Fuel Electric Generation v2.4 (DEH, 2005)
	Boiler (oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Fuel storage (petrol)	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent based)	
	Surface coating (primer)	
	Surface coating (thinner)	
	Turbine (distillate)	NPI EET Manual for Fossil Fuel Electric Generation v2.4 (DEH, 2005)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (coal)	Site specific emission estimates & NPI EET Manual for Fossil Fuel Electric Generation v2.4 (DEH, 2005)
	Boiler (oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Bulldozers (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Coal crushing (controlled wet suppression)	Table 11.19.2-1 USEPA AP42 (USEPA, 2004). Assuming emission factor for coal crushing controlled by wet suppression can be estimated with emission factors from this manual (see AP42 Chapter 12.2 USEPA, 2008d).
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Loading stockpiles (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (coal)	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Trucks (dumping coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Turbine (distillate)	NPI EET Manual for Fossil Fuel Electric Generation v2.4 (DEH, 2005)
	Unloading from stockpiles (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Speciated organics (including methane)	Boiler (coal)
Boiler (oil)		SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)
Fuel storage (diesel)		Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
Fuel storage (oil)		SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
Fuel storage (petrol)		Average petrol vapour concentration from petrol

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		produced at BP refineries around Australia (BP, 2001b)
	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Turbine (distillate)	SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (coal)	NPI EET Manual for Fossil Fuel Electric Generation v2.4 (DEH, 2005)
	Boiler (oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Bulldozers (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Coal crushing (controlled wet suppression)	
	Internal combustion engine (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Loading stockpiles (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (coal)	
	Trucks (dumping coal)	
	Turbine (distillate)	NPI EET Manual for Fossil Fuel Electric Generation v2.4 (DEH, 2005)
	Unloading from stockpiles (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	Boiler (coal)	NPI EET Manual for Fossil Fuel Electric Generation v2.4 (DEH, 2005)
	Boiler (oil)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Internal combustion engine (diesel)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	Boiler (coal)	Mass balance and NPI EET Manual for Fossil Fuel Electric Generation v2.4 (DEH, 2005)
PAH	Boiler (coal)	NPI EET Manual for Fossil Fuel Electric Generation v2.4 (DEH, 2005)
	Boiler (oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Internal combustion engine (diesel)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Turbine (distillate)	NPI EET Manual for Fossil Fuel Electric Generation v2.4 (DEH, 2005)
PCDD/PCDF	Boiler (coal)	Technical Report 3 - Inventory of Dioxin Emissions in

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Boiler (oil)	Australia, 2004 (Bawden et al, 2004)
	Turbine (distillate)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (coal)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (oil)	
	Internal combustion engine (diesel)	
	Turbine (distillate)	

3.28.4 Emission Estimates

Total estimated annual emissions (for selected substances) from generation of electrical power from coal for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-156. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-156: Total estimated annual emissions from generation of electrical power from coal in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	10.7	10.7
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	16	16
CARBON MONOXIDE	0	0	0	7,530,000	7,530,000
FORMALDEHYDE	0	0	0	247	247
ISOMERS OF XYLENE	0	0	0	431,000	431,000
LEAD AND COMPOUNDS	0	0	0	1140	1140
OXIDES OF NITROGEN	0	0	0	166,000,000	166,000,000
PARTICULATE MATTER ≤ 10 µm	0	0	0	6,520,000	6,520,000
PARTICULATE MATTER ≤ 2.5 µm	0	0	0	3,340,000	3,340,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	301	301
SULFUR DIOXIDE	0	0	0	251,000,000	251,000,000
TETRACHLOROETHYLENE	0	0	0	22.2	22.2
TOLUENE	0	0	0	51,100	51,100
TOTAL SUSPENDED PARTICULATE	0	0	0	8,280,000	8,280,000
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	0	904,000	904,000
TRICHLOROETHYLENE	0	0	0	48.2	48.2

3.28.5 Emission Projection Methodology

Projection factors for generation of electrical power from coal have been derived based on primary energy consumption projections for coal combustion from electricity generation in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-157 and illustrated in Figure 3-8.

Table 3-157: Projection factors for generation of electrical power from coal

Year	Projection Factor	Year	Projection Factor
2009	1.0126	2023	1.1793
2010	1.0245	2024	1.1886
2011	1.0370	2025	1.1974
2012	1.0508	2026	1.2050
2013	1.0666	2027	1.2115
2014	1.0817	2028	1.2175
2015	1.0933	2029	1.2232
2016	1.1038	2030	1.2421
2017	1.1146	2031	1.2639
2018	1.1260	2032	1.2752
2019	1.1368	2033	1.2865
2020	1.1475	2034	1.2978
2021	1.1587	2035	1.3091
2022	1.1694	2036	1.3204

Source: ABARE (2006)

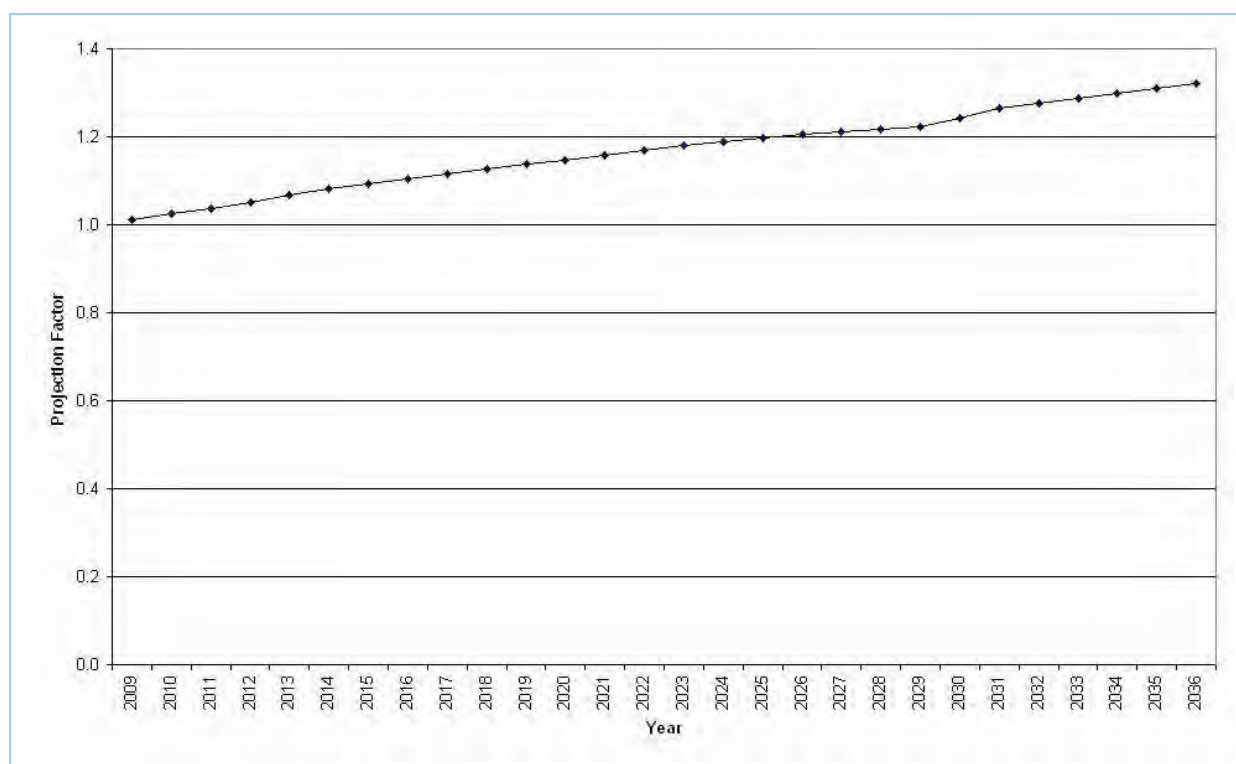


Figure 3-8: Projection factors for generation of electrical power from coal

3.29 Generation of Electrical Power from Gas 34B

3.29.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-158.

3. Data Sources and Results

Table 3-158: Generation of electrical power from gas facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
TALLAWARRA POWER STATION	555	PRINCES HIGHWAY	YALLAH	2530
LUCAS HEIGHTS 1 LFG POWER STATION	4805	542 - 600 NEW ILLAWARRA ROAD	MENAI	2234
BELROSE LFG POWER STATION	5180	CROZIER RD	BELROSE	2085
TOWER COAL SEAM METHANE POWER STATION	5357	DOUGLAS PARK DRIVE	DOUGLAS PARK	2569
APPIN COAL SEAM METHANE POWER STATION	5482	NORTHHAMPTON DALE ROAD	APPIN	2560
SMITHFIELD ENERGY FACILITY	5701	33 HERBERT PLACE	SMITHFIELD	2164
LUCAS HEIGHTS 2 LFG POWER STATION	6345	LITTLE FOREST ROAD	LUCAS HEIGHTS	2234
JACKS GULLY WASTE MANAGEMENT CENTRE	10021	RICHARDSON ROAD	MOUNT ANNAN	2567
EASTERN CREEK WASTE MANAGEMENT CENTRE	10042	WALLGROVE ROAD	EASTERN CREEK	2766
TAHMOOR POWER GENERATION PLANT	11768	REMEMBRANCE DRIVEWAY	TAHMOOR	2573
TERALBA POWER GENERATION PLANT	12088	1 RAILWAY STREET	TERALBA	2284
GLENNIES CREEK WASTE COAL MINE GAS POWER STATION	12614	CNR NOBLES LAND & MIDDLE FALBROOK ROAD	SINGLETON	2330
COGENT ENERGY PTY LTD	12790	101-103 MILLER STREET	NORTH SYDNEY	2060

The emission sources and associated releases to air from generation of electrical power from gas are presented in Table 3-159.

Table 3-159: Generation of electrical power from gas – emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Cooling tower	PM
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Internal combustion engine (landfill gas)	Combustion products
Internal combustion engine (natural gas)	Combustion products
Turbine (natural gas)	Combustion products
Wastewater treatment	VOC
Wheel generated dust (paved roads)	PM

Detailed information on gas fired units included in the inventory is provided in Table 3-160.

3. Data Sources and Results

Table 3-160: Detailed information on gas fired units included in the emissions inventory

Facility EPL	Facility	Combustion Device	Number of units	Unit Capacity (MW)	Fuel type	Plant capacity (MW)
555	TALLAWARRA POWER STATION	Gas turbine	1	260	Natural gas	260
4805	LUCAS HEIGHTS 1 LFG POWER STATION	Internal combustion engine	5	1	Landfill gas	5
5180	BELROSE LFG POWER STATION	Internal combustion engine	1	1	Landfill gas	1
5357	TOWER COAL SEAM METHANE POWER STATION	Internal combustion engine	40	1	Coal seam methane	40
5482	APPIN COAL SEAM METHANE POWER STATION	Internal combustion engine	54	1	Coal seam methane	54
5701	SMITHFIELD ENERGY FACILITY	Gas turbine and duct burners	3	38	Natural gas	114
6345	LUCAS HEIGHTS 2 LFG POWER STATION	Internal combustion engine	15	1	Landfill gas	15
10021	JACKS GULLY WASTE MANAGEMENT CENTRE	Internal combustion engine	1	1	Landfill gas	1
10042	EASTERN CREEK WASTE MANAGEMENT CENTRE	Internal combustion engine	3	1	Landfill gas	3
11768	TAHMOOR POWER GENERATION PLANT	Internal combustion engine	7	1	Natural gas	7
12088	TERALBA POWER GENERATION PLANT	Internal combustion engine	4	1	Natural gas	4
12614	GLENNIES CREEK WASTE COAL MINE GAS POWER STATION	Internal combustion engine	10	1	Coal seam methane	10
12790	COGENT ENERGY PTY LTD	Internal combustion engine	2	1	Natural gas	2

3.29.2 Activity Data

Summary activity data collected from the industrial questionnaires for generation of electrical power from gas is presented in Table 3-161.

Table 3-161: Summary activity data for generation of electrical power from gas

Parameter	Value	Unit
Total amount of electricity generated	3,033	GWh/year
Total installed capacity	656	MW
Amount of natural gas combusted	23,544,962	GJ/year
Amount of coal seam methane combusted	4,400,265	GJ/year
Amount of landfill gas combusted	2,146,090	GJ/year
Total vehicle kilometres travelled	6	km/year
Amount of electricity consumed	97,494	MWh/year

3.29.3 Emission and Speciation Factors

The emission and speciation factors for all substances from generation of electrical power from gas sources are detailed in Table 3-162.

Table 3-162: Emission and speciation factors for all substances from generation of electrical power from gas

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Internal combustion engine (landfill gas)	Site specific emission estimates
	Internal combustion engine (natural gas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
	Turbine (natural gas)	NPI EET Manual for Fossil Fuel Electric Power Generation (DEH, 2005)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Cooling tower	AP42 Chapter 13.4 Wet Cooling Towers (USEPA, 1995)
	Internal combustion engine (landfill gas)	Site specific emission estimates
	Internal combustion engine (natural gas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
	Turbine (natural gas)	NPI EET Manual for Fossil Fuel Electric Power Generation (DEH, 2005)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Internal combustion engine (landfill gas)	SPECIATEv4.2 (Profile ID=1001) (USEPA, 2008e)
	Internal combustion engine (natural gas)	
	Turbine (natural gas)	SPECIATEv4.2 (Profile ID=0007) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (landfill gas)	Site specific emission estimates
	Internal combustion engine (natural gas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
	Turbine (natural gas)	NPI EET Manual for Fossil Fuel Electric Power Generation (DEH, 2005)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Internal combustion engine (landfill gas)	
	Internal combustion engine (natural gas)	
	Turbine (natural gas)	
	Wheel generated dust (paved roads)	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (landfill gas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
	Internal combustion engine (natural gas)	
	Turbine (natural gas)	NPI EET Manual for Fossil Fuel Electric Power Generation (DEH, 2005)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Turbine (natural gas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Internal combustion engine (landfill gas)	
	Internal combustion engine (natural gas)	
	Turbine (natural gas)	

3.29.4 Emission Estimates

Total estimated annual emissions (for selected substances) from generation of electrical power from gas for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-163. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-163: Total estimated annual emissions from generation of electrical power from gas in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	441	41.3	0	19.4	502
BENZENE	1710	152	0	71	1,930
CARBON MONOXIDE	1,640,000	86,000	445,000	40,300	2,220,000
FORMALDEHYDE	20,700	1,120	11,600	523	33,900
ISOMERS OF XYLENE	588	55.1	0	25.8	669
LEAD AND COMPOUNDS	2.38	0	3.09	0	5.46
OXIDES OF NITROGEN	2,080,000	61,600	178,000	47,100	2,360,000
PARTICULATE MATTER ≤ 10 µm	49,300	20.9	35,600	9.8	84,900

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
PARTICULATE MATTER $\leq 2.5 \mu\text{m}$	49,300	20.9	35,600	9.8	84,900
POLYCYCLIC AROMATIC HYDROCARBONS	85.6	7.13	11.9	3.34	108
SULFUR DIOXIDE	14,800	159	2,760	74.7	17,800
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	634	55.1	0	25.8	715
TOTAL SUSPENDED PARTICULATE	49,300	20.9	35,600	9.8	84,900
TOTAL VOLATILE ORGANIC COMPOUNDS	352,000	32,100	11,600	15,000	411,000
TRICHLOROETHYLENE	0	0	0	0	0

3.29.5 Emission Projection Methodology

Projection factors for generation of electrical power from gas have been derived based on primary energy consumption projections for natural gas combustion from electricity generation in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-164 and illustrated in Figure 3-9.

Table 3-164: Projection factors for generation of electrical power from gas

Year	Projection Factor	Year	Projection Factor
2009	1.0528	2023	1.7095
2010	1.1022	2024	1.7554
2011	1.1480	2025	1.8024
2012	1.1929	2026	1.8532
2013	1.2446	2027	1.9087
2014	1.2983	2028	1.9670
2015	1.3464	2029	2.0274
2016	1.3911	2030	2.0681
2017	1.4361	2031	2.1020
2018	1.4825	2032	2.1498
2019	1.5281	2033	2.1975
2020	1.5734	2034	2.2453
2021	1.6191	2035	2.2930
2022	1.6641	2036	2.3408

Source: ABARE (2006)

3. Data Sources and Results

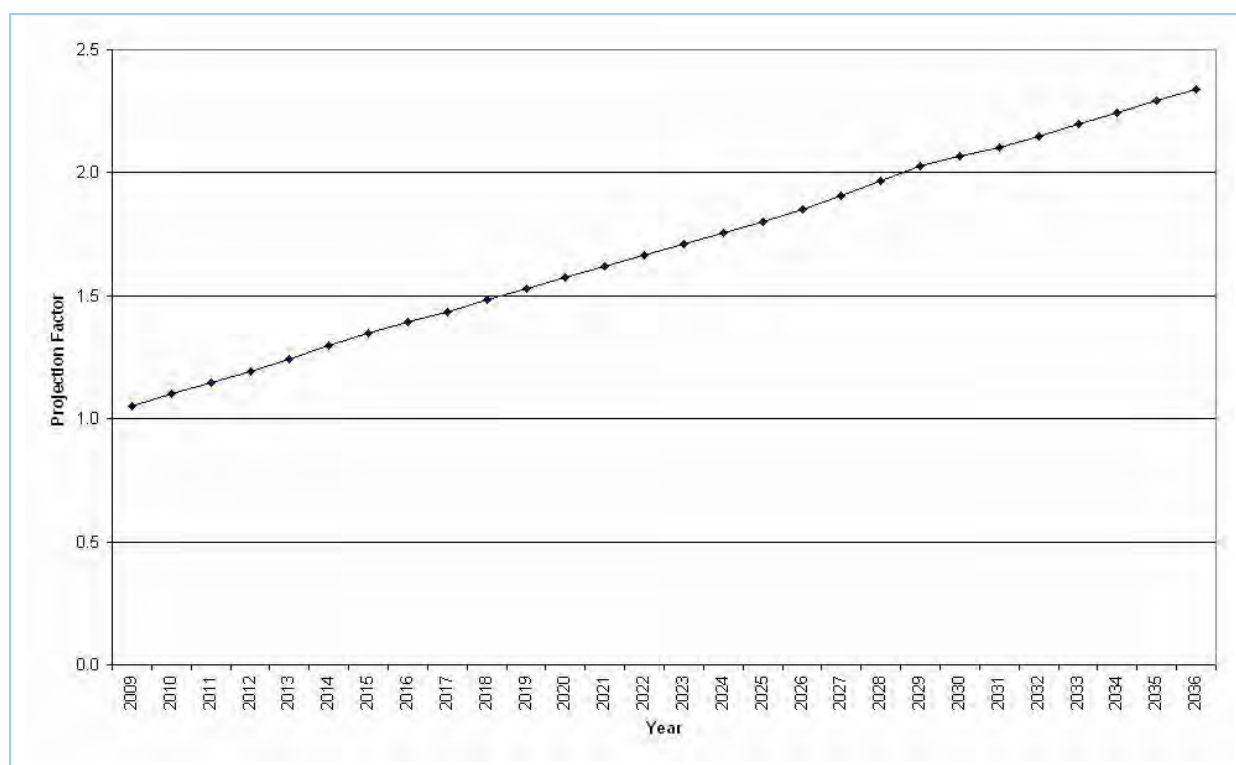


Figure 3-9: Projection factors for generation of electrical power from gas

3.30 Generation of electricity not coal or gas34C

3.30.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-165.

Table 3-165: Generation of electricity not coal or gas facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
GRANGE AVENUE WASTE AND RECYCLING CENTRE	5273	GRANGE AVENUE (WEST)	MARSDEN PARK	2765
EARTHPOWER BIOMASS FACILITY	11797	35 GRAND AVENUE	CAMELLIA	2142
EASTERN CREEK 2 GAS UTILISATION FACILITY	12569	FERRERS ROAD	EASTERN CREEK	2766
CUMMINS POWER STATION	12745	SPINE ROAD	KURRI KURRI	2327

The emission sources and associated releases to air from generation of electrical power from not coal or gas are presented in Table 3-166.

Table 3-166: Generation of electrical power from not coal or gas – emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Composting (mixture of bio-solids and green wastes)	VOC, ammonia
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Internal combustion engine (diesel)	Combustion products
Internal combustion engine (landfill gas/biogas)	Combustion products
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM

Detailed information on units included in the inventory under this scheduled activity is provided in Table 3-167.

Table 3-167: Detailed information on gas fired units included in the emissions inventory

Facility EPL	Facility	Combustion Device	Number of units	Unit Capacity (MW)	Fuel type	Plant capacity (MW)
5273	GRANGE AVENUE WASTE AND RECYCLING CENTRE	Internal combustion engine	1	1.25	Landfill gas	1.25
11797	EARTHPOWER BIOMASS FACILITY	Internal combustion engine and boiler	2	1x3.75 MW (engine) & 1x1.5 MW (boiler)	Biogas	5.25
12569	EASTERN CREEK 2 GAS UTILISATION FACILITY	Internal combustion engine	6	1.1	Landfill gas	6.6
12745	CUMMINS POWER STATION	Internal combustion engine	3	2 x 10.8 MW & 1 x 7.2 MW	Diesel	28.8

3.30.2 Activity Data

Summary activity data collected from the industrial questionnaires for generation of electrical power from not coal or gas is presented in Table 3-168.

Table 3-168: Summary activity data for generation of electrical power from not coal or gas

Parameter	Value	Unit
Total amount of electricity generated	84	GWh/year
Total installed capacity	41.9	MW
Amount of natural gas combusted	5,630	GJ/year
Amount of landfill/biogas combusted	635,037	GJ/year
Amount of diesel combusted	303	kL/year
Total vehicle kilometres travelled	1,460	km/year
Amount of electricity consumed	6,400	MWh/year

3. Data Sources and Results

3.30.3 Emission and Speciation Factors

The emission and speciation factors for all substances from generation of electrical power from not coal or gas sources are detailed in Table 3-169.

Table 3-169: Emission and speciation factors for all substances from generation of electrical power from not coal or gas

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Composting	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Internal combustion engine (landfill gas/biogas)	Site specific emission estimates
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Internal combustion engine (landfill gas/biogas)	Site specific emission estimates
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Composting	Site specific emission test reports
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Internal combustion engine (landfill gas/biogas)	SPECIATEv4.2 (Profile ID=1001) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Internal combustion engine (landfill gas/biogas)	Site specific emission estimates
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Composting	
	Internal combustion engine	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	(diesel)	
	Internal combustion engine (landfill gas/biogas)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Internal combustion engine (landfill gas/biogas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Internal combustion engine (diesel)	
	Internal combustion engine (landfill gas/biogas)	

3.30.4 Emission Estimates

Total estimated annual emissions (for selected substances) from generation of electrical power from not coal or gas for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-170. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-170: Total estimated annual emissions from generation of electrical power from not coal or gas in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	3.17	3.17
ACETALDEHYDE	42.3	0	0	0	42.3
BENZENE	156	0	0	3.57	160
CARBON MONOXIDE	282,000	0	0	424	283,000
FORMALDEHYDE	1,150	0	0	0	1,150
ISOMERS OF XYLENE	62.5	0	0	0.24	62.7
LEAD AND COMPOUNDS	0.02	0	0	0.28	0.3
OXIDES OF NITROGEN	129,000	0	0	797	130,000
PARTICULATE MATTER ≤ 10 µm	1,990	0	0	49.7	2,040
PARTICULATE MATTER ≤ 2.5 µm	1,960	0	0	49.1	2,010
POLYCYCLIC AROMATIC HYDROCARBONS	7.46	0	0	0.84	8.3
SULFUR DIOXIDE	10,900	0	0	25.6	10,900
TETRACHLOROETHYLENE	7.13	0	0	0	7.13
TOLUENE	61	0	0	0.07	61.1
TOTAL SUSPENDED PARTICULATE	2,120	0	0	50.9	2,170
TOTAL VOLATILE ORGANIC COMPOUNDS	34,400	0	0	42.6	34,500
TRICHLOROETHYLENE	1.02	0	0	0	1.02

3. Data Sources and Results

3.30.5 Emission Projection Methodology

Projection factors for generation of electricity from not coal or gas have been derived based on primary energy consumption projections for biomass and biogas combustion from electricity generation in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-171 and illustrated in Figure 3-10.

Table 3-171: Projection factors for generation of electricity from not coal or gas

Year	Projection Factor	Year	Projection Factor
2009	1.0255	2023	1.1718
2010	1.0529	2024	1.1967
2011	1.0713	2025	1.2233
2012	1.0812	2026	1.2510
2013	1.0885	2027	1.2795
2014	1.0926	2028	1.3094
2015	1.0968	2029	1.3409
2016	1.1013	2030	1.3620
2017	1.1064	2031	1.3772
2018	1.1117	2032	1.3976
2019	1.1172	2033	1.4179
2020	1.1219	2034	1.4383
2021	1.1314	2035	1.4587
2022	1.1495	2036	1.4791

Source: ABARE (2006)

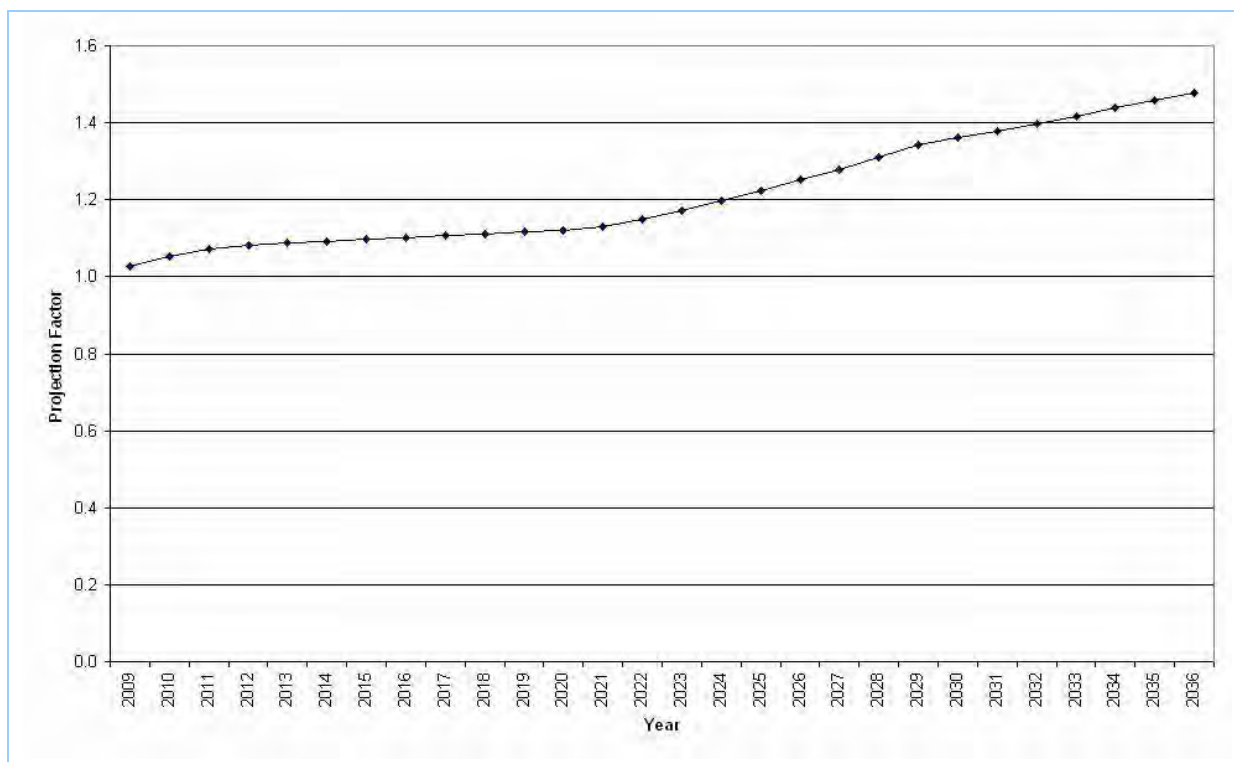


Figure 3-10: Projection factors for generation of electricity from not coal or gas

3.31 Glass Production (Container and Float) 12A, 12B

3.31.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under the category glass production (container) are outlined in Table 3-172.

Table 3-172: Glass production (container) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ACI GLASS PACKAGING	6357	130-172 ANDREW ROAD	PENRITH	2750

Industrial facilities within the GMR that are included in the emissions inventory under the category glass production (float) are outlined in Table 3-173.

Table 3-173: Glass production (float) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
PILKINGTON GLASS ALEXANDRIA	838	8-40 EUSTON ROAD	ALEXANDRIA	2015
CSR VIRIDIAN LIMITED	2692	8 WILLIAMSON ROAD	INGLEBURN	2565

The emission sources and associated releases to air from glass production (container) are presented in Table 3-174.

Table 3-174: Glass production (container) - emission sources

Source	Emissions to Air
Fuel storage (diesel)	VOC
Glass production (melting furnace (container))	Combustion products
Material transfer	PM
Material transfer (coal)	PM
Material transfer (sandstone)	PM
Wheel generated dust (paved roads)	PM

The emission sources and associated releases to air from glass production (float) are presented in Table 3-175.

Table 3-175: Glass production (float) - emission sources

Source	Emissions to Air
Fuel storage (diesel)	VOC
Aggregate transfer to conveyor	PM
Fly ash transfer (cement supplement)	PM
Sand transfer to ground	PM
Process emissions	PM
Glass production (melting furnace (float))	Combustion products
Internal combustion engine (natural gas)	Combustion products
Loaders (overburden)	PM
Wheel generated dust (paved roads)	PM

3. Data Sources and Results

3.31.2 Activity Data

Summary activity data collected from the industrial questionnaires for glass production (container) is presented in Table 3-176.

Table 3-176: Summary activity data for glass production (container and float)

Parameter	Value	Unit
Amount of glass produced	500,491	tonne/year
Amount of natural gas combusted	3,230,293	GJ/year
Total vehicle kilometres travelled	106,923	km/year
Amount of electricity consumed	149,358	MWh/year

3.31.3 Emission and Speciation Factors

The emission and speciation factors for all substances from glass production (container) sources are detailed in Table 3-177.

Table 3-177: Emission and speciation factors for all substances from glass production (container)

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Glass production (melting furnace (container))	AP42 Chapter 11.15 Glass Manufacturing (USEPA, 1986a)
PM _{2.5} , PM ₁₀ & TSP	Glass production (melting furnace (container))	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Material transfer	
	Material transfer (coal)	
	Material transfer (sandstone)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Wheel generated dust (paved roads)		
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Glass production (melting furnace (container))	SPECIATEv4.2 (Profile ID=9011) (USEPA, 2008e)
Speciated particulate matter	Glass production (melting furnace (container))	NPI EET Manual for Glass and Glass Fibre Manufacturing (DEH, 2004a)
	Material transfer (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (sandstone)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	NA	NA
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	Glass production (melting furnace (container))	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Glass production (melting furnace (container))	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3. Data Sources and Results

The emission and speciation factors for all substances from glass production (float) sources are detailed in Table 3-178.

Table 3-178: Emission and speciation factors for all substances from glass production (float)

Substance	Emission Source	Emission Factor Source
CO, NO _x ¹ , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Glass production (melting furnace (float))	AP42 Chapter 11.15 Glass Manufacturing (USEPA, 1986a)
	Internal combustion engine (natural gas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
PM _{2.5} , PM ₁₀ & TSP	Aggregate transfer to conveyor	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Fly ash transfer (cement supplement)	
	Sand transfer to ground	
	Process emissions	Site specific emission estimates
	Glass production (melting furnace (float))	AP42 Chapter 11.15 Glass Manufacturing (USEPA, 1986a)
	Internal combustion engine (natural gas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
	Loaders (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Glass production (melting furnace (float))	SPECIATEv4.2 (Profile ID=9011) (USEPA, 2008e)
	Internal combustion engine (natural gas)	SPECIATEv4.2 (Profile ID=1001) (USEPA, 2008e)
Speciated particulate matter	Glass production (melting furnace (float))	NPI EET Manual for Glass and Glass Fibre Manufacturing (DEH, 2004a)
	Internal combustion engine (natural gas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
	Loaders (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Internal combustion engine (natural gas)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Internal combustion engine (natural gas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
PCDD/PCDF	Glass production (melting furnace (float))	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Glass production (melting furnace (float))	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Internal combustion engine (natural gas)	

3. Data Sources and Results

3.31.4 Emission Estimates

Total estimated annual emissions (for selected substances) from glass production (container) for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-179. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-179: Total estimated annual emissions from glass production (container)

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	1,240	0	0	0	1,240
CARBON MONOXIDE	35,200	0	0	0	35,200
FORMALDEHYDE	691	0	0	0	691
ISOMERS OF XYLENE	0.12	0	0	0	0.12
LEAD AND COMPOUNDS	1,570	0	0	0	1,570
OXIDES OF NITROGEN	1,090,000	0	0	0	1,090,000
PARTICULATE MATTER $\leq 10 \mu\text{m}$	118,000	0	0	0	118,000
PARTICULATE MATTER $\leq 2.5 \mu\text{m}$	114,000	0	0	0	114,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	327,000	0	0	0	327,000
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	337	0	0	0	337
TOTAL SUSPENDED PARTICULATE	125,000	0	0	0	125,000
TOTAL VOLATILE ORGANIC COMPOUNDS	35,200	0	0	0	35,200
TRICHLOROETHYLENE	0	0	0	0	0

Total estimated annual emissions (for selected substances) from glass production (float) for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-180. Total estimated annual emissions of all substances are presented in Appendix A

Table 3-180: Total estimated annual emissions from glass production (float)

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0.58	0	0	0	0.58
BENZENE	175	0	0	0	175
CARBON MONOXIDE	41,000	0	0	0	41,000
FORMALDEHYDE	112	0	0	0	112
ISOMERS OF XYLENE	1	0	0	0	1
LEAD AND COMPOUNDS	292	0	0	0	292
OXIDES OF NITROGEN	225,000	0	0	0	225,000
PARTICULATE MATTER ≤ 10 µm	31,600	0	0	0	31,600
PARTICULATE MATTER ≤ 2.5 µm	27,700	0	0	0	27,700
POLYCYCLIC AROMATIC HYDROCARBONS	0.1	0	0	0	0.1
SULFUR DIOXIDE	223,000	0	0	0	223,000
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	48	0	0	0	48
TOTAL SUSPENDED PARTICULATE	40,800	0	0	0	40,800
TOTAL VOLATILE ORGANIC COMPOUNDS	5,370	0	0	0	5,370
TRICHLOROETHYLENE	0	0	0	0	0

3.31.5 Emission Projection Methodology

Projection factors for glass production (container and float) have been derived based on final energy consumption projections for non-metallic minerals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-49 and illustrated in Figure 3-4.

3.32 Hazardous, industrial or group A waste disposal 75A

3.32.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-181.

Table 3-181: Hazardous, industrial or group A waste disposal facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
GILEAD	12231	588 APPIN RD	APPIN	2560
FERNDALE	12547	415-417 APPIN ROAD	APPIN	2560

The emission sources and associated releases to air from hazardous, industrial or group A waste disposal are presented in Table 3-182.

Table 3-182: Hazardous, industrial or group A waste disposal – emission sources

Source	Emissions to Air
Wheel generated dust (unpaved roads)	PM

3.32.2 Activity Data

Summary activity data collected from the industrial questionnaires for hazardous, industrial or group A waste disposal is presented in Table 3-183.

Table 3-183: Summary activity data for hazardous, industrial or group A waste disposal

Parameter	Value	Unit
Total vehicle kilometres travelled	31,207	km/year
Amount of electricity consumed	0	MWh/year

3.32.3 Emission and Speciation Factors

The emission and speciation factors for all substances from hazardous, industrial or group A waste disposal sources are detailed in Table 3-184.

Table 3-184: Emission and speciation factors for all substances from hazardous, industrial or group A waste disposal

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	NA	NA
PM _{2.5} , PM ₁₀ & TSP	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	NA	NA
Speciated particulate matter	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	NA	NA
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.32.4 Emission Estimates

Total estimated annual emissions (for selected substances) from hazardous, industrial or group A waste disposal for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-185. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-185: Total estimated annual emissions from hazardous, industrial or group A waste disposal

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	0	0
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0	0	0	0	0
LEAD AND COMPOUNDS	9.64	0	0	0	9.64
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	21,100	0	0	0	21,100
PARTICULATE MATTER ≤ 2.5 µm	2,110	0	0	0	2,110
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	0	0	0	0
TOTAL SUSPENDED PARTICULATE	74,200	0	0	0	74,200
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	0	0	0
TRICHLOROETHYLENE	0	0	0	0	0

3.32.5 Emission Projection Methodology

Projection factors for hazardous, industrial or group A waste disposal have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

3.33 Hazardous, Industrial or Group A Waste Generation 73

3.33.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-186.

Table 3-186: Hazardous, industrial or group A waste generation facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
HAZTECH INDUSTRIES	11903	LOT 423 HEATHER STREET	HEATHERBRAE	2324
MRI (AUST) PTY LTD	12612	1-5 BENTLEY STREET	WETHERILL PARK	2164

The emission sources and associated releases to air from hazardous, industrial or group A waste generation are presented in Table 3-187.

3. Data Sources and Results

Table 3-187: Hazardous, industrial or group A waste generation – emission sources

Source	Emissions to Air
Wheel generated dust (unpaved roads)	PM

3.33.2 Activity Data

Summary activity data collected from the industrial questionnaires for hazardous, industrial or group A waste generation is presented in Table 3-188.

Table 3-188: Summary activity data for hazardous, industrial or group A waste generation

Parameter	Value	Unit
Total vehicle kilometres travelled	6,265	km/year
Amount of electricity consumed	137	MWh/year

3.33.3 Emission and Speciation Factors

The emission and speciation factors for all substances from hazardous, industrial or group A waste generation sources are detailed in Table 3-189.

Table 3-189: Emission and speciation factors for all substances from hazardous, industrial or group A waste generation

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	NA	NA
PM _{2.5} , PM ₁₀ & TSP	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	NA	NA
Speciated particulate matter	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	NA	NA
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.33.4 Emission Estimates

Total estimated annual emissions (for selected substances) from hazardous, industrial or group A waste generation for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-190. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-190: Total estimated annual emissions from hazardous, industrial or group A waste generation

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	0	0
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0	0	0	0	0
LEAD AND COMPOUNDS	0	0	0	0	0
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	0.56	1.06	0	0	1.61
PARTICULATE MATTER ≤ 2.5 µm	0.14	0.26	0	0	0.39
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	0	0	0	0
TOTAL SUSPENDED PARTICULATE	2.91	5.5	0	0	8.4
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	0	0	0
TRICHLOROETHYLENE	0	0	0	0	0

3.33.5 Emission Projection Methodology

Projection factors for hazardous, industrial or group A waste generation have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

3.34 Helicopter-related Activity 4

3.34.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-191.

Table 3-191: Helicopter-related activity facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
CHANNEL SEVEN SYDNEY	2915	MOBBS LANE	EPPING	2121
TCN CHANNEL NINE PTY LIMITED	2989	24 ARTARMON ROAD	WILLOUGHBY	2068
GRANVILLE HELIPORT	3906	25 WENTWORTH STREET	GRANVILLE	2142
NEWCASTLE PORT CORPORATION	10772	LOT 30 DP 871235 - DYKE POINT	CARRINGTON	2294
NEWCASTLE REGIONAL HELIPORT	12192	10 LAURIO PLACE	MAYFIELD WEST	2304
CAPERTEE HELIPORT	12830	4675 CASTLEREAGH	CAPERTEE	2846

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
		HIGHWAY		
TOUCHDOWN HELICOPTERS PTY LTD	12936	HANGAR 1 - 32 AIRPORT ROAD	ALBION PARK RAIL	2527

The emission sources and associated releases to air from helicopter-related activity are presented in Table 3-192.

Table 3-192: Helicopter-related activity - emission sources

Source	Emissions to Air
Fuel storage (AVTUR)	VOC

3.34.2 Activity Data

Summary activity data collected from the industrial questionnaires for helicopter-related activity is presented in Table 3-193.

Table 3-193: Summary activity data for helicopter-related activity

Parameter	Value	Unit
Amount of electricity consumed	88.3	MWh/year

3.34.3 Emission and Speciation Factors

The emission and speciation factors for all substances from helicopter-related activity sources are detailed in Table 3-194.

Table 3-194: Emission and speciation factors for all substances from helicopter-related activity

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (AVTUR)	TANKS 4.09D software (USEPA, 2006e)
PM _{2.5} , PM ₁₀ & TSP	NA	NA
Speciated organics (including methane)	Fuel storage (AVTUR)	CEIDARS Organic Profile Jet fuel evaporation (jet a) (CARB, 2005)
Speciated particulate matter	NA	NA
Ammonia	NA	NA
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.34.4 Emission Estimates

Total estimated annual emissions (for selected substances) from helicopter-related activity for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-195. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-195: Total estimated annual emissions from helicopter-related activity

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	0	0
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0	0	0	0	0
LEAD AND COMPOUNDS	0	0	0	0	0
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	0	0	0	0	0
PARTICULATE MATTER ≤ 2.5 µm	0	0	0	0	0
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	0	0	0	0
TOTAL SUSPENDED PARTICULATE	0	0	0	0	0
TOTAL VOLATILE ORGANIC COMPOUNDS	2.33	0.78	0	0.13	3.24
TRICHLOROETHYLENE	0	0	0	0	0

3.34.5 Emission Projection Methodology

Projection factors for helicopter-related activity have been derived based on primary energy consumption projections for domestic air transport in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-196 and illustrated in Figure 3-11.

Table 3-196: Projection factors for domestic air transport related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0424	2023	1.6152
2010	1.0831	2024	1.6612
2011	1.1224	2025	1.7075
2012	1.1604	2026	1.7543
2013	1.1987	2027	1.8022
2014	1.2374	2028	1.8514
2015	1.2764	2029	1.9018
2016	1.3157	2030	1.9326
2017	1.3558	2031	1.9589
2018	1.3966	2032	2.0008
2019	1.4384	2033	2.0428

3. Data Sources and Results

Year	Projection Factor	Year	Projection Factor
2020	1.4814	2034	2.0848
2021	1.5252	2035	2.1267
2022	1.5698	2036	2.1687

Source: ABARE (2006)

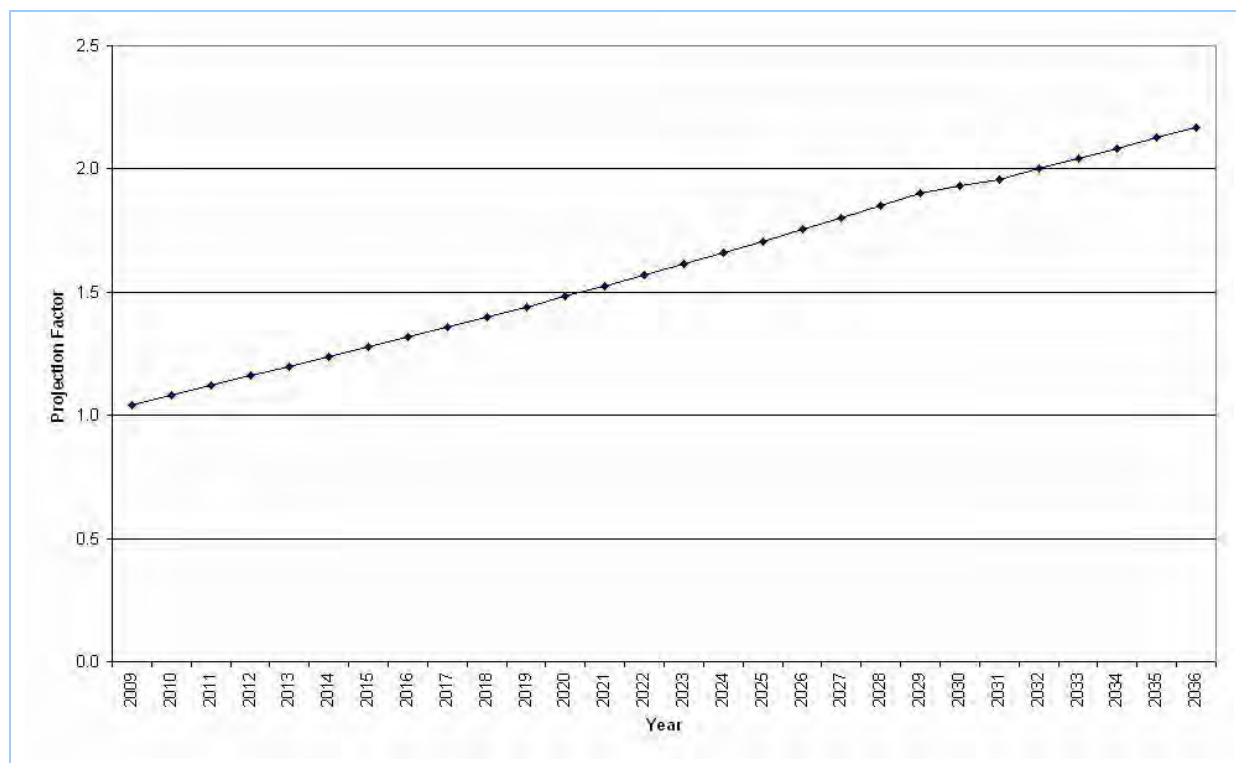


Figure 3-11: Projection factors for domestic air transport related sources

3.35 Inert waste landfilling 77

3.35.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-197.

Table 3-197: Inert waste landfilling facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
NEWLINE ROAD LANDFILL	7628	330 NEWLINE ROAD	RAYMOND TERRACE	2324
KOORAGANG ISLAND WASTE FACILITY	7675	CORMORANT ROAD	KOORAGANG	2304
BORAL PROSPECT QUARRY	11769	CLUNIES ROSS STREET	PROSPECT	2148

The emission sources and associated releases to air from inert waste landfilling are presented in Table 3-198.

3. Data Sources and Results

Table 3-198: Inert waste landfilling - emission sources

Source	Emissions to Air
Exposed area (wind erosion)	PM
Landfill (digestion)	Ammonia, CO ₂ , CO, H ₂ S, mercury, VOC
Primary crushing (M < 4%)	PM
Screening	PM
Trucks (dumping overburden)	PM
Wheel generated dust (unpaved roads)	PM

3.35.2 Activity Data

Summary activity data collected from the industrial questionnaires for inert waste landfilling is presented in Table 3-199.

Table 3-199: Summary activity data for inert waste landfilling

Parameter	Value	Unit
Total vehicle kilometres travelled	1,200	km/year
Amount of electricity consumed	0	MWh/year

3.35.3 Emission and Speciation Factors

The emission and speciation factors for all substances from inert waste landfilling sources are detailed in Table 3-200.

Table 3-200: Emission and speciation factors for all substances from inert waste landfilling

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (DEWHA, 2010).
PM _{2.5} , PM ₁₀ & TSP	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Primary crushing (M < 4%)	
	Screening	
	Trucks (dumping overburden)	
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (DEWHA, 2010).
Speciated particulate matter	Exposed area (wind erosion)	Appendix B, NPI EET Manual for Mining (EA, 2003b)
	Primary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Screening	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock screening (CARB, 2007)
	Trucks (dumping overburden)	Appendix B, NPI EET Manual for Mining (EA, 2003b)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (DEWHA,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		2010).
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (DEWHA, 2010).

3.35.4 Emission Estimates

Total estimated annual emissions (for selected substances) from inert waste landfilling for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-201. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-201: Total estimated annual emissions from inert waste landfilling

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	291	291
CARBON MONOXIDE	0	0	0	1,610	1,610
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0	0	0	436	436
LEAD AND COMPOUNDS	0	1.81	0	0.74	2.55
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	0	26,400	0	9,150	35,500
PARTICULATE MATTER ≤ 2.5 µm	0	5,270	0	1,800	7,070
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	145	145
TOLUENE	0	0	0	5,090	5,090
TOTAL SUSPENDED PARTICULATE	0	52,800	0	19,000	71,800
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	0	18,300	18,300
TRICHLOROETHYLENE	0	0	0	0	0

3.35.5 Emission Projection Methodology

Projection factors for inert waste landfilling have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.36 Land-based Extractive Activity 36

3.36.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-202.

Table 3-202: Land-based extractive activity facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
BORAL DUNMORE QUARRY	77	PRINCES HIGHWAY	DUNMORE	2529
RAILCORP QUARRY	79	PANAMA STREET	BOMBO	2533
READYMIX ALBION PARK QUARRY	122	WOOLLYBUTT DRIVE	ALBION PARK RAIL	2527
BORAL BOMBO QUARRY	313	PANAMA STREET	BOMBO	2533
METROMIX QUARRIES	536	RHONDDA ROAD	TERALBA	2284
ALLANDALE QUARRY	544	ALLANDALE ROAD	MAITLAND	2320
EXETER QUARRY	870	ROCKLEIGH ROAD	EXETER	2579
D & J QUARRIES	1246	LOT 1 PACIFIC HIGHWAY	FRAZER PARK	2259
MARTINS CREEK QUARRY	1378	DOUGLAS STREET	MARTINS CREEK	2420
METROMIX QUARRIES	1464	138 OAKEY FOREST ROAD	MARRANGAROO	2790
HANSON CONSTRUCTION MATERIALS PTY LTD	1879	OFF SEAHAM ROAD	SEAHAM	2324
BORAL PEATS RIDGE QUARRY	2068	BUSHELLS ROAD	PEATS RIDGE	2250
HANSON CONSTRUCTION MATERIALS PTY LTD	2147	61 GEORGE DOWNES DRIVE	KULNURA	2250
HANSON CONSTRUCTION MATERIALS PTY LTD	2193	BOOLLWARROO PARADE	SHELLHARBOUR	2529
KINCUMBER QUARRY	2807	45 KERNS RD	KINCUMBER	2251
KURRAJONG QUARRY	2892	BULLRIDGE ROAD	EAST KURRAJONG	2758
WUNDERLICH LONDONDERRY CLAY PIT	3058	WILSHIRE ROAD	LONDONDERRY	2753
MITTAGONG SANDS	3132	WOMBEGAN CAVES ROAD	MITTAGONG	2575
ROCLA PTY LIMITED	3218	LOT 23 SANDHAM ROAD	NEWNES	2790
ETRA PTY LTD	3407	WISEMANS FERRY ROAD	MARROTA	2756
HANSON CONSTRUCTION MATERIALS PTY LTD	3751	RESERVOIR ROAD	SOMERSBY	2250
HORNSBY SITES	3829	OLD NORTHERN ROAD	MARROTA	2756
SEAHAM QUARRY	3956	ITALIA ROAD	SEAHAM	2324
MENANGLE SAND & SOIL PTY LTD	3991	MENANGLE ROAD	MENANGLE	2568
THE AUSTRAL BRICK CO PTY LTD	4249	BUNNYGALORE ROAD	BOWRAL	2576
WARRINGAH GRAVEL & STONE SUPPLIES	4504	END OF CHALLENGER DRIVE	BELROSE	2085
BENEDICT RECLAMATIONS	4612	146 NEWBRIDGE ROAD	MOOREBANK	2170
DIXON SAND AGNES BANKS OPERATION	4939	2 CASTLEREAGH ROAD	CASTLEREAGH	2749
BLACKHILL QUARRY	4978	BLACKHILL ROAD	BLACK HILL	2322

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
HANSON CONSTRUCTION MATERIALS PTY LTD	5073	OFF WALLGROVE ROAD	EASTERN CREEK	2766
STOCKRINGTON QUARRY	5108	DOGHOLE ROAD	STOCKRINGTON	2322
BRANDOWN PTY LIMITED	5186	LOT 90 ELIZABETH DRIVE	KEMPS CREEK	2178
SPEERS POINT QUARRY	5225	HOPKINS STREET	SPEERS POINT	2284
DARACON QUARRIES	5517	DIEMARS ROAD	SALAMANDER BAY	2317
SOMERSBY SANDS	5635	RMB 3260 WISEMANS FERRY ROAD	SOMERSBY	2250
BESMAW PTY LIMITED	5658	280-282 CAPTAIN COOK DRIVE	KURNELL	2231
HB MAROOTA PTY LTD	6535	CNR ROBERTS & OLD NORTHERN ROADS	MAROOTA	2756
HEBDEN QUARRY	7390	LOT 5 HEBDEN ROAD	HEBDEN	2330
ROCLA QUARRY PRODUCTS	7485	251 PACIFIC HIGHWAY	RAYMOND TERRACE	2324
WHITE LODGE / SPRINGS ROAD	7630	RICHARDSON ROAD	NARELLAN	2567
STOCKTON SAND QUARRY	10132	18-20 COX'S LANE	FULLERTON COVE	2318
THE MAROOTA MINING TRUST	10357	LOT 2 OLD TELEGRAPH ROAD	MAROOTA	2756
GRANTS ROAD SAND	11240	270 GRANTS ROAD	SOMERSBY	2250
CALGA QUARRY	11295	RMB 1215 PEATS RIDGE ROAD	CALGA	2250
HUNTER QUARRIES PTY LIMITED	11569	LOT 21 & LOT 1 - PACIFIC HIGHWAY	KARUAH	2324
TANILBA NORTHERN DUNE	11633	OFF OYSTER COVE ROAD	OYSTER COVE	2318
ORCHARD HOLDINGS (NSW) PTY LTD	11706	123-179 PATONS LANE	ORCHARD HILLS	2748
UNIMIN AUSTRALIA PTY LTD - ANNA BAY	11710	NELSON BAY ROAD	BOBS FARM	2316
ROSEBROOK SAND & GRAVEL	11933	88 CAMPBELLS ROAD	MAITLAND VALE	2320
CATTAI SANDSTONE QUARRY	12023	WISEMANS FERRY ROAD	CATTAI	2756
CAWSEY PARK	12116	DENMAN ROAD	DENMAN	2328
WILD QUARRY	12301	GRASSTREE RIDGE ROAD - 1440 NEW ENGLAND HIGHWAY	MUSWELLBROOK	2333
WILLOWDELL QUARRY	12308	LOT 1 DENMAN ROAD	DENMAN	2328
AUS-10 QUARRY	12323	391 JENOLAN CAVES ROAD	HARTLEY	2790
MANGROVE MOUNTAIN QUARRY	12419	189 WISEMANS FERRY ROAD	CENTRAL MANGROVE	2250
GOSFORTH QUARRIES PTY LTD	12510	442 ANAMBAH ROAD	GOSFORTH	2320
DIXON SAND (PENRITH) PTY LIMITED	12513	HAERSES RD & INTERSECTION OF WISEMANS FERRY ROAD	MAROOTA	2756
ROSALIND PARK QUARRY	12577	MEDHURST ROAD	MENANGLE PARK	2563

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
DALWINSTON QUARRIES	12709	DALWINSTON ROAD	DENMAN	2328
MOUNT HUNTER QUARRY	12998	440 BURRAGORANG ROAD	GLENMORE	2570

The emission sources and associated releases to air from land-based extractive activity are presented in Table 3-203.

Table 3-203: Land-based extractive activity - emission sources

Source	Emissions to Air
Aggregate transfer to conveyor	PM
Aggregate transfer to ground	PM
Blasting	PM
Bulldozers (overburden)	PM
Bulldozers (sandstone)	PM
Cement unloading	PM
Conveyor transfer of aggregate to elevated storage	PM
Conveyor transfer of sand to elevated storage	PM
Drilling	PM
Explosives (ANFO)	CO, NO _x , SO ₂
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Fuel storage (petrol)	VOC
Graders	PM
Internal combustion engine (diesel, P<450kW)	Combustion products
Loaders (overburden)	PM
Material transfer (overburden)	PM
Material transfer (sandstone)	PM
Mixer loading (central mix)	PM
Primary crushing (M < 4%)	PM
Primary crushing (M > 4%)	PM
Sand transfer to conveyor	PM
Sand transfer to ground	PM
Screening	PM
Secondary crushing (M < 4%)	PM
Secondary crushing (M > 4%)	PM
Surface coating (degreaser)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (thinner)	VOC
Tertiary crushing (M < 4%)	PM
Trucks (dumping overburden)	PM
Trucks (dumping sandstone)	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM
Wind erosion (sandstone)	PM

3. Data Sources and Results

3.36.2 Activity Data

Summary activity data collected from the industrial questionnaires for land-based extractive activity is presented in Table 3-204.

Table 3-204: Summary activity data for land-based extractive activity

Parameter	Value	Unit
Total aggregated (gravel, sand road-base) produced	19,650,743	tonne/year
Total diesel combusted ^a	705	kL/year
Total vehicle kilometres travelled	2,338,602	km/year
Amount of electricity consumed	28,761	MWh/year

^a Includes fuel combusted in stationary equipment only

3.36.3 Emission and Speciation Factors

The emission and speciation factors for all substances from land-based extractive activity are detailed in Table 3-205.

Table 3-205: Emission and speciation factors for all substances from land-based extractive activity

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Explosives (ANFO)	AP42 Chapter 13.3 Explosives Detonation (ANFO), (USEPA, 1980)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Fuel storage (petrol)	
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Surface coating (degreaser)	Mass balance
	Surface coating (paint - solvent based)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (thinner)	
PM _{2.5} , PM ₁₀ & TSP	Aggregate transfer to conveyor	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Aggregate transfer to ground	
	Blasting	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Bulldozers (overburden)	
	Bulldozers (sandstone)	
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Conveyor transfer of aggregate to elevated storage	
	Conveyor transfer of sand to elevated storage	
	Drilling	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	
	Graders	
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Loaders (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (overburden)	
	Material transfer (sandstone)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Mixer loading (central mix)	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Primary crushing (M < 4%)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Primary crushing (M > 4%)	
	Sand transfer to conveyor	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Sand transfer to ground	
	Screening	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Secondary crushing (M < 4%)	
	Tertiary crushing (M < 4%)	
	Trucks (dumping overburden)	
	Trucks (dumping sandstone)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wind erosion (sandstone)	
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Internal combustion engine (diesel, P<450kW)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
Speciated particulate matter	Blasting	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Bulldozers (overburden)	
	Bulldozers (sandstone)	
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Drilling	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	
	Graders	
	Internal combustion engine (diesel, P<450kW)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Loaders (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (overburden)	
	Material transfer (sandstone)	
	Mixer loading (central mix)	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Primary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Primary crushing (M > 4%)	
	Screening	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock screening (CARB, 2007)
	Secondary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Tertiary crushing (M < 4%)	
	Trucks (dumping overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping sandstone)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wind erosion (sandstone)	
Ammonia	Internal combustion engine (diesel, P<450kW)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	Internal combustion engine (diesel, P<450kW)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Internal combustion engine (diesel, P<450kW)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.36.4 Emission Estimates

Total estimated annual emissions (for selected substances) from land-based extractive activity for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-206. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-206: Total estimated annual emissions from land-based extractive activity

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	296	296
ACETALDEHYDE	0	0	0	0	0
BENZENE	3.02	0	0	356	359
CARBON MONOXIDE	0	0	0	16,700	16,700
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	24.1	0.21	0	92.2	117
LEAD AND COMPOUNDS	49	40.9	0	611	701
OXIDES OF NITROGEN	0	0	0	52,500	52,500
PARTICULATE MATTER ≤ 10 µm	294,000	207,000	0	2300000	2,800,000
PARTICULATE MATTER ≤ 2.5 µm	61,200	44,600	0	463,000	569,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	1.95	1.95
SULFUR DIOXIDE	0	0	0	227	227
TETRACHLOROETHYLENE	22.4	0	0	165	187
TOLUENE	76.4	0.07	0	202	278
TOTAL SUSPENDED PARTICULATE	982,000	715,000	0	8,570,000	10,300,000
TOTAL VOLATILE ORGANIC COMPOUNDS	453	2.37	0	6,100	6,550
TRICHLOROETHYLENE	63.8	0	0	469	533

3.36.5 Emission Projection Methodology

Projection factors for land-based extractive activity have been derived based on final energy consumption projections for mining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-75 and illustrated in Figure 3-5.

3.37 Metal Plating or Coating 61

3.37.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-207.

Table 3-207: Metal plating or coating facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
GALVANISING SERVICES PTY LTD	142	135 ROOKWOOD ROAD	YAGOONA	2199
MONROE SPRINGS (AUSTRALIA) PTY LTD	155	52 O'RIORDAN STREET	ALEXANDRIA	2015
CRM WORKS	397	OLD PORT ROAD	PORT KEMBLA	2505
INDUSTRIAL GALVANIZERS (NEWCASTLE)	505	312 PACIFIC HIGHWAY	HEXHAM	2322
GOYEN CONTROLS COMPANY PTY LTD	511	268 MILPERRA ROAD	MILPERRA	2214
AUSTRALIAN & NEW ZEALAND MANUFACTURING BUSINESS - SPRINGHILL WORKS	571	SPRINGHILL ROAD	PORT KEMBLA	2505
PRYSMIAN POWER CABLES & SYSTEMS AUSTRALIA PTY LIMITED	818	1 HEATHCOTE ROAD	LIVERPOOL	2170
DEXION	974	23 TATTERSALL ROAD	KINGS PARK	2148
INDUSTRIAL GALVANIZERS	1165	LOT 2 SHELLHARBOUR ROAD	PORT KEMBLA	2505
INDUSTRIAL GALVANIZERS CORPORATION PTY LTD	1895	22 AMAX AVE	GIRRAWEE	2145
PIRELLI TELECOM CABLES & SYSTEMS AUSTRALIA PTY LIMITED	2972	1 THEW PARADE	DEE WHY	2099
ELITE PLATING PTY LTD	6356	113 WOODPARK ROAD	SMITHFIELD	2164
CCA HARDCHROME	6656	36 TATTERSALL ROAD	BLACKTOWN	2148
GENERAL ENGRAVING PTY LTD	6688	1-7 ROSE CRESCENT	REGENTS PARK	2143
SMC PNEUMATICS (AUSTRALIA) PTY LTD	6701	18 HUDSON AVENUE	CASTLE HILL	2154
SWIFT ELECTROPLATERS NSW PTY LIMITED	6741	53 VORE STREET	SILVERWATER	2141
VERTIKOTE CORP. LIMITED	6870	85 GOVERNOR MACQUARIE DRIVE	CHIPPING NORTON	2170
RHEEM AUSTRALIA PTY LIMITED	6990	55 BRODIE STREET	RYDALMERE	2116
MACKIES MANUFACTURING	6994	112-116 CANTERBURY	BANKSTOWN	2200

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
PTY LIMITED		ROAD		
HUNTER DOUGLAS LIMITED	7022	322 & 338 VICTORIA ROAD	RYDALMERE	2116
WESTWOOD WINTER PLATING PTY LTD	7025	128 CARNARVON STREET	SILVERWATER	2128
GALVATECH PTY LTD	7029	49 GOW STREET	PADSTOW	2211
S E C PLATING PTY LTD	7059	105 LAKEMBA STREET	BELMORE	2192
ADEPT HARDCHROME (AUSTRALIA) PTY LTD	7084	30 WHITAKER ST	YENNORA	2161
PERFECTION PLATE HOLDINGS PTY LTD	7116	19 SKINNER AVE	RIVERWOOD	2210
TASMAN AVIATION ENTERPRISES (RICHMOND) PTY LTD	7627	RAAF BASE	RICHMOND	2755
ENWARE CHROME FACTORY	7700	64-66 WOODFIELD BLVD	CARINGBAH	2229
BREDERO SHAW	10776	66 WEST DAPTO ROAD	KEMBLA GRANGE	2526
UNIVERSAL ANODISERS	11201	207-211 NEWTON ROAD	WETHERILL PARK	2164
DUX MANUFACTURING LIMITED	11481	COLLINS ROAD	MOSS VALE	2577
ASTOR METAL FINISHES	11533	93 - 95 MALTA STREET	VILLAWOOD	2163
APC SOCOTHERM PTY LTD	11894	LOT 562 REDDALLS ROAD	KEMBLA GRANGE	2526
SYDNEY GALVANISING SERVICES	11945	2/12 ASH ROAD	PRESTONS	2170
HUNTER GALVANIZING	12014	13 OLD PUNT ROAD	TOMAGO	2322
ALUMINIUM SPECIALTIES GROUP PTY LIMITED	12454	3 ALSPEC PLACE	HORSLEY PARK	2175
WESTERN SYDNEY SERVICE CENTRE	12495	TEMPLAR ROAD	ERSKINE PARK	2759
COIL COATERS PTY LTD	12522	3A CONTAPLAS	ARNDELL PARK	2148
INGAL CIVIL PRODUCTS	12593	57-65 AIRDS ROAD	MINTO	2566

The emission sources and associated releases to air from metal plating or coating are presented in Table 3-208.

Table 3-208: Metal plating or coating – emission sources

Source	Emissions to Air
Abrasive blasting	PM
Acid emissions	Hydrochloric acid, nitric acid, phosphoric acid, sulfuric acid
Aggregate transfer to ground	PM
Boiler (diesel)	Combustion products
Boiler (LPG)	Combustion products
Boiler (natural gas)	Combustion products
Cement unloading	PM
Chromic acid anodising	PM, chromium VI
Electroplating (cadmium cyanide)	PM, cadmium, cyanide
Electroplating (copper cyanide)	PM, cyanide
Electroplating (copper sulphate)	PM, copper
Electroplating (hard chromium)	PM, chromium

3. Data Sources and Results

Source	Emissions to Air
Electroplating (nickel)	PM, nickel
Electroplating (zinc)	PM, zinc
Fuel storage (diesel)	VOC
Fugitive process emissions	VOC
Galvanising	PM, zinc
Internal combustion engine (diesel)	Combustion products
Metal cutting (mild steel, 8 mm)	NO _x , magnesium oxide fume
Organic liquid storage (primer)	VOC
Organic liquid storage (trichloroethylene)	VOC
Process emissions	Combustion products, PM, VOC, NaOH, PAH
Rubber product manufacturing (calendaring)	VOC
Rubber product manufacturing (extrusion)	VOC, PM
Rubber product manufacturing (milling)	VOC
Rubber product manufacturing (mixing)	VOC, PM
Sand transfer to ground	PM
Surface coating (adhesive)	VOC
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Surface coating (lacquer)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (paint - water based)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Wastewater treatment	VOC, ammonia
Welding	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Zinc production (casting)	PM
Zinc production (electric induction furnace, fugitive)	PM
Zinc production (kettle pot melting furnace, fugitive)	PM
Zinc production (kettle pot melting furnace, point)	NO _x , PM, PCCD/F, SO ₂

3.37.2 Activity Data

Summary activity data collected from the industrial questionnaires for metal plating or coating is presented in Table 3-209.

Table 3-209: Summary activity data for metal plating or coating

Parameter	Value	Unit
Amount of metal products produced (galvanised steel, automotive springs, water heaters, beams, uprights etc)	1,597,832	tonne/year
Amount of natural gas combusted	1,747,015	GJ/year
Total vehicle kilometres travelled	1,925,059	km/year
Amount of diesel combusted	1.5	kL/year
Amount of electricity consumed	252,925	MWh/year

3. Data Sources and Results

3.37.3 Emission and Speciation Factors

The emission and speciation factors for all substances from metal plating or coating are detailed in Table 3-210.

Table 3-210: Emission and speciation factors for all substances from metal plating or coating

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fugitive process emissions	Site specific emission estimates
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Metal cutting (mild steel, 8 mm)	NPI EET Manual for Structural & Fabricated Metal Product Manufacture (EA, 1999g)
	Organic liquid storage (primer)	TANKS 4.09D software (USEPA, 2006e)
	Organic liquid storage (trichloroethylene)	
	Process emissions	Site specific emission estimates
	Rubber product manufacturing (calendaring)	NPI EET Manual for Rubber Product Manufacture v1.1 (EA, 2002b)
	Rubber product manufacturing (extrusion)	
	Rubber product manufacturing (milling)	
	Rubber product manufacturing (mixing)	
	Surface coating (adhesive)	NPI EET Manual for Aggregated Emissions from Motor Vehicle Refinishing (EA, 1999a)
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	Table 26, VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (lacquer)	
	Surface coating (paint - solvent based)	
	Surface coating (paint - water based)	
	Surface coating (primer)	
	Surface coating (thinner)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
Zinc production (kettle pot melting furnace, fugitive)	NPI EET Manual for Non-Ferrous Foundries, v1.0 (EA, 1999f)	
Zinc production (kettle pot melting furnace, point)		
PM _{2.5} , PM ₁₀ & TSP	Abrasive blasting	NPI EET Manual for Surface Coating (EA, 1999h) and CEIDARS PM Size Speciation Profile for Steel Abrasive Blasting (CARB, 2005)
	Aggregate transfer to ground	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source	
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)	
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)	
	Chromic acid anodising	AP42 Chapter 12.20 Electroplating (USEPA, 1996c)	
	Electroplating (cadmium cyanide)		
	Electroplating (copper cyanide)		
	Electroplating (copper sulphate)		
	Electroplating (hard chromium)		
	Electroplating (nickel)		
	Electroplating (zinc)		
	Galvanising		NPI EET Manual for Galvanising v1.1 (EA, 2001a)
	Internal combustion engine (diesel)		AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Process emissions	Site specific emission estimates	
	Rubber product manufacturing (extrusion)	NPI EET Manual for Rubber Product Manufacture v1.1 (EA, 2002b)	
	Rubber product manufacturing (mixing)		
	Sand transfer to ground	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)	
	Welding	NPI EET Manual for Fugitive Emissions (assuming manual metal arc welding and electrode type 14Mn-4Cr) (EA, 1999d)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)	
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)	
	Zinc production (casting)	NPI EET Manual for Non-Ferrous Foundries, v1.0 (EA, 1999f)	
	Zinc production (electric induction furnace, fugitive)		
	Zinc production (kettle pot melting furnace, fugitive)		
	Zinc production (kettle pot melting furnace, point)		
Speciated organics (including methane)	Boiler (diesel)	SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)	
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)	
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)	
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)	
	Fugitive process emissions	Site specific emission profiles	
	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)	
	Organic liquid storage (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)	
	Organic liquid storage (trichloroethylene)	Mass balance (100% trichloroethylene)	
	Process emissions	Site specific emission profiles	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Rubber product manufacturing (calendaring)	SPECIATEv4.2 (Profile ID=9014) (USEPA, 2008e)
	Rubber product manufacturing (extrusion)	
	Rubber product manufacturing (milling)	
	Rubber product manufacturing (mixing)	
	Surface coating (adhesive)	SPECIATE 4.2 (Profile ID 1020) (USEPA, 2008e)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (lacquer)	SPECIATEv4.2 (Profile ID=1017) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (paint - water based)	SPECIATE 4.2 (Profile ID 1013) (USEPA, 2008e)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Abrasive blasting	NPI EET Manual for Surface Coating (assuming GMA garnet is used) (EA, 1999h)
	Boiler (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Chromic acid anodising	AP42 Chapter 12.20 Electroplating (USEPA, 1996c)
	Electroplating (cadmium cyanide)	
	Electroplating (copper cyanide)	
	Electroplating (copper sulfate)	
	Electroplating (hard chromium)	
	Electroplating (nickel)	
	Electroplating (zinc)	
	Galvanising	NPI EET Manual for Galvanising v1.1 (EA, 2001a)
	Internal combustion engine (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Process emissions	Site specific emission estimates
	Rubber product manufacturing (extrusion)	NPI EET Manual for Rubber Product Manufacture v1.1 (EA, 2002b)
	Rubber product manufacturing (mixing)	
Welding	NPI EET Manual for Fugitive Emissions (assuming manual metal arc welding and electrode type 14Mn-4Cr) (EA, 1999d)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (diesel)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (LPG)	
	Boiler (natural gas)	
	Internal combustion engine (diesel)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	Acid emissions	Raoult's law (Raoult, M, 1882a; 1882b, 1887a; 1887b), using chemical properties from Perry and Green (1997)
	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Process emissions	Site specific emission estimates
PAH	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fugitive process emissions	Site specific emission estimates
	Process emissions	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	Boiler (diesel)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (LPG)	
	Boiler (natural gas)	
	Zinc production (kettle pot melting furnace, point)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (diesel)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (LPG)	
	Boiler (natural gas)	
	Internal combustion engine (diesel)	

3.37.4 Emission Estimates

Total estimated annual emissions (for selected substances) from land-based extractive activity for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-211. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-211: Total estimated annual emissions from metal plating or coating

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	540	0	0	0	540
ACETALDEHYDE	0.01	0	0	0	0.01
BENZENE	226	34.3	2190	88.8	2540
CARBON MONOXIDE	20,700	5,760	1,050,000	2.96	1,080,000

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
FORMALDEHYDE	247	68.5	2,690	0.1	3,000
ISOMERS OF XYLENE	12,100	154	1,830	53,500	67,600
LEAD AND COMPOUNDS	2.95	2.11	52.1	0.03	57.2
OXIDES OF NITROGEN	27,500	7,040	58,600	3.52	93,100
PARTICULATE MATTER ≤ 10 µm	28,000	5,500	18,500	210	52,200
PARTICULATE MATTER ≤ 2.5 µm	27,100	2,970	10,600	43.2	40,800
POLYCYCLIC AROMATIC HYDROCARBONS	0.17	0.05	3,770	0	3,770
SULFUR DIOXIDE	134	35.8	24,200	0.02	24,300
TETRACHLOROETHYLENE	69.5	0	457	0.44	527
TOLUENE	21,000	526	11,600	37,500	70,600
TOTAL SUSPENDED PARTICULATE	37,100	18,900	43,700	431	100,000
TOTAL VOLATILE ORGANIC COMPOUNDS	111,000	1,820	132,000	222,000	467,000
TRICHLOROETHYLENE	7,350	0	440	0.06	7,790

3.37.5 Emission Projection Methodology

Projection factors for metal plating or coating have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

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3.38.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-212.

Table 3-212: Metal processing facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
UNICAST DIECASTING	948	63-73 JEDDA ROAD	PRESTONS	2170
CRANE ENFIELD METALS	1098	2115 CASTLEREAGH ROAD	PENRITH	2750
INTERCAST & FORGE PTY LIMITED	1268	18-24 ABBOTT ROAD	SEVEN HILLS	2147
MM KEMBLA PRODUCTS	6158	GLOUCESTER BOULEVARDE	PORT KEMBLA	2505
ONESTEEL- NEWCASTLE MARKET MILLS	11149	INDUSTRIAL DRIVE	MAYFIELD	2304
ALUMINIUM EXTRUSION AND DISTRIBUTION PTY LIMITED	12405	2115 CASTLEREAGH ROAD	PENRITH	2750
NEWCASTLE PIPE & TUBE	12665	51 INDUSTRIAL DRIVE	MAYFIELD WEST	2304
ONESTEEL OIL AND GAS PIPE	12978	132 WEST DAPTO ROAD	KEMBLA GRANGE	2526

3. Data Sources and Results

The emission sources and associated releases to air from metal processing are presented in Table 3-213.

Table 3-213: Metal processing - emission sources

Source	Emissions to Air
Acid storage (hydrochloric)	Hydrochloric acid
Boiler (natural gas)	Combustion products
Copper (electric arc furnace, point)	PM
Copper (electric induction furnace, fugitive)	PM
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Galvanising	PM
Metal cutting (mild steel, 8 mm)	NO _x , magnesium oxide fume
Organic liquid storage (ethanol)	VOC
Organic liquid storage (trichloroethylene)	VOC
Process emissions	Combustion products
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (paint - water based)	VOC
Surface coating (thinner)	VOC
Welding	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.38.2 Activity Data

Summary activity data collected from the industrial questionnaires for metal processing is presented in Table 3-214.

Table 3-214: Summary activity data for metal processing

Parameter	Value	Unit
Amount of metal products produced (steel castings, steel forgings, copper tube rod and wire, extruded aluminium etc)	847,006	tonne/year
Amount of natural gas combusted	1,496,210	GJ/year
Total vehicle kilometres travelled	769,311	km/year
Amount of electricity consumed	214,891	MWh/year

3.38.3 Emission and Speciation Factors

The emission and speciation factors for all substances from metal processing sources are detailed in Table 3-215.

Table 3-215: Emission and speciation factors for all substances from metal processing

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Metal cutting (mild steel, 8 mm)	NPI EET Manual for Structural & Fabricated Metal Product Manufacture (EA, 1999g)
	Organic liquid storage (ethanol)	TANKS 4.09D software (USEPA, 2006e)
	Organic liquid storage (trichloroethylene)	
	Process emissions	Site specific emission estimates
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent based)	
	Surface coating (paint - water based)	
	Surface coating (thinner)	
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Copper (electric arc furnace, point)	NPI EET Manual for Non-Ferrous Foundries, v1.0 (EA, 1999f)
	Copper (electric induction furnace, fugitive)	
	Galvanising	NPI EET Manual for Galvanising v1.1 (EA, 2001a)
	Process emissions	Site specific emission estimates
	Welding	NPI EET Manual for Fugitive Emissions (assuming manual metal arc welding and electrode type 14Mn-4Cr) (EA, 1999d)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Organic liquid storage (ethanol)	Mass balance (100% ethanol)
	Organic liquid storage (trichloroethylene)	Mass balance (100% trichloroethylene)
	Process emissions	Site specific emission estimates
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (paint - water based)	SPECIATE 4.2 (Profile ID 1013) (USEPA, 2008e)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	based)	
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Copper (electric arc furnace, point)	NPI EET Manual for Non-Ferrous Foundries, v1.0 (EA, 1999f)
	Process emissions	Site specific emission estimates
	Welding	NPI EET Manual for Fugitive Emissions (assuming manual metal arc welding and electrode type 14Mn-4Cr) (EA, 1999d)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Process emissions	Site specific emission estimates
Sulfuric or hydrochloric acid	Acid storage (hydrochloric)	Raoult's law (Raoult, M, 1882a; 1882b, 1887a; 1887b), using chemical properties from Perry and Green (1997)
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Copper (electric arc furnace, point)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.38.4 Emission Estimates

Total estimated annual emissions (for selected substances) from metal processing for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-216. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-216: Total estimated annual emissions from metal processing

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	300	247	61.5	0	608
CARBON MONOXIDE	83,600	35,600	10,300	0	130,000
FORMALDEHYDE	75.5	424	123	0	622
ISOMERS OF XYLENE	2,080	9,340	1,030	0	12,500
LEAD AND COMPOUNDS	5.91	0.35	6.91	0	13.2
OXIDES OF NITROGEN	8,330	64,000	12,900	0	85,200
PARTICULATE MATTER ≤ 10 µm	5,970	8,600	21,400	0	35,900
PARTICULATE MATTER ≤ 2.5 µm	4,940	8,420	9,630	0	23,000
POLYCYCLIC AROMATIC HYDROCARBONS	0.05	0.29	0.08	0	0.42

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
SULFUR DIOXIDE	910	932	64.3	0	1,910
TETRACHLOROETHYLENE	0	200	0	0	200
TOLUENE	9,370	12,500	993	0	22,800
TOTAL SUSPENDED PARTICULATE	11,700	9,510	68,900	0	90,100
TOTAL VOLATILE ORGANIC COMPOUNDS	25,400	59,300	6,940	0	91,700
TRICHLOROETHYLENE	191	569	0	0	761

3.38.5 Emission Projection Methodology

Projection factors for metal processing have been derived based on final energy consumption projections for basic non-ferrous metal products in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-217 and illustrated in Figure 3-12.

Table 3-217: Projection factors for basic non-ferrous metal products related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0064	2023	1.1224
2010	1.0129	2024	1.1315
2011	1.0206	2025	1.1406
2012	1.0287	2026	1.1498
2013	1.0367	2027	1.1592
2014	1.0448	2028	1.1688
2015	1.0532	2029	1.1785
2016	1.0616	2030	1.1848
2017	1.0700	2031	1.1903
2018	1.0784	2032	1.1987
2019	1.0870	2033	1.2071
2020	1.0958	2034	1.2154
2021	1.1045	2035	1.2238
2022	1.1134	2036	1.2322

Source: ABARE (2006)

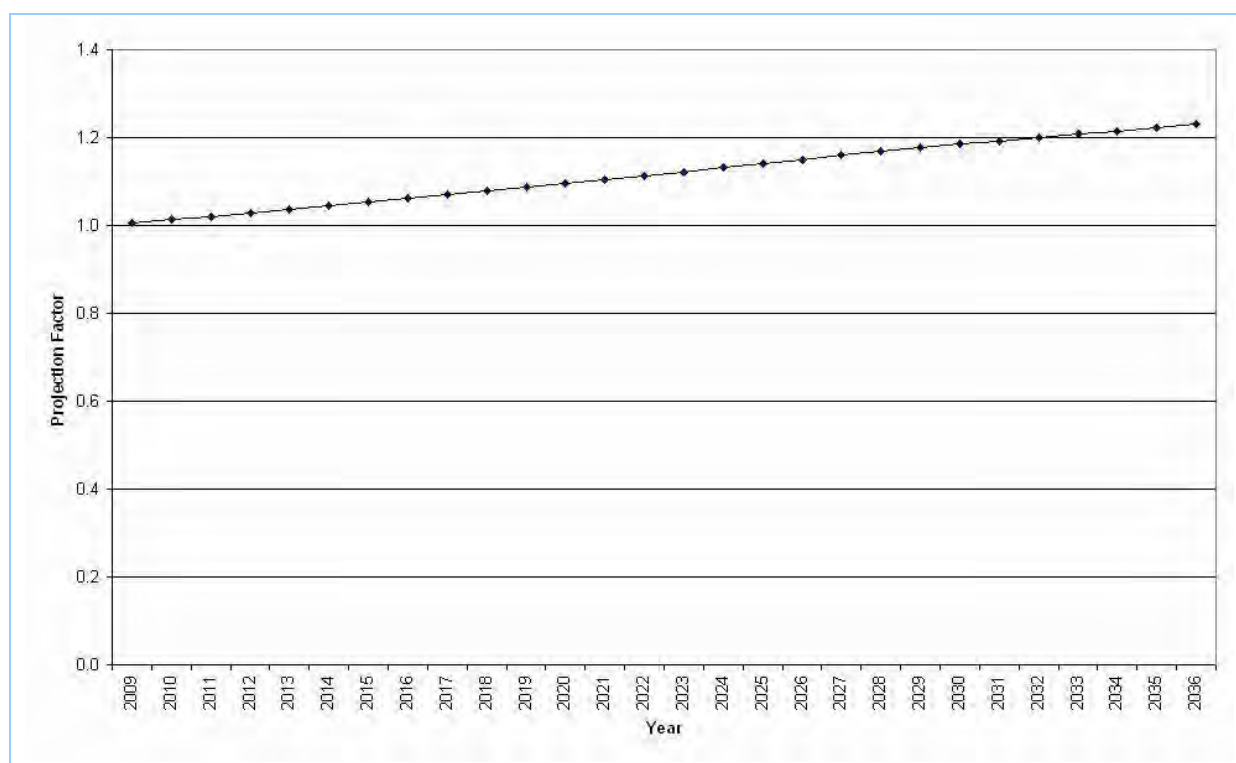


Figure 3-12: Projection factors for basic non-ferrous metal products related sources

3.39 Metal Production (Primary) 55, 57

3.39.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR included in the emissions inventory under the category 'aluminium production (alumina)' are outlined in Table 3-218.

Table 3-218: Aluminium production (alumina) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
HYDRO ALUMINIUM KURRI KURRI PTY LTD	1548	HART ROAD	LOXFORD	2327
TOMAGO ALUMINIUM COMPANY PTY LIMITED	6163	35 & 45 TOMAGO ROAD	TOMAGO	2322

Industrial facilities within the GMR included in the emissions inventory under the category 'iron or steel production (iron ore)' are outlined in Table 3-219.

Table 3-219: Iron or steel production (iron ore) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
PORT KEMBLA STEELWORKS	6092	FIVE ISLANDS ROAD	CRINGILA	2505

The emission sources and associated releases to air from aluminium production (alumina) are presented in Table 3-220.

3. Data Sources and Results

Table 3-220: Aluminium production (alumina) – emission sources

Process	Operation	Emissions to Air
Anode set-up	Anode paste production	PM, fluoride, VOC, PAH
	Green anode production	
	Baking	
	Rodding	
Alumina reduction		PM, VOC, PAH, NO _x , SO ₂ , CO, HCl, Cl ₂ , CO ₂
Casting		PM, VOC, PAH, NO _x , SO ₂ , CO, HCl, Cl ₂
Anode recycling		PM
Materials handling		PM
Bauxite grinding		PM
Fuel storage		VOC
Surface coating		VOC
Boiler (natural gas)		Combustion products
Wheel generated dust - paved roads		PM
Wheel generated dust - unpaved roads		PM

The emission sources and associated releases to air from iron and steel production (iron ore) are presented in Table 3-221.

Table 3-221: Iron and steel production (iron ore) – emission sources

Source	Emissions to Air
3500 mm furnace	Combustion products
Batch annealing furnaces	Combustion products
Blast furnace	Combustion products
Blast furnace casthouse dedusting	PM
Blast furnace highline dedusting	PM
Blast furnace slag granulator	H ₂ S
Blast furnace stockhouse dedusting	PM
Blast furnace stoves heating	Combustion products
Blower station - boiler	Combustion products
CA line furnaces	Combustion products
CAS baghouse	Combustion products
COG excess bleeder stack	Combustion products
Coke ovens battery fume suppression	Combustion products
Coke ovens battery fumes	Combustion products
Coke ovens battery heating	Combustion products
Coke ovens battery quench tower	Combustion products
Coke screen house dedusting	Combustion products
Cold mill ventilation	PM
Conveyor transfer (miscellaneous)	PM
Diffuse gas	Combustion products
ECOCHEM slag dryer	Combustion products
ET/TFS line rinse and TFS stack	PM and SO ₃
Flare	Combustion products
Gas processing ammonia absorbers	VOC
Gas processing fugitives	Ammonia, cyanide, H ₂ S, PAH, VOC
Gas processing NH ₄ SO ₃	PM

3. Data Sources and Results

Source	Emissions to Air
GEGA M/C cut to length	PM
Hammer mill dedusting	PM
Hot metal treatment station	PM
Lime kiln discharge building	PM
Lime kiln storage bins	PM
Lime kiln transfer house	PM
Lime kiln waste heat	Combustion products
Metserv scrap cutting	PM
Oven fugitives	Combustion products
PCI facility	PM
PCI hot gas	Combustion products
Raw materials road & rail dumping	PM
Rollservice technology	PM
Secondary dedusting	Combustion products
Sinter machine	Combustion products
Sinter machine room dedusting stack	PM
Sinter machine rotary cooler	Combustion products
Slab caster	PM
Slab caster misc fuel use	Combustion products
Slab handling - slab scarfing machine	Combustion products
Standpipe emissions	Combustion products
Surface coating (acrylic)	VOC
Surface coating (alkyd)	VOC
Surface coating (epoxy)	VOC
Surface coating (thinners)	VOC
Surface coating (urethane)	VOC
Temper mill	PM
Trucks dumping (coal)	PM
Trucks dumping (coke)	PM
Trucks dumping (dolomite)	PM
Trucks dumping (limestone)	PM
Trucks dumping (slag and fines)	PM
Vacuum degasser	Combustion products
Walking beam furnace	Combustion products
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (clean coal stockpile)	PM
Wind erosion (coke breeze stockpile)	PM
Wind erosion (coke lump stockpile)	PM
Wind erosion (exposed areas)	PM

3.39.2 Activity Data

Summary activity data collected from the industrial questionnaires for metal production (primary) is presented in Table 3-222.

3. Data Sources and Results

Table 3-222: Summary activity data for metal production (primary)

Parameter	Value	Unit
Amount of aluminium produced	700,000	tonne/year
Amount of iron ore used	7,200,000	tonne/year
Amount of raw steel produced	5,300,000	tonne/year
Total coal used	3,700,000	tonne/year
Total natural gas combusted	4,769,514	GJ/year
Electricity consumed	11,545,889	MWh/year

3.39.3 Emission and Speciation Factors

The emission and speciation factors for all substances from aluminium production (alumina) sources are detailed in Table 3-223.

Table 3-223: Emission and speciation factors for all substances from aluminium production (alumina)

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Alumina reduction	Site specific emission estimates
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Surface coating	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Fuel storage	TANKS 4.09D software (USEPA, 2006e)
PM _{2.5} , PM ₁₀ & TSP	Alumina reduction	Site specific emission estimates
	Materials handling	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Bauxite grinding	Site specific emission estimates
	Anode recycling	
	Anode paste production	
	Green anode production	
	Baking	
	Rodding	
	Wheel generated dust - paved roads	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Wheel generated dust - unpaved roads	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)	
Speciated organics (including methane)	Alumina reduction	SPECIATEv4.2 (Profile ID=1202) (USEPA, 2008e)
	Combustion (boilers) - natural gas	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Surface coating	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Fuel storage	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust - paved roads	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust - unpaved roads	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 and after (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		2004)
Sulfuric or hydrochloric acid	Reduction lines	Site specific emission estimates
	Casting	
PAH	Reduction lines	Site specific emission estimates
	Anode paste production	
	Green anode production	
	Baking	
	Rodding	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Reduction lines	Site specific emission estimates
	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Reduction lines (baked carbon anode consumption)	National Greenhouse and Energy Reporting System Measurement: Technical Guidelines v1.1 (DCC, 2009a)
	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

The emission and speciation factors for all substances from iron or steel production (iron ore) sources are detailed in Table 3-224.

Table 3-224: Emission and speciation factors for all substances from iron or steel production (iron ore)

Substance	Emission Source	Emission Factor Source
CO, NO _x ¹ , SO ₂ & VOC	3500 mm furnace	Site specific emission estimates
	Batch annealing furnaces	
	Blast furnace	
	Blast furnace stoves heating	
	Blower station - boiler	
	CA line furnaces	
	CAS baghouse	
	COG excess bleeder stack	
	Coke ovens battery fume suppression	
	Coke ovens battery fumes	
	Coke ovens battery heating	
	Coke ovens battery quench tower	
	Coke screen house dedusting	
	Diffuse gas	
	ECOCEM slag dryer	
	Flare	
	Gas processing ammonia absorbers	
	Gas processing fugitives	
	Lime kiln waste heat	
	Oven fugitives	
PCI hot gas		
Secondary dedusting		

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Substance	Emission Source	Emission Factor Source	
	Sinter machine		
	Sinter machine rotary cooler		
	Slab caster misc fuel use		
	Slab handling - slab scarfing machine		
	Standpipe emissions		
	Surface coating (acrylic)		VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (alkyd)		
	Surface coating (epoxy)		
	Surface coating (thinners)		
	Surface coating (urethane)		
	Vacuum degasser		Site specific emission estimates
	Walking beam furnace		
Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)		
PM _{2.5} , PM ₁₀ & TSP	3500 mm furnace	Site specific emission estimates	
	Batch annealing furnaces		
	Blast furnace		
	Blast furnace casthouse dedusting		
	Blast furnace highline dedusting		
	Blast furnace stockhouse dedusting		
	Blast furnace stoves heating		
	Blower station - boiler		
	CA line furnaces		
	CAS baghouse		
	COG excess bleeder stack		
	Coke ovens battery fume suppression		
	Coke ovens battery fumes		
	Coke ovens battery heating		
	Coke ovens battery quench tower		
	Coke screen house dedusting		
	Cold mill ventilation		
	Conveyor transfer (miscellaneous)		AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Diffuse gas		Site specific emission estimates
	ECOCEM slag dryer		
	ET/TFS line rinse and TFS stack		
	Flare		
	Gas processing NH ₄ SO ₃		
	GECA M/C cut to length		
	Hammer mill dedusting		
	Hot metal treatment station		
	Lime kiln discharge building		
	Lime kiln storage bins		
	Lime kiln transfer house		

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Lime kiln waste heat	
	Metserv scrap cutting	
	Oven fugitives	
	PCI facility	
	PCI hot gas	
	Raw materials road & rail dumping	
	Rollservice technology	
	Secondary dedusting	
	Sinter machine	
	Sinter machine room dedusting stack	
	Sinter machine rotary cooler	
	Slab caster	
	Slab caster misc fuel use	
	Slab handling - slab scarfing machine	
	Standpipe emissions	
	Temper mill	
	Trucks dumping (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks dumping (coke)	
	Trucks dumping (dolomite)	
	Trucks dumping (limestone)	
	Trucks dumping (slag and fines)	
	Vacuum degasser	Site specific emission estimates
	Walking beam furnace	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (clean coal stockpile)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wind erosion (coke breeze stockpile)	
	Wind erosion (coke lump stockpile)	
	Wind erosion (exposed areas)	
Speciated organics (including methane)	3500 mm furnace	Site specific emission estimates and CEIDARS Organic Gas Speciation Profiles (Profile ID=11) (for unaccounted organics) (CARB, 2005)
	Blast furnace	
	Blast furnace stoves heating	
	Blower station - boiler	
	COG excess bleeder stack	
	Coke ovens battery fume suppression	Site specific emission estimate
	Coke ovens battery fumes	Site specific emission estimates and CEIDARS Organic Gas Speciation Profiles (Profile ID=11) (for unaccounted organics) (CARB, 2005)
	Coke ovens battery heating	
	Coke ovens battery quench tower	
	Diffuse gas	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source	
	Gas processing ammonia absorbers	Site specific emission estimates	
	Gas processing fugitives	Site specific emission estimates and SPECIATEv4.2 (Profile ID=0013) (for unaccounted organics) (USEPA, 2008e)	
	Lime kiln waste heat	Site specific emission estimate	
	Oven fugitives	Site specific emission estimates and SPECIATEv4.2 (Profile ID=0016) (for unaccounted organics) (USEPA, 2008e)	
	Sinter machine	Site specific emission estimate	
	Slab caster misc fuel use	Site specific emission estimate (100% formaldehyde)	
	Slab handling - slab scarfing machine	Site specific emission estimate	
	Standpipe emissions	Site specific emission estimates and SPECIATEv4.2 (Profile ID=0013) (for unaccounted organics) (USEPA, 2008e)	
	Surface coating (acrylic)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)	
	Surface coating (alkyd)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)	
	Surface coating (epoxy)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)	
	Surface coating (thinners)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)	
	Surface coating (urethane)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)	
	Vacuum degasser	Site specific emission estimate	
	Walking beam furnace	Site specific emission estimates and CEIDARS Organic Gas Speciation Profiles (Profile ID=11) (for unaccounted organics) (CARB, 2005)	
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)	
Speciated particulate matter	Blast furnace casthouse dedusting	Site specific emission estimates	
	Blast furnace stockhouse dedusting		
	Blast furnace stoves heating		
	Blower station - boiler		
	Coke ovens battery fume suppression		
	Coke ovens battery fumes		
	Flare		
	Oven fugitives		
	Secondary dedusting		
	Sinter machine room dedusting stack		
	Slab caster misc fuel use		
	Trucks dumping (coal)		Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks dumping (coke)		
	Trucks dumping (dolomite)		
	Trucks dumping (limestone)		
Trucks dumping (slag and fines)			
Vacuum degasser	Site specific emission estimates		

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (clean coal stockpile)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wind erosion (coke breeze stockpile)	
	Wind erosion (coke lump stockpile)	
	Wind erosion (exposed areas)	
Ammonia	Coke ovens battery heating	Site specific emission estimates
	Coke ovens battery quench tower	
	Coke ovens battery fume suppression	
	Coke ovens battery fumes	
	Sinter machine	
	Gas processing fugitives	
	Oven fugitives	
	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	Coke ovens battery heating	Site specific emission estimates
	Coke ovens battery quench tower	
	Coke ovens battery fume suppression	
	Coke ovens battery fumes	
	Flare	
	Secondary dedusting	
	Lime kiln waste heat	
	Blower station - boiler	
	ET/TFS line rinse and TFS stack	
	Oven fugitives	
	Secondary dedusting	
	Sinter machine room dedusting stack	
	PAH	
Blast furnace stoves heating		
Blower station boiler		
COG excess bleeder		
Coke ovens battery fume suppression		
Coke ovens battery fumes		
Coke ovens battery heating		
Coke ovens battery quench tower		
Diffuse gas		

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Gas processing fugitives	
	Lime kiln waste heat	
	Oven fugitives	
	Sinter machine emission reduction	
	Standpipe emissions	
PCDD/PCDF	Coke ovens battery heating	Site specific emission estimates
	Coke ovens battery quench tower	
	Coke ovens battery quench tower	
	Coke ovens battery fume suppression	
	Blower station boiler	
	Coke ovens battery fumes	
	Sinter machine emission reduction	
Greenhouse gases (CO ₂ and N ₂ O)	3500mm furnace	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b) and estimated oxidation of carbon contained in blast furnace gas, coke ovens gas, natural gas and BOS-off gas. Emissions of greenhouse gases were attributed to sources based on specified emissions of CO.
	Batch annealing furnaces	
	Blast furnace slag granulator	
	Blast furnace stoves heating	
	Blower station boiler	
	CA line furnaces	
	CAS baghouse	
	Coke ovens battery fume supp No1	
	Coke ovens battery fumes	
	Coke ovens battery heating	
	Coke ovens battery quench tower	
	ECOCEM slag dryer dust collector	
	Flare	
	PCI hot gas	
	Secondary dedusting	
	Sinter machine emission reduction	

3.39.4 Emission Estimates

Total estimated annual emissions (for selected substances) from aluminium production (alumina) for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-225. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-225: Total estimated annual emissions from aluminium production (alumina) in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	95.8	0	95.2	191
CARBON MONOXIDE	0	39,200,000	0	13,800,000	53,000,000
FORMALDEHYDE	0	15	0	152	167
ISOMERS OF XYLENE	0	241	0	8.99	250
LEAD AND COMPOUNDS	0	119	0	477	597
OXIDES OF NITROGEN	0	347,000	0	164,000	511,000
PARTICULATE MATTER ≤ 10 µm	0	186,000	0	205,000	391,000
PARTICULATE MATTER ≤ 2.5 µm	0	119,000	0	135,000	255,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	6,620	0	3,170	9,790
SULFUR DIOXIDE	0	10,100,000	0	3,740,000	13,900,000
TETRACHLOROETHYLENE	0	444	0	0	444
TOLUENE	0	530	0	58	588
TOTAL SUSPENDED PARTICULATE	0	482,000	0	380,000	862,000
TOTAL VOLATILE ORGANIC COMPOUNDS	0	11,400	0	4,400	15,800
TRICHLOROETHYLENE	0	1,260	0	0	1,260

Total estimated annual emissions (for selected substances) from iron or steel production (iron ore) for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-226. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-226: Total estimated annual emissions from iron or steel production (iron ore)

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	1,500	0	1,500
ACETALDEHYDE	0	0	132	0	132
BENZENE	0	0	250,000	0	250,000
CARBON MONOXIDE	0	0	528,000,000	0	528,000,000
FORMALDEHYDE	0	0	69.9	0	69.9
ISOMERS OF XYLENE	0	0	4,780	0	4,780
LEAD AND COMPOUNDS	0	0	3,480	0	3,480
OXIDES OF NITROGEN	0	0	7,510,000	0	7,510,000
PARTICULATE MATTER ≤ 10 µm	0	0	1,750,000	0	1,750,000
PARTICULATE MATTER ≤ 2.5 µm	0	0	1,220,000	0	1,220,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	30,300	0	30,300
SULFUR DIOXIDE	0	0	8,220,000	0	8,220,000
TETRACHLOROETHYLENE	0	0	94.8	0	94.8
TOLUENE	0	0	21,500	0	21,500
TOTAL SUSPENDED PARTICULATE	0	0	4,590,000	0	4,590,000
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	452,000	0	452,000
TRICHLOROETHYLENE	0	0	13.5	0	13.5

3.39.5 Emission Projection Methodology

Projection factors for aluminium production (alumina) have been derived based on final energy consumption projections for other basic non-ferrous metals in NSW published by ABARE (ABARE, 2006).

Derived projection factors for aluminium production (alumina) are provided in Table 3-240 and illustrated in Figure 3-13.

Projection factors for iron and steel production (iron ore) have been derived based on primary energy consumption projections for iron and steel in NSW published by ABARE (ABARE, 2006).

Derived projection factors for iron and steel production (iron ore) are provided in Table 3-241 and illustrated in Figure 3-14.

3.40 Metal Production (secondary) 56, 58, 60

3.40.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR included in the emissions inventory under the category aluminium production (scrap metal) are outlined in Table 3-227.

Table 3-227: Aluminium production (scrap metal) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ALCOA	642	KIORA CRESCENT	YENNORA	2161
DINGA ENTERPRISES PTY LIMITED	5726	UNIT 4/29-31 HOBART STREET	RIVERSTONE	2765
WESTON ALUMINIUM PTY LTD	6423	129 MITCHELL AVENUE	KURRI KURRI	2327

Industrial facilities within the GMR included in the emissions inventory under the category iron or steel production (scrap metal) are outlined in Table 3-228.

Table 3-228: Iron or steel production (scrap metal) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
COMMONWEALTH STEEL COMPANY LTD	822	2 MAUD STREET	MAYFIELD WEST	2304
WEIR MINERALS AUSTRALIA LTD	957	1 MARDEN STREET	ARTARMON	2064
TYCO WATER	1990	DURSLEY ROAD	YENNORA	2161
ONESTEEL SYDNEY STEEL MILL	6125	22 KELLOGG ROAD	ROOTY HILL	2766

3. Data Sources and Results

Industrial facilities within the GMR included in the emissions inventory under the category non-ferrous metal production (scrap) are outlined in Table 3-229.

Table 3-229: Non-ferrous metal production (scrap) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
AUSTRALIAN REFINED ALLOYS	1108	202-212 EUSTON ROAD	ALEXANDRIA	2015

The emission sources and associated releases to air from aluminium production (scrap metal) are presented in Table 3-230.

Table 3-230: Aluminium production (scrap metal) - emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Material transfer	PM
Smelting	PM and PCDD/F
Surface coating	VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

The emission sources and associated releases to air from iron or steel production (scrap metal) are presented in Table 3-231.

Table 3-231: Iron or steel production (scrap metal) - emission sources

Source	Emissions to Air
Binders (low nitrogen furan)	Ammonia, hydrogen cyanide, hydrogen sulfide, NO _x , PAH, SO ₂ , VOC
Binders (phenolic nobake)	Ammonia, hydrogen cyanide, hydrogen sulfide, NO _x , PAH, SO ₂ , VOC
Binders (phenolic urethane)	Ammonia, hydrogen cyanide, hydrogen sulfide, NO _x , PAH, SO ₂ , VOC
Boilers (natural gas)	Combustion products
Fibreglass (manual resin application (vapour suppressed))	VOC
Foundry operations (cleaning/finishing)	PM
Foundry operations (cold box catalyst)	VOC
Foundry operations (core making/baking)	PM
Foundry operations (electric induction furnace)	PM
Foundry operations (magnesium treatment)	PM
Foundry operations (pouring/cooling)	PM
Foundry operations (sand handling)	PM
Foundry operations (scrap and charge handling)	PM
Foundry operations (shake-out)	PM
Foundry operations (shot blasting (baghouse))	PM
Foundry operations (XSA/TSA furan resin catalyst)	VOC
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC

3. Data Sources and Results

Source	Emissions to Air
Iron and steel production (steel making, electric arc furnace)	CO, PM
Iron making (blast furnace)	PM
Iron production (furnace, cupola)	CO, lead, PM, PCDD/F, SO ₂
Iron production (scrap and charge handling)	PM
Material transfer	PM
Metal cutting (mild steel, 8mm)	NO _x , magnesium oxide fume
Primary crushing (M < 4%)	PM
Process emissions	PM
Rubber product manufacturing (extrusion)	VOC, PM
Rubber product manufacturing (platen press)	VOC
Steel production (furnace, electric arc)	NO _x , PM, PCDD/F
Steel production (pouring and casting)	PM
Surface coating (adhesive)	VOC
Surface coating (enamel)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (paint - water based)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

The emission sources and associated releases to air from non-ferrous metal production (scrap) are presented in Table 3-232.

Table 3-232: Non-ferrous metal production (scrap) - emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Fuel storage (diesel)	VOC
Lead production (casting, fugitive)	PM
Wheel generated dust (paved roads)	PM

3.40.2 Activity Data

Summary activity data collected from the industrial questionnaires for metal production (secondary) is presented in Table 3-233.

Table 3-233: Summary activity data for metal production (secondary)

Parameter	Value	Unit
Amount of aluminium produced	113,000	tonne/year
Amount of steel products produced	820,979	tonne/year
Amount of iron products produced	55,149	tonne/year
Amount of lead products produced	21,000	tonne/year
Total vehicle kilometres travelled	500,675	km/year
Amount of natural gas combusted	2,809,958	GJ/year
Amount of electricity consumed	595,064	MWh/year

3.40.3 Emission and Speciation Factors

The emission and speciation factors for all substances from aluminium production (scrap metal) sources are detailed in Table 3-234.

Table 3-234: Emission and speciation factors for all substances from aluminium production (scrap metal)

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Surface coating	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
PM _{2.5} , PM ₁₀ & TSP	Materials handling	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Smelting	AP42, Chapter 12.8 Secondary Aluminium Operations (USEPA, 1986c)
	Wheel generated dust – paved roads	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust – unpaved roads	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Surface coating	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust – paved roads	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust – unpaved roads	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 and after (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Smelting	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

The emission and speciation factors for all substances from iron or steel production (scrap metal) sources are detailed in Table 3-235.

Table 3-235: Emission and speciation factors for all substances from iron or steel production (scrap metal)

Substance	Emission Source	Emission Factor Source
CO, NO _x ¹ , SO ₂ & VOC	Binders (low nitrogen furan)	NPI EET Manual for Non-Ferrous Foundries v1.0 (EA, 1999f)
	Binders (phenolic nobake)	
	Binders (phenolic urethane)	
	Boilers (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fibreglass (manual resin application (vapour suppressed))	NPI EET Manual for Fibreglass Product Manufacturing (average for all resin types) (assuming all VOC are styrene) (EA, 1999c)
	Foundry operations (cold box catalyst)	Estimated based on a mass balance of VOC in the resin catalyst
	Foundry operations (XSA/TSA furan resin catalyst)	
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Iron and steel production (steel making, electric arc furnace)	AP42 Chapter 12.5 Iron and Steel Production (USEPA, 1986b)
	Iron production (furnace, cupola)	AP42 Chapter 12.10 Gray Iron Foundries (USEPA, 2003c)
	Metal cutting (mild steel, 8mm)	NPI EET Manual for Structural & Fabricated Metal Product Manufacture (EA, 1999g)
	Rubber product manufacturing (extrusion)	NPI EET Manual for Rubber Product Manufacture v1.1 (EA, 2002b)
	Rubber product manufacturing (platen press)	
	Steel production (furnace, electric arc)	AP42 Chapter 12.13 Steel Foundries (USEPA, 1995d)
	Surface coating (adhesive)	NPI EET Manual for Aggregated Emissions from Motor Vehicle Refinishing (EA, 1999a)
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent based)	
	Surface coating (paint - water based)	
	Surface coating (primer)	
Surface coating (thinner)		
PM _{2.5} , PM ₁₀ & TSP	Boilers (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Foundry operations (cleaning/finishing)	<i>Calculating Emission Factors for Pouring, Cooling, and Shakeout</i> by Gary E. Mosher, Director of Environmental Affairs, American Foundrymen's Society, in the journal, <i>Modern Casting</i> , the October 1994 issue., Emission Factors replicated in Minnesota Pollution Control Agency (MPCA, 2010)
	Foundry operations (core making/baking)	
	Foundry operations (electric induction furnace)	
	Foundry operations (magnesium treatment)	
	Foundry operations (pouring/cooling)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Foundry operations (sand handling)	
	Foundry operations (scrap and charge handling)	
	Foundry operations (shake-out)	
	Foundry operations (shot blasting (baghouse))	
	Iron and steel production (steel making, electric arc furnace)	AP42 Chapter 12.5 Iron and Steel Production (USEPA, 1986b)
	Iron making (blast furnace)	
	Iron production (furnace, cupola)	AP42 Chapter 12.10 Gray Iron Foundries (USEPA, 2003c)
	Iron production (scrap and charge handling)	
	Material transfer	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Primary crushing (M < 4%)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Process emissions	Site specific emission estimates
	Rubber product manufacturing (extrusion)	NPI EET Manual for Rubber Product Manufacture v1.1 (EA, 2002b)
	Steel production (furnace, electric arc)	AP42 Chapter 12.13 Steel Foundries (USEPA, 1995d)
	Steel production (pouring and casting)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Binders (low nitrogen furan)	SPECIATE 4.2 (Profile ID 1089) (USEPA, 2008e)
	Binders (phenolic nobake)	
	Binders (phenolic urethane)	
	Boilers (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fibreglass (manual resin application (vapour suppressed))	SPECIATEv4.2 (Profile ID=1005) (USEPA, 2008e)
	Foundry operations (cold box catalyst)	SPECIATE 4.2 (Profile ID 1089) (USEPA, 2008e)
	Foundry operations (XSA/TSA furan resin catalyst)	
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Rubber product manufacturing (extrusion)	SPECIATE 4.2 (Profile ID 9014) (USEPA, 2008e)
	Rubber product manufacturing (platen press)	
	Surface coating (adhesive)	SPECIATE 4.2 (Profile ID 1020) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATE 4.2 (Profile ID 1018) (USEPA, 2008e)
	Surface coating (paint - solvent)	SPECIATE 4.2 (Profile ID 1003) (USEPA, 2008e)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	based)	
	Surface coating (paint - water based)	SPECIATE 4.2 (Profile ID 1013) (USEPA, 2008e)
	Surface coating (primer)	SPECIATE 4.2 (Profile ID 1019) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
Speciated particulate matter	Boilers (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Foundry operations (cleaning/finishing)	SPECIATEv4.2 PM Profile ID 9001010 (USEPA, 2008e)
	Foundry operations (core making/baking)	
	Foundry operations (electric induction furnace)	
	Foundry operations (magnesium treatment)	
	Foundry operations (pouring/cooling)	
	Foundry operations (sand handling)	
	Foundry operations (scrap and charge handling)	
	Foundry operations (shake-out)	
	Foundry operations (shot blasting (baghouse))	
	Primary crushing (M < 4%)	
	Rubber product manufacturing (extrusion)	NPI EET Manual for Rubber Product Manufacture v1.1 (EA, 2002b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Binders (low nitrogen furan)	NPI EET Manual for Non-Ferrous Foundries v1.0 (EA, 1999f)
	Binders (phenolic nobake)	
	Binders (phenolic urethane)	
	Boilers (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Binders (low nitrogen furan)	NPI EET Manual for Non-Ferrous Foundries v1.0 (EA, 1999f)
	Binders (phenolic nobake)	
	Binders (phenolic urethane)	
	Boilers (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boilers (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Iron production (furnace, cupola)	
	Steel production (furnace, electric arc)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

The emission and speciation factors for all substances from non-ferrous metal production (scrap) sources are detailed in Table 3-236.

Table 3-236: Emission and speciation factors for all substances from non-ferrous metal production (scrap)

Substance	Emission Source	Emission Factor Source
CO, NO _x ¹ , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Lead production (casting, fugitive)	NPI EET Manual for Non-Ferrous Foundries v1.0 (EA, 1999f)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Lead production (casting, fugitive)	NPI EET Manual for Non-Ferrous Foundries v1.0 (EA, 1999f)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.40.4 Emission Estimates

Total estimated annual emissions (for selected substances) from aluminium production (scrap metal) for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-237. Total estimated annual emissions of all substances are presented in Appendix A.

3. Data Sources and Results

Table 3-237: Total estimated annual emissions from aluminium production (scrap metal) in each region

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	2,350	0	0	38.6	2,390
CARBON MONOXIDE	46,900	0	0	22,500	69,400
FORMALDEHYDE	4,700	0	0	77.3	4,770
ISOMERS OF XYLENE	20.7	0	0	73.2	93.8
LEAD AND COMPOUNDS	1.31	0	0	1.19	2.5
OXIDES OF NITROGEN	33,800	0	0	10,800	44,700
PARTICULATE MATTER ≤ 10 µm	9,560	0	0	14,300	23,900
PARTICULATE MATTER ≤ 2.5 µm	9,180	0	0	10,200	19,400
POLYCYCLIC AROMATIC HYDROCARBONS	693	0	0	0.05	693
SULFUR DIOXIDE	22,200	0	0	5,080	27,200
TETRACHLOROETHYLENE	40	0	0	0	40
TOLUENE	1,220	0	0	109	1,330
TOTAL SUSPENDED PARTICULATE	24,900	0	0	21,800	46,700
TOTAL VOLATILE ORGANIC COMPOUNDS	34,000	0	0	951	35,000
TRICHLOROETHYLENE	114	0	0	0	114

Total estimated annual emissions (for selected substances) from iron or steel production (scrap metal) for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-238. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-238: Total estimated annual emissions from iron or steel production (scrap metal)

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	200	0	0	0	200
ACETALDEHYDE	0	0	0	0	0
BENZENE	88,900	9,840	0	0	98,700
CARBON MONOXIDE	6,880,000	2,210,000	0	0	9,090,000
FORMALDEHYDE	2,100	687	0	0	2,790
ISOMERS OF XYLENE	38,100	3,790	0	0	41,900
LEAD AND COMPOUNDS	103	3.08	0	0	106
OXIDES OF NITROGEN	26,100	142,000	0	0	168,000
PARTICULATE MATTER ≤ 10 µm	90,500	58,800	0	0	149,000
PARTICULATE MATTER ≤ 2.5 µm	75,500	52,600	0	0	128,000
POLYCYCLIC AROMATIC HYDROCARBONS	67.7	7.6	0	0	75.3
SULFUR DIOXIDE	1,630	8,910	0	0	10,500
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	55,800	6,250	0	0	62,000
TOTAL SUSPENDED PARTICULATE	162,000	89,300	0	0	251,000
TOTAL VOLATILE ORGANIC COMPOUNDS	350,000	34,800	0	0	385,000
TRICHLOROETHYLENE	0	0	0	0	0

3. Data Sources and Results

Total estimated annual emissions (for selected substances) from non-ferrous metal production (scrap) for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-239. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-239: Total estimated annual emissions from non-ferrous metal production (scrap)

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	197	0	0	0	197
CARBON MONOXIDE	281,000	0	0	0	281,000
FORMALDEHYDE	393	0	0	0	393
ISOMERS OF XYLENE	41.4	0	0	0	41.4
LEAD AND COMPOUNDS	670	0	0	0	670
OXIDES OF NITROGEN	16,200	0	0	0	16,200
PARTICULATE MATTER ≤ 10 µm	4,000	0	0	0	4,000
PARTICULATE MATTER ≤ 2.5 µm	3,370	0	0	0	3,370
POLYCYCLIC AROMATIC HYDROCARBONS	0.03	0	0	0	0.03
SULFUR DIOXIDE	130,000	0	0	0	130,000
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	98.3	0	0	0	98.3
TOTAL SUSPENDED PARTICULATE	7,830	0	0	0	7,830
TOTAL VOLATILE ORGANIC COMPOUNDS	2,160	0	0	0	2,160
TRICHLOROETHYLENE	0	0	0	0	0

3.40.5 Emission Projection Methodology

Projection factors for aluminium production (scrap metal) have been derived based on final energy consumption projections for other basic non-ferrous metals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-240 and illustrated in Figure 3-13.

Table 3-240: Projection factors for other basic non-ferrous metal related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0243	2023	1.3528
2010	1.0479	2024	1.3778
2011	1.0714	2025	1.4028
2012	1.0941	2026	1.4280
2013	1.1166	2027	1.4537
2014	1.1394	2028	1.4798
2015	1.1622	2029	1.5064
2016	1.1852	2030	1.5262
2017	1.2083	2031	1.5444
2018	1.2315	2032	1.5680
2019	1.2552	2033	1.5917
2020	1.2792	2034	1.6153

3. Data Sources and Results

Year	Projection Factor	Year	Projection Factor
2021	1.3035	2035	1.6390
2022	1.3280	2036	1.6626

Source: ABARE (2006)

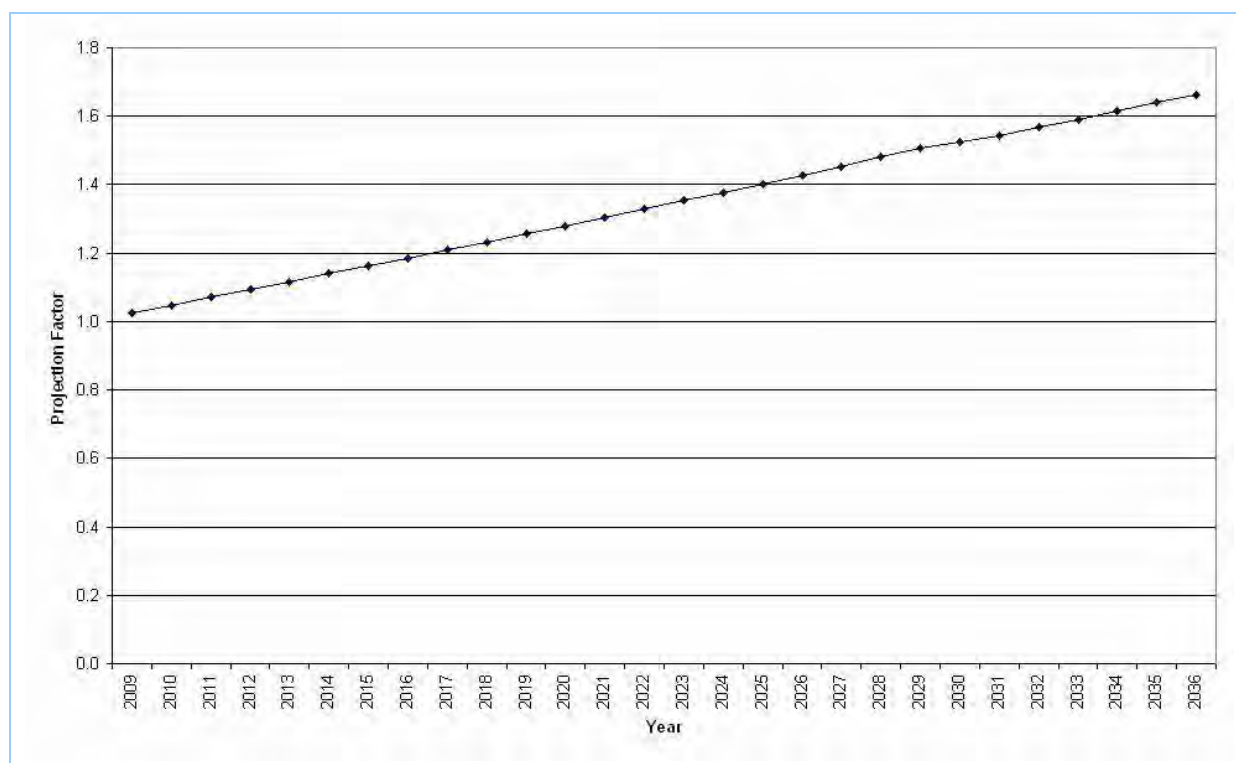


Figure 3-13: Projection factors for other basic non-ferrous metal related sources

Projection factors for iron and steel production (scrap metal) have been derived based on primary energy consumption projections for iron and steel in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-241 and illustrated in Figure 3-14.

Table 3-241: Projection factors for iron and steel related sources

Year	Projection Factor	Year	Projection Factor
2009	0.9968	2023	0.9958
2010	0.9950	2024	0.9959
2011	0.9946	2025	0.9961
2012	0.9944	2026	0.9963
2013	0.9944	2027	0.9965
2014	0.9944	2028	0.9967
2015	0.9944	2029	0.9969
2016	0.9946	2030	0.9953
2017	0.9947	2031	0.9935
2018	0.9949	2032	0.9932
2019	0.9951	2033	0.9930
2020	0.9953	2034	0.9927
2021	0.9954	2035	0.9925
2022	0.9956	2036	0.9922

Source: ABARE (2006)

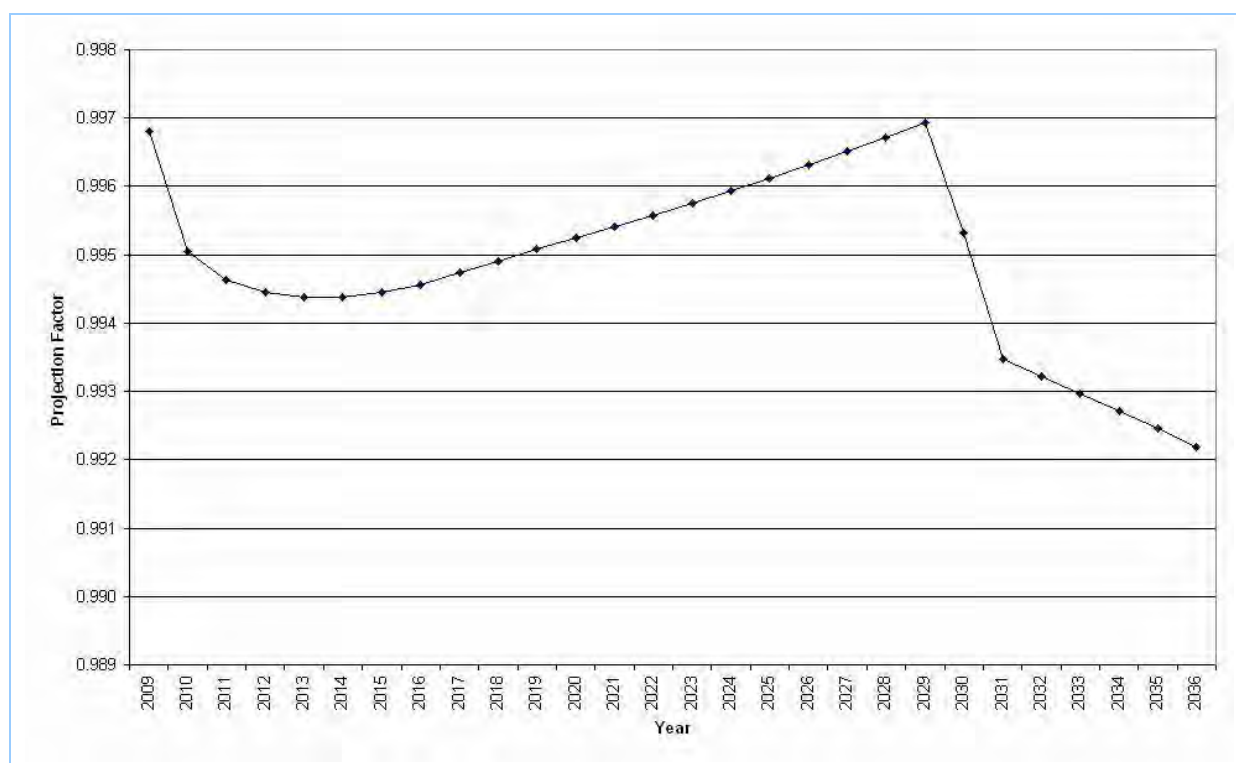


Figure 3-14: Projection factors for iron and steel related sources

Projection factors for non-ferrous metal production (scrap) have been derived based on final energy consumption projections for other basic non-ferrous metal products in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-240 and illustrated in Figure 3-13.

3.41 Mining for Coal 26

3.41.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-242.

Table 3-242: Mining for coal facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
CUMNOCK NO. 1 COLLIERY	37	OFF OLD NEW ENGLAND HIGHWAY	RAVENSWORTH	2330
BAYSWATER COLLIERY	113	THOMAS MITCHELL DRIVE	MUSWELLBROOK	2333
MANNERING COLLIERY	191	VALES ROAD	WYEE	2259
MANDALONG MINE AND COORANBONG COLLIERY	365	MANDALONG ROAD - GRADWELLS ROAD AND RUTLEYS RD	DORA CREEK	2264
MYUNA COLLIERY	366	WANGI POINT ROAD	WANGI WANGI	2267
NEWSTAN COLLIERY	395	WAKEFIELD ROAD	FASSIFERN	2283

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
BLOOMFIELD COLLIERY	396	FOUR MILE CREEK ROAD	ASHTONFIELD	2323
DOUGLAS COLLIERY	398	DOUGLAS PARK DRIVE	DOUGLAS PARK	2569
AUSTAR COAL MINE	416	WOLLOMBI ROAD	PELTON	2325
AWABA COLLIERY	443	WILTON ROAD	AWABA	2283
ANGUS PLACE COLLIERY	467	WOLGAN ROAD	LIDSDALE	2790
KANDOS COLLIERIES PTY LTD	503	DABEE ROAD	KANDOS	2848
CHARBON COAL PTY LIMITED	528	CHARBON ROAD	CHARBON	2848
WAMBO COAL PTY LTD	529	JERRYS PLAINS ROAD	WARKWORTH	2330
SAXONVALE COLLIERY HOLDING	563	BROKE ROAD	SINGLETON	2330
BERRIMA COLLIERY	608	MEDWAY ROAD	MEDWAY	2577
CORDEAUX COLLIERY	611	MT KEIRA ROAD	WOLLONGONG	2500
IVANHOE NO.2 COLLIERY	631	BOULDER ROAD	PORTLAND	2847
HUNTER VALLEY OPERATIONS	640	LEMINGTON RD	SINGLETON	2330
MUSWELLBROOK COLLIERY HOLDING	656	COAL ROAD	MUSWELLBROOK	2333
CLARENCE COLLIERY	726	OFF BELLS LINE OF ROAD	NEWNES JUNCTION	2790
APPIN COLLIERY	758	OFF APPIN ROAD	APPIN	2560
BAAL BONE COLLIERY	765	CASTLEREAGH HIGHWAY	LITHGOW	2790
METROPOLITAN COLLIERY	767	PARKES STREET	HELENSBURGH	2508
NRE WONGAWILLI COLLIERY	1087	MAIN ROAD	WONGAWILLI	2530
THE INVINCIBLE COLLIERY	1095	CASTLEREAGH HIGHWAY	CULLEN BULLEN	2790
DRAYTON COAL MINE	1323	THOMAS MITCHELL DRIVE	MUSWELLBROOK	2333
TERALBA COLLIERY	1360	PITT ST	TERALBA	2284
WEST WALLSEND COLLIERY	1360	THE BROADWAY	KILLINGWORTH	2278
MACQUARIE COAL PREPARATION PLANT	1360	PITT ST	TERALBA	2284
WARKWORTH COAL MINE	1376	PUTTY ROAD	MOUNT THORLEY	2330
TAHMOOR COLLIERY	1389	REMEMBRANCE DRIVE	TAHMOOR	2573
WALLARAH COLLIERY/MOONEE COLLIERY AND CATHERINE HILL BAY PREPARATION PLANT	1558	FLOWERS DRIVE	CATHERINE HILL BAY	2281
CHAIN VALLEY COLLIERY	1770	CONSTRUCTION ROAD	CHAIN VALLEY BAY	2259
MOUNT THORLEY OPERATIONS	1976	MOUNT THORLEY ROAD	MOUNT THORLEY	2330
LIDDELL COAL OPERATIONS	2094	OLD NEW ENGLAND HIGHWAY RAVENSWORTH VIA SINGLETON	RAVENSWORTH	2330
MUNMORAH COLLIERY	2316	SCENIC DRIVE	DOYALSON	2262

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
WESTCLIFF AND NORTHCLIFF COLLIERIES	2504	WEDDERBURN ROAD	APPIN	2560
RAVENSWORTH/NARAMA MINE	2652	OFF LEMINGTON ROAD	RAVENSWORTH	2330
UNITED COLLIERY	3141	134 JERRYS PLAINS ROAD	WARKWORTH	2330
DENDROBIUM MINE	3241	CORDEAUX ROAD	MOUNT KEMBLA	2526
CAMBERWELL COAL MINE	3390	BRIDGMAN ROAD	SINGLETON	2330
RIX'S CREEK COLLIERY	3391	RIX'S CREEK LANE	SINGLETON	2330
SPRINGVALE COLLIERY	3607	CASTLEREAGH HIGHWAY	LIDSDALE	2790
WESTSIDE MINE	4033	WAKEFIELD ROAD	KILLINGWORTH	2278
MT OWEN COAL MINE	4460	HEBDEN ROAD	RAVENSWORTH	2330
PINE DALE MINE	4911	CASTLEREAGH HIGHWAY	LIDSDALE	2790
BENGALLA MINE	6538	BENGALLA ROAD VIA	MUSWELLBROOK	2333
GLENNIES CREEK COLLIERY	7622	640 MIDDLE FALBROOK ROAD	SINGLETON	2330
RAVENSWORTH UNDERGROUND MINE	10337	LEASES CML 1348 & CML 1349 & PART OF CML 378	SINGLETON	2330
CULLEN VALLEY MINE	10341	PORTLAND ROAD	CULLEN BULLEN	2790
RAVENSWORTH EAST MINE	10860	HEBDEN ROAD	RAVENSWORTH	2330
DONALDSON COAL PTY LTD	11080	JOHN RENSHAW DRIVE	MAITLAND	2320
MT ARTHUR NORTH COAL MINE	11457	THOMAS MITCHELL DRIVE	MUSWELLBROOK	2333
HEBBURN NO.2 COLLIERY REHABILITATION	11635	MAIN ROAD 195	ABERMAIN	2326
DURALIE COAL MINE	11701	BETWEEN THE VILLAGES OF STROUD ROAD & WARDS RIVER	STROUD ROAD	2415
ASHTON COAL MINE	11879	GLENNIES CREEK ROAD AND NEW ENGLAND HIGHWAY	CAMBERWELL	2330
NRE NO 1 COLLIERY	12040	BROKER STREET	RUSSELL VALE	2517
AIRLY COAL PROJECT	12374	GLEN DAVIS ROAD	CAPERTEE	2846
WILPINJONG COAL PTY LTD	12425	ULAN-WOLLAR RD	WOLLAR	2850
TASMAN COAL MINE	12483	GEORGE BOOTH DRIVE	SEAHAMPTON	2286
GLENDELL MINE	12840	HEBDEN ROAD	RAVENSWORTH	2330
ABEL UNDERGROUND MINE	12856	1132 JOHN RENSHAW DRIVE	BLACK HILL	2322
XSTRATA MANGOOLA (ANVIL HILL MINE)	12894	WYBONG ROAD	WYBONG	2333
RICHMOND MAIN EAST	13027	EAST OF LEGGETTS DRIVE - NW OF RICHMOND VALE ROAD	CESSNOCK	2325

The emission sources and associated releases to air from mining for coal are presented in Table 3-243.

Table 3-243: Mining for coal – emission sources

Source	Emissions to Air
Blasting	PM
Boiler (natural gas)	Combustion products
Bulldozers (coal)	PM
Bulldozers (overburden)	PM
Coal crushing (controlled wet suppression)	PM
Dragline	PM
Drilling	PM
Explosives (ANFO)	CO, NO _x , SO ₂
Explosives (Energen, large)	CO, NO _x
Explosives (Powergel Gold, large)	CO
Exposed area (wind erosion)	PM
Flares (natural gas, csm, lfg)	Combustion products
Fuel storage (diesel)	VOC
Fuel storage (fuel oil)	VOC
Fuel storage (petrol)	VOC
Graders	PM
Internal combustion engine (diesel)	Combustion products
Loaders (coal)	PM
Loaders (overburden)	PM
Loading stockpiles (coal)	PM
Loading trains (coal)	PM
Material transfer (coal)	PM
Material transfer (overburden)	PM
Organic liquid storage (solcenic oil)	VOC
Scrapers (overburden)	PM
Screening	PM
Spontaneous combustion/coal fires	Combustion products
Surface coating (adhesive)	VOC
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Trucks (dumping coal)	PM
Trucks (dumping overburden)	PM
Unloading from stockpiles (coal)	PM
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (coal)	PM
Wind erosion (overburden)	PM

A detailed analysis of the mining for coal sector is presented in Katestone Environmental (2011) based on emission estimates performed for the 2008 air emissions inventory.

3.41.2 Activity Data

Summary activity data collected from the industrial questionnaires for mining for coal is presented in Table 3-244.

Table 3-244: Summary activity data for mining for coal

Parameter	Value	Unit
Total run of mine (ROM) black coal produced	206	Mt/year
Total product coal produced	128	Mt/year
Amount of coal seam methane flared	696,608	GJ/year
Amount of natural gas combusted	4,098	GJ/year
Amount of diesel combusted ^a	24,076	kL/year
Total vehicle kilometres travelled	41,759,637	km/year
Amount of electricity consumed	1,833,209	MWh/year

a Includes fuel combusted in stationary equipment only

3.41.3 Emission and Speciation Factors

The emission and speciation factors for all substances from mining for coal sources are detailed in Table 3-245.

Table 3-245: Emission and speciation factors for all substances from mining for coal

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Explosives (ANFO)	AP42 Chapter 13.3 Explosives Detonation (ANFO), (USEPA, 1980)
	Explosives (Energen, large)	NPI EET Manual for Explosives and Detonation v2 (DEWHA, 2008)
	Explosives (Powergel Gold, large)	
	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (fuel oil)	
	Fuel storage (petrol)	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Organic liquid storage (solcenic oil)	TANKS 4.09D software (USEPA, 2006e)
	Spontaneous combustion/ coal fires	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a) (assuming emissions are similar to an underfeed stoker)
	Surface coating (adhesive)	NPI EET Manual for Aggregated Emissions from Motor Vehicle Refinishing (EA, 1999a)
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
Surface coating (paint - solvent based)		
Surface coating (primer)		

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source	
	Surface coating (thinner)		
	Trucks (dumping coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Trucks (dumping overburden)		
	Unloading from stockpiles (coal)		
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)	
PM _{2.5} , PM ₁₀ & TSP	Blasting	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)	
	Bulldozers (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Bulldozers (overburden)		
	Coal crushing (controlled wet suppression)	AP42 Chapter 11.19.2 Crushed Stone Processing and Pulverized Mineral Processing (USEPA, 2004). Assuming emission factor for coal crushing controlled by wet suppression can be estimated with emission factors from this manual (see AP42 Chapter 12.2 USEPA, 2008d).	
	Dragline	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Drilling		
	Exposed area (wind erosion)		
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)	
	Graders	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)	
	Loaders (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Loaders (overburden)		
	Loading stockpiles (coal)		
	Loading trains (coal)		
	Material transfer (coal)		
	Material transfer (overburden)		
	Scrapers (overburden)		
	Screening		
	Spontaneous combustion/ coal fires		AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a) (assuming emissions are similar to an underfeed stoker)
	Trucks (dumping coal)		NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping overburden)		
	Unloading from stockpiles (coal)		
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)	
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)	
	Wind erosion (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Wind erosion (overburden)		
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)	
	Flares (natural gas, csm, lfg)	SPECIATEv4.2 (Profile ID=0051) (USEPA, 2008e)	
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Fuel storage (fuel oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Organic liquid storage (solcenic oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Spontaneous combustion/coal fires	SPECIATEv4.2 (Profile ID=1178) (USEPA, 2008e)
	Surface coating (adhesive)	SPECIATE 4.2 (Profile ID 1020) (USEPA, 2008e)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Blasting	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Bulldozers (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Bulldozers (overburden)	
	Coal crushing (controlled wet suppression)	
	Dragline	
	Drilling	
	Exposed area (wind erosion)	
	Flares (natural gas, csm, lfg)	
	Graders	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Internal combustion engine (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Loaders (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Loaders (overburden)	
	Loading stockpiles (coal)	
	Loading trains (coal)	
	Material transfer (coal)	
	Material transfer (overburden)	
	Scrapers (overburden)	
	Screening	
	Spontaneous combustion/coal fires	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a)
	Trucks (dumping coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping overburden)	
	Unloading from stockpiles (coal)	
Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wind erosion (overburden)	
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Flares (natural gas, csm, lfg)	
	Internal combustion engine (diesel)	
	Spontaneous combustion/coal fires	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a) (assuming emissions are similar to an underfeed stoker)
	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	Spontaneous combustion/coal fires	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a) (assuming emissions are similar to an underfeed stoker)
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Spontaneous combustion/coal fires	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a) (assuming emissions are similar to an underfeed stoker)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Flares (natural gas, csm, lfg)	
	Spontaneous combustion/coal fires	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Flares (natural gas, csm, lfg)	
	Internal combustion engine (diesel)	
	Spontaneous combustion/coal fires	

3.41.4 Emission Estimates

Total estimated annual emissions (for selected substances) from mining for coal for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-246. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-246: Total estimated annual emissions from mining for coal

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	796	0	2,660	3,460
ACETALDEHYDE	0	0	0	0	0
BENZENE	39.7	911	0	3,940	4,890
CARBON MONOXIDE	68.5	70,400	0	4,500,000	4,570,000
FORMALDEHYDE	2.19	0.04	0.01	405	407
ISOMERS OF XYLENE	153	452	0.57	20,200	20,800
LEAD AND COMPOUNDS	55.8	419	7.71	12,700	13,200
OXIDES OF NITROGEN	161	147,000	0	2,310,000	2,460,000
PARTICULATE MATTER ≤ 10 µm	410,000	1,750,000	85,800	50,200,000	52,500,000
PARTICULATE MATTER ≤ 2.5 µm	52,000	302,000	11,700	8,470,000	8,830,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	5.24	0	62	67.2
SULFUR DIOXIDE	0.89	1,360	0	495,000	496,000
TETRACHLOROETHYLENE	291	96.2	0.04	6,940	7,330
TOLUENE	325	1,770	0.19	13,300	15,400
TOTAL SUSPENDED PARTICULATE	1,100,000	4,820,000	239,000	139,000,000	145,000,000
TOTAL VOLATILE ORGANIC COMPOUNDS	3,950	17,200	6.17	177,000	199,000
TRICHLOROETHYLENE	820	273	0.01	19,700	20,800

3.41.5 Emission Projection Methodology

Projection factors for mining for coal have been derived based on final energy consumption projections for mining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-75 and illustrated in Figure 3-5.

3.42 Mining for minerals 64

3.42.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-247.

Table 3-247: Mining for minerals facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
CLEARY BROS (BOMBO) PTY LTD	299	LOT 3 PRINCES HIGHWAY	ALBION PARK RAIL	2527
AUSTRALIAN CEMENT LIMITED	314	QUARRY ROAD	KANDOS	2848
EXCELSIOR QUARRY	953	EXCELSIOR ROAD VIA CASTLEREAGH HIGHWAY	CAPERTEE	2846
ROUSE HILL SHALE PIT	5800	SCHOFIELDS ROAD	ROUSE HILL	2155

3. Data Sources and Results

The emission sources and associated releases to air from mining for minerals are presented in Table 3-248.

Table 3-248: Mining for minerals – emission sources

Source	Emissions to Air
Aggregate transfer to conveyor	PM
Aggregate transfer to ground	PM
Blasting	PM
Cement unloading	PM
Conveyor transfer of aggregate to elevated storage	PM
Conveyor transfer of sand to elevated storage	PM
Drilling	PM
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Loaders (overburden)	PM
Material transfer	PM
Primary crushing (M < 4%)	PM
Sand transfer to conveyor	PM
Sand transfer to ground	PM
Screening	PM
Secondary crushing (M < 4%)	PM
Trucks (dumping overburden)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM
Wind erosion (sandstone)	PM

3.42.2 Activity Data

Summary activity data collected from the industrial questionnaires for mining for minerals is presented in Table 3-249.

Table 3-249: Summary activity data for mining for minerals

Parameter	Value	Unit
Total material mined (limestone, roadbase and basalt)	1,500,000	tonne/year
Total vehicle kilometres travelled	158,533	km/year
Amount of electricity consumed	2,243	MWh/year

3.42.3 Emission and Speciation Factors

The emission and speciation factors for all substances from mining for minerals sources are detailed in Table 3-250.

Table 3-250: Emission and speciation factors for all substances from mining for minerals

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
PM _{2.5} , PM ₁₀ & TSP	Aggregate transfer to conveyor	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Aggregate transfer to ground	
	Blasting	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Conveyor transfer of aggregate to elevated storage	
	Conveyor transfer of sand to elevated storage	
	Drilling	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	
	Loaders (overburden)	
	Material transfer	
	Primary crushing (M < 4%)	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Sand transfer to conveyor	
	Sand transfer to ground	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Screening	
	Secondary crushing (M < 4%)	
	Trucks (dumping overburden)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wheel generated dust (unpaved roads)	
Wind erosion (overburden)		
Wind erosion (sandstone)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
Speciated particulate matter	Blasting	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Drilling	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	
	Loaders (overburden)	
	Primary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Screening	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock screening (CARB, 2007)
	Secondary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Trucks (dumping overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wind erosion (sandstone)	
Ammonia	NA	NA
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3. Data Sources and Results

3.42.4 Emission Estimates

Total estimated annual emissions (for selected substances) from mining for minerals for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-251. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-251: Total estimated annual emissions from mining for minerals

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	0.33	0.33
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0	0	0	1.84	1.84
LEAD AND COMPOUNDS	0	0	0	85.6	85.6
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	0	0	0	441,000	441,000
PARTICULATE MATTER ≤ 2.5 µm	0	0	0	79,000	79,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	0	0	1.3	1.3
TOTAL SUSPENDED PARTICULATE	0	0	0	1,330,000	1,330,000
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	0	59.1	59.1
TRICHLOROETHYLENE	0	0	0	0	0

3.42.5 Emission Projection Methodology

Projection factors for mining for minerals have been derived based on final energy consumption projections for mining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-75 and illustrated in Figure 3-5.

3.43 Miscellaneous Licensed Discharges to Waters 90, 91

3.43.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-252.

Table 3-252: Miscellaneous licensed discharges to waters facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
HORNSBY AQUATIC CENTRE	186	203 PACIFIC HIGHWAY	HORNSBY	2077
NORTH SYDNEY OLYMPIC POOL	741	4 ALFRED STREET	MILSONS POINT	2061

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
SANCHEZ GROUP	1638	LOT 6 GALLEGHAN STREET	HEXHAM	2322
KANDOS SEWAGE TREATMENT WORKS	1737	RYLSTONE ROAD	KANDOS	2848
RYLSTONE SEWAGE TREATMENT WORKS	1958	CARWELL STREET	RYLSTONE	2849
OAKEY PARK WATER TREATMENT PLANT	2396	BELLS ROAD	LITHGOW	2790
DUNOGG WATER TREATMENT PLANT	2863	SHORT ST	DUNOGG	2420
DUCKMALOI WATER CLARIFICATION PLANT	3743	OFF HAMPTON ROAD	DUCKMALOI	2787
BOAT (BARGE) DOCK	4000	TOMAGO ROAD	TOMAGO	2322
SYDNEY HARBOUR TUNNEL	4062	130 MOUNT STREET	NORTH SYDNEY	2060
CASCADES WATER FILTRATION PLANT	4406	MORT STREET	KATOOMBA	2780
NORTH RICHMOND WATER FILTRATION PLANT	5425	GROSE VALE ROAD	NORTH RICHMOND	2754
MA-REFINE OILS	7246	27 POWERS ROAD	SEVEN HILLS	2147
WILSON PARK	10243	NEAR SILVERWATER RD FRONTING THE PARRAMATTA RIVER	SILVERWATER	2128
WATERS WITHIN UPPER HUNTER COUNTY COUNCIL	11677	NEW ENGLAND HIGHWAY	MUSWELLBROOK	2333
PEAT ISLAND SEWAGE TREATMENT SYSTEM	12035	PACIFIC HIGHWAY	MOONEY MOONEY	2083
AVONDALE COLLIERY	12442	OFF AVONDALE ROAD	AVONDALE	2530
WATERWAY CONSTRUCTIONS PTY LTD	12848	FARRER ROAD	PORT KEMBLA	2505
MAINLAND CIVIL PTY LTD	12868	BERTH 103 - TOM THUMB ROAD	PORT KEMBLA	2505
SYDNEY DESALINATION PLANT	12904	SIR JOSEPH BANKS DRIVE	KURNELL	2231
FITZROY FALLS RESERVOIR	12944	MYRA VALE ROAD	FITZROY FALLS	2577

The emission sources and associated releases to air from miscellaneous licensed discharges to water are presented in Table 3-253.

Table 3-253: Miscellaneous licensed discharges to water- emission sources

Source	Emissions to Air
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3. Data Sources and Results

3.43.2 Activity Data

Summary activity data collected from the industrial questionnaires for miscellaneous licensed discharges to water is presented in Table 3-254.

Table 3-254: Summary activity data for miscellaneous licensed discharges to waters

Parameter	Value	Unit
Total vehicle kilometres travelled	35,685	km/year
Amount of electricity consumed	39,846	MWh/year

3.43.3 Emission and Speciation Factors

The emission and speciation factors for all substances from miscellaneous licensed discharges to water sources are detailed in Table 3-255.

Table 3-255: Emission and speciation factors for all substances from miscellaneous licensed discharges to waters

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Ammonia	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.43.4 Emission Estimates

Total estimated annual emissions (for selected substances) from mining for minerals for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-256. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-256: Total estimated annual emissions from miscellaneous licensed discharges to waters (at any time)

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0.01	0	0	0	0.01
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0.07	0	0	0.44	0.51
ISOMERS OF XYLENE	0.43	0	0	2.66	3.09
LEAD AND COMPOUNDS	3.75	0	0	0	3.75
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	8,110	0	0	0	8,110
PARTICULATE MATTER ≤ 2.5 µm	848	0	0	0	848
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0.48	0	0	3.1	3.58
TOLUENE	0.3	0	0	1.77	2.07
TOTAL SUSPENDED PARTICULATE	28,900	0	0	0	28,900
TOTAL VOLATILE ORGANIC COMPOUNDS	3.94	0	0	19	23
TRICHLOROETHYLENE	0.07	0	0	0.44	0.51

3.43.5 Emission Projection Methodology

Projection factors for miscellaneous licensed discharges to waters have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.44 Non-thermal Treatment of Waste 92**3.44.1 Emission Sources and Associated Releases to Air**

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-257.

3. Data Sources and Results

Table 3-257: Non-thermal treatment of waste facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
PORT KEMBLA COPPER PTY LTD	1753	MILITARY ROAD	PORT KEMBLA	2505
AUSCOL (NSW) PTY LTD	2550	148 RIVERSTONE PDE	RIVERSTONE	2765
CLEANAWAY	2977	12 STUART STREET	PADSTOW	2211
COLLEX PTY LTD	3070	75 ANZAC STREET	GREENACRE	2190
STERIHEALTH NSW PTY LTD	3245	2-16 WIBLEN STREET	SILVERWATER	2128
DELTA EMD AUSTRALIA PTY LTD	3278	80 TOURLE STREET	MAYFIELD	2304
VISY RECYCLING	3984	CORNER MOORE & BAKER STREETS	BOTANY	2019
COASTAL RECYCLED COOKING OILS PTY LTD	4359	87 GAVENLOCK ROAD	TUGGERAH	2259
AUBURN WASTE & RECYCLING CENTRE	4547	HILL ROAD	HOME BUSH BAY	2127
DAVIS ROAD RECYCLING & WASTE TRANSFER STATION	4548	20 DAVIS ROAD	WETHERILL PARK	2164
ROCKDALE WASTE & RECYCLING CENTRE	4557	LINDSAY STREET	ROCKDALE	2216
HOME BUSH BAY LIQUID TREATMENT PLANT	4560	CORNER OF PONDAGE LINK & HILL RD	HOME BUSH BAY	2127
SEVEN HILLS WASTE & RECYCLING CENTRE	4571	29 POWERS ROAD	SEVEN HILLS	2147
HLEBAR; VINKO AND DRAGA	4578	NORTH STREET	SCHOFIELDS	2762
NUMEVE PTY LTD	4584	50 MEATWORKS AVE	OXFORD FALLS	2100
POLLUTION & LABORATORY SERVICES PTY LIMITED	4619	12 SCHOFIELDS STREET	RIVERWOOD	2210
COLLEX PTY LTD	4679	76-82 BURROWS ROAD	ALEXANDRIA	2015
CATERAIR AIRPORT SERVICES (SYDNEY) PTY LIMITED	4729	300 COWARD STREET	MASCOT	2020
COLLEX TREATMENT PLANT	4806	37 GRAND AVE	CAMELLIA	2142
ROCK AND DIRT RECYCLING	4849	306 RACECOURSE ROAD	SOUTH WINDSOR	2756
REEFWAY WASTE	4994	3-7 O'RIORDAN ST	ALEXANDRIA	2015
PASMINCO COCKLE CREEK SMELTER PTY LIMITED	5042	MAIN ROAD	BOOLAROO	2284
SIMS TYRECYCLE	5125	CNR ERSKINE PARK ROAD & MAMRE RD	ERSKINE PARK	2759
VISY RECYCLING	5157	9 BESSEMER STREET	BLACKTOWN	2148
SOLVECO PTY LTD	5661	38 LINKS ROAD	ST MARYS	2760
HASSALL STREET RECYCLING CENTRE	5713	HASSALL STREET	WETHERILL PARK	2164
SOLVENTS AUSTRALIA PTY. LIMITED	5790	77-79 BASSETT STREET	MONA VALE	2103
HYDROMET OPERATIONS (SOUTHERN) LIMITED	5874	LOT 3 FIVE ISLANDS ROAD	UNANDERRA	2526
BRANDSTER SERVICES	5973	UNIT 5 - 6 & 7; 15 LEE	ST MARYS	2760

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Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
		HOLM ROAD		
SOUTHERN OIL COLLECTION PTY LTD	6099	1 DAINTREE PLACE	GOSFORD WEST	2250
BELLAMBI TRADE CENTRE	6133	UNIT 6 - BELLAMBI LANE	BELLAMBI	2518
BITUPAVE LTD	6893	25 POWERS ROAD	SEVEN HILLS	2147
SPECIALISED WASTE TREATMENT SERVICES PTY LTD	7434	25 SANDPIPER CLOSE	KOORAGANG	2304
DUMPEX WASTE	7518	76 VIOLET ST	REVESBY	2212
DIAL-A-DUMP WASTE SORT/SEPARATE/TRANSFER FACILITY	10350	33 BURROWS ROAD	ST PETERS	2044
BENEDICT RECLAMATIONS	10490	146 NEWBRIDGE ROAD	MOOREBANK	2170
ECO CYCLE MATERIALS PTY LTD	10699	155 NEWTON ROAD	WETHERILL PARK	2164
TRANSPACIFIC WASTE SERVICES	10771	LOT 3 CHARCOAL CLOSE	UNANDERRA	2526
J.J. RICHARDS LIQUID WASTE SOLUTIONS - SEVEN HILLS	10870	UNITS 23-24/20 TUCKS ROAD	SEVEN HILLS	2147
CARDINAL GROUP PTY LTD	10935	3-5 DUCK STREET	AUBURN	2144
GOW ST RECYCLING	10943	81 GOW STREET	PADSTOW	2211
SLUDGE KING	11180	843 JOHN RENSHAW DRIVE	BLACK HILL	2322
G.P.P EXCAVATION & DEMOLITION CONTRACTORS PTY LTD	11219	2 FORD STREET	CHULLORA	2190
COAST & VALLEY OIL DISTRIBUTORS	11289	15 APPRENTICE DRIVE	BERKELEY VALE	2261
METROPOLITAN DEMOLITIONS AND RECYCLING	11483	396 PRINCES HIGHWAY	ST PETERS	2044
AIR FILTER DRY CLEANING SYSTEMS - NSW	11658	18 ENTERPRISE CRESCENT	SINGLETON	2330
TF GROUP PTY LIMITED	11673	5A CANAL ROAD	ST PETERS	2044
C & R TYRE RECYCLING PTY LTD	11686	36 STENHOUSE DRIVE	CAMERON PARK	2285
ECO CYCLE INDUSTRIES	11753	52-54 POWER STREET	ST MARYS	2760
WIDEMERE WEST - PROSPECT QUARRY	11815	38 WIDEMERE ROAD	WETHERILL PARK	2164
SYDNEYWIDE PIPE CLEANING PTY LTD	11949	40 EDWARD STREET	RIVERSTONE	2765
CMA METALS	11950	37-67 VIOLET STREET	REVESBY	2212
EARTHCARE RECYCLERS	12109	95 WISEMANS FERRY ROAD	SOMERSBY	2250
SILTECH PTY LTD	12114	15 RODBOROUGH ROAD	FRENCHS FOREST	2086
REDLAM WASTE SERVICES PTY LTD	12171	10 INDUSTRIAL ROAD	UNANDERRA	2526
SITA ENVIRONMENTAL SOLUTIONS	12242	9 DEVON STREET	ROSEHILL	2142

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
GROUNDWATER REMEDIATION TEST SITE (GRTS) - UNIVERSITY OF NEWCASTLE	12249	UNIVERSITY DRIVE	CALLAGHAN	2308
WASTE TRANS (AUST) PTY LTD	12289	10 ROBERT STREET	SMITHFIELD	2164
THIESS MATERIAL RECYCLING FACILITY	12297	31 WATERLOO AVENUE	THORNTON	2322
BIODIESEL INDUSTRIES AUSTRALIA PTY LTD	12627	62 RACECOURSE ROAD	RUTHERFORD	2320
CHEMSAL	12628	40 CHRISTIE STREET	ST MARYS	2760
WANLESS WASTECORP - NSW	12661	13 LONG STREET	SMITHFIELD	2164
BUILDING WASTE RESOURCE RECOVERY FACILITY	12857	38 MCPHERSON STREET	BANKSMEADOW	2019

The emission sources and associated releases to air from non-thermal treatment of waste are presented in Table 3-258.

Table 3-258: Non-thermal treatment of waste - emission sources

Source	Emissions to Air
Acid storage (hydrochloric)	Hydrochloric acid
Acid storage (sulfuric)	Sulfuric acid
Aluminium (pouring, casting)	NO _x , SO ₂
Boiler (diesel)	Combustion products
Boiler (heavy fuel oil)	Combustion products
Boiler (natural gas)	Combustion products
Boiler (waste oil)	Combustion products
Bottle crusher	VOC
Casting (hot metal transfer)	PM
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Loaders (overburden)	PM
Material transfer	PM
Material transfer (overburden)	PM
Primary crushing (M < 4%)	PM
Primary crushing (M > 4%)	PM
Process emissions	Combustion products
Screening	PM
Secondary crushing (M < 4%)	PM
Secondary crushing (M > 4%)	PM
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Tertiary crushing (M < 4%)	PM
Trucks (dumping overburden)	PM

3. Data Sources and Results

Source	Emissions to Air
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM

3.44.2 Activity Data

Summary activity data collected from the industrial questionnaires for non-thermal treatment of waste is presented in Table 3-259.

Table 3-259: Summary activity data for non-thermal treatment of waste

Parameter	Value	Unit
Amount of natural gas combusted	176,648	GJ/year
Amount of oil (waste oil and heavy fuel oil)	531	kL/year
Total vehicle kilometres travelled	222,933	km/year
Amount of diesel combusted	0.4	kL/year
Amount of electricity consumed	101,477	MWh/year

3.44.3 Emission and Speciation Factors

The emission and speciation factors for all substances from non-thermal treatment of waste are detailed in Table 3-255.

Table 3-260: Emission and speciation factors for all substances from non-thermal treatment of waste

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Aluminium (pouring, casting)	NPI EET Manual for Non-Ferrous Foundries v1.0 (EA, 1999f)
	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (heavy fuel oil)	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler (waste oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Bottle crusher	AP42, Chapter 9.12.1 Malt Beverages (USEPA, 1996b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Process emissions	Site specific emission estimates
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent based)	
	Surface coating (primer)	
	Surface coating (thinner)	
Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)	
PM _{2.5} , PM ₁₀ & TSP	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (heavy fuel oil)	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source	
	Boiler (waste oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)	
	Casting (hot metal transfer)	NPI EET Manual for Iron and Steel Production (EA, 1999e)	
	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Loaders (overburden)		
	Material transfer		
	Material transfer (overburden)		
	Primary crushing (M < 4%)		
	Primary crushing (M > 4%)		
	Process emissions		Site specific emission estimates
	Screening		NPI EET Manual for Mining v2.3 (EA, 2003b)
	Secondary crushing (M < 4%)		
	Secondary crushing (M > 4%)		
	Tertiary crushing (M < 4%)		
	Trucks (dumping overburden)		
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)	
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)	
	Wind erosion (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
Speciated organics (including methane)	Boiler (diesel)	SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)	
	Boiler (heavy fuel oil)	SPECIATEv4.2 (Profile ID=0001) (USEPA, 2008e)	
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)	
	Boiler (waste oil)	SPECIATEv4.2 (Profile ID=0001) (USEPA, 2008e)	
	Bottle crusher	SPECIATEv4.2 (Profile ID=1188) (USEPA, 2008e)	
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)	
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)	
	Process emissions	SPECIATEv4.2 (Profile ID=0122) (USEPA, 2008e)	
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)	
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)	
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)	
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)	
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)	
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)	
Speciated particulate matter	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)	
	Boiler (heavy fuel oil)		
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)	
	Boiler (waste oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)	
	Exposed area (wind erosion)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)	
	Loaders (overburden)		
	Material transfer (overburden)		
	Primary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)	
	Primary crushing (M > 4%)		
	Process emissions	Site specific emission estimates	
	Screening	CEIDARS Particulate Matter (PM) Speciation Profiles -	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		Rock screening (CARB, 2007)
	Secondary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Secondary crushing (M > 4%)	
	Tertiary crushing (M < 4%)	
	Trucks (dumping overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	Boiler (diesel)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (heavy fuel oil)	
	Boiler (natural gas)	
	Boiler (waste oil)	
	Process emissions	Site specific emission estimates
	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	Acid storage (hydrochloric)	Raoult's law (Raoult, M, 1882a; 1882b, 1887a; 1887b), using chemical properties from Perry and Green (1997)
	Acid storage (sulfuric)	
	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (heavy fuel oil)	
	Boiler (waste oil)	
	Process emissions	Site specific emission estimates
PAH	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (heavy fuel oil)	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler (waste oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Process emissions	Site specific emission estimates
PCDD/PCDF	Boiler (diesel)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (heavy fuel oil)	
	Boiler (natural gas)	
	Boiler (waste oil)	
	Process emissions	Site specific emission estimates
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (diesel)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (heavy fuel oil)	
	Boiler (natural gas)	
	Boiler (waste oil)	
	Process emissions	Site specific emission estimates

3.44.4 Emission Estimates

Total estimated annual emissions (for selected substances) from non-thermal treatment of waste for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-261. Total estimated annual emissions of all substances are presented in Appendix A.

3. Data Sources and Results

Table 3-261: Total estimated annual emissions from non-thermal treatment of waste

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	5,080	0.25	2.8	45.1	5,130
CARBON MONOXIDE	8,520	41.7	470	325	9,350
FORMALDEHYDE	178	4.57	5.6	6.84	195
ISOMERS OF XYLENE	2,060	24.9	0	171	2,250
LEAD AND COMPOUNDS	69.8	0.49	0.06	0.08	70.4
OXIDES OF NITROGEN	21,000	49.6	560	568	22,200
PARTICULATE MATTER ≤ 10 µm	89,100	3,250	131	384	92,900
PARTICULATE MATTER ≤ 2.5 µm	22,500	532	63.9	293	23,400
POLYCYCLIC AROMATIC HYDROCARBONS	0.34	0	0	0.01	0.35
SULFUR DIOXIDE	1,290	0.26	2.93	996	2,290
TETRACHLOROETHYLENE	1,260	28.5	0	328	1,620
TOLUENE	4,060	16.5	1.4	364	4,440
TOTAL SUSPENDED PARTICULATE	242,000	8,850	503	885	252,000
TOTAL VOLATILE ORGANIC COMPOUNDS	20,700	183	30.8	4400	25,300
TRICHLOROETHYLENE	483	4.07	0	912	1,400

3.44.5 Emission Projection Methodology

Projection factors for non-thermal treatment of waste have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.45 Other Land-based Extraction 37**3.45.1 Emission Sources and Associated Releases to Air**

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-262.

Table 3-262: Other land-based extraction facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
HANSON CONSTRUCTION MATERIALS PTY LTD	1852	BELLS LINE OF ROAD	CLARENCE	2790
PROSPECT QUARRY	2200	RECONCILIATION ROAD	PROSPECT	2148
P B WHITE MINERALS PTY LTD	2257	END OF TORKINGTON ROAD	LONDONDERRY	2753
M. COLLINS & SONS (CONTRACTORS) PTY LTD	2767	CUT HILL ROAD	COBBITTY	2570
PENRITH LAKES SCHEME	2956	89-151 OLD CASTLEREAGH ROAD	CRANEBROOK	2749
ROCLA PTY LIMITED	3629	CAPTAIN COOK DRIVE	KURNELL	2231

3. Data Sources and Results

DIXON SAND (PENRITH) PTY LTD	3916	4610 OLD NORTHERN ROAD	MAROOKA	2756
PENROSE QUARRY	4720	LOT 5 HUME HIGHWAY	PADDYS RIVER	2577
SALT ASH PLANT	11685	NELSON BAY ROAD	SALT ASH	2318
MACKA'S SAND AND SOIL	12108	2846 NELSON BAY ROAD	SALT ASH	2318

The emission sources and associated releases to air from other land based extraction are presented in Table 3-263.

Table 3-263: Other land based extraction – emission sources

Source	Emissions to Air
Blasting	PM
Boiler (LPG)	Combustion products
Boiler (natural gas)	Combustion products
Bulldozers (overburden)	PM
Bulldozers (sandstone)	PM
Drilling	PM
Explosives (powergel gold, large)	CO
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Graders	PM
Loaders (overburden)	PM
Material transfer (sandstone)	PM
Primary crushing (M < 4%)	PM
Scrapers (overburden)	PM
Screening	PM
Surface coating (degreaser)	VOC
Trucks (dumping overburden)	PM
Trucks (dumping sandstone)	PM
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (sandstone)	PM

3.45.2 Activity Data

Summary activity data collected from the industrial questionnaires for other land-based extraction is presented in Table 3-264.

Table 3-264: Summary activity data for other land-based extraction

Parameter	Value	Unit
Amount of material produced (sand and soil product)	2,089,900	tonne/year
Amount of natural gas combusted	46	GJ/year
Total vehicle kilometres travelled	1,370,699	km/year
Amount of electricity consumed	7,530	MWh/year

3. Data Sources and Results

3.45.3 Emission and Speciation Factors

The emission and speciation factors for all substances from other land-based extraction are detailed in Table 3-194.

Table 3-265: Emission and speciation factors for all substances from other land-based extraction

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Explosives (powergel gold, large)	NPI EET Manual for Explosives and Detonation v2 (DEWHA, 2008)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Surface coating (degreaser)	Mass balance
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Blasting	NPI EET Manual for Mining v2.3 (EA, 2003)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Bulldozers (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003)
	Bulldozers (sandstone)	
	Drilling	
	Exposed area (wind erosion)	
	Graders	
	Loaders (overburden)	
	Material transfer (sandstone)	
	Primary crushing (M < 4%)	
	Scrapers (overburden)	
	Screening	
	Trucks (dumping overburden)	
	Trucks (dumping sandstone)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)	
Wind erosion (sandstone)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
Speciated organics (including methane)	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Blasting	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Bulldozers (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Bulldozers (sandstone)	
	Drilling	
	Exposed area (wind erosion)	
	Graders	
	Loaders (overburden)	
	Material transfer (sandstone)	
	Primary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Scrapers (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Screening	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock screening (CARB, 2007)
	Trucks (dumping overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping sandstone)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Wind erosion (sandstone)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)	
Ammonia	Boiler (LPG)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (natural gas)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (LPG)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (natural gas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (LPG)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (natural gas)	

3.45.4 Emission Estimates

Total estimated annual emissions (for selected substances) from other land-based extraction for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-266. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-266: Total estimated annual emissions from other land-based extraction

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0.01	0	0	0	0.01
BENZENE	26.7	7.95	0	0	34.6
CARBON MONOXIDE	5,020	264	0	0	5,280

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
FORMALDEHYDE	0.06	15.9	0	0	16
ISOMERS OF XYLENE	102	0.1	0	0.07	103
LEAD AND COMPOUNDS	532	10.1	0	13.9	556
OXIDES OF NITROGEN	1.92	529	0	0	531
PARTICULATE MATTER ≤ 10 µm	1,300,000	25,500	0	37,000	1,360,000
PARTICULATE MATTER ≤ 2.5 µm	145,000	2,860	0	4,190	152,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0.01	3.85	0	0	3.86
TETRACHLOROETHYLENE	197	0	0	0	197
TOLUENE	221	3.99	0	0.02	225
TOTAL SUSPENDED PARTICULATE	4,460,000	83,800	0	124,000	4,670,000
TOTAL VOLATILE ORGANIC COMPOUNDS	2,670	32.8	0	0.83	2,710
TRICHLOROETHYLENE	560	0	0	0	560

3.45.5 Emission Projection Methodology

Projection factors for other land-based extraction have been derived based on final energy consumption projections for mining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-75 and illustrated in Figure 3-5.

3.46 Paints/Polishes/Adhesives Production 17

3.46.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-267.

Table 3-267: Paints/polishes/adhesives production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
NATIONAL STARCH AND CHEMICAL PTY LTD	258	7 STANTON ROAD	SEVEN HILLS	2147
WATTYL AUSTRALIA PTY LTD	1270	4 STEEL STREET	BLACKTOWN	2148
PPG INDUSTRIES	1996	9 BIRMINGHAM AVE	VILLAWOOD	2163
DIC AUSTRALIA	2095	323 CHISHOLM ROAD	AUBURN	2144
CHEMCOLOUR INDUSTRIES AUSTRALIA PTY LIMITED	2131	19-25 ANNE STREET	ST MARYS	2760
SI GROUP-AUSTRALIA PTY LIMITED	2494	72 CHRISTIE STREET	ST MARYS	2760
THE VALSPAR (AUSTRALIA) CORPORATION PTY LTD	2785	203 POWER STREET	GLENDENNING	2761
FLINT GROUP AUSTRALIA PTY LTD	5463	14A WILLIAMSON ROAD	INGLEBURN	2565
DAVCO CONSTRUCTION	6459	67 ELIZABETH STREET	WETHERILL PARK	2164

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
MATERIALS PTY LTD				
SELLEYS PTY LTD	7106	1 GOW STREET	PADSTOW	2211
ARCHITECTURAL & STRUCTURAL ADHESIVES	7382	106-108 REDFERN STREET	WETHERILL PARK	2164
BOSTIK AUSTRALIA PTY LTD	10631	21 TATTERSALL ROAD	BLACKTOWN	2148
RLA POLYMERS ATLAS TILE ADHESIVES	13019	363 WENTWORTH AVENUE	PENDLE HILL	2145

The emission sources and associated releases to air from paints/polishes/adhesives production are presented in Table 3-268.

Table 3-268: Paints/polishes/adhesives production - emission sources

Source	Emissions to Air
Boiler (light fuel oil)	Combustion products
Boiler (LPG)	Combustion products
Boiler (natural gas)	Combustion products
Cement unloading	PM
Conveyor transfer of aggregate to elevated storage	PM
Conveyor transfer of sand to elevated storage	PM
Fuel storage (diesel)	VOC
Internal combustion engine (diesel)	Combustion products
Material transfer	PM
Mixer loading (central mix)	PM
Organic liquid storage (various chemicals)	VOC
Paint production (paint grinding & mixing)	PM, VOC
Paint production (solvent reclamation - fugitive (spills & loading))	VOC
Process emissions	Combustion products
Sand transfer to ground	PM
Surface coating (paint - solvent based)	VOC
Surface coating (primer)	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.46.2 Activity Data

Summary activity data collected from the industrial questionnaires for paints/polishes/adhesives production is presented in Table 3-269.

Table 3-269: Summary activity data for paints/polishes/adhesives production

Parameter	Value	Unit
Amount of adhesives manufactured	61,715	kL/year
Amount of paint manufactured	48,909	kL/year
Amount of ink manufactured	31,968	kL/year
Amount of light fuel oil/diesel combusted	12	kL/year
Amount of natural gas combusted	60,101	GJ/year
Total vehicle kilometres travelled	335,186	km/year
Amount of electricity consumed	29,336	MWh/year

3. Data Sources and Results

3.46.3 Emission and Speciation Factors

The emission and speciation factors for all substances from paints/polishes/adhesives production sources are detailed in Table 3-270.

Table 3-270: Emission and speciation factors for all substances from paints/polishes/adhesives production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (light fuel oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Organic liquid storage (various chemicals)	TANKS 4.09D software (USEPA, 2006e)
	Paint production (paint grinding & mixing)	AP42 Chapter 6.4 Paint and Varnish (USEPA, 1983)
	Paint production (solvent reclamation - fugitive (spills & loading))	
	Process emissions	Site specific emission estimates
	Surface coating (paint - solvent based)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (primer)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (light fuel oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Conveyor transfer of aggregate to elevated storage	
	Conveyor transfer of sand to elevated storage	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Material transfer	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Mixer loading (central mix)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Paint production (paint grinding & mixing)	AP42 Chapter 6.4 Paint and Varnish (USEPA, 1983)
	Process emissions	Site specific emission estimates
	Sand transfer to ground	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (light fuel oil)	SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Organic liquid storage (various chemicals)	Mass balance
	Paint production (paint grinding & mixing)	SPECIATEv4.2 (Profile ID=1094) (USEPA, 2008e)
	Paint production (solvent reclamation - fugitive (spills & loading))	SPECIATEv4.2 (Profile ID=1094) (USEPA, 2008e)
	Process emissions	Site specific emission estimates
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (light fuel oil)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Internal combustion engine (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Mixer loading (central mix)	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (light fuel oil)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (LPG)	
	Boiler (natural gas)	
	Internal combustion engine (diesel)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	Boiler (light fuel oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
PAH	Boiler (light fuel oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Process emissions	Site specific emission estimates
PCDD/PCDF	Boiler (light fuel oil)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (LPG)	
	Boiler (natural gas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (light fuel oil)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (LPG)	
	Boiler (natural gas)	
	Internal combustion engine (diesel)	

3.46.4 Emission Estimates

Total estimated annual emissions (for selected substances) from paints/polishes/adhesives production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-271. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-271: Total estimated annual emissions from paints/polishes/adhesives production

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	26.1	0	0	0	26.1
BENZENE	130	0	0	0	130
CARBON MONOXIDE	8,170	0	0	0	8,170
FORMALDEHYDE	160	0	0	0	160
ISOMERS OF XYLENE	1,180	0	0	0	1,180
LEAD AND COMPOUNDS	0.07	0	0	0	0.07
OXIDES OF NITROGEN	2,550	0	0	0	2,550
PARTICULATE MATTER ≤ 10 µm	10,300	0	0	0	10,300
PARTICULATE MATTER ≤ 2.5 µm	7,630	0	0	0	7,630
POLYCYCLIC AROMATIC HYDROCARBONS	0.02	0	0	0	0.02
SULFUR DIOXIDE	103	0	0	0	103
TETRACHLOROETHYLENE	18.1	0	0	0	18.1
TOLUENE	18,200	0	0	0	18,200
TOTAL SUSPENDED PARTICULATE	12,600	0	0	0	12,600
TOTAL VOLATILE ORGANIC COMPOUNDS	99,900	0	0	0	99,900
TRICHLOROETHYLENE	3.5	0	0	0	3.5

3.46.5 Emission Projection Methodology

Projection factors for paints/polishes/adhesives production have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

3.47 Paper or Pulp Production (Using Virgin or Recycled Materials) 66, 67

3.47.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-272.

Table 3-272: Paper or pulp production (using virgin or recycled materials) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
AMCOR PACKAGING - BOTANY MILL	1594	1891 BOTANY ROAD	MATRAVILLE	2036
VISY PAPER PTY LTD	4100	6 HERBERT PLACE	SMITHFIELD	2164
ABC PAPER AND PAPER MILLS PTY LIMITED	12530	63-65 REDFERN STREET	WETHERILL PARK	2164

The emission sources and associated releases to air from paper or pulp production are presented in Table 3-273.

Table 3-273: Paper or pulp production - emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Fuel storage (diesel)	VOC
Process emissions	PM
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (thinner)	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM

3.47.2 Activity Data

Summary activity data collected from the industrial questionnaires for paper or pulp production is presented in Table 3-274.

Table 3-274: Summary activity data for paper or pulp production

Parameter	Value	Unit
Amount of paper product produced	756,134	tonne/year
Amount of natural gas combusted	1,852,188	GJ/year
Total vehicle kilometres travelled	496,111	km/year
Amount of electricity consumed	125,153	MWh/year

3.47.3 Emission and Speciation Factors

The emission and speciation factors for all substances from paper or pulp production are detailed in Table 3-275.

3. Data Sources and Results

Table 3-275: Emission and speciation factors for all substances from paper or pulp production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent based)	
	Surface coating (thinner)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Process emissions	Site specific emission estimates
	Wheel generated dust - paved roads	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust - paved roads	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.47.4 Emission Estimates

Total estimated annual emissions (for selected substances) from paper or pulp production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-276. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-276: Total estimated annual emissions from paper or pulp production

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	363	0	0	0	363
CARBON MONOXIDE	59,400	0	0	0	59,400
FORMALDEHYDE	727	0	0	0	727
ISOMERS OF XYLENE	174	0	0	0	174
LEAD AND COMPOUNDS	0.66	0	0	0	0.66
OXIDES OF NITROGEN	135,000	0	0	0	135,000
PARTICULATE MATTER ≤ 10 µm	5,860	0	0	0	5,860
PARTICULATE MATTER ≤ 2.5 µm	5,510	0	0	0	5,510
POLYCYCLIC AROMATIC HYDROCARBONS	0.49	0	0	0	0.49
SULFUR DIOXIDE	371	0	0	0	371
TETRACHLOROETHYLENE	182	0	0	0	182
TOLUENE	428	0	0	0	428
TOTAL SUSPENDED PARTICULATE	7,840	0	0	0	7,840
TOTAL VOLATILE ORGANIC COMPOUNDS	6,140	0	0	0	6,140
TRICHLOROETHYLENE	186	0	0	0	186

3.47.5 Emission Projection Methodology

Projection factors for paper or pulp production (using virgin or recycle materials) have been derived based on final energy consumption projections for wood, paper in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-277 and illustrated in Figure 3-15.

Table 3-277: Projection factors for wood, paper related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0143	2023	1.1965
2010	1.0282	2024	1.2096
2011	1.0419	2025	1.2225
2012	1.0548	2026	1.2355
2013	1.0676	2027	1.2487
2014	1.0804	2028	1.2620
2015	1.0930	2029	1.2755
2016	1.1056	2030	1.2886
2017	1.1183	2031	1.3016
2018	1.1310	2032	1.3147
2019	1.1440	2033	1.3278
2020	1.1570	2034	1.3409
2021	1.1701	2035	1.3540
2022	1.1833	2036	1.3671

Source: ABARE (2006)

3. Data Sources and Results

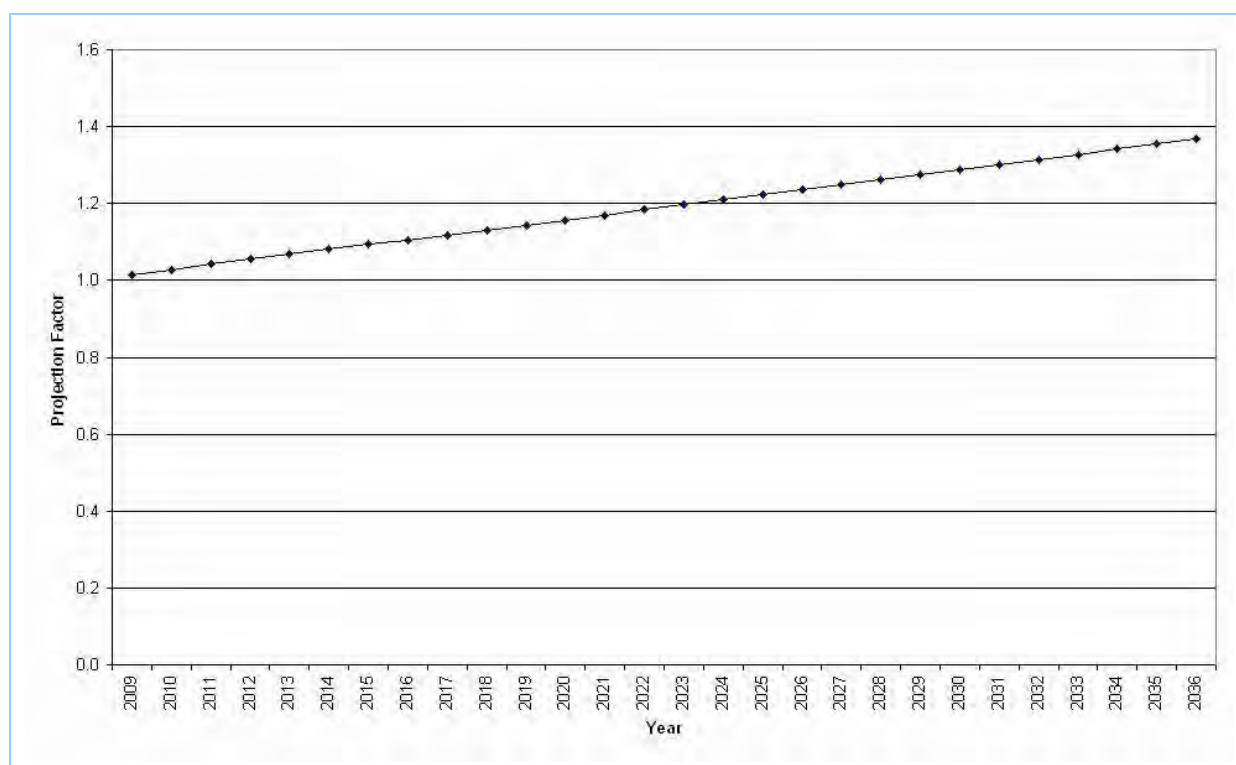


Figure 3-15: Projection factors for wood, paper related sources

3.48 Pesticides and Related Products Production 19

3.48.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-278.

Table 3-278: Pesticides and related products production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
CHEMINOVA (MFG) PTY LIMITED	472	16-18 LUCCA ROAD	WYONG	2259
ALPHA CHEMICALS PTY LTD	531	18 INMAN ROAD	DEE WHY	2099
DU PONT (AUSTRALIA) LTD	6696	179 MAGOWAR ROAD	GIRRAWEEEN	2145
TROY LABORATORIES PTY LTD	6983	98 LONG STREET	SMITHFIELD	2164
YATES	11115	9 COVENTRY PLACE	MOUNT DRUITT	2770

The emission sources and associated releases to air from pesticides and related products production are presented in Table 3-279.

Table 3-279: Pesticides and related products production – emission sources

Source	Emissions to Air
Acid storage (hydrochloric)	Hydrochloric acid
Boiler (LPG)	Combustion products
Boiler (natural gas)	Combustion products
Fuel storage (diesel)	VOC
Organic liquid storage (ethanol)	VOC
Polypropylene manufacturing	PM, VOC
Process emissions	PM, VOC, PAH
Surface coating (paint - solvent based)	VOC
Surface coating (thinner)	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM

3.48.2 Activity Data

Summary activity data collected from the industrial questionnaires for pesticides and related products production is presented in Table 3-280.

Table 3-280: Summary activity data for pesticides and related products production

Parameter	Value	Unit
Amount of natural gas combusted	6,543	GJ/year
Amount of LPG combusted	66	m ³ /year
Total vehicle kilometres travelled	47,188	km/year
Amount of electricity consumed	2,661	MWh/year

3.48.3 Emission and Speciation Factors

The emission and speciation factors for all substances from pesticides and related products production sources are detailed in Table 3-281.

Table 3-281: Emission and speciation factors for all substances from pesticides and related products production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Organic liquid storage (ethanol)	
	Polypropylene manufacturing	AP42 Chapter 6.6.4 Polypropylene (USEPA, 1991)
	Process emissions	Site specific emission estimates
	Surface coating (paint - solvent based)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (thinner)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		1998b)
	Polypropylene manufacturing	AP42 Chapter 6.6.4 Polypropylene (USEPA, 1991)
	Process emissions	Site specific emission estimates
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Organic liquid storage (ethanol)	Mass balance (100% ethanol)
	Polypropylene manufacturing	CEIDARS Organic Gas Speciation Profiles (Profile ID=9016) (CARB, 2005)
	Process emissions	Site specific emission estimates
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (LPG)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (assuming the same emissions per joule as natural gas) (Pechan, 2004)
	Boiler (natural gas)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	Acid storage (hydrochloric)	Raoult's law (Raoult, M, 1882a; 1882b, 1887a; 1887b), using chemical properties from Perry and Green (1997)
PAH	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Process emissions	Site specific emission estimates
PCDD/PCDF	Boiler (LPG)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (natural gas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (LPG)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009)
	Boiler (natural gas)	

3.48.4 Emission Estimates

Total estimated annual emissions (for selected substances) from pesticides and related products production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-282. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-282: Total estimated annual emissions from pesticides and related products production

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0.01
BENZENE	2.07	0	0	0	2.07
CARBON MONOXIDE	245	0	0	0	245
FORMALDEHYDE	4.12	0	0	0	4.13
ISOMERS OF XYLENE	2.84	0	0	0.02	2.86
LEAD AND COMPOUNDS	0.01	0	0	0.06	0.06
OXIDES OF NITROGEN	387	0	0	0	387
PARTICULATE MATTER ≤ 10 µm	1,840	0	0	107	1,940
PARTICULATE MATTER ≤ 2.5 µm	1,630	0	0	40.6	1,670
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	1.43	0	0	0	1.43
TETRACHLOROETHYLENE	0.1	0	0	0.01	0.1
TOLUENE	14.3	0	0	0.01	14.3
TOTAL SUSPENDED PARTICULATE	1,860	0	0	478	2,340
TOTAL VOLATILE ORGANIC COMPOUNDS	10,500	0	0	0.2	10,500
TRICHLOROETHYLENE	0.01	0	0	0	0.01

3.48.5 Emission Projection Methodology

Projection factors for pesticides and related products production have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

3.49 Petrochemical Production 18

3.49.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-283.

Table 3-283: Petrochemical production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
QENOS PTY LTD	10000	LOT 5-LOT 10 OF BOTANY IND PK - 20 BEAUCHAMP ROAD	MATRAVILLE	2036
SAMI PTY LTD	12120	12 GRAND AVENUE	CAMELLIA	2142
SIKA AUSTRALIA	12239	18 HARGRAVES PLACE	WETHERILL PARK	2164

The emission sources and associated releases to air from petrochemical production are presented in Table 3-284.

Table 3-284: Petrochemical production – emission sources

Source	Emissions to Air
Aggregate transfer to ground	PM
Boiler (coal)	Combustion products
Boiler (natural gas)	Combustion products
Cement unloading	PM
Conveyor transfer of aggregate to elevated storage	PM
Fuel storage (diesel)	VOC
Fuel storage (fuel oil)	VOC
Fuel storage (jet fuel)	VOC
Internal combustion engine (diesel)	Combustion products
Organic liquid storage (bitumen)	VOC
Organic liquid storage (hexane)	VOC
Organic liquid storage (hexene)	VOC
Organic liquid storage (methanol)	VOC
Organic liquid storage (pygas/pyrolysis gas)	VOC
Process emissions	VOC
Sand transfer to ground	PM
Wheel generated dust (paved roads)	PM

3.49.2 Activity Data

Summary activity data collected from the industrial questionnaires for petrochemical production is presented in Table 3-285.

Table 3-285: Summary activity data for petrochemical production

Parameter	Value	Unit
Amount of natural gas combusted	6,063,029	GJ/year
Amount of coal combusted	36,209	tonne/year
Total vehicle kilometres travelled	245,751	km/year
Amount of electricity consumed	185,467	MWh/year

3.49.3 Emission and Speciation Factors

The emission and speciation factors for all substances from petrochemical production sources are detailed in Table 3-286.

Table 3-286: Emission and speciation factors for all substances from petrochemical production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (coal)	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (fuel oil)	
	Fuel storage (jet fuel)	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Organic liquid storage (bitumen)	TANKS 4.09D software (USEPA, 2006e)
	Organic liquid storage (hexane)	
	Organic liquid storage (hexene)	
	Organic liquid storage (methanol)	
	Organic liquid storage (pygas/pyrolysis gas)	
	Process emissions	Site specific emission estimates
PM _{2.5} , PM ₁₀ & TSP	Aggregate transfer to ground	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Boiler (coal)	AP42 Chapter Bituminous And Subbituminous Coal Combustion (USEPA, 1998) and CEIDARS profile ID131 Coal/Coke combustion (CARB, 2008)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Conveyor transfer of aggregate to elevated storage	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Sand transfer to ground	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Boiler (coal)	SPECIATEv4.2 (Profile ID=1178) (USEPA, 2008e)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (fuel oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Fuel storage (jet fuel)	CEIDARS Organic Profile Jet fuel evaporation (jet a) (CARB, 2005)
	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Organic liquid storage (bitumen)	CEIDARS Organic Profile 716 (CARB, 2005)
	Organic liquid storage (hexane)	Site specific emission estimates/mass balance
	Organic liquid storage (hexene)	
	Organic liquid storage (methanol)	
	Organic liquid storage (pygas/pyrolysis gas)	
	Process emissions	
Speciated particulate matter	Boiler (coal)	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Internal combustion engine (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Wheel generated dust (paved	California Emissions Inventory and Reporting System -

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	roads)	Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (coal)	NPI EET Manual for Fossil Fuel Electric Power Generation v2.4 (DEH, 2005)
	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Internal combustion engine (diesel)	
Sulfuric or hydrochloric acid	Boiler (coal)	Mass balance
PAH	Boiler (coal)	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Process emissions	Site specific emission estimates
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	Boiler (coal)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden, K et al, 2004)
	Boiler (natural gas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (coal)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (natural gas)	
	Internal combustion engine (diesel)	

3.49.4 Emission Estimates

Total estimated annual emissions (for selected substances) from petrochemical production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-287. Estimated annual emissions of all substances are presented in Appendix A.

Table 3-287: Total estimated annual emissions from petrochemical production

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	2.48	0	0	0	2.48
ACETALDEHYDE	0	0	0	0	0
BENZENE	16,100	0	0	0	16,100
CARBON MONOXIDE	257,000	0	0	0	257,000
FORMALDEHYDE	66,800	0	0	0	66,800
ISOMERS OF XYLENE	1,880	0	0	0	1,880
LEAD AND COMPOUNDS	5.91	0	0	0	5.91
OXIDES OF NITROGEN	1,100,000	0	0	0	1,100,000
PARTICULATE MATTER ≤ 10 µm	24,000	0	0	0	24,000
PARTICULATE MATTER ≤ 2.5 µm	17,500	0	0	0	17,500
POLYCYCLIC AROMATIC HYDROCARBONS	2.17	0	0	0	2.17
SULFUR DIOXIDE	229,000	0	0	0	229,000
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	6,740	0	0	0	6,740
TOTAL SUSPENDED PARTICULATE	40,500	0	0	0	40,500
TOTAL VOLATILE ORGANIC COMPOUNDS	699,000	0	0	0	699,000
TRICHLOROETHYLENE	0	0	0	0	0

3.49.5 Emission Projection Methodology

Projection factors for petrochemical production have been derived based on primary energy consumption projections for petroleum refining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-288 and illustrated in Figure 3-16.

Table 3-288: Projection factors for petroleum refining related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0162	2023	1.1714
2010	1.0314	2024	1.1827
2011	1.0436	2025	1.1942
2012	1.0537	2026	1.2057
2013	1.0638	2027	1.2174
2014	1.0741	2028	1.2292
2015	1.0845	2029	1.2411
2016	1.0950	2030	1.2531
2017	1.1056	2031	1.2648
2018	1.1163	2032	1.2762
2019	1.1271	2033	1.2877
2020	1.1381	2034	1.2992
2021	1.1491	2035	1.3106
2022	1.1602	2036	1.3221

Source: ABARE (2006)

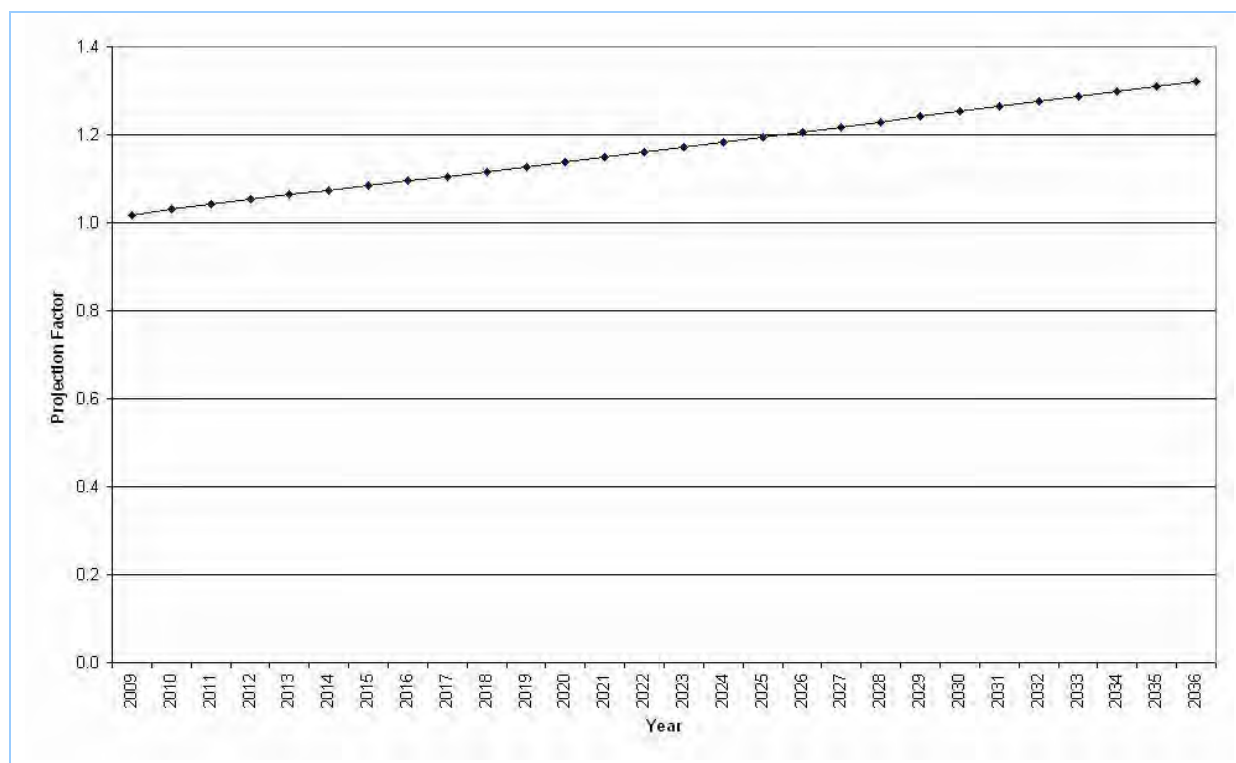


Figure 3-16: Projection factors for petroleum refining related sources

3.50 Petroleum Products and Fuel Production 68

3.50.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-289.

Table 3-289: Petroleum products and fuel production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
LUBRIZOL AUSTRALIA	134	28 RIVER STREET	SILVERWATER	2128
HARRISON MANUFACTURING CO PTY LTD	139	75 OLD PITTWATER ROAD	BROOKVALE	2100
CLYDE REFINERY	570	DURHAM STREET	CAMELLIA	2142
CALTEX REFINERIES (NSW) PTY LTD	837	2 SOLANDER STREET	KURNELL	2231
HC EXTRACTIONS PTY LTD	2695	LOT 1 - CAPTAIN COOK DRIVE	KURNELL	2231
VALVOLINE (AUSTRALIA) PTY LIMITED	3182	30 DAVIS ROAD	WETHERILL PARK	2164
ITW POLYMERS & FLUIDS	7366	100 HASSALL STREET	WETHERILL PARK	2164
RAY BEDDOE TREATMENT PLANT	11713	WESTBROOK ROAD	CAWDOR	2570
ROSALIND PARK GAS PLANT	12003	MEDHURST ROAD	GILEAD	2560
GULF WESTERN OIL	12132	1 COOMBES DRIVE	PENRITH	2750
TRANSPACIFIC REFINERS PTY LTD	12555	11 KYLE STREET	RUTHERFORD	2320

The emission sources and associated releases to air from petroleum products and fuel production are presented in Table 3-290.

Table 3-290: Petroleum products and fuel production – emission sources

Source	Emissions to Air
Air (preheater)	Combustion products
Blend tank	VOC
Boiler (natural gas)	Combustion products
Boiler 7/9 stack	Combustion products
Carbon scrubber vent	PM, fluoride
CCU stack	Combustion products
CDU stack	Combustion products
CLOR hot oil heater	Combustion products
CLOR HTU HVI reactor heater	Combustion products
CLOR HTU LVI hydrogen heater	Combustion products
CLOR HTU LVI oil heater	Combustion products
CLOR HVI extracts heater	Combustion products
CLOR HVI WFO heater	Combustion products
CLOR LVI extracts heater	Combustion products
CLOR VDU feed heater	Combustion products

3. Data Sources and Results

Source	Emissions to Air
CO boiler and FCCU#2 stack	Combustion products
Common stack	Combustion products
Crude distillation unit heater	Combustion products
FCCU1 reactor and regenerator	Combustion products
Flares	Combustion products
Floor cleaning	VOC
Fuel storage (crude oil)	VOC
Fuel storage (diesel)	VOC
Fuel storage (jet fuel)	VOC
Fuel storage (oil)	VOC
Fuel storage (petrol)	VOC
HC flares	Combustion products
HDS stack	Combustion products
Hood	VOC
Hydrogen reformer	Combustion products
Internal combustion engine (natural gas)	Combustion products
Isosiv heaters stack	Combustion products
Light ends scrubber	Combustion products
Oil fume blending	Combustion products
Organic liquid storage (bitumen)	VOC
Organic liquid storage (general chemicals)	VOC
Organic liquid storage (refinery products)	VOC
PDU heater	Combustion products
Platformer 3 stack	Combustion products
Platformer heater	Combustion products
Powerplant boiler	Combustion products
Product loading (additives)	VOC
Recycle tank	VOC
Refinery flare	Combustion products
Refinery fugitives (bioremediation plot)	VOC, PAH, H ₂ S
Refinery fugitives (spills, leaks, fires)	VOC, PAH, H ₂ S
Refinery fugitives (valves, seals, flanges)	VOC, PAH, H ₂ S
Scrubber	Combustion products
Ship loading (150SN)	VOC
Ship loading (160B)	VOC
Ship loading (500SN)	VOC
Ship loading (ADF)	VOC
Ship loading (CLO)	VOC
Ship loading (diesel)	VOC
Ship loading (DXL)	VOC
Ship loading (FCCU feed)	VOC
Ship loading (FCCU)	VOC
Ship loading (fuel oil)	VOC
Ship loading (Gasoil 2500 ppm)	VOC
Ship loading (Gasoil)	VOC
Ship loading (HNN)	VOC
Ship loading (HSR)	VOC
Ship loading (naphtha (LSR))	VOC
Ship loading (naphtha)	VOC

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Source	Emissions to Air
Ship loading (PULP)	VOC
Ship loading (SCF)	VOC
Ship loading (SPULP)	VOC
Ship loading (SRD)	VOC
Ship loading (Super PULP)	VOC
Ship loading (Sweet FCCU)	VOC
Ship loading (unleaded)	VOC
Surface coating (enamel)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (paint - water based)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Teg reflux column vent	VOC, PAH
Thermal oil heater	Combustion products
Turbine (natural gas)	Combustion products
Unifiner feed heater	Combustion products
VDU heater	Combustion products
VOC fugitives	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (civil work material stockpiles)	PM

3.50.2 Activity Data

Summary activity data collected from the industrial questionnaires for petroleum products and fuel production is presented in Table 3-291.

Table 3-291: Summary activity data for petroleum products and fuel production

Parameter	Value	Unit
Amount of petroleum products produced	7,273,706	kL/year
Amount of petrol produced	3,300,000	kL/year
Amount of diesel produced	2,140,000	kL/year
Amount of jet fuel produced	1,300,000	kL/year
Amount of natural gas combusted	1,838,951	GJ/year
Total vehicle kilometres travelled	103,394	km/year
Amount of electricity consumed	303,213	MWh/year

3.50.3 Emission and Speciation Factors

The emission and speciation factors for all substances from petroleum products and fuel production sources are detailed in Table 3-292.

Table 3-292: Emission and speciation factors for all substances from petroleum products and fuel production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Air (preheater)	Site specific emission estimates
	Blend tank	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler 7/9 stack	Site specific emission estimates
	CCU stack	
	CDU stack	
	CLOR hot oil heater	
	CLOR HTU HVI reactor heater	
	CLOR HTU LVI hydrogen heater	
	CLOR HTU LVI oil heater	
	CLOR HVI extracts heater	
	CLOR HVI WFO heater	
	CLOR LVI extracts heater	
	CLOR VDU feed heater	
	CO boiler and FCCU#2 stack	
	Common Stack	
	Crude distillation unit heater	
	FCCU1 reactor and regenerator	
	Flares	
	Floor cleaning	
	Fuel storage (crude oil)	
	Fuel storage (diesel)	
	Fuel storage (jet fuel)	
	Fuel storage (oil)	
	Fuel storage (petrol)	
	HC flares	
	HDS stack	
	Hood	
	Hydrogen reformer	
	Internal combustion engine (natural gas)	NPI EET Manual for Combustion Engines v3.0 (DEWHA, 2008b)
	Isosiv heaters stack	Site specific emission estimates
	Light ends scrubber	
	Oil fume blending	
	Organic liquid storage (bitumen)	
	Organic liquid storage (general chemicals)	
	Organic liquid storage (refinery products)	
	PDU heater	
	Platformer 3 stack	
	Platformer heater	
	Powerplant boiler	
	Product loading (additives)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Recycle tank	
	Refinery flare (9F-2X)	
	Refinery fugitives (bioremediation plot)	
	Refinery fugitives (spills, leaks, fires)	
	Refinery fugitives (valves, seals, flanges)	
	Scrubber	
	Ship loading (150SN)	
	Ship loading (160B)	
	Ship loading (500SN)	
	Ship loading (ADF)	
	Ship loading (CLO)	
	Ship loading (diesel)	
	Ship loading (DXL)	
	Ship loading (FCCU feed)	
	Ship loading (FCCU)	
	Ship loading (fuel oil)	
	Ship loading (Gasoil 2500 ppm)	
	Ship loading (Gasoil)	
	Ship loading (HNN)	
	Ship loading (HSR)	
	Ship loading (naphtha (LSR))	
	Ship loading (naphtha)	
	Ship loading (PULP)	
	Ship loading (SCF)	
	Ship loading (SPULP)	
	Ship loading (SRD)	
	Ship loading (Super PULP)	
	Ship loading (Sweet FCCU)	
	Ship loading (Unleaded)	
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent based)	
	Surface coating (paint - water based)	
	Surface coating (primer)	
	Surface coating (thinner)	
	Teg reflux column vent	Site specific emission estimates
	Thermal oil heater	
	Turbine (natural gas)	NPI EET Manual for Fossil Fuel Electric Power Generation v2.4 (DEH, 2005)
	Unifiner feed heater	Site specific emission estimates
	VDU heater	
	VOC fugitives	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Air (preheater)	Site specific emission estimates
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Boiler 7/9 stack	Site specific emission estimates
	Carbon scrubber vent	
	CCU stack	
	CDU stack	
	CLOR hot oil heater	
	CLOR HTU HVI reactor heater	
	CLOR HTU LVI hydrogen heater	
	CLOR HTU LVI oil heater	
	CLOR HVI extracts heater	
	CLOR HVI WFO heater	
	CLOR LVI extracts heater	
	CLOR VDU feed heater	
	CO boiler and FCCU#2 stack	
	Common Stack	
	Crude distillation unit heater	
	FCCU1 reactor and regenerator	
	Flares	
	HC flares	
	HDS stack	
	Hydrogen reformer	
Internal combustion engine (natural gas)	NPI EET Manual for Combustion Engines v3.0 (DEWHA, 2008b)	
	Isosiv heaters stack	Site specific emission estimates
	Light ends scrubber	
	Oil fume blending	
	PDU heater	
	Platformer 3 stack	
	Platformer heater	
	Powerplant boiler	
	Refinery flare	
	Scrubber	
	Thermal oil heater	
Turbine (natural gas)	NPI EET Manual for Fossil Fuel Electric Power Generation v2.4 (DEH, 2005)	
	Unifiner feed heater	Site specific emission estimates
	VDU heater	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (civil work material stockpiles)	NPI EET Manual for Mining v2.3 (EA, 2003b)
Speciated organics (including methane)	Air (preheater)	Site specific emission estimates
	Blend tank	
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Boiler 7/9 stack	Site specific emission estimates
	CCU stack	
CDU stack		

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	CLOR hot oil heater	
	CLOR HTU HVI reactor heater	
	CLOR HTU LVI hydrogen heater	
	CLOR HTU LVI oil heater	
	CLOR HVI extracts heater	
	CLOR HVI WFO heater	
	CLOR LVI extracts heater	
	CLOR VDU feed heater	
	CO boiler and FCCU#2 stack	
	Common Stack	
	Crude distillation unit heater	
	FCCU1 reactor and regenerator	
	Flares	SPECIATEv4.2 (Profile ID=0051) (USEPA, 2008e)
	Fuel storage (crude oil)	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (jet fuel)	CEIDARS Organic Profile Jet fuel evaporation (jet a) (CARB, 2005)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	HC flares	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	HDS stack	
	Hood	
	Hydrogen reformer	
	Internal combustion engine (natural gas)	SPECIATEv4.2 (Profile ID=1001) (USEPA, 2008e)
	Isosiv heaters stack	Site specific emission estimates/ SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Light ends scrubber	
	Oil fume blending	
	Organic liquid storage (bitumen)	CEIDARS Organic Profile 716 (CARB, 2005)
	Organic liquid storage (general chemicals)	Site specific emission estimates/mass balance
	Organic liquid storage (refinery products)	Site specific emission estimates/ SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	PDU heater	
	Platformer 3 stack	
	Platformer heater	
	Powerplant boiler	
	Product loading (additives)	
	Recycle tank	
	Refinery flare (9F-2X)	SPECIATEv4.2 (Profile ID=0051) (USEPA, 2008e)
	Refinery fugitives (bioremediation plot)	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Refinery fugitives (spills, leaks, fires)	
	Refinery fugitives (valves, seals, flanges)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Scrubber	
	Ship loading (150SN)	
	Ship loading (160B)	
	Ship loading (500SN)	
	Ship loading (ADF)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Ship loading (CLO)	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Ship loading (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Ship loading (DXL)	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Ship loading (FCCU feed)	
	Ship loading (FCCU)	
	Ship loading (fuel oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Ship loading (Gasoil 2500 ppm)	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Ship loading (Gasoil)	
	Ship loading (HNN)	
	Ship loading (HSR)	
	Ship loading (naphtha (LSR))	
	Ship loading (naphtha)	
	Ship loading (PULP)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Ship loading (SCF)	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Ship loading (SPULP)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Ship loading (SRD)	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Ship loading (Super PULP)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Ship loading (Sweet FCCU)	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Ship loading (Unleaded)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (paint - water based)	SPECIATEv4.2 (Profile ID=1013) (USEPA, 2008e)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Teg reflux column vent	Site specific emission estimates
	Thermal oil heater	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Turbine (natural gas)	SPECIATEv4.2 (Profile ID=0007) (USEPA, 2008e)
	Unifiner feed heater	Site specific emission estimates
	VDU heater	
	VOC fugitives	
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Air (preheater)	Site specific emission estimates
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler 7/9 stack	Site specific emission estimates

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Substance	Emission Source	Emission Factor Source
	Carbon scrubber vent	
	CCU stack	
	CDU stack	
	CLOR hot oil heater	
	CLOR HTU HVI reactor heater	
	CLOR HTU LVI hydrogen heater	
	CLOR HTU LVI oil heater	
	CLOR HVI extracts heater	
	CLOR HVI WFO heater	
	CLOR LVI extracts heater	
	CLOR VDU feed heater	
	CO boiler and FCCU#2 stack	
	Common Stack	
	Crude distillation unit heater	
	FCCU1 reactor and regenerator	
	Flares	
	HC flares	
	HDS stack	
	Hydrogen reformer	
	Internal combustion engine (natural gas)	
	Isosiv heaters stack	Site specific emission estimates
	Light ends scrubber	
	Oil fume blending	
	PDU heater	
	Platformer 3 stack	
	Platformer heater	
	Powerplant boiler	
Refinery flare		
Scrubber		
Thermal oil heater		
Turbine (natural gas)	NPI EET Manual for Fossil Fuel Electric Power Generation v2.4 (DEH, 2005)	
Unifiner feed heater	Site specific emission estimates	
VDU heater		
Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)	
Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)	
Wind erosion (civil work material stockpiles)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)	
Ammonia	Air (preheater)	Site specific emission estimates
	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler 7/9 stack	Site specific emission estimates
	CCU stack	
	CDU stack	
	CLOR hot oil heater	

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Substance	Emission Source	Emission Factor Source	
	CLOR HTU HVI reactor heater		
	CLOR HTU LVI hydrogen heater		
	CLOR HTU LVI oil heater		
	CLOR HVI extracts heater		
	CLOR HVI WFO heater		
	CLOR LVI extracts heater		
	CLOR VDU feed heater		
	CO boiler and FCCU#2 stack		
	Common Stack		
	Crude distillation unit heater		
	FCCU1 reactor and regenerator		
	Flares		Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	HC flares		Site specific emission estimates
	HDS stack		
	Hydrogen reformer	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)	
	Internal combustion engine (natural gas)	Site specific emission estimates	
	Isosiv heaters stack		
	PDU heater		
	Platformer 3 stack		
	Platformer heater		
	Powerplant boiler		
	Refinery flare		
	Thermal oil heater		
	Turbine (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)	
	Unifiner feed heater	Site specific emission estimates	
	VDU heater		
Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)		
Sulfuric or hydrochloric acid	Air (preheater)	Site specific emission estimates	
	Boiler 7/9 stack		
	CCU stack		
	CDU stack		
	CLOR hot oil heater		
	CLOR HTU HVI reactor heater		
	CLOR HTU LVI hydrogen heater		
	CLOR HTU LVI oil heater		
	CLOR HVI extracts heater		
	CLOR HVI WFO heater		
	CLOR LVI extracts heater		
	CLOR VDU feed heater		
	CO boiler and FCCU#2 stack		
	Common Stack		
	Crude distillation unit heater		

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	FCCU1 reactor and regenerator	
	HC flares	
	HDS stack	
	Isosiv heaters stack	
	PDU heater	
	Platformer 3 stack	
	Platformer heater	
	Powerplant boiler	
	Refinery flare	
	Unifiner feed heater	
	VDU heater	
PAH	Air (preheater)	Site specific emission estimates
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler 7/9 stack	Site specific emission estimates
	CCU stack	
	CDU stack	
	CLOR hot oil heater	
	CLOR HTU HVI reactor heater	
	CLOR HTU LVI hydrogen heater	
	CLOR HTU LVI oil heater	
	CLOR HVI extracts heater	
	CLOR HVI WFO heater	
	CLOR LVI extracts heater	
	CLOR VDU feed heater	
	CO boiler and FCCU#2 stack	
	Common Stack	
	Crude distillation unit heater	
	FCCU1 reactor and regenerator	
	Flares	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	HC flares	Site specific emission estimates
	HDS stack	
	Hydrogen reformer	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Isosiv heaters stack	Site specific emission estimates
	PDU heater	
	Platformer 3 stack	
	Platformer heater	
	Powerplant boiler	
	Refinery flare	
Refinery fugitives (bioremediation plot)		
Refinery fugitives (spills, leaks, fires)		
Refinery fugitives (valves, seals, flanges)		
Teg reflux column vent		
Thermal oil heater	AP42 Chapter 1.4 Natural Gas Combustion (USEPA,	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		1998b)
	Turbine (natural gas)	NPI EET Manual for Fossil Fuel Electric Power Generation v2.4 (DEH, 2005)
	Unifiner feed heater	Site specific emission estimates
	VDU heater	
PCDD/PCDF	Air (preheater)	Site specific emission estimates
	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler 7/9 stack	Site specific emission estimates
	CCU stack	
	CDU stack	
	CLOR hot oil heater	
	CLOR HTU HVI reactor heater	
	CLOR HTU LVI hydrogen heater	
	CLOR HTU LVI oil heater	
	CLOR HVI extracts heater	
	CLOR HVI WFO heater	
	CLOR LVI extracts heater	
	CLOR VDU feed heater	
	CO boiler and FCCU#2 stack	
	Common stack	
	Crude distillation unit heater	
	FCCU1 reactor and regenerator	
	Flares	
	HC flares	Site specific emission estimates
	HDS stack	
	Hydrogen reformer	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Isosiv heaters stack	Site specific emission estimates
	PDU heater	
	Platformer 3 stack	
	Platformer heater	
	Powerplant boiler	
	Refinery flare	
Thermal oil heater	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)	
Turbine (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)	
Unifiner feed heater	Site specific emission estimates	
VDU heater		
Greenhouse gases (CO ₂ and N ₂ O)	Air (preheater)	Site specific emission estimates/National Greenhouse Accounts (NGA) Factors June 2009 (DCC, 2009)
	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009 (DCC, 2009)
	Boiler 7/9 stack	Site specific emission estimates/National Greenhouse Accounts (NGA) Factors June 2009 (DCC, 2009)
	CCU stack	
	CDU stack	
	CLOR hot oil heater	
	CLOR HTU HVI reactor heater	
CLOR HTU LVI hydrogen		

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Substance	Emission Source	Emission Factor Source
	heater	
	CLOR HTU LVI oil heater	
	CLOR HVI extracts heater	
	CLOR HVI WFO heater	
	CLOR LVI extracts heater	
	CLOR VDU feed heater	
	CO boiler and FCCU#2 stack	
	Common Stack	
	Crude distillation unit heater	
	FCCU1 reactor and regenerator	
	Flares	National Greenhouse Accounts (NGA) Factors June 2009 (DCC, 2009)
	HC flares	Site specific emission estimates/National Greenhouse Accounts (NGA) Factors June 2009 (DCC, 2009)
	HDS stack	
	Hydrogen reformer	National Greenhouse Accounts (NGA) Factors June 2009 (DCC, 2009)
	Isosiv heaters stack	Site specific emission estimates/National Greenhouse Accounts (NGA) Factors June 2009 (DCC, 2009)
	PDU heater	
	Platformer 3 stack	
	Platformer heater	
	Powerplant boiler	
	Refinery flare	
	Thermal oil heater	National Greenhouse Accounts (NGA) Factors June 2009 (DCC, 2009)
	Turbine (natural gas)	
	Unifiner feed heater	Site specific emission estimates/National Greenhouse Accounts (NGA) Factors June 2009 (DCC, 2009)
	VDU heater	

3.50.4 Emission Estimates

Total estimated annual emissions (for selected substances) from petroleum products and fuel production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-293. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-293: Total estimated annual emissions from petroleum products and fuel production

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	6.78	0	0	0	6.78
ACETALDEHYDE	143	0	0	0	143
BENZENE	9,040	0	0	41.1	9,080
CARBON MONOXIDE	1,380,000	0	0	2,880	1,380,000
FORMALDEHYDE	78,300	0	0	288	78,600
ISOMERS OF XYLENE	10,600	0	0	4.75	10,600
LEAD AND COMPOUNDS	64.5	0	0	0.07	64.6
OXIDES OF NITROGEN	1,890,000	0	0	8,520	1,900,000
PARTICULATE MATTER ≤ 10 µm	179,000	0	0	690	180,000
PARTICULATE MATTER ≤ 2.5 µm	98,400	0	0	655	99,100
POLYCYCLIC AROMATIC HYDROCARBONS	916	0	0	0.05	916
SULFUR DIOXIDE	3,110,000	0	0	7,620	3,120,000

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
TETRACHLOROETHYLENE	9.58	0	0	0	9.58
TOLUENE	16,600	0	0	26.8	16,600
TOTAL SUSPENDED PARTICULATE	347,000	0	0	1,530	349,000
TOTAL VOLATILE ORGANIC COMPOUNDS	1,420,000	0	0	2,530	1,420,000
TRICHLOROETHYLENE	1.37	0	0	0	1.37

3.50.5 Emission Projection Methodology

Projection factors for petroleum products and fuel production have been derived based on primary energy consumption projections for petroleum refining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-288 and illustrated in Figure 3-16.

3.51 Petroleum Products Storage 25B

3.51.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-294.

Table 3-294: Petroleum products storage facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ORIGIN ENERGY LPG LIMITED	245	47 FRIENDSHIP ROAD	PORT BOTANY	2036
THE SHELL COMPANY OF AUSTRALIA LIMITED	369	5 CHATHAM RD	HAMILTON	2303
CALTEX NEWCASTLE TERMINAL	452	156 HANNELL STREET	WICKHAM	2293
HYDROCARBON STORAGE TERMINAL	464	FRIENDSHIP ROAD	PORT BOTANY	2036
CONTINENTAL CARBON AUSTRALIA PTY LTD	516	145-161 SIR JOSEPH BANKS DRIVE	KURNELL	2231
BP AUSTRALIA PTY LTD	527	CNR HANNELL & ELIZABETH STREETS	CARRINGTON	2294
PORT KEMBLA MARINE FUELS	654	LOT 2 FLINDERS STREET	PORT KEMBLA	2505
PARRAMATTA TERMINAL	660	DURHAM STREET	ROSEHILL	2142
GORE BAY TERMINAL	661	MANN'S AVENUE	GREENWICH	2065
TERMINALS PTY LTD	1048	45 FRIENDSHIP ROAD	PORT BOTANY	2036
SYDNEY METROPOLITAN PIPELINE	1969	CNR HOLKER & NEWINGTON RD	SILVERWATER	2128
ALMC PTY LTD	2822	132 MCCREDIE ROAD	GUILDFORD	2161
VOPAK TERMINALS AUSTRALIA	6007	20 FRIENDSHIP ROAD	PORT BOTANY	2036
MOBIL BOTANY TERMINAL	6457	STEPHEN ROAD	BOTANY	2019
VOPAK TERMINALS AUSTRALIA	6581	49 FRIENDSHIP ROAD	PORT BOTANY	2036
CALTEX SYDNEY TERMINAL	6950	PENRHYN RD	BANKSMEADOW	2019

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ELGAS LIMITED - SYDNEY LPG CAVERN	10698	30 FRIENDSHIP ROAD	PORT BOTANY	2036
AUSTRALIAN PETROCHEMICAL STORAGE PTY LTD	11690	14 WILLIAMSON ROAD	INGLEBURN	2565
KOALA DEPOT	11914	166 INGLEBURN ROAD	LEPPINGTON	2171
MANILDRA PARK PTY LIMITED	12977	GREENLEAF ROAD	KOORAGANG	2304

The emission sources and associated releases to air from petroleum products storage are presented in Table 3-295.

Table 3-295: Petroleum products storage - emission sources

Source	Emissions to Air
Boiler (LPG)	Combustion products
Boiler (natural gas)	Combustion products
Carbon black production (boiler)	Combustion products
Carbon black production (tread EBF Stack)	Combustion products
Flares (natural gas, csm, lfg)	Combustion products
Fuel storage (crude oil)	VOC
Fuel storage (diesel)	VOC
Fuel storage (jet fuel)	VOC
Fuel storage (oil)	VOC
Fuel storage (petrol)	VOC
Internal combustion engine (diesel)	Combustion products
Organic liquid storage (general chemicals)	VOC
Organic liquid storage (refinery products)	VOC
Petroleum handling (transit losses - empty tanker)	VOC
Petroleum handling (transit losses - full road tanker)	VOC
Process emissions	PM, VOC, H ₂ S
Surface coating (enamel)	VOC
Surface coating (paint - water based)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Tank truck loading - diesel (dedicated normal service)	VOC
Tank truck loading - fuel oil (dedicated normal service)	VOC
Tank truck loading - jet kerosene (dedicated normal service)	VOC
Tank truck loading - jet naphtha (JP4) (dedicated vapour balance)	VOC
Tank truck loading - petrol (dedicated vapour balance)	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.51.2 Activity Data

Summary activity data collected from the industrial questionnaires for petroleum products storage is presented in Table 3-296.

Table 3-296: Summary activity data for petroleum products storage

Parameter	Value	Unit
Amount of petrol handled	3,364,935	kL/year
Amount of diesel handled	2,496,346	kL/year
Amount of natural gas combusted	1,700,612	GJ/year
Total vehicle kilometres travelled	141,027	km/year
Amount of electricity consumed	68,158	MWh/year

3.51.3 Emission and Speciation Factors

The emission and speciation factors for all substances from petroleum product storage are detailed in Table 3-297.

Table 3-297: Emission and speciation factors for all substances from petroleum products storage

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Carbon black production (Boiler)	Site specific emission estimates
	Carbon black production (Tread EBF Stack)	
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Fuel storage (crude oil)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (diesel)	
	Fuel storage (jet fuel)	
	Fuel storage (oil)	
	Fuel storage (petrol)	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Organic liquid storage (general chemicals)	TANKS 4.09D software (USEPA, 2006e)
	Organic liquid storage (refinery products)	
	Petroleum handling (transit losses - empty tanker)	Emission Inventory Improvement Program (EIIP), Volume III: Chapter 11, Gasoline Marketing (ERG, 2001)
	Petroleum handling (transit losses - full road tanker)	
	Process emissions	Site specific emission estimates
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - water based)	
	Surface coating (primer)	
	Surface coating (thinner)	
Tank truck loading - diesel (dedicated normal service)	AP42 Chapter 5.2 Transportation And Marketing Of Petroleum Liquids (USEPA, 2008) and fuel parameters obtained from USEPA TANKS 4.09D using meteorological data for NSW	
Tank truck loading - fuel oil (dedicated normal service)		
Tank truck loading - jet		

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Substance	Emission Source	Emission Factor Source
	kerosene (dedicated normal service)	
	Tank truck loading - jet naphtha (JP4) (dedicated vapour balance)	
	Tank truck loading - petrol (dedicated vapour balance)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Carbon black production (boiler)	Site specific emission estimates
	Carbon black production (Tread EBF Stack)	
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Process emissions	Site specific emission estimates
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Carbon black production (Boiler)	SPECIATEv4.2 (Profile ID=0217) (USEPA, 2008e)
	Carbon black production (Tread EBF Stack)	
	Flares (natural gas, csm, lfg)	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Fuel storage (crude oil)	SPECIATEv4.2 (Profile ID=1211) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (jet fuel)	CEIDARS Organic Profile Jet fuel evaporation (jet a) (CARB, 2005)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Organic liquid storage (general chemicals)	Site specific emission estimates/mass balance
	Organic liquid storage (refinery products)	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Petroleum handling (transit losses - empty tanker)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Petroleum handling (transit losses - full road tanker)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Process emissions	SPECIATEv4.2 (Profile ID=9012) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (paint - water based)	SPECIATEv3.2 (Profile ID=1013) (USEPA, 2008e)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Tank truck loading - diesel (dedicated normal service)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Tank truck loading - fuel oil (dedicated normal service)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Tank truck loading - jet kerosene (dedicated normal service)	CEIDARS Organic Profile Jet fuel evaporation (jet a) (CARB, 2005)
	Tank truck loading - jet naphtha (JP4) (dedicated vapour balance)	
	Tank truck loading - petrol (dedicated vapour balance)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
	Speciated particulate matter	Boiler (LPG)
Boiler (natural gas)		AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
Carbon black production (Boiler)		Site specific emission estimates
Carbon black production (Tread EBF Stack)		
Flares (natural gas, csm, lfg)		AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
Internal combustion engine (diesel)		CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
Wheel generated dust (paved roads)		California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Wheel generated dust (unpaved roads)		California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (LPG)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (natural gas)	
	Flares (natural gas, csm, lfg)	
	Internal combustion engine (diesel)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	Carbon black production (Boiler)	Site specific emission estimates
	Carbon black production (Tread EBF Stack)	
PAH	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	AP42 Chapter 1.4 External Combustion - Natural Gas (USEPA, 1998)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Process emissions	Site specific emission estimates
PCDD/PCDF	Boiler (LPG)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (natural gas)	
	Flares (natural gas, csm, lfg)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (LPG)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (natural gas)	
	Carbon black production (Boiler)	Site specific emission estimates
	Carbon black production (Tread EBF Stack)	
	Flares (natural gas, csm, lfg)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Internal combustion engine (diesel)	

3.51.4 Emission Estimates

Total estimated annual emissions (for selected substances) from petroleum products storage for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-298. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-298: Total estimated annual emissions from petroleum products storage

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0.42	0	0	0	0.42
ACETALDEHYDE	0	0	0	0	0
BENZENE	11,300	1,740	0.26	0	13,000
CARBON MONOXIDE	1,460,000	0	0	0	1,460,000
FORMALDEHYDE	999	1,010	0	0	2,010
ISOMERS OF XYLENE	3,850	2,120	107	0	6,080
LEAD AND COMPOUNDS	8.43	0.01	0	0	8.44
OXIDES OF NITROGEN	533,000	0	0	0	533,000
PARTICULATE MATTER ≤ 10 µm	45,300	21.5	0	0	45,300
PARTICULATE MATTER ≤ 2.5 µm	43,500	4.1	0	0	43,500
POLYCYCLIC AROMATIC HYDROCARBONS	0.04	0	0	0	0.04
SULFUR DIOXIDE	737,000	0	0	0	737,000
TETRACHLOROETHYLENE	5.35	0	0	0	5.35
TOLUENE	9,050	4,430	32.9	0	13,500
TOTAL SUSPENDED PARTICULATE	56,200	98.8	0	0	56,300
TOTAL VOLATILE ORGANIC COMPOUNDS	630,000	233,000	1390	0	864,000
TRICHLOROETHYLENE	0.76	0	0	0	0.76

3.51.5 Emission Projection Methodology

Projection factors for petroleum products storage have been derived based on primary energy consumption projections for petroleum refining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-288 and illustrated in Figure 3-16.

3.52 Pharmaceutical and Veterinary Products Production 20**3.52.1 Emission Sources and Associated Releases to Air**

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-299.

Table 3-299: Pharmaceutical and veterinary products production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
GLAXOSMITHKLINE	1024	82 HUGHES AVENUE	ERMINGTON	2115
AUTOPAK FORMULATORS PTY LIMITED	1035	39 HARRIS STREET	ST MARYS	2760
MERCK SHARP & DOHME (AUSTRALIA) PTY LTD	2170	54-68 FERNDILL STREET (SOUTH GRANVILLE)	GRANVILLE	2142
JOHNSON & JOHNSON PACIFIC	2184	32 CAWARRA RD	CARINGBAH	2229
INOVA PHARMACEUTICALS (AUSTRALIA) PTY LIMITED	2773	9 CHILVERS ROAD	THORNLEIGH	2120
PFIZER PTY LIMITED	2838	38-42 WHARF RD	WEST RYDE	2114
VETLAB PTY LTD	4452	25 HARRIS STREET	ST MARYS	2760
WHITELEY CORPORATION PTY LTD	5007	19-23 LAVERICK AVE	TOMAGO	2322
FORT DODGE AUSTRALIA P/L	5269	2152 CASTLEREAGH ROAD	PENRITH	2750
SIGMA PHARMACEUTICALS PTY LTD	6080	7 MAITLAND PLACE	BAULKHAM HILLS	2153
SPHERE HEALTHCARE	6453	10-12 CHURCH ROAD	MOOREBANK	2170
MILPHARMA PTY LTD	6689	19A GAREMA CIRCUIT	KINGSGROVE	2208
NOVOGEN	6853	140 WICKS ROAD	NORTH RYDE	2113
ASTRAZENECA PTY LTD	6891	10-14 KHARTOUM ROAD	NORTH RYDE	2113
ORICA AUSTRALIA	6964	GATE 3 - 2 CHRISTINA ROAD	VILLAWOOD	2163
LIPA PHARMACEUTICALS LTD	12125	21 REAGHS FARM ROAD	MINTO	2566
SIGMA-ALDRICH PTY. LIMITED	12202	12 ANELLA AVENUE	CASTLE HILL	1765
BAXTER HEALTHCARE PTY LTD	12257	1 BAXTER DRIVE	OLD TOONGABBIE	2146
JUROX PTY LTD	12846	85 GARDINER ROAD	RUTHERFORD	2320

3. Data Sources and Results

The emission sources and associated releases to air from pharmaceutical and veterinary products production are presented in Table 3-300.

Table 3-300: Pharmaceutical and veterinary products production – emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Fuel storage (diesel)	VOC
Fuel storage (jet fuel)	VOC
Internal combustion engine (diesel)	Combustion products
Organic liquid storage (general chemicals)	VOC
Process emissions/solvent usage	VOC, PAH
Surface coating (paint - solvent based)	VOC
Surface coating (thinner)	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.52.2 Activity Data

Summary activity data collected from the industrial questionnaires for pharmaceutical and veterinary products production is presented in Table 3-301.

Table 3-301: Summary activity data for pharmaceutical and veterinary products production

Parameter	Value	Unit
Amount of natural gas combusted	294,389	GJ/year
Amount of diesel combusted	0.62	kL/year
Total vehicle kilometres travelled	608,132	km/year
Amount of electricity consumed	72,830	MWh/year

3.52.3 Emission and Speciation Factors

The emission and speciation factors for all substances from pharmaceutical and veterinary products production are detailed in Table 3-302.

Table 3-302: Emission and speciation factors for all substances from pharmaceutical and veterinary products production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (jet fuel)	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Organic liquid storage (general chemicals)	TANKS 4.09D software (USEPA, 2006e)
	Process emissions/solvent usage	Site specific emission estimates
	Surface coating (paint - solvent)	VOCs from Surface Coatings Final Report (ENVIRON,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	based)	2009)
	Surface coating (thinner)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (jet fuel)	CEIDARS Organic Profile Jet fuel evaporation (jet a) (CARB, 2005)
	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Organic liquid storage (general chemicals)	Site specific emissions estimates/mass balance
	Process emissions/solvent usage	Site specific emissions estimates/mass balance
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Internal combustion engine (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Internal combustion engine (diesel)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Process emissions	Site specific emission estimates
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
(CO ₂ and N ₂ O)	Internal combustion engine (diesel)	(DCC, 2009b)

3.52.4 Emission Estimates

Total estimated annual emissions (for selected substances) from pharmaceutical and veterinary products production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-303. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-303: Total estimated annual emissions from pharmaceutical and veterinary products production

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0.1	0	0	0	0.1
ACETALDEHYDE	1.46	0	0	0	1.46
BENZENE	66.1	0	0	0	66.1
CARBON MONOXIDE	10,000	0	0	0	10,000
FORMALDEHYDE	153	0	0	0	153
ISOMERS OF XYLENE	344	0	0	0	344
LEAD AND COMPOUNDS	0.15	0	0	0	0.15
OXIDES OF NITROGEN	14,800	0	0	0	14,800
PARTICULATE MATTER ≤ 10 µm	1,050	0	0	0.13	1,050
PARTICULATE MATTER ≤ 2.5 µm	945	0	0	0.03	945
POLYCYCLIC AROMATIC HYDROCARBONS	0.09	0	0	0	0.09
SULFUR DIOXIDE	64.8	0	0	0	64.8
TETRACHLOROETHYLENE	207	0	0	0	207
TOLUENE	508	0	0	0	508
TOTAL SUSPENDED PARTICULATE	1,640	0	0	0.7	1,640
TOTAL VOLATILE ORGANIC COMPOUNDS	26,500	0	0	0	26,500
TRICHLOROETHYLENE	29.6	0	0	0	29.6

3.52.5 Emission Projection Methodology

Projection factors for pharmaceutical and veterinary products production have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

3.53 Pig Accommodation 42

3.53.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-304.

Table 3-304: Pig production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
BOEN BOE STUD	730	64 JOADJA ROAD	MITTAGONG	2575
GEORGE BORG PIGGERY	3511	66-104 BURLEY ROAD	HORSLEY PARK	2164

The emission sources and associated releases to air from pig accommodation are presented in Table 3-305.

Table 3-305: Pig accommodation – emission sources

Source	Emissions to Air
Fuel storage (diesel)	VOC
Pig farming (boars, conventional farm)	Ammonia
Pig farming (finishers, conventional farm)	Ammonia
Pig farming (gestating sows, conventional farm)	Ammonia
Pig farming (gilts, conventional farm)	Ammonia
Pig farming (growers, conventional farm)	Ammonia
Pig farming (lactating sows, conventional farm)	Ammonia
Pig farming (weaners, conventional farm)	Ammonia
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM

3.53.2 Activity Data

Summary activity data collected from the industrial questionnaires for pig accommodation is presented in Table 3-306.

Table 3-306: Summary activity data for pig accommodation

Parameter	Value	Unit
Number of gilts	23	pigs/year
Number of boars	20	pigs/year
Number of gestating sows	900	pigs/year
Number of lactating sows	371	pigs/year
Number of weaners	1138	pigs/year
Number of growers	2023	pigs/year
Number of finishers	507	pigs/year
Total vehicle kilometres travelled	800	km/year
Amount of electricity consumed	No data	MWh/year

3.53.3 Emission and Speciation Factors

The emission and speciation factors for all substances from pig accommodation are detailed in Table 3-307.

Table 3-307: Emission and speciation factors for all substances from pig accommodation

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Wheel generated dust – paved roads	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Wheel generated dust – paved roads	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Pig farming (boars, conventional farm)	NPI EET Manual for Intensive Pig Farming v2.0 (DEW, 2007b)
	Pig farming (finishers, conventional farm)	
	Pig farming (gestating sows, conventional farm)	
	Pig farming (gilts, conventional farm)	
	Pig farming (growers, conventional farm)	
	Pig farming (lactating sows, conventional farm)	
	Pig farming (weaners, conventional farm)	
	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.53.4 Emission Estimates

Total estimated annual emissions (for selected substances) from pig accommodation for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-308. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-308: Total estimated annual emissions from pig accommodation

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
BENZENE	0	0	0	0	0
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0.62	0	0	0.41	1.03
ISOMERS OF XYLENE	3.71	0	0	2.48	6.19
LEAD AND COMPOUNDS	0.01	0	0	0	0.01
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	16.9	0	0	0	16.9
PARTICULATE MATTER ≤ 2.5 µm	4.09	0	0	0	4.09
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	4.33	0	0	2.85	7.18
TOLUENE	2.47	0	0	1.64	4.11
TOTAL SUSPENDED PARTICULATE	88	0	0	0	88
TOTAL VOLATILE ORGANIC COMPOUNDS	26.6	0	0	17.9	44.5
TRICHLOROETHYLENE	0.62	0	0	0.41	1.03

3.53.5 Emission Projection Methodology

Projection factors for pig accommodation have been derived based on final energy consumption projections for agriculture in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-6 and illustrated in Figure 3-1.

3.54 Plastics Resins Production 21

3.54.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-309.

Table 3-309: Plastic resins production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
DUNLOP FLEXIBLE FOAMS	2732	LOT 103 FRANK STREET	WETHERILL PARK	2164
JOYCE FOAM PRODUCTS	3099	5-9 BRIDGES ROAD	MOOREBANK	2170
D & R HENDERSON PTY LTD	3185	104-106 HAM STREET	SOUTH WINDSOR	2756
FOAMCO INDUSTRIES PTY LTD	4244	27-29 PEMBURY ROAD	MINTO	2566
BASELL POLYOLEFINS	5104	DURHAM STREET	ROSEHILL	2142
DUNLOP FLOORING	12721	183-187 NEWTON ROAD	WETHERILL PARK	2164

The emission sources and associated releases to air from plastic resins production are presented in Table 3-310.

3. Data Sources and Results

Table 3-310: Plastics resins production – emission sources

Source	Emissions to Air
Boiler (diesel)	Combustion products
Boiler (natural gas)	Combustion products
Flare (fuel gas)	Combustion products
Foam manufacturing (curing exhaust)	VOC, PAH
Foam manufacturing (rebond manufacturing (carpet underlay))	VOC
Wheel generated dust (paved roads)	PM

3.54.2 Activity Data

Summary activity data collected from the industrial questionnaires for plastics resins production is presented in Table 3-311.

Table 3-311: Summary activity data for plastic resins production

Parameter	Value	Unit
Amount of polyurethane foam produced	17,155	tonne/year
Amount of diesel combusted	2.3	kL/year
Amount of natural gas combusted	38,679	GJ/year
Total vehicle kilometres travelled	518,563	km/year
Amount of electricity consumed	68,174	MWh/year

3.54.3 Emission and Speciation Factors

The emission and speciation factors for all substances from plastics resins production sources are detailed in Table 3-312.

Table 3-312: Emission and speciation factors for all substances from plastics resins production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flare (fuel gas)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Foam manufacturing (curing exhaust)	Site specific emission estimates
	Foam manufacturing (rebond manufacturing (carpet underlay))	Average emission rate taken from: Isocyanate Emissions Toolbox, European Diisocyanate & Polyol Producers Association, (Isopa, 2010)
PM _{2.5} , PM ₁₀ & TSP	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flare (fuel gas)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics	Boiler (diesel)	SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
(including methane)	Flare (fuel gas)	SPECIATEv4.2 (Profile ID=0051) (USEPA, 2008e)
	Foam manufacturing (curing exhaust)	Site specific emission estimates
	Foam manufacturing (rebond manufacturing (carpet underlay))	Site specific/mass balance (assumed to be 100% toluene diisocyanate)
Speciated particulate matter	Boiler (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flare (fuel gas)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (diesel)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (natural gas)	
	Flare (fuel gas)	
Sulfuric or hydrochloric acid	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flare (fuel gas)	
	Foam manufacturing (curing exhaust)	Site specific emission estimates
PCDD/PCDF	Boiler (diesel)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (natural gas)	
	Flare (fuel gas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (diesel)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (natural gas)	
	Flare (fuel gas)	

3.54.4 Emission Estimates

Total estimated annual emissions (for selected substances) from plastic resins production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-313. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-313: Total estimated annual emissions from plastic resins production

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	33.7	0	0	0	33.7
CARBON MONOXIDE	25,700	0	0	0	25,700
FORMALDEHYDE	2,920	0	0	0	2,920
ISOMERS OF XYLENE	0	0	0	0	0
LEAD AND COMPOUNDS	0.27	0	0	0	0.27
OXIDES OF NITROGEN	7,230	0	0	0	7,230
PARTICULATE MATTER ≤ 10 µm	801	0	0	0	801
PARTICULATE MATTER ≤ 2.5 µm	509	0	0	0	509
POLYCYCLIC AROMATIC HYDROCARBONS	0.02	0	0	0	0.02

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
SULFUR DIOXIDE	14.2	0	0	0	14.2
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	21.8	0	0	0	21.8
TOTAL SUSPENDED PARTICULATE	2,420	0	0	0	2,420
TOTAL VOLATILE ORGANIC COMPOUNDS	128,000	0	0	0	128,000
TRICHLOROETHYLENE	0	0	0	0	0

3.54.5 Emission Projection Methodology

Projection factors for ammonium nitrate production have been derived based on final energy consumption projections for basic chemicals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-135 and illustrated in Figure 3-7.

3.55 Printing, Packaging and Visual Media Production 94

3.55.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-314.

Table 3-314: Printing, packaging and visual media production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
AMCOR BEVERAGE CANS AUSTRALASIA	643	146 CARRINGTON STREET	REVESBY	2212
AMCOR CARTONS	1036	2-6 MOORE STREET	BOTANY	2019
AMCOR FLEXIBLES AUSTRALASIA	2810	40-62 BELLONA AVE	REGENTS PARK	2143
FAIRFAX PRINTERS PTY LIMITED	5233	1 WORTH STREET	CHULLORA	2190
VISYPAK	5680	102-122 GIPPS ROAD	SMITHFIELD	2164
APERIO GROUP (AUSTRALIA) PTY LIMITED	6191	149 ORCHARD ROAD	CHESTER HILL	2162
MORRIS GRAPHICS	6973	4-10 HARP STREET	CAMPSIE	2194
FAIRFAX REGIONAL PRINTERS PTY LTD	11422	7 ENTERPRISE DRIVE HOLMWOOD BUSINESS PARK	BERESFIELD	2322

The emission sources and associated releases to air from printing, packaging and visual media production are presented in Table 3-315.

Table 3-315: Printing, packaging and visual media production – emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Fuel storage (diesel)	VOC
Fuel storage (jet fuel)	VOC
Internal combustion engine (diesel)	Combustion products
Organic liquid storage (general chemicals)	VOC
Printing (heat set)	VOC
Printing (non-heat set)	VOC
Process emissions	VOC, PAH
Surface coating (thinner)	VOC
Wastewater treatment	VOC, ammonia

3.55.2 Activity Data

Summary activity data collected from the industrial questionnaires for printing, packaging and visual media production is presented in Table 3-316.

Table 3-316: Summary activity data for printing, packaging and visual media production

Parameter	Value	Unit
Amount of diesel combusted	8.0	kL/year
Amount of natural gas combusted	133,024	GJ/year
Total vehicle kilometres travelled	321,910	km/year
Amount of electricity consumed	58,571	MWh/year

3.55.3 Emission and Speciation Factors

The emission and speciation factors for all substances from printing, packaging and visual media production sources are detailed in Table 3-317.

Table 3-317: Emission and speciation factors for all substances from printing, packaging and visual media production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (jet fuel)	
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Organic liquid storage (general chemicals)	TANKS 4.09D software (USEPA, 2006e)
	Printing (heat set)	NPI EET Manual for Aggregated Emissions from Printing and Graphic Arts (EA, 1999i)
	Printing (non-heat set)	
	Process emissions	Site specific emission estimates
	Surface coating (thinner)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ &	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA,

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
TSP		1998b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (jet fuel)	CEIDARS Organic Profile Jet fuel evaporation (jet a) (CARB, 2005)
	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Organic liquid storage (general chemicals)	Site specific emission estimates/mass balance
	Printing (heat set)	SPECIATEv4.2 (Profile ID=1191) (USEPA, 2008e)
	Printing (non-heat set)	
	Process emissions	Site specific emission estimates/mass balance
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel)	CEIDARS PM Organic Profile 114 for speciated metals (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Internal combustion engine (diesel)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Process emissions	Site specific emission estimates
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Internal combustion engine (diesel)	

3.55.4 Emission Estimates

Total estimated annual emissions (for selected substances) from printing, packaging and visual media production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-318. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-318: Total estimated annual emissions from printing, packaging and visual media production

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	3.34	0	0	0	3.34
ACETALDEHYDE	0.05	0	0	0	0.05
BENZENE	27.9	0	0	0	27.9
CARBON MONOXIDE	4,790	0	0	0	4,790
FORMALDEHYDE	39,700	0	0	0	39,700
ISOMERS OF XYLENE	20,400	0.01	0	0	20,400
LEAD AND COMPOUNDS	0.15	0	0	0	0.15
OXIDES OF NITROGEN	6,130	0	0	0	6,130
PARTICULATE MATTER $\leq 10 \mu\text{m}$	541	1.95	0	0	543
PARTICULATE MATTER $\leq 2.5 \mu\text{m}$	481	0.47	0	0	482
POLYCYCLIC AROMATIC HYDROCARBONS	0.06	0	0	0	0.06
SULFUR DIOXIDE	29.7	0	0	0	29.7
TETRACHLOROETHYLENE	81.7	0	0	0	81.7
TOLUENE	22,900	0	0	0	22,900
TOTAL SUSPENDED PARTICULATE	870	10.1	0	0	880
TOTAL VOLATILE ORGANIC COMPOUNDS	1,740,000	86,200	0	0	1,830,000
TRICHLOROETHYLENE	11.7	0	0	0	11.7

3.55.5 Emission Projection Methodology

Projection factors for printing, packaging and visual media production have been derived based on final energy consumption projections for wood, paper in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-277 and illustrated in Figure 3-15.

3.56 Railway Systems Activities 70

3.56.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-319.

3. Data Sources and Results

Table 3-319: Railway systems activities facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
AUSTRALIAN RAIL TRACK CORPORATION LTD	3142	GPO BOX 14	SYDNEY	2001
PARRAMATTA RAIL LINK BETWEEN EPPING AND CHATSWOOD AS DEFINED IN A2.2	11735	43 WATERLOO ROAD	MACQUARIE PARK	2113
RAIL CORPORATION NEW SOUTH WALES (RAILCORP)	12208	PO BOX K349	HAYMARKET	1238
RAIL CLEARWAYS PROGRAM AS DEFINED IN A2.2	12413	LOCKED BAG 6501	ST LEONARDS	2065
KINGSGROVE TO REVESBY RAIL CLEARWAYS PROJECT	12908	KING GEORGES ROAD	BEVERLY HILLS	2209
SOUTHERN SYDNEY FREIGHT LINE	12971	COOPER ROAD - BIRRONG TO MILLER ROAD CHESTER HILL	BIRRONG	2143

The emission sources and associated releases to air from railway systems activities are presented in Table 3-320.

Table 3-320: Railway systems activities – emission sources

Source	Emissions to Air
Fuel storage (diesel)	VOC
Graders	PM
Material transfer (overburden)	PM
Surface coating (degreaser)	VOC
Surface coating (paint - solvent based)	VOC
Trucks (dumping overburden)	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM

3.56.2 Activity Data

Summary activity data collected from the industrial questionnaires for railway systems activities are presented in Table 3-321.

Table 3-321: Summary activity data for railway systems activities

Parameter	Value	Unit
Total vehicle kilometres travelled	ND	km/year
Amount of electricity consumed	2,681	MWh/year

3.56.3 Emission and Speciation Factors

The emission and speciation factors for all substances from railway systems activities sources are detailed in Table 3-322.

Table 3-322: Emission and speciation factors for all substances from railway systems activities

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Surface coating (degreaser)	Mass balance
	Surface coating (paint - solvent based)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
PM _{2.5} , PM ₁₀ & TSP	Graders	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (overburden)	
	Trucks (dumping overburden)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
Speciated particulate matter	Graders	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (overburden)	
	Trucks (dumping overburden)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	NA	NA
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.56.4 Emission Estimates

Total estimated annual emissions (for selected substances) from railway systems activities for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-323. Total estimated annual emissions of all substances are presented in Appendix A.

3. Data Sources and Results

Table 3-323: Total estimated annual emissions from railway systems activities

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0.65	0	0	0	0.65
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	21.7	0	0	0	21.7
LEAD AND COMPOUNDS	35.3	0	0	0	35.3
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	79,600	0	0	0	79,600
PARTICULATE MATTER ≤ 2.5 µm	9,140	0	0	0	9,140
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	4.8	0	0	0	4.8
TOLUENE	94.4	0	0	0	94.4
TOTAL SUSPENDED PARTICULATE	282,000	0	0	0	282,000
TOTAL VOLATILE ORGANIC COMPOUNDS	298	0	0	0	298
TRICHLOROETHYLENE	13.7	0	0	0	13.7

3.56.5 Emission Projection Methodology

Projection factors for railway systems activities have been derived based on final energy consumption projections for rail transport in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-324 and illustrated in Figure 3-17.

Table 3-324: Projection factors for rail transport related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0151	2023	1.1989
2010	1.0296	2024	1.2116
2011	1.0438	2025	1.2241
2012	1.0574	2026	1.2365
2013	1.0707	2027	1.2490
2014	1.0838	2028	1.2616
2015	1.0968	2029	1.2743
2016	1.1095	2030	1.2889
2017	1.1222	2031	1.3036
2018	1.1348	2032	1.3167
2019	1.1475	2033	1.3298
2020	1.1604	2034	1.3430
2021	1.1733	2035	1.3561
2022	1.1861	2036	1.3692

Source: ABARE (2006)

3. Data Sources and Results

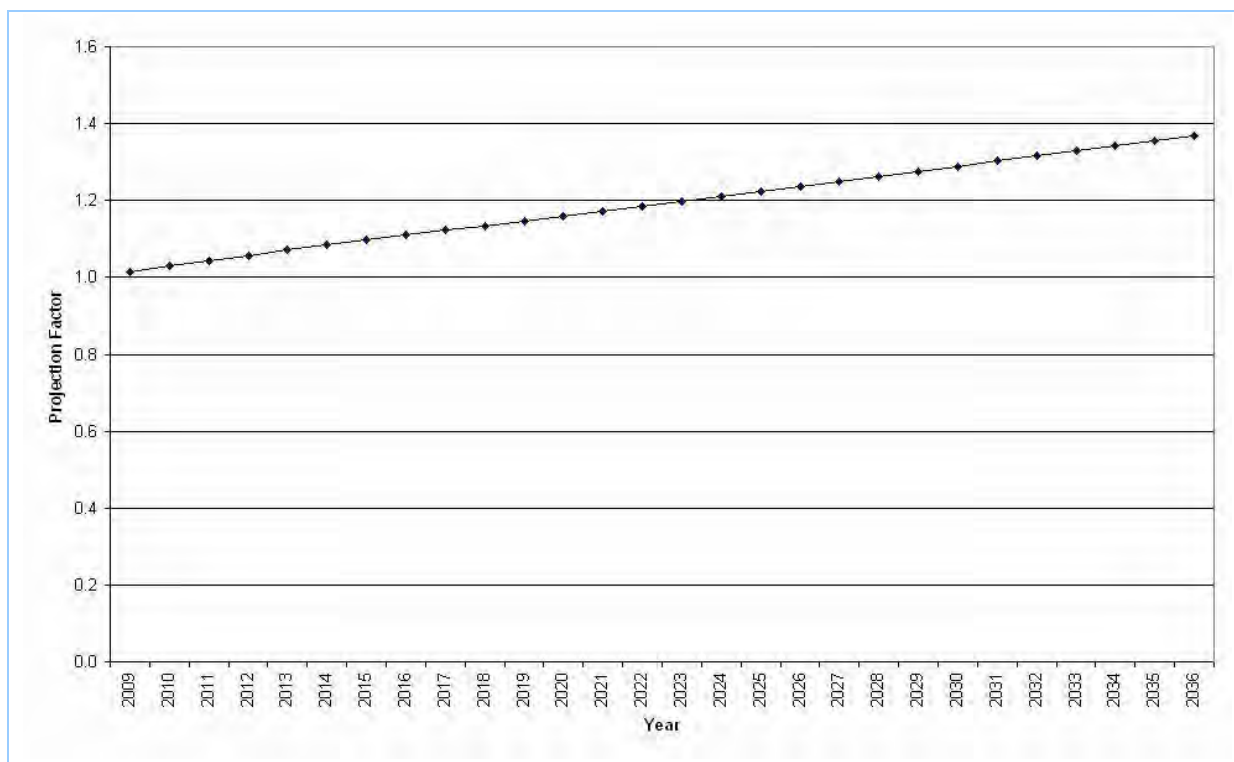


Figure 3-17: Projection factors for rail transport related sources

3.57 Recovery of Waste 75

3.57.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-325.

Table 3-325: Waste recovery facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
HI-QUALITY WASTE MANAGEMENT PTY LTD	5857	37 LEE HOLM STREET	ST MARYS	2760
MATERIALS RECYCLING DEPOT	5923	25 BURROWS ROAD	ST PETERS	2044
CONCRETE RECYCLERS (GROUP) PTY LIMITED	6664	14 THACKERAY STREET	CAMELLIA	2142
RECYCLED RESOURCES PTY LTD	7481	134 CARNARVON STREET	SILVERWATER	2128
YATES GARDEN PRODUCTS FACTORY	11470	34 WYEE ROAD	WYEE	2259
BORAL COUNTRY CONCRETE AND QUARRIES AND BORAL RECYCLING	11968	100 CORMORANT ROAD	KOORAGANG	2304
VISY RECYCLING	12107	43 BAY ROAD	TAREN POINT	2229
VISY RECYCLING	12371	32 SOUTH STREET	RYDALMERE	2116

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ALEXANDRIA RECYCLING CENTRE	12594	10-16 ALBERT STREET	ST PETERS	2044
HOMEBUSH BAY RECYCLING CENTRE PTY LTD	12696	3 BURROWAY ROAD	HOMEBUSH BAY	2127
BENEDICT RECYCLING PTY LTD	12794	33-35 RIVERSIDE ROAD	CHIPPING NORTON	2170
THIESS SERVICES PTY LTD - CENTRAL COAST DEPOT	12853	75 PILE ROAD	SOMERSBY	2250
ENVIRONMENTAL TREATMENT SOLUTIONS PTY LTD	12990	UNIT 12 - 7-10 TECHNOLOGY DRIVE	APPIN	2560

The emission sources and associated releases to air from waste recovery activities are presented in Table 3-326.

Table 3-326: Recovery of waste – emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Bulldozers (overburden)	PM
Cement or lime production (raw material crushing)	PM
Composting (100% biosolids)	VOC, ammonia
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Loaders (overburden)	PM
Material transfer	PM
Material transfer (overburden)	PM
Primary crushing (M < 4%)	PM
Screening	PM
Secondary crushing (M < 4%)	PM
Surface coating (enamel)	VOC
Trucks (dumping overburden)	PM
Trucks (dumping sandstone)	PM
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM
Wind erosion (sandstone)	PM

3.57.2 Activity Data

Summary activity data collected from the industrial questionnaires for recovery of waste is presented in Table 3-327.

Table 3-327: Summary activity data for recovery of waste

Parameter	Value	Unit
Amount of waste processed	1,163,824	tonne/year
Amount of natural gas combusted	17,503	GJ/year
Total vehicle kilometres travelled	117,959	km/year
Amount of electricity consumed	5,596	MWh/year

3.57.3 Emission and Speciation Factors

The emission and speciation factors for all substances from waste recovery sources are detailed in Table 3-328.

Table 3-328: Emission and speciation factors for all substances from recovery of waste

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Composting	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Bulldozers (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Cement or lime production (Raw material crushing)	NPI EET Manual for Cement Manufacturing v1.2 (EA, 2003) and CEIDARS Profile 343 - Cement production (CARB, 2008)
	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Loaders (overburden)	
	Material transfer	
	Material transfer (overburden)	
	Primary crushing (M < 4%)	
	Screening	
	Secondary crushing (M < 4%)	
	Trucks (dumping overburden)	
	Trucks (dumping sandstone)	
	Wheel generated dust (paved roads)	
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
Wind erosion (sandstone)		
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Composting	Site specific emission test reports
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Bulldozers (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	
	Loaders (overburden)	
	Material transfer (overburden)	
	Primary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Screening	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock screening (CARB, 2007)
	Secondary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Trucks (dumping overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping sandstone)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Wind erosion (sandstone)		
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Composting	
	Wastewater treatment	
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.57.4 Emission Estimates

Total estimated annual emissions (for selected substances) from recovery of waste for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-329. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-329: Total estimated annual emissions from recovery of waste

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	3.66	3.66
CARBON MONOXIDE	0	0	0	614	614
FORMALDEHYDE	0	0	0	7.37	7.37

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
ISOMERS OF XYLENE	163	0	0	1.32	164
LEAD AND COMPOUNDS	21.8	0.31	0	0.2	22.3
OXIDES OF NITROGEN	0	0	0	731	731
PARTICULATE MATTER $\leq 10 \mu\text{m}$	87,700	6,990	0	447	95,100
PARTICULATE MATTER $\leq 2.5 \mu\text{m}$	13,600	1,400	0	170	15,100
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0.01	0.01
SULFUR DIOXIDE	0	0	0	3.82	3.82
TETRACHLOROETHYLENE	0	0	0	0.39	0.39
TOLUENE	112	0	0	2.35	114
TOTAL SUSPENDED PARTICULATE	283,000	19,800	0	1,700	305,000
TOTAL VOLATILE ORGANIC COMPOUNDS	671	0	0	5,110	5,780
TRICHLOROETHYLENE	0	0	0	0.06	0.06

3.57.5 Emission Projection Methodology

Projection factors for recovery of waste have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.58 Rendering or Fat Extraction 47

3.58.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-330.

Table 3-330: Rendering or fat extraction facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
A.J BUSH & SONS (MANUFACTURES) PTY LTD	1100	WINDSOR ROAD	RIVERSTONE	2765
CAMILLERI STOCKFEEDS PTY LTD	2421	4777 OLD NORTHERN ROAD	MARROOTA	2756
OLD HEBBURN NO 2 COLLIERY	7504	264 HEBBURN RD	ABERMAIN	2326
SINGLETON ABATTOIR	11279	OLD NORTHERN RD - CNR NEW ENGLAND AND GOLDEN HWYS	WHITTINGHAM	2330

The emission sources and associated releases to air from rendering or fat extraction activities are presented in Table 3-331.

Table 3-331: Rendering or fat extraction – emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Flares (natural gas, csm, lfg)	Combustion products
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Process emissions	VOC, ammonia
Surface coating (degreaser)	VOC
Surface coating (enamel)	VOC
Surface coating (paint - solvent based)	VOC
Surface coating (paint - water based)	VOC
Surface coating (primer)	VOC
Surface coating (thinner)	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.58.2 Activity Data

Summary activity data collected from the industrial questionnaires for rendering or fat extraction is presented in Table 3-332.

Table 3-332: Summary activity data for rendering or fat extraction

Parameter	Value	Unit
Amount of natural gas combusted	611,416	GJ/year
Total vehicle kilometres travelled	72,397	km/year
Amount of electricity consumed	18644	MWh/year

3.58.3 Emission and Speciation Factors

The emission and speciation factors for all substances from rendering or fat extraction sources are detailed in Table 3-333.

Table 3-333: Emission and speciation factors for all substances from rendering or fat extraction

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Process emissions	Site specific emission estimates
	Surface coating (degreaser)	Mass balance
	Surface coating (enamel)	VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Surface coating (paint - solvent based)	
	Surface coating (paint - water based)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Surface coating (primer)	
	Surface coating (thinner)	
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Flares (natural gas, csm, lfg)	SPECIATEv4.2 (Profile ID=0051) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Process emissions	Site specific emission estimates
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
	Surface coating (enamel)	SPECIATEv4.2 (Profile ID=1018) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
	Surface coating (paint - water based)	SPECIATEv4.2 (Profile ID=1013) (USEPA, 2008e)
	Surface coating (primer)	SPECIATEv4.2 (Profile ID=1019) (USEPA, 2008e)
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Flares (natural gas, csm, lfg)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Process emissions	Site specific emission estimates
	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Flares (natural gas, csm, lfg)	

3.58.4 Emission Estimates

Total estimated annual emissions (for selected substances) from rendering or fat extraction for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-334. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-334: Total estimated annual emissions from rendering or fat extraction

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	106	0	0	23.5	130
CARBON MONOXIDE	17,600	0	0	4,050	21,600
FORMALDEHYDE	218	0	0	50.2	268
ISOMERS OF XYLENE	49.2	0	0	12	61.1
LEAD AND COMPOUNDS	1.04	0	0	0.06	1.1
OXIDES OF NITROGEN	39,000	0	0	7,100	46,100
PARTICULATE MATTER ≤ 10 µm	3,330	0	0	453	3,780
PARTICULATE MATTER ≤ 2.5 µm	1,910	0	0	406	2,320
POLYCYCLIC AROMATIC HYDROCARBONS	0.14	0	0	0.03	0.18
SULFUR DIOXIDE	114	0	0	25.2	139
TETRACHLOROETHYLENE	63.1	0	0	9.11	72.2
TOLUENE	97.6	0	0	27.5	125
TOTAL SUSPENDED PARTICULATE	8,970	0	0	690	9,660
TOTAL VOLATILE ORGANIC COMPOUNDS	1,680	0	0	365	2,040
TRICHLOROETHYLENE	52.3	0	0	1.3	53.6

3.58.5 Emission Projection Methodology

Projection factors for rendering or fat extraction have been derived based on final energy consumption projections for agriculture in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-6 and illustrated in Figure 3-1.

3.59 Road Construction 38

3.59.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-335.

3. Data Sources and Results

Table 3-335: Road construction facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
LANE COVE TUNNEL PROJECT	12076	EPPING ROAD	LANE COVE	2066
F5 WIDENING	12303	BTW BROOKS RD - INGLEBURN & NARELLAN RD - BLAIR ATH	INGLEBURN	2565
M5 WIDENING	12344	M5 (BETWEEN GEORGES RIVER AND CAMDEN VALLEY WAY)	MOOREBANK	2170
F3 FREEWAY EXPANSION - MT COLAH TO COWAN	12573	SYDNEY - NEWCASTLE FREEWAY	BEROWRA	2081
OAK FLATS TO DUNMORE REALIGNMENT PROJECT	12717	DUNSTERS LANE	OAK FLATS	2529
GREAT WESTERN HIGHWAY UPGRADE WOODFORD TO HAZELBROOK	12959	STATION ST WOODFORD TO WINBOURNE RD HAZELBROOK	HAZELBROOK	2779

The emission sources and associated releases to air from road construction are presented in Table 3-336.

Table 3-336: Road construction – emission sources

Source	Emissions to Air
Aggregate transfer to conveyor	PM
Aggregate transfer to ground	PM
Cement unloading	PM
Conveyor transfer of aggregate to elevated storage	PM
Conveyor transfer of sand to elevated storage	PM
Fly ash transfer (cement supplement)	PM
Graders	PM
Internal combustion engine (diesel)	Combustion products
Loaders (overburden)	PM
Material transfer (overburden)	PM
Material transfer (sandstone)	PM
Mixer loading (central mix)	PM
Primary crushing (M < 4%)	PM
Sand transfer to conveyor	PM
Sand transfer to ground	PM
Screening	PM
Trucks (dumping overburden)	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM

3.59.2 Activity Data

Summary activity data collected from the industrial questionnaires for road construction are presented in Table 3-337.

3. Data Sources and Results

Table 3-337: Summary activity data for road construction

Parameter	Value	Unit
Total vehicle kilometres travelled	62,505	km/year
Amount of electricity consumed	120	MWh/year

3.59.3 Emission and Speciation Factors

The emission and speciation factors for all substances from road construction sources are detailed in Table 3-338.

Table 3-338: Emission and speciation factors for all substances from road construction

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PM _{2.5} , PM ₁₀ & TSP	Aggregate transfer to conveyor	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Aggregate transfer to ground	
	Cement unloading	
	Conveyor transfer of aggregate to elevated storage	
	Conveyor transfer of sand to elevated storage	
	Fly ash transfer (cement supplement)	
	Graders	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Loaders (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (overburden)	
	Material transfer (sandstone)	
	Mixer loading (central mix)	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Primary crushing (M < 4%)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Sand transfer to conveyor	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Sand transfer to ground	
	Screening	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping overburden)	
Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)	
Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)	
Wind erosion (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)	
Speciated organics (including methane)	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
Speciated particulate matter	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Graders	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Internal combustion engine (diesel)	CEIDARS PM profile 114 for speciated metals (CARB, 2007)
	Loaders (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Material transfer (overburden)	
	Material transfer (sandstone)	
	Mixer loading (central mix)	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Primary crushing (M < 4%)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Screening	
	Trucks (dumping overburden)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	Internal combustion engine (diesel, P<450kW)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	Internal combustion engine (diesel)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.59.4 Emission Estimates

Total estimated annual emissions (for selected substances) from road construction for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-339. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-339: Total estimated annual emissions from road construction

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	5.46	0	0	0	5.46
ACETALDEHYDE	0	0	0	0	0
BENZENE	6.16	0	0	0	6.16
CARBON MONOXIDE	203	0	0	0	203
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0	0	0	0	0
LEAD AND COMPOUNDS	7.91	0	0.76	0	8.67
OXIDES OF NITROGEN	943	0	0	0	943
PARTICULATE MATTER ≤ 10 µm	19,700	0	5,900	0	25,500
PARTICULATE MATTER ≤ 2.5 µm	2,390	0	1,270	0	3,660
POLYCYCLIC AROMATIC HYDROCARBONS	0.04	0	0	0	0.04
SULFUR DIOXIDE	1.1	0	0	0	1.1
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	0	0	0	0
TOTAL SUSPENDED PARTICULATE	70,200	0	38,200	0	108,000
TOTAL VOLATILE ORGANIC COMPOUNDS	68.9	0	0	0	68.9
TRICHLOROETHYLENE	0	0	0	0	0

3. Data Sources and Results

3.59.5 Emission Projection Methodology

Projection factors for road construction have been derived based on final energy consumption projections for road transport in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-340 and illustrated in Figure 3-18.

Table 3-340: Projection factors for road transport related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0048	2023	1.0238
2010	1.0085	2024	1.0243
2011	1.0105	2025	1.0248
2012	1.0116	2026	1.0252
2013	1.0129	2027	1.0256
2014	1.0141	2028	1.0260
2015	1.0152	2029	1.0263
2016	1.0164	2030	1.0303
2017	1.0179	2031	1.0348
2018	1.0192	2032	1.0363
2019	1.0206	2033	1.0377
2020	1.0217	2034	1.0392
2021	1.0224	2035	1.0407
2022	1.0231	2036	1.0421

Source: ABARE (2006)

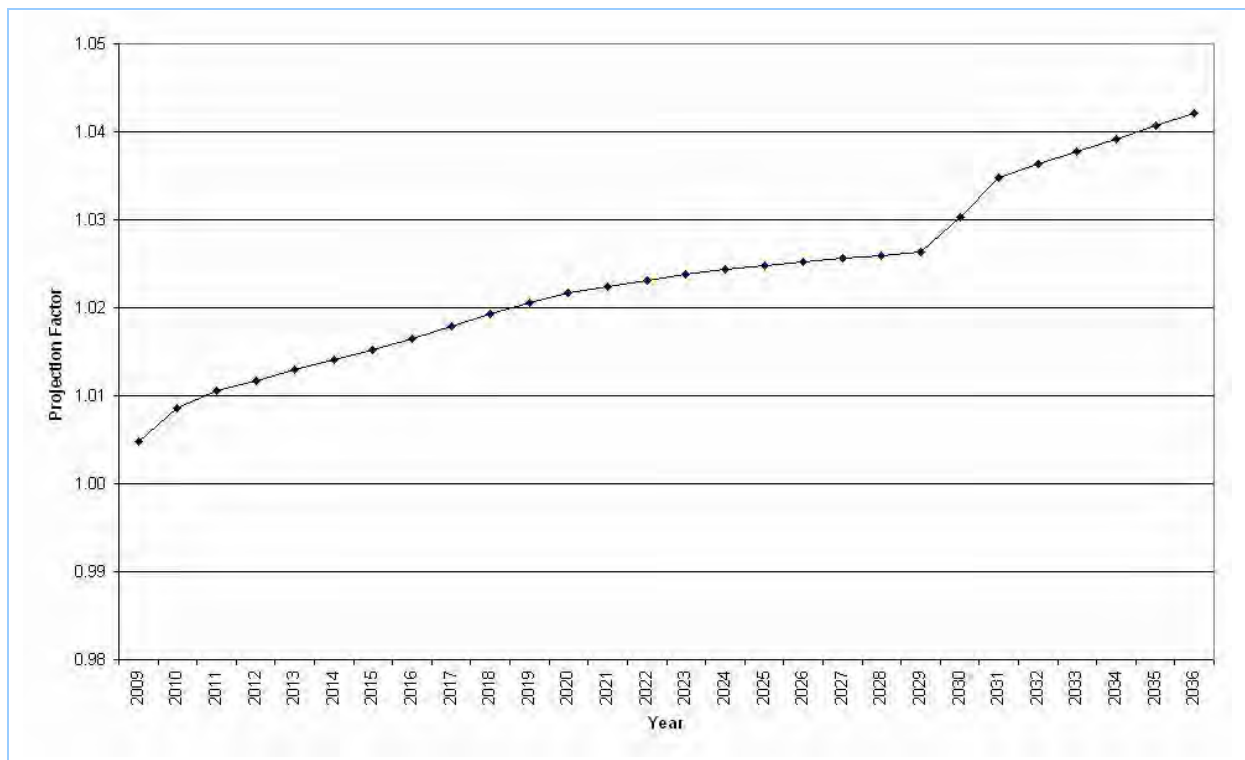


Figure 3-18: Projection factors for road transport related sources

3.60 Rubber Products/Tyre Production and Recovery of Waste Oil and Tyres 22, 69, 76

3.60.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR included in the emissions inventory under the category rubber products/tyre production are outlined in Table 3-341.

Table 3-341: Rubber products/tyre production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
TOYO TYRE AND RUBBER	12824	137-149 AIRDS ROAD	MINTO	2566

Industrial facilities within the GMR that are included in the emissions inventory under the category recovery of waste oil and tyres are outlined in Table 3-342.

Table 3-342: Recovery of waste oil and tyres facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
NATIONWIDE OIL PTY LTD	854	6 DAVIS ROAD	WETHERILL PARK	2164
WORTH RECYCLING PTY LTD	4602	CNR BLACKMAN CRES & FAIREY ROAD	SOUTH WINDSOR	2756
TRANSPACIFIC BITUMINOUS PRODUCTS PTY LTD	5267	33 VIOLET ST	REVESBY	2212
TRUEGAIN PTY LTD	7638	62 KYLE STREET	RUTHERFORD	2320
EAGLE FLY PTY LTD	11666	36 LISBON STREET	FAIRFIELD EAST	2165

The emission sources and associated releases to air from rubber products/tyre production are presented in Table 3-343.

Table 3-343: Rubber products/tyre production - emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Organic liquid storage (naphtha)	VOC
Rubber product manufacturing (autoclave)	VOC
Rubber product manufacturing (calendering)	VOC
Rubber product manufacturing (extrusion)	VOC, PM
Rubber product manufacturing (milling)	VOC
Rubber product manufacturing (mixing)	VOC, PM
Wheel generated dust (paved roads)	PM

The emission sources and associated releases to air from recovery of waste oil and tyres activities are presented in Table 3-344.

Table 3-344: Recovery of waste oil and tyres – emission sources

Source	Emissions to Air
Boiler (diesel)	Combustion products
Boiler (heavy fuel oil)	Combustion products
Boiler (light fuel oil)	Combustion products
Boiler (natural gas)	Combustion products
Flares (natural gas, csm, lfg)	Combustion products
Fuel storage (diesel)	VOC
Fuel storage (jet fuel)	VOC
Fuel storage (oil)	VOC
Internal combustion engine (natural gas)	Combustion products
Organic liquid storage (general chemicals)	VOC
Process emissions	VOC
Rubber product manufacturing (milling)	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.60.2 Activity Data

Summary activity data collected from the industrial questionnaires for rubber products/tyre production and recovery of waste oil/tyres is presented in Table 3-345.

Table 3-345: Summary activity data for rubber products/tyre production and recovery of waste oil and tyres

Parameter	Value	Unit
Amount of waste oil recycled	68,760	kL/year
Amount of crumbed rubber produced	1.700	tonne/year
Amount of natural gas combusted	147,750	GJ/year
Amount of diesel combusted	3.97	kL/year
Amount of light fuel oil combusted	3,397	kL/year
Amount of heavy fuel oil combusted	2	kL/year
Total vehicle kilometres travelled	12,440	km/year
Amount of electricity consumed	10,017	MWh/year

3.60.3 Emission and Speciation Factors

The emission and speciation factors for all substances from rubber products/tyre production are detailed in Table 3-346.

Table 3-346: Emission and speciation factors for all substances from rubber products/tyre production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Organic liquid storage (naphtha)	TANKS 4.09D software (USEPA, 2006e)
	Rubber product manufacturing	NPI EET Manual for Rubber Product Manufacture v1.1

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	(autoclave)	(EA, 2002b)
	Rubber product manufacturing (calendaring)	
	Rubber product manufacturing (extrusion)	
	Rubber product manufacturing (milling)	
	Rubber product manufacturing (mixing)	
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Rubber product manufacturing (extrusion)	NPI EET Manual for Rubber Product Manufacture v1.1 (EA, 2002b)
	Rubber product manufacturing (mixing)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Organic liquid storage (naphtha)	CEIDARS Organic Profile Jet fuel evaporation (jet a) (CARB, 2005)
	Rubber product manufacturing (autoclave)	SPECIATEv4.2 (Profile ID=9014) (USEPA, 2008e)
	Rubber product manufacturing (calendaring)	
	Rubber product manufacturing (extrusion)	
	Rubber product manufacturing (milling)	
	Rubber product manufacturing (mixing)	
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Rubber product manufacturing (extrusion)	NPI EET Manual for Rubber Product Manufacture v1.1 (EA, 2002b)
	Rubber product manufacturing (mixing)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3. Data Sources and Results

The emission and speciation factors for all substances from recovery of waste oil and tyres sources are detailed in Table 3-347.

Table 3-347: Emission and speciation factors for all substances from recovery of waste oil and tyres

Substance	Emission Source	Emission Factor Source
CO, NO _x ¹ , SO ₂ & VOC	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (heavy fuel oil)	
	Boiler (light fuel oil)	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (jet fuel)	
	Fuel storage (oil)	
	Internal combustion engine (natural gas)	NPI EET Manual for Combustion Engines v3.0 (DEWHA, 2008b)
	Organic liquid storage (general chemicals)	TANKS 4.09D software (USEPA, 2006e)
	Process emissions	Site specific emission estimates
	Rubber product manufacturing (milling)	NPI EET Manual for Rubber Product Manufacture v1.1 (EA, 2002b)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (heavy fuel oil)	
	Boiler (light fuel oil)	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Internal combustion engine (natural gas)	NPI EET Manual for Combustion Engines v3.0 (DEWHA, 2008b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (diesel)	SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)
	Boiler (heavy fuel oil)	SPECIATEv4.2 (Profile ID=0001) (USEPA, 2008e)
	Boiler (light fuel oil)	SPECIATEv4.2 (Profile ID=0002) (USEPA, 2008e)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Flares (natural gas, csm, lfg)	SPECIATEv4.2 (Profile ID=0051) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (jet fuel)	CEIDARS Organic Profile Jet fuel evaporation (jet a) (CARB, 2005)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Internal combustion engine (natural gas)	SPECIATEv4.2 (Profile ID=1001) (USEPA, 2008e)
	Organic liquid storage (general chemicals)	Mass balance

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Process emissions	CEIDARS Organic Profile Mineral spirits (CARB, 2005)
	Rubber product manufacturing (milling)	SPECIATEv4.2 (Profile ID=9014) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (diesel)	CEIDARS PM profile 114 for speciated metals (CARB, 2007)
	Boiler (heavy fuel oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (light fuel oil)	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	
	Internal combustion engine (natural gas)	CEIDARS PM profile ID 123 Stat. I.C. engine - gas (CARB, 2007)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)	
Ammonia	Boiler (diesel)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (heavy fuel oil)	
	Boiler (light fuel oil)	
	Boiler (natural gas)	
	Flares (natural gas, csm, lfg)	
	Internal combustion engine (natural gas)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (heavy fuel oil)	
	Boiler (light fuel oil)	
PAH	Boiler (heavy fuel oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (light fuel oil)	
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (natural gas, csm, lfg)	
	Internal combustion engine (natural gas)	
PCDD/PCDF	Boiler (diesel)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (heavy fuel oil)	
	Boiler (light fuel oil)	
	Boiler (natural gas)	
	Flares (natural gas, csm, lfg)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (diesel)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (heavy fuel oil)	
	Boiler (light fuel oil)	
	Boiler (natural gas)	
	Flares (natural gas, csm, lfg)	
	Internal combustion engine (natural gas)	

3. Data Sources and Results

3.60.4 Emission Estimates

Total estimated annual emissions (for selected substances) from rubber products/tyre production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-348. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-348: Total estimated annual emissions from rubber products/tyre production

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	713	0	0	0	713
ACETALDEHYDE	0	0	0	0	0
BENZENE	125	0	0	0	125
CARBON MONOXIDE	8.51	0	0	0	8.51
FORMALDEHYDE	0.21	0	0	0	0.21
ISOMERS OF XYLENE	2.24	0	0	0	2.24
LEAD AND COMPOUNDS	0	0	0	0	0
OXIDES OF NITROGEN	20	0	0	0	20
PARTICULATE MATTER ≤ 10 µm	49.6	0	0	0	49.6
PARTICULATE MATTER ≤ 2.5 µm	45.2	0	0	0	45.2
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0.11	0	0	0	0.11
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	6.77	0	0	0	6.77
TOTAL SUSPENDED PARTICULATE	74.1	0	0	0	74.1
TOTAL VOLATILE ORGANIC COMPOUNDS	3,650	0	0	0	3,650
TRICHLOROETHYLENE	0	0	0	0	0

Total estimated annual emissions (for selected substances) from recovery of waste oil and tyres for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-349. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-349: Total estimated annual emissions from recovery of waste oil and tyres

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	52.3	0	0	0	52.3
ACETALDEHYDE	0.06	0	0	0	0.06
BENZENE	39.9	0	0	10.1	49.9
CARBON MONOXIDE	5,660	0	0	2,080	7,730
FORMALDEHYDE	74.3	0	0	88.4	163
ISOMERS OF XYLENE	104	0	0	12.6	117
LEAD AND COMPOUNDS	0.21	0	0	0.51	0.72
OXIDES OF NITROGEN	6,760	0	0	8,200	15,000
PARTICULATE MATTER ≤ 10 µm	863	0	0	216	1,083
PARTICULATE MATTER ≤ 2.5 µm	663	0	0	212	875
POLYCYCLIC AROMATIC HYDROCARBONS	0.06	0	0	0.49	0.54
SULFUR DIOXIDE	53.6	0	0	6,110	6,170

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
TETRACHLOROETHYLENE	29.3	0	0	14.7	44
TOLUENE	85.4	0	0	13.4	98.8
TOTAL SUSPENDED PARTICULATE	1,973	0	0	229	2,203
TOTAL VOLATILE ORGANIC COMPOUNDS	1,245	0	0	337	1,581
TRICHLOROETHYLENE	4.19	0	0	2.09	6.28

3.60.5 Emission Projection Methodology

Projection factors for rubber products/tyre production have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

Projection factors for recovery of waste oil and tyres have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.61 Scrap Metal Processing 62**3.61.1 Emission Sources and Associated Releases to Air**

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-350.

Table 3-350: Scrap metal processing facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
METALCORP RECYCLERS PTY LTD	872	53-57 RIVERSIDE ROAD	CHIPPING NORTON	2170
SMORGON STEEL RECYCLING	1977	23 DAVIS ROAD	WETHERILL PARK	2164
SIMS GROUP LIMITED	2207	43 ASHFORD AVE	MILPERRA	2214
METALCORP RECYCLERS PTY LIMITED	2270	79 STEPHEN ROAD	BOTANY	2019
SIMS GROUP LIMITED	2950	35-37 FRANK STREET	WETHERILL PARK	2164
METALCORP RECYCLERS PTY LTD	4414	LOT 5/243 BERKELEY RD	UNANDERRA	2526
METALCORP RECYCLERS PTY LTD T/A SMORGON STEEL RECYCLING	5345	NO. 14 & NO. 41 SPARKE STREET	HEXHAM	2322
SIMS GROUP LIMITED	6934	76 - 100 CHRISTIE STREET	ST MARYS	2760
SIMS GROUP LIMITED	11264	CORMORANT ROAD - KOORAGANG ISLAND	NEWCASTLE	2304
SELL AND PARKER PTY LTD	11555	45 TATTERSALL ROAD	BLACKTOWN	2148

3. Data Sources and Results

The emission sources and associated releases to air from scrap metal processing are presented in Table 3-351.

Table 3-351: Scrap metal processing – emission sources

Source	Emissions to Air
Fuel storage (diesel)	VOC
Fuel storage (oil)	VOC
Metal cutting (mild steel, 8 mm)	NO _x , magnesium oxide fume
Wheel generated dust (paved roads)	PM

3.61.2 Activity Data

Summary activity data collected from the industrial questionnaires for scrap metal processing is presented in Table 3-352.

Table 3-352: Summary activity data for scrap metal processing

Parameter	Value	Unit
Amount of scrap metal processed	996,600	tonne/year
Amount of electricity consumed	21,831	MWh/year

3.61.3 Emission and Speciation Factors

The emission and speciation factors for all substances from scrap metal processing sources are detailed in Table 3-353.

Table 3-353: Emission and speciation factors for all substances from scrap metal processing

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (oil)	
	Metal cutting (mild steel, 8 mm)	NPI EET Manual for Structural and Fabricated Metal Product Manufacture (EA, 1999g)
PM _{2.5} , PM ₁₀ & TSP	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
Speciated particulate matter	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	NA	NA
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.61.4 Emission Estimates

Total estimated annual emissions (for selected substances) from scrap metal processing for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-354. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-354: Total estimated annual emissions from scrap metal processing

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	0	0	0	0	0
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0.43	0.26	0.06	0	0.75
LEAD AND COMPOUNDS	0.13	0.12	0	0	0.25
OXIDES OF NITROGEN	4,810	3,110	0	0	7,930
PARTICULATE MATTER ≤ 10 µm	52,600	187	0.35	0	52,800
PARTICULATE MATTER ≤ 2.5 µm	39,300	45.4	0.08	0	39,300
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0.13	0.08	0.02	0	0.23
TOTAL SUSPENDED PARTICULATE	83,800	977	1.81	0	84,800
TOTAL VOLATILE ORGANIC COMPOUNDS	4.75	2.92	0.61	0	8.29
TRICHLOROETHYLENE	0	0	0	0	0

3.61.5 Emission Projection Methodology

Projection factors for scrap metal processing have been derived based on final energy consumption projections for other basic non-ferrous metals in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-240 and illustrated in Figure 3-13.

3.62 Sewage Treatment – Large Plants 71B**3.62.1 Emission Sources and Associated Releases to Air**

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-355.

Table 3-355: Sewage treatment – large plants facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
WOLLONGONG SEWAGE TREATMENT SYSTEM	218	PORT KEMBLA ROAD	WOLLONGONG	2500
SOUTHERN SUBURBS SEWAGE TREATMENT	372	FISHERMANS ROAD	MALABAR	2036

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
SYSTEM				
LIVERPOOL SEWAGE TREATMENT SYSTEM	372	SCRIVENER STREET	LIVERPOOL	2170
MALABAR SEWAGE TREATMENT SYSTEM	372	FISHERMANS ROAD	MALABAR	2036
NORTHERN SUBURBS SEWAGE TREATMENT SYSTEM	372	VICTORIA ROAD	MACQUARIE FIELDS	2564
FAIRFIELD SEWAGE TREATMENT SYSTEM	372	SYMONS STREET	FAIRFIELD	2165
GLENFIELD SEWAGE TREATMENT SYSTEM	372	VICTORIA ROAD	MACQUARIE FIELDS	2564
NORTHERN SUBURBS SEWAGE TREATMENT SYSTEM	378	BLUE FISH ROAD	MANLY	2095
PENRITH SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	1409	CASTLEREAGH ROAD	PENRITH	2750
NEWCASTLE SEWERAGE SYSTEM INCLUDING BURWOOD BEACH WASTEWATER TREATMENT PLANT	1683	OFF SCENIC DRIVE	MEREWETHER	2291
BONDI SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	1688	MILITARY ROAD	BONDI	2026
QUAKERS HILL SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	1724	QUAKERS ROAD (NEAR MELROSE AVENUE)	QUAKERS HILL	2763
CRONULLA SEWAGE TREATMENT SYSTEM INCLUDING THE STP ADJACENT TO	1728	CAPTAIN COOK DRIVE	KURNELL	2231
ST MARYS SEWAGE TREATMENT SYSTEM INCLUDING THE STP	1729	OFF LINKS ROAD	ST MARYS	2760
EDGEWORTH WASTE WATER TREATMENT PLANT	1771	OFF GARTH STREET	EDGEWORTH	2285
BELMONT WASTE WATER TREATMENT PLANT	1771	OFF OCEAN PARK ROAD	BELMONT	2280
TORONTO WASTE WATER TREATMENT PLANT	1771	FAUCETT STREET	TORONTO	2283
KINCUMBER SEWAGE TREATMENT SYSTEM	1802	DOYLE STREET	KINCUMBER	2251
TOUKLEY SEWAGE TREATMENT SYSTEM	2647	WILFRED BARRETT DRIVE	NORAVILLE	2263

The emission sources and associated releases to air from sewage treatment – large plants are presented in Table 3-356.

Table 3-356: Sewage treatment – large plants – emission sources

Source	Emissions to Air
Boiler (diesel)	Combustion products
Boiler (LPG)	Combustion products
Boiler (biogas)	Combustion products
Flares (biogas)	Combustion products
Internal combustion engine (biogas)	Combustion products
Internal combustion engine (diesel)	Combustion products
Odour scrubber	Chlorine, hydrogen sulfide
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.62.2 Activity Data

Summary activity data collected from the industrial questionnaires for sewage treatment – large plants is presented in Table 3-357.

Table 3-357: Summary activity data for sewage treatment – large plants

Parameter	Value	Unit
Volume of wastewater treated	517,467	ML/year
Amount of diesel combusted	26	kL/year
Amount of biogas combusted	377,033	GJ/year
Amount of biogas flared	225,486	GJ/year
Amount of LPG combusted	47.2	m ³ /year
Amount of electricity consumed	171,854	MWh/year

3.62.3 Emission and Speciation Factors

The emission and speciation factors for all substances from sewage treatment – large plants sources are detailed in Table 3-358.

Table 3-358: Emission and speciation factors for all substances from sewage treatment – large plants

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (biogas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (biogas)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Internal combustion engine (biogas)	Site specific emission estimates/ AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (biogas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Flares (biogas)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Internal combustion engine (biogas)	Site specific emission estimates/ AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (biogas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Flares (biogas)	SPECIATEv4.2 (Profile ID=0051) (USEPA, 2008e)
	Internal combustion engine (biogas)	SPECIATEv4.2 (Profile ID=1001) (USEPA, 2008e)
	Internal combustion engine (diesel)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (diesel)	CEIDARS PM profile 114 for speciated metals (CARB, 2007)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule as natural gas)
	Boiler (biogas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (biogas)	
	Internal combustion engine (biogas)	Site specific emission estimates
	Internal combustion engine (diesel)	CEIDARS PM profile 114 for speciated metals (CARB, 2007)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (diesel)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (LPG)	
	Boiler (biogas)	
	Flares (biogas)	
	Internal combustion engine (biogas)	
	Internal combustion engine (diesel)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
PAH	Boiler (diesel)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA,
	Boiler (LPG)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (biogas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (biogas)	
	Internal combustion engine (biogas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
	Internal combustion engine (diesel)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	Boiler (diesel)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (LPG)	
	Boiler (biogas)	
	Flares (biogas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (diesel)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (LPG)	
	Boiler (biogas)	
	Flares (biogas)	
	Internal combustion engine (biogas)	
	Internal combustion engine (diesel)	

3.62.4 Emission Estimates

Total estimated annual emissions (for selected substances) from sewage treatment – large plants for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-359. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-359: Total estimated annual emissions from sewage treatment – large plants

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0.84	0	0	0	0.84
ACETALDEHYDE	21	0	0	0	21
BENZENE	90.4	0	1.34	0.76	92.5
CARBON MONOXIDE	52,500	0	819	507	53,800
FORMALDEHYDE	1,180	247	35.6	501	1,960
ISOMERS OF XYLENE	2,860	1,480	134	2,950	7,430
LEAD AND COMPOUNDS	0.83	0.19	0.01	0.22	1.25
OXIDES OF NITROGEN	115,000	0	777	471	116,000
PARTICULATE MATTER ≤ 10 µm	3,250	308	212	480	4,250
PARTICULATE MATTER ≤ 2.5 µm	2,460	68	212	218	2,960
POLYCYCLIC AROMATIC HYDROCARBONS	3.7	0	0.01	0	3.71
SULFUR DIOXIDE	141	0	4.87	3.08	149
TETRACHLOROETHYLENE	3,310	1,730	156	3,450	8,640
TOLUENE	1,920	988	89.8	1,970	4,970
TOTAL SUSPENDED PARTICULATE	7,540	1,530	212	1,810	11,100
TOTAL VOLATILE ORGANIC COMPOUNDS	37,200	10,600	1,020	21,200	70,100
TRICHLOROETHYLENE	473	247	22.3	492	1,230

3.62.5 Emission Projection Methodology

Projection factors for sewage treatment – large plants have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.63 Sewage Treatment – Small Plants 71A

3.63.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-360.

Table 3-360: Sewage treatment – small plants facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
BEROWRA WATERS MARINA	177	199 BAY ROAD	BEROWRA WATERS	2082
NORTH RICHMOND SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	190	CNR BELLS LINE OF ROAD & CROOKED LANE	NORTH RICHMOND	2754
SHELLHARBOUR SEWAGE TREATMENT SYSTEM INCLUDING STP AT	211	JUNCTION ROAD	SHELLHARBOUR	2529
RAYMOND TERRACE WASTEWATER TREATMENT WORKS	217	OFF ELIZABETH AVENUE	RAYMOND TERRACE	2324
CESSNOCK WASTEWATER TREATMENT WORKS	227	OFF GOVERNMENT ROAD	CESSNOCK	2325
LITHGOW SEWAGE TREATMENT PLANT	236	GEORDIE STREET	LITHGOW	2790
MCDONALD'S HEXHAM	329	23 MAITLAND ROAD	HEXHAM	2322
PORTLAND WASTEWATER TREATMENT PLANT	597	ALBION ROAD	PORTLAND	2847
WALLERAWANG SEWERAGE TREATMENT PLANT	598	107 BRAYS LANE	WALLERAWANG	2845
FARLEY WASTEWATER TREATMENT WORKS	733	OFF OWL PEN LANE	FARLEY	2320
HORNSBY HEIGHTS SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	750	PIKE ROAD	HORNSBY HEIGHTS	2077
VISION VALLEY CONFERENCE & RECREATION CENTRE	1584	7 VISION VALLEY ROAD	ARCADIA	2159
HEXHAM BOWLING CLUB CO-OP LTD	1586	290 OLD MAITLAND ROAD	HEXHAM	2322
MUSWELLBROOK SEWAGE TREATMENT WORKS	1593	SKELLATOR STOCK ROUTE	MUSWELLBROOK	2333
THE RUGBY LEAGUE COUNTRY CLUB LTD	1617	810 CAMDEN VALLEY WAY	CATHERINE FIELD	2171

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Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
WEST CAMDEN SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	1675	CORNER OF SHEATHERS AND FERGUSON LANES	GRASMERE	2570
HEXHAM ENGINEERING	1676	230 OLD MAITLAND ROAD	HEXHAM	2322
TARONGA ZOO	1677	BRADLEYS HEAD ROAD	MOSMAN	2088
BRANXTON WASTEWATER TREATMENT WORKS	1680	OFF NEW ENGLAND HIGHWAY	BRANXTON	2335
MCGRATHS HILL SEWAGE TREATMENT PLANT	1684	10-38 MULGRAVE ROAD	MCGRATHS HILL	2756
WEST HORNSBY SEWAGE TREATMENT SYSTEM INCLUDING THE STP	1695	OFF VALLEY ROAD	HORNSBY	2077
CASTLE HILL SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	1725	WRIGHTS ROAD	KELLYVILLE	2155
RICHMOND SEWAGE TREATMENT SYSTEM INCLUDING THE STP	1726	BLACKTOWN ROAD	RICHMOND	2753
MOSS VALE SEWAGE TREATMENT PLANT	1731	KENNEDY CLOSE	MOSS VALE	2577
BOWRAL SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	1749	BURRADOO ROAD	BOWRAL	2576
KURRI KURRI WASTEWATER TREATMENT WORKS	1767	OFF MCLEOD ROAD	KURRI KURRI	2327
WARRIEWOOD SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	1784	WARRIEWOOD ROAD	WARRIEWOOD	2102
RIVERSTONE SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	1796	BANDON ROAD	VINEYARD	2765
BATEAU BAY SEWAGE TREATMENT SYSTEM	1942	THE ENTRANCE ROAD	BATEAU BAY	2261
JENOLAN CAVES SEWAGE TREATMENT WORKS	1962	MAIN ROAD 253	JENOLAN CAVES	2790
WINMALEE SEWAGE TREATMENT SYSTEM INCLUDING THE STP	1963	OFF HAWKESBURY ROAD	WINMALEE	2777
BOMBO SEWAGE TREATMENT SYSTEM INCLUDING STP AT	2269	DARIEN AVENUE	BOMBO	2533
KENTGROVE RETIREMENT VILLAGE	2342	2C JONES ROAD	KENTHURST	2156
BUNDANOON SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	2436	FERNDALE ROAD	BUNDANOON	2578
DORA CREEK WASTEWATER TREATMENT WORKS	2541	MARCONI ROAD	DORA CREEK	2264
STROUD SEWAGE	2561	OFF LAMAN STREET	STROUD	2425

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
TREATMENT WORKS				
SINGLETON SEWAGE TREATMENT PLANT	3088	ARMY CAMP ROAD	SINGLETON	2330
KEARSLEY WASTEWATER TREATMENT WORKS	3232	OFF NEATH ROAD	KEARSLEY	2325
SOUTH WINDSOR SEWAGE TREATMENT PLANT	3306	FAIREY ROAD	SOUTH WINDSOR	2756
BERRIMA WASTEWATER TREATMENT PLANT	3575	TAYLOR AVE	NEW BERRIMA	2577
PAXTON WASTEWATER TREATMENT WORKS	3755	OFF MILLFIELD ROAD	PAXTON	2325
RIVERVIEW HOSTELS PTY LTD	4045	300 FREEMANS DRIVE	COORANBONG	2265
DUNGOG SEWAGE TREATMENT WORKS	4197	ALISON ROAD	DUNGOG	2420
TANILBA BAY WASTEWATER TREATMENT WORKS	4435	OFF LEMON TREE PASSAGE ROAD	MALLABULA	2319
ROUSE HILL SEWAGE TREATMENT SYSTEM INCLUDING THE STP AT	4965	MILE END ROAD	ROUSE HILL	2155
DENMAN SEWAGE TREATMENT SYSTEM	5059	PALACE STREET	DENMAN	2328
SYDNEY OLYMPIC PARK	10020	MARJORIE JACKSON PARKWAY - EDWIN FLACK AVENUE	HOME BUSH BAY	2127
KARUAH SEWAGE TREATMENT WORKS - SEWAGE TRANSPORT SYSTEM & KARUAH EFFLUENT REUSE ENTERPRISE.	10230	CLARENCE TOWN ROAD	KARUAH	2324
MITTAGONG SEWAGE TREATMENT PLANT	10362	DRAPERS ROAD	MITTAGONG	2575
PICTON SEWAGE TREATMENT SYSTEM INCLUDING STP AT	10555	REMEMBRANCE DRIVE	PICTON	2571
MORPETH WASTEWATER TREATMENT WORKS	10693	BUTCHER LANE	MORPETH	2321
MAYFIELD INDUSTRIAL ESTATE SEWAGE TREATMENT PLANT	11549	CLOSURE AREA OF FORMER BHP STEELWKS OFF SELWYN ST	MAYFIELD	2304
WALLACIA SEWAGE TREATMENT SYSTEM	12235	INCLUDING THE STP AT NORTONS BASIN ROAD	WALLACIA	2745
BROOKLYN SEWAGE TREATMENT SYSTEM INCLUDING THE BROOKLYN STP AT	12438	LOT 4 BROOKLYN ROAD	BROOKLYN	2083
UPPER BLUE MOUNTAINS SEWERAGE SCHEME -	12581	OLD BLACKHEATH AIRFIELD SITE - HAT HILL	BLACKHEATH	2785

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
INCLUDING THE CONSTRUCTION SITE OFFICE AT		ROAD		
MOONEY MOONEY AND CHEERO POINT SEWERAGE SCHEME	12633	PACIFIC HIGHWAY	MOONEY MOONEY	2083
BONA VISTA	12883	BOOTLES LANE	PITT TOWN	2756
GLOSSODIA-FREEMANS REACH-WILBERFORCE SEWERAGE SCHEME INCLUDING	13017	THE TOWNSHIPS OF GLOSSODIA - FREEMANS REACH AND	WILBERFORCE	2756

The emission sources and associated releases to air from sewage treatment - small plants are presented in Table 3-361.

Table 3-361: Sewage treatment - small plants - emission sources

Source	Emissions to Air
Boiler (biogas)	Combustion products
Boiler (diesel)	Combustion products
Boiler (LPG)	Combustion products
Flares (biogas)	Combustion products
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Internal combustion engine (biogas)	Combustion products
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.63.2 Activity Data

Summary activity data collected from the industrial questionnaires for sewage treatment - small plants is presented in Table 3-362.

Table 3-362: Summary activity data for sewage treatment - small plants

Parameter	Value	Unit
Volume of wastewater treated	74,220	ML/year
Amount of diesel combusted	2	kL/year
Amount of biogas combusted	18,105	GJ/year
Amount of biogas flared	34,337	GJ/year
Amount of LPG combusted	155	m ³ /year
Amount of electricity consumed	59,391	MWh/year

3.63.3 Emission and Speciation Factors

The emission and speciation factors for all substances from sewage treatment - small plants sources are detailed in Table 3-363.

3. Data Sources and Results

Table 3-363: Emission and speciation factors for all substances from sewage treatment – small plants

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (biogas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (biogas)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Internal combustion engine (biogas)	Site specific emission estimates/ AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (biogas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (biogas)	AP42 Chapter 2.4 Municipal Solid Waste Landfills (USEPA, 2008b)
	Internal combustion engine (biogas)	Site specific emission estimates/ AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (biogas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Flares (biogas)	SPECIATEv4.2 (Profile ID=0051) (USEPA, 2008e)
	Internal combustion engine (biogas)	SPECIATEv4.2 (Profile ID=1001) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (diesel)	CEIDARS PM profile 114 for speciated metals (CARB, 2007)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule as natural gas)
	Boiler (biogas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (biogas)	
	Internal combustion engine (biogas)	Site specific emission estimates
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (diesel)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Boiler (LPG)	
	Boiler (biogas)	
	Flares (biogas)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Internal combustion engine (biogas)	
	Wastewater treatment	
Sulfuric or hydrochloric acid	Boiler (diesel)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
PAH	Boiler (diesel)	
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (biogas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Flares (biogas)	
	Internal combustion engine (biogas)	AP42 Chapter 3.2 Natural Gas-fired Reciprocating Engines (USEPA, 2000)
PCDD/PCDF	Boiler (diesel)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
	Boiler (LPG)	
	Boiler (biogas)	
	Flares (biogas)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (diesel)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (LPG)	
	Boiler (biogas)	
	Flares (biogas)	
	Internal combustion engine (biogas)	

3.63.4 Emission Estimates

Total estimated annual emissions (for selected substances) from sewage treatment – small plants for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-364. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-364: Total estimated annual emissions from sewage treatment – small plants

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	3.9	0	0	6.18	10.1
CARBON MONOXIDE	688	0	0	1,190	1,880
FORMALDEHYDE	79.5	0.25	0	716	796
ISOMERS OF XYLENE	415	1.47	0	4,150	4,560
LEAD AND COMPOUNDS	7.18	1.87	0	1.08	10.1
OXIDES OF NITROGEN	694	0	0	1,290	1,980
PARTICULATE MATTER ≤ 10 µm	15,800	3,370	0	2,000	21,200
PARTICULATE MATTER ≤ 2.5 µm	1,740	588	0	655	2,990
POLYCYCLIC AROMATIC HYDROCARBONS	0.01	0	0	0.01	0.02
SULFUR DIOXIDE	4.3	0	0	8.3	12.6
TETRACHLOROETHYLENE	482	1.72	0	4,840	5,320
TOLUENE	282	0.98	0	2,770	3,050

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
TOTAL SUSPENDED PARTICULATE	55,400	14,800	0	8,820	79,000
TOTAL VOLATILE ORGANIC COMPOUNDS	3,270	10.6	0	29,800	33,100
TRICHLOROETHYLENE	68.9	0.25	0	691	760

3.63.5 Emission Projection Methodology

Projection factors for sewage treatment – small plants have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.64 Shipping in Bulk 72

3.64.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-365.

Table 3-365: Shipping in bulk facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
NO 6 JETTY	702	CHRISTY DRIVE	PORT KEMBLA	2505
NEWCASTLE GRAIN TERMINAL	1296	DENISON STREET	CARRINGTON	2294
SAWMILLERS EXPORTS PTY LTD	1419	LOT 3 - 16 HERON ROAD	KOORAGANG	2304
THE CARRINGTON SHIPLOADER	1431	NO 2 DYKE BERTH	CARRINGTON	2294
P & O; NO 2 BERTH-KOORAGANG ISLAND	1967	HERON ROAD	KOORAGANG	2304
KOORAGANG BULK FACILITIES PTY LTD	2367	48 HERON ROAD - KOORAGANG ISLAND	KOORAGANG	2304
PORT KEMBLA GATEWAY PTY LTD STORAGE SHEDS	3114	CHRISTY DRIVE	PORT KEMBLA	2505
GRAIN BERTH	3577	TOM THUMB ROAD INNER HARBOUR	PORT KEMBLA	2505
AAT FACILITY	3578	FARRER ROAD INNER HARBOUR	PORT KEMBLA	2505
PORT KEMBLA GRAIN TERMINAL	3693	TOM THUMB ROAD	WOLLONGONG	2500
NO 3 BERTH KOORAGANG ISLAND	4687	HERON ROAD	KOORAGANG	2304
CARRINGTON BASIN BULK BERTHS: NO'S 3 & 4 WESTERN BASIN BERTHS & NO'S 1 & 2 EASTERN BASIN BERTH	4688	COWPER STREET EXTENDED	CARRINGTON	2294
WHARF 7 GLEBE ISLAND	7093	SOMMERVILLE ROAD	GLEBE	2037

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
GYPSUM RESOURCES AUSTRALIA PTY. LIMITED	11906	SOMMERVILLE ROAD	ROZELLE	2039
BERTH 4 WHITE BAY	12095	ROBERT STREET	BALMAIN	2041
JUICE TERMINALS PTY LTD	12147	1/20 NEWCASTLE HARBOUR	NEWCASTLE	2300
PORT KEMBLA GATEWAY PTY LTD	12380	CHRISTY DRIVE	PORT KEMBLA	2505
MOUNTAIN INDUSTRIES PTY LTD	12521	CNR TEAL STREET AND CORMORANT ROAD	KOORAGANG	2304
GLEBE ISLAND BERTH 1	13008	SOMMERVILLE ROAD	ROZELLE	2039

The emission sources and associated releases to air from shipping in bulk are presented in Table 3-366.

Table 3-366: Shipping in bulk - emission sources

Source	Emissions to Air
Concrete batching (cement unloading)	PM
Direct entry - ammonia and organics	Ammonia, VOC
Direct entry - dust and fluoride	PM, fluoride
Food manufacturing (grain receiving)	PM
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Internal combustion engine (diesel, P<450kW)	Combustion products
Material transfer	PM
Surface coating (paint - solvent based)	VOC
Trucks (dumping coal)	PM
Trucks (dumping overburden)	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (coal)	PM

3.64.2 Activity Data

Summary activity data collected from the industrial questionnaires for shipping in bulk is presented in Table 3-367.

Table 3-367: Summary activity data for shipping in bulk

Parameter	Value	Unit
Amount of alumina and aluminium fluoride handled	2,970,000	tonne/year
Amount of coke handled	396,625	tonne/year
Amount of copper and zinc concentrate handled	830,000	tonne/year
Amount of fertiliser handled	287,360	tonne/year
Amount of grain handled	4,100,000	tonne/year
Amount of woodchip handled	300,000	tonne/year
Amount of diesel combusted	0.9	kL/year
Amount of electricity consumed	30,097	MWh/year

3.64.3 Emission and Speciation Factors

The emission and speciation factors for all substances from shipping in bulk sources are detailed in Table 3-368.

Table 3-368: Emission and speciation factors for all substances from shipping in bulk

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Direct entry - ammonia and organics	Site specific emission estimates
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Surface coating (paint - solvent based)	Table 26, VOCs from Surface Coatings Final Report (ENVIRON, 2009)
PM _{2.5} , PM ₁₀ & TSP	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Direct entry - dust and fluoride	Site specific emission estimates
	Grain receiving	AP42 Chapter 9.9.1 Grain Receiving and Processing (USEPA, 2003)
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Material transfer	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Trucks (dumping coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping overburden)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (coal)	NPI EET Manual for Mining v2.3 (EA, 2003b)
Speciated organics (including methane)	Direct entry - ammonia and organics	Site specific emission estimates
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Internal combustion engine (diesel, P<450kW)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Surface coating (paint - solvent based)	SPECIATEv4.2 (Profile ID=1003) (USEPA, 2008e)
Speciated particulate matter	Cement unloading	AP42 Chapter 11.12 Concrete Batching (USEPA, 2006b)
	Direct entry - dust and fluoride	Site specific emission estimates
	Internal combustion engine (diesel, P<450kW)	CEIDARS PM profile 114 for speciated metals (CARB, 2007)
	Material transfer	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping coal)	
	Trucks (dumping overburden)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (coal)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	Direct entry - ammonia and organics	Site specific emission estimates
	Internal combustion engine (diesel, P<450kW)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	Internal combustion engine (diesel, P<450kW)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.64.4 Emission Estimates

Total estimated annual emissions (for selected substances) from shipping in bulk for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-369. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-369: Total estimated annual emissions from shipping in bulk

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0.38	0	0	0	0.38
ACETALDEHYDE	0	0	0	0	0
BENZENE	0.43	0	2.67	0	3.1
CARBON MONOXIDE	14	0	0	0	14
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	0.01	0.11	51.5	0	51.6
LEAD AND COMPOUNDS	0.01	0.33	2.71	0	3.05
OXIDES OF NITROGEN	65.3	0	0	0	65.3
PARTICULATE MATTER ≤ 10 µm	2,430	32,700	9,840	0	44,900
PARTICULATE MATTER ≤ 2.5 µm	246	12,700	1,950	0	14,900
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0.08	0	0	0	0.08
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	0.03	235	0	236
TOTAL SUSPENDED PARTICULATE	5,170	58,100	33,200	0	96,500
TOTAL VOLATILE ORGANIC COMPOUNDS	4.88	1.17	22,500	0	22,500
TRICHLOROETHYLENE	0	0	0	0	0

3.64.5 Emission Projection Methodology

Projection factors for shipping in bulk have been derived based on primary energy consumption projections for international water transport in NSW published by ABARE (ABARE, 2006).

3. Data Sources and Results

Derived projection factors are provided in Table 3-370 and illustrated in Figure 3-19.

Table 3-370: Projection factors for international water transport related sources

Year	Projection Factor	Year	Projection Factor
2009	1.0067	2023	1.0594
2010	1.0125	2024	1.0624
2011	1.0174	2025	1.0653
2012	1.0216	2026	1.0680
2013	1.0255	2027	1.0708
2014	1.0293	2028	1.0735
2015	1.0330	2029	1.0763
2016	1.0365	2030	1.0825
2017	1.0399	2031	1.0894
2018	1.0432	2032	1.0932
2019	1.0465	2033	1.0970
2020	1.0498	2034	1.1008
2021	1.0531	2035	1.1046
2022	1.0563	2036	1.1084

Source: ABARE (2006)

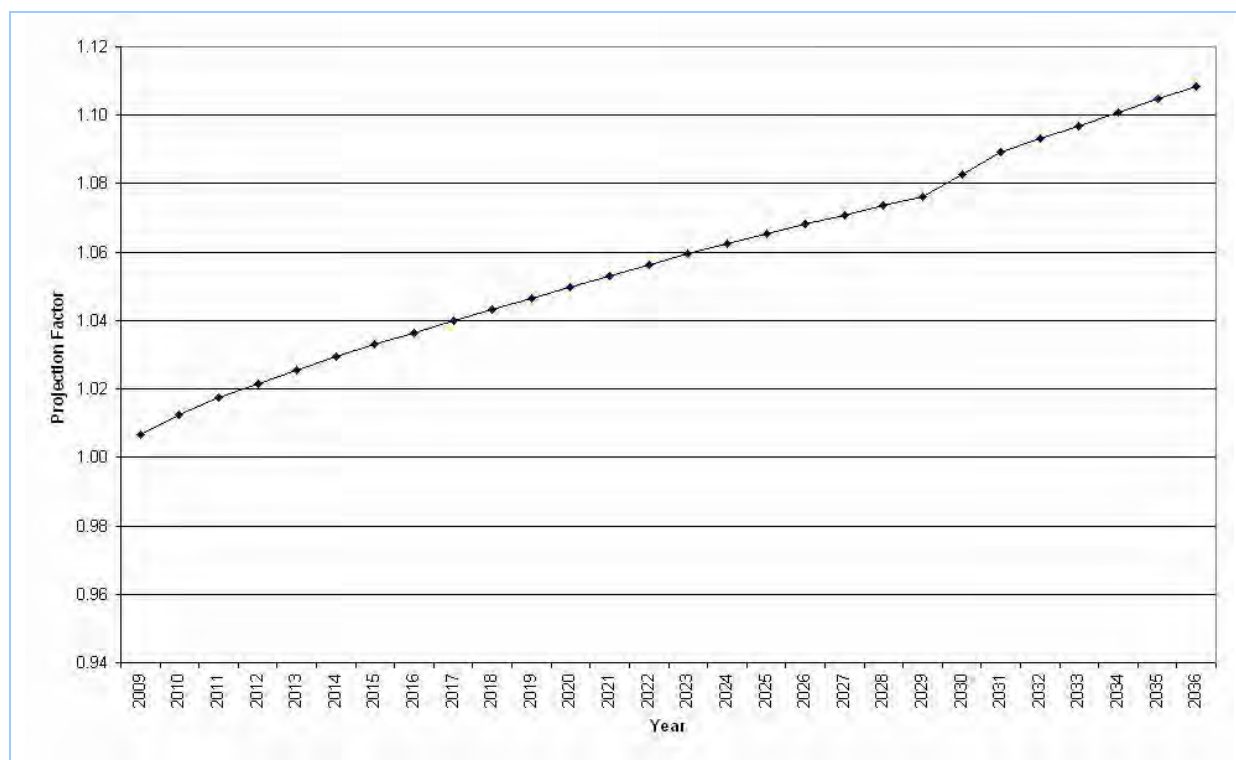


Figure 3-19: Projection factors for international water transport related sources

3.65 Slaughtering or Processing of Animals 45

3.65.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-371.

3. Data Sources and Results

Table 3-371: Slaughtering or animal-processing facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
WOLLONDILLY ABATTOIRS PTY LTD	422	48 KOORANA ROAD	PICTON	2571
HOXTON PARK PROCESSING PLANT	949	KURRAJONG ROAD	HOXTON PARK	2171
BARTTER ENTERPRISES PTY LTD	1329	HAWTHORN STREET	BERESFIELD	2322
TAHMOOR PLANT	1699	ROCKFORD ROAD	TAHMOOR	2573
HAWKESBURY VALLEY MEAT PROCESSORS PTY LTD	2656	52-62 KING ROAD	WILBERFORCE	2756
CORDINA CHICKEN FARMS	2880	55 MANDOON RD	GIRRAWEE	2145
SUMMERTIME CHICKEN PTY LIMITED	3844	26-28 CROSSLANDS ROAD	GALSTON	2159
RED LEA CHICKENS PTY LTD	5069	421-427 FLUSHCOMBE ROAD	BLACKTOWN	2148
HALAL QUALITY CHICKENS PTY LTD	5228	26 BELLFIELD AVENUE	ROSSMORE	2171
J.R. BURNETT PTY LTD	7667	MAIN ROAD	KURRI KURRI	2327
BAIADA POULTRY PTY LIMITED	10869	642 GREAT WESTERN HIGHWAY	PENDLE HILL	2145
INGHAMS ENTERPRISES PTY LTD	11401	42 PENDLEBURY ROAD	CARDIFF	2285
OBERON ABATTOIR	11816	54 HAZELGROVE ROAD	OBERON	2787

The emission sources and associated releases to air from slaughtering or processing of animals are presented in Table 3-372.

Table 3-372: Slaughtering or processing of animals - emission sources

Source	Emissions to Air
Boiler (coal)	Combustion products
Boiler (LPG)	Combustion products
Boiler (natural gas)	Combustion products
Boiler (waste oil)	Combustion products
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Internal combustion engine (diesel, P<450kW)	Combustion products
Poultry raising (broilers)	PM, ammonia
Poultry raising (turkeys for slaughter)	PM, ammonia
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.65.2 Activity Data

Summary activity data collected from the industrial questionnaires for slaughtering or processing of animals is presented in Table 3-373.

Table 3-373: Summary activity data for slaughtering or processing of animals

Parameter	Value	Unit
Amount of natural gas combusted	186,149	GJ/year
Amount of coal combusted	6,475	tonne/year
Amount of diesel combusted	2	kL/year
Amount of LPG combusted	229	m ³ /year
Amount of waste oil combusted	447	kL/year
Amount of electricity consumed	18,644	MWh/year

3.65.3 Emission and Speciation Factors

The emission and speciation factors for all substances from slaughtering or processing of animals sources are detailed in Table 3-374.

Table 3-374: Emission and speciation factors for all substances from slaughtering or processing of animals

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (coal)	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler (waste oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)	
PM _{2.5} , PM ₁₀ & TSP	Boiler (coal)	AP42 Chapter Bituminous And Subbituminous Coal Combustion (USEPA, 1998a) and CEIDARS profile ID131 Coal/Coke combustion (CARB, 2008)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler (waste oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Poultry raising (broilers)	Source testing presented in "Silverweir" Broiler Farm Development Approval Application Air Quality Assessment (Mirrabooka, 2002)
	Poultry raising (turkeys for slaughter)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (coal)	SPECIATEv4.2 (Profile ID=1178) (USEPA, 2008e)
	Boiler (LPG)	AP42 Chapter 1.5 LPG Combustion (USEPA, 2008a)
	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Boiler (waste oil)	SPECIATEv4.2 (Profile ID=0001) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Internal combustion engine (diesel, P<450kW)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Boiler (coal)	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler (waste oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Internal combustion engine (diesel, P<450kW)	CEIDARS PM profile 114 for speciated metals (CARB, 2007)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (coal)	NPI EET Manual for Fossil Fuel Electric Power Generation v2.4 (DEH, 2005)
	Boiler (LPG)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (assuming the same emissions per joule as natural gas) (Pechan, 2004)
	Boiler (natural gas)	
	Boiler (waste oil)	
	Internal combustion engine (diesel, P<450kW)	
	Poultry raising (broilers)	NPI EET Manual for Intensive Livestock - Poultry Raising v1.0 (EA, 2002a)
	Poultry raising (turkeys for slaughter)	
Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)	
Sulfuric or hydrochloric acid	Boiler (coal)	NPI EET Manual for Fossil Fuel Electric Power Generation v2.4 (DEH, 2005)
	Boiler (waste oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
PAH	Boiler (coal)	AP42 Chapter 1.1 Bituminous and Subbituminous Coal Combustion (USEPA, 1998a)
	Boiler (LPG)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b) (assuming the same emissions per joule combusted as natural gas)
	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Boiler (waste oil)	AP42 Chapter 1.3 Fuel Oil Combustion (USEPA, 1999)
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	Boiler (coal)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden, K et al, 2004)
	Boiler (LPG)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Boiler (natural gas)	
	Boiler (waste oil)	
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (coal)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Boiler (LPG)	
	Boiler (natural gas)	
	Boiler (waste oil)	
	Internal combustion engine (diesel, P<450kW)	

3.65.4 Emission Estimates

Total estimated annual emissions (for selected substances) from slaughtering or processing of animals for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-375. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-375: Total estimated annual emissions from slaughtering or processing of animals

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0.84	0	0	0	0.84
ACETALDEHYDE	0	0	0	0	0
BENZENE	34.1	10.1	0	0	44.2
CARBON MONOXIDE	4,960	3,590	0	0	8,550
FORMALDEHYDE	179	74.1	0	0.09	254
ISOMERS OF XYLENE	689	264	0	0.55	954
LEAD AND COMPOUNDS	12	2,950	0	0.04	2,970
OXIDES OF NITROGEN	6,300	41,900	0	0	48,200
PARTICULATE MATTER ≤ 10 µm	19,500	48,600	0	85	68,200
PARTICULATE MATTER ≤ 2.5 µm	4,780	12,400	0	8.5	17,100
POLYCYCLIC AROMATIC HYDROCARBONS	0.05	0.1	0	0	0.15
SULFUR DIOXIDE	31.1	65,500	0	0	65,500
TETRACHLOROETHYLENE	803	199	0	0.64	1,000
TOLUENE	477	130	0	0.37	608
TOTAL SUSPENDED PARTICULATE	96,100	110,000	0	298	206,000
TOTAL VOLATILE ORGANIC COMPOUNDS	5,380	1,590	0	3.94	6,980
TRICHLOROETHYLENE	115	28.5	0	0.09	143

3.65.5 Emission Projection Methodology

Projection factors for slaughtering or processing of animals have been derived based on final energy consumption projections for agriculture in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-6 and illustrated in Figure 3-1.

3.66 Soap and Detergent Production 23

3.66.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-376.

Table 3-376: Soap or detergent production facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ALBRIGHT & WILSON (AUSTRALIA) LIMITED	1974	22 DAVIS ROAD	WETHERILL PARK	2164
COLGATE-PALMOLIVE PTY LTD	2096	50 MARPLE AVE	VILLAWOOD	2163
HUNTSMAN SURFACTANTS PLANT	7494	16-20 BEAUCHAMP RD	MATRAVILLE	2036

The emission sources and associated releases to air from soap and detergent production are presented in Table 3-377.

Table 3-377: Soap and detergent production - emission sources

Source	Emissions to Air
Acid storage (sulfuric)	Sulfuric acid
Boiler (natural gas)	Combustion products
Direct entry - SO _x	SO ₂ , SO ₃
Fuel storage (diesel)	VOC
Fugitive emissions - ammonia	Ammonia
Fugitive emissions - VOC	VOC, ammonia
Internal combustion engine (diesel, P<450kW)	Combustion products
Organic liquid storage (ethanol)	VOC
Organic liquid storage (glycol ethers)	VOC
Organic liquid storage (methanol)	VOC
Organic liquid storage (propylene oxide)	VOC
VOC - direct entry	VOC
Wastewater treatment	VOC, ammonia
Wheel generated dust (paved roads)	PM

3.66.2 Activity Data

Summary activity data collected from the industrial questionnaires for soap and detergent production is presented in Table 3-378.

Table 3-378: Summary activity data for soap and detergent production

Parameter	Value	Unit
Amount of natural gas combusted	127,830	GJ/year
Amount of diesel combusted	0.5	kL/year
Amount of electricity consumed	43,168	MWh/year

3. Data Sources and Results

3.66.3 Emission and Speciation Factors

The emission and speciation factors for all substances from soap and detergent production sources are detailed in Table 3-379.

Table 3-379: Emission and speciation factors for all substances from soap and detergent production

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Direct entry - SO _x	Site specific emission estimates
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fugitive emissions - VOC	Site specific emission estimates
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Organic liquid storage (ethanol)	TANKS 4.09D software (USEPA, 2006e)
	Organic liquid storage (glycol ethers)	
	Organic liquid storage (methanol)	
	Organic liquid storage (propylene oxide)	
	VOC - direct entry	Site specific emission estimates
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fugitive emissions - VOC	ARB Organic Gas Speciation Profiles 19/03/2003 (ID = 1404) (Profile ID=9004) (CARB, 2005)
	Internal combustion engine (diesel, P<450kW)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Organic liquid storage (ethanol)	Mass balance (100% ethanol)
	Organic liquid storage (glycol ethers)	Mass balance (100% glycol ether)
	Organic liquid storage (methanol)	Mass balance (100% methanol)
	Organic liquid storage (propylene oxide)	Mass balance (100% propylene oxide)
	VOC - direct entry	CEIDARS Organic Gas Speciation Profiles 19/03/2003 (ID = 1404) (Profile ID=9004) (CARB, 2005)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel, P<450kW)	CEIDARS PM profile 114 for speciated metals (CARB, 2007)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Fugitive emissions - ammonia	Site specific emission estimates
	Internal combustion engine (diesel, P<450kW)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Wastewater treatment	
Sulfuric or hydrochloric acid	Acid storage (sulfuric)	Raoult's law (Raoult, M, 1882a; 1882b, 1887a; 1887b), using chemical properties from Perry and Green (1997)
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fugitive emissions - VOC	Site specific emission estimates
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Internal combustion engine (diesel, P<450kW)	

3.66.4 Emission Estimates

Total estimated annual emissions (for selected substances) from soap and detergent production for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-380. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-380: Total estimated annual emissions from soap and detergent production

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0.21	0	0	0	0.21
ACETALDEHYDE	1240	0	0	0	1,240
BENZENE	5700	0	0	0	5,700
CARBON MONOXIDE	4490	0	0	0	4,490
FORMALDEHYDE	73.8	0	0	0	73.8
ISOMERS OF XYLENE	321	0	0	0	321
LEAD AND COMPOUNDS	0.08	0	0	0	0.08
OXIDES OF NITROGEN	4,340	0	0	0	4,340
PARTICULATE MATTER ≤ 10 µm	480	0	0	0	480
PARTICULATE MATTER ≤ 2.5 µm	426	0	0	0	426
POLYCYCLIC AROMATIC HYDROCARBONS	0.04	0	0	0	0.04
SULFUR DIOXIDE	791	0	0	0	791
TETRACHLOROETHYLENE	2.47	0	0	0	2.47
TOLUENE	1,240	0	0	0	1,240
TOTAL SUSPENDED PARTICULATE	781	0	0	0	781
TOTAL VOLATILE ORGANIC COMPOUNDS	69,200	0	0	0	69,200
TRICHLOROETHYLENE	0.35	0	0	0	0.35

3.66.5 Emission Projection Methodology

Projection factors for soap and detergent production have been derived based on final energy consumption projections for other industry in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-12 and illustrated in Figure 3-2.

3.67 Solid Waste Landfilling 79

3.67.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-381.

Table 3-381: Solid waste landfilling facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
CASTLEREAGH WASTE MANAGEMENT CENTRE	4601	THE NORTHERN ROAD	BERKSHIRE PARK	2765
DUNMORE RECYCLING AND WASTE FACILITY	5984	DUNMORE WASTE DEPOT - BUCKLEYS ROAD	BLACKBUTT	2529
MOUNT VINCENT ROAD WASTE LANDFILL FACILITY	6116	109 & 110 MOUNT VINCENT ROAD	EAST MAITLAND	2323

The emission sources and associated releases to air from solid waste landfilling are presented in Table 3-382.

Table 3-382: Solid waste landfilling – emission sources

Source	Emissions to Air
Bulldozers (overburden)	PM
Composting (100% green wastes)	VOC, ammonia
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Landfill (digestion)	Ammonia, CO ₂ , CO, H ₂ S, mercury, VOC
Material transfer	PM
Wheel generated dust (unpaved roads)	PM

3.67.2 Activity Data

Summary activity data collected from the industrial questionnaires for solid waste landfilling is presented in Table 3-383.

Table 3-383: Summary activity data for solid waste landfilling

Parameter	Value	Unit
Amount of waste accepted	102,145	tonne/year
Amount of electricity consumed	123	MWh/year

3.67.3 Emission and Speciation Factors

The emission and speciation factors for all substances from solid waste landfilling sources are detailed in Table 3-384.

Table 3-384: Emission and speciation factors for all substances from solid waste landfilling

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Composting (100% green wastes)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (DEWHA, 2010).
PM _{2.5} , PM ₁₀ & TSP	Bulldozers (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	
	Material transfer	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Composting (100% green wastes)	Site specific emission test reports
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (DEWHA, 2010).
Speciated particulate matter	Bulldozers (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Composting (100% green wastes)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (DEWHA, 2010).
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (DEWHA, 2010).

3.67.4 Emission Estimates

Total estimated annual emissions (for selected substances) from solid waste landfilling for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-385. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-385: Total estimated annual emissions from solid waste landfilling

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	1,170	0	0	344	1,510
CARBON MONOXIDE	6,470	0	0	1,910	8,380
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	1,750	0	0	515	2,260
LEAD AND COMPOUNDS	1.6	0	0	4.78	6.38
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	18,400	0	0	42,100	60,400
PARTICULATE MATTER ≤ 2.5 µm	3,590	0	0	8,050	11,600
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	583	0	0	172	755
TOLUENE	20,400	0	0	6,010	26,400
TOTAL SUSPENDED PARTICULATE	38,100	0	0	100,000	138,000
TOTAL VOLATILE ORGANIC COMPOUNDS	73,400	0	0	44,800	118,000
TRICHLOROETHYLENE	0	0	0	0	0

3.67.5 Emission Projection Methodology

Projection factors for solid waste landfilling have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.68 Sterilisation Activities 74

3.68.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-386.

Table 3-386: Sterilisation facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
STERITECH PTY LTD	12902	5 WIDEMERE ROAD	WETHERILL PARK	2164
UNOMEDICAL FACTORY	12916	11-17 WILMETTE PLACE	MONA VALE	2103

The emission sources and associated releases to air from sterilisation activities are presented in Table 3-387.

Table 3-387: Sterilisation activities – emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Wheel generated dust (paved roads)	PM

3.68.2 Activity Data

Summary activity data collected from the industrial questionnaires for sterilisation activities is presented in Table 3-388.

Table 3-388: Summary activity data for sterilisation activities

Parameter	Value	Unit
Amount of natural gas combusted	30,127	GJ/year
Amount of electricity consumed	3,775	MWh/year

3.68.3 Emission and Speciation Factors

The emission and speciation factors for all substances from sterilisation activities sources are detailed in Table 3-389.

3. Data Sources and Results

Table 3-389: Emission and speciation factors for all substances from sterilisation activities

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Wheel generated dust - paved roads	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (natural gas)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.68.4 Emission Estimates

Total estimated annual emissions (for selected substances) from sterilisation activities for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-390. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-390: Total estimated annual emissions from sterilisation activities

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	6.29	0	0	0	6.29
CARBON MONOXIDE	1,050	0	0	0	1,050
FORMALDEHYDE	12.6	0	0	0	12.6
ISOMERS OF XYLENE	0	0	0	0	0
LEAD AND COMPOUNDS	0.01	0	0	0	0.01
OXIDES OF NITROGEN	1,230	0	0	0	1,230
PARTICULATE MATTER ≤ 10 µm	96.2	0	0	0	96.2
PARTICULATE MATTER ≤ 2.5 µm	95.8	0	0	0	95.8
POLYCYCLIC AROMATIC HYDROCARBONS	0.01	0	0	0	0.01

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
SULFUR DIOXIDE	6.58	0	0	0	6.58
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	3.15	0	0	0	3.15
TOTAL SUSPENDED PARTICULATE	98.3	0	0	0	98.3
TOTAL VOLATILE ORGANIC COMPOUNDS	69.2	0	0	0	69.2
TRICHLOROETHYLENE	0	0	0	0	0

3.68.5 Emission Projection Methodology

Projection factors for sterilisation activities have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.69 Waste Disposal (Application to Land) 7

3.69.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-391.

Table 3-391: Waste disposal (application to land) facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
PENRITH WASTE SERVICES PTY LTD	3438	842 MULGOA ROAD	MULGOA	2745
ELIZABETH DRIVE LANDFILL FACILITY	4068	1725 ELIZABETH DRIVE	KEMPS CREEK	2178
BLAXLAND WASTE MANAGEMENT FACILITY	4525	28-30 ATTUNGA ROAD	BLAXLAND	2774
HYLAND ROAD DEPOT	4537	HYLAND ROAD	GREYSTANES	2145
KIMBRIKI RECYCLING & WASTE DISPOSAL CENTRE	4600	KIMBRIKI ROAD	TERREY HILLS	2084
KELSO TIP	4606	BRANGROVE ROAD	MILPERRA	2214
KURNELL LAND FILL COMPANY	4608	CAPTAIN COOK DRIVE	KURNELL	2231
GLENFIELD WASTE DISPOSALS	4614	CAMBRIDGE AVE	GLENFIELD	2167
RANGERS ROAD TIPPING FACILITY	4623	CNR RANGERS AND LYNWOOD ROADS	WEDDERBURN	2560
ALEXANDRIA LANDFILL	4627	10 ALBERT STREET	ST PETERS	2044
GREENWOOD LANDFILL	4669	451 MONA VALE ROAD	ST IVES	2075
BELROSE WASTE AND RECYCLING CENTRE	4807	CROZIER ROAD	BELROSE	2085
ERSKINE PARK LANDFILL	4865	QUARRY ROAD OFF MAMRE ROAD	ERSKINE PARK	2759
FINES DISPOSAL FACILITY	5022	CURLEW STREET	KOORAGANG	2304

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
LUCAS HEIGHTS WASTE & RECYCLING CENTRE	5065	NEW ILLAWARRA ROAD	LUCAS HEIGHTS	2234
JACKS GULLY WASTE & RECYCLING CENTRE	5105	275 RICHARDSON ROAD	SPRING FARM	2570
EASTERN CREEK WASTE MANAGEMENT CENTRE	5272	WALLGROVE ROAD	EASTERN CREEK	2766
HAWKESBURY CITY WASTE MANAGEMENT FACILITY	5293	THE DRIFTWAY	SOUTH WINDSOR	2753
KATOOMBA WASTE MANAGEMENT FACILITY	5481	49-89 WOODLANDS ROAD	KATOOMBA	2780
HELENSBURGH WASTE DISPOSAL DEPOT	5861	NIXON PLACE	HELENSBURGH	2508
WHYTE'S GULLY WASTE DISPOSAL FACILITY	5862	REDDALLS ROAD	KEMBLA GRANGE	2526
AWABA WASTE DISPOSAL FACILITY	5873	60 WILTON ROAD	AWABA	2283
DUNOGG SHIRE COUNCIL WASTE FACILITY	5894	SHORT STREET	DUNOGG	2420
SUMMERHILL WASTE MANAGEMENT FACILITY	5897	141 MINMI RD	WALLSEND	2287
SINGLETON WASTE DEPOT	5927	DYRRING ROAD	SINGLETON	2330
PORT KEMBLA BUILDERS LANDFILL & RECYCLING CENTRE	5954	33 FIVE ISLANDS ROAD	PORT KEMBLA	2505
BUTTONDERRY WASTE MANAGEMENT FACILITY	5955	HUE HUE ROAD	WARNERVALE	2259
MUSWELLBROOK WASTE & RECYCLE FACILITY	5980	COAL ROAD	MUSWELLBROOK	2333
SALAMANDER BAY WASTE FACILITY	5982	360 SOLDIERS POINT ROAD	SALAMANDER BAY	2317
LITHGOW SOLID WASTE FACILITY	6004	GEORDIE ST	LITHGOW	2790
WALLAROO WASTE FACILITY	6048	OLD SWAN BAY ROAD	SWAN BAY	2324
KINCUMBER LANDFILL FACILITY	6052	CULLENS RD	KINCUMBER	2251
WOY WOY LANDFILL	6053	NAGARI ROAD	WOY WOY	2256
BARGO WASTE MANAGEMENT CENTRE	6061	ANTHONY ROAD	BARGO	2574
WARRAGAMBA WASTE MANAGEMENT CENTRE	6062	PRODUCTION AVE	WARRAGAMBA	2752
CESSNOCK WASTE AND REUSE CENTRE	6121	OLD MAITLAND ROAD	CESSNOCK	2325
KOORAGANG ISLAND WASTE FACILITY	6437	CORMORANT DRIVE	KOORAGANG	2304
SOUTH WINDSOR RESOURCE RECOVERY CENTRE	6675	723 - 727 GEORGE STREET	SOUTH WINDSOR	2756
C & M EDWARDS- MAIN OAK	7056	ELDERSLIE RD	MITCHELLS FLAT	2330
KATOOMBA WASTE	10034	49-89 + 70-78 WOODLANDS	KATOOMBA	2780

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
MANAGEMENT FACILITY		ROAD		
BLAXLAND WASTE MANAGEMENT FACILITY	10039	28-30 ATTUNGA ROAD	BLAXLAND	2774
SALT PAN CREEK TIP	10636	KENTUCKY ROAD	RIVERWOOD	2210
PORTLAND GARBAGE DEPOT	10936	CULLEN BULLEN RD	PORTLAND	2847
MANGROVE MOUNTAIN MEMORIAL GOLF CLUB	11395	LOT 582 - DP 1123656 - HALLARDS ROAD	CENTRAL MANGROVE	2250
MARSDEN PARK LANDFILL	11497	RICHMOND ROAD	MARSDEN PARK	2765
HORSLEY PARK WASTE MANAGEMENT FACILITY	11584	WALLGROVE ROAD	HORSLEY PARK	2164
KEMPS CREEK LANDFILL	12901	CLIFTON AVENUE	KEMPS CREEK	2171

The emission sources and associated releases to air from waste disposal (application to land) facilities are presented in Table 3-392.

Table 3-392: Waste disposal (application to land) - emission sources

Source	Emissions to Air
Bulldozers (overburden)	PM
Composting (100% green wastes)	Ammonia, VOC
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Fuel storage (fuel oil)	VOC
Graders	PM
Landfill (digestion)	Ammonia, CO ₂ , CO, H ₂ S, mercury, VOC
Loaders (overburden)	PM
Material transfer	PM
Primary crushing (M < 4%)	PM
Scrapers (overburden)	PM
Screening	PM
Secondary crushing (M < 4%)	PM
Surface coating (thinner)	VOC
Tertiary crushing (M < 4%)	PM
Trucks (dumping overburden)	PM
Trucks (dumping sandstone)	PM
Wastewater treatment	Ammonia, VOC
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM
Wind erosion (overburden)	PM
Wind erosion (sandstone)	PM

3.69.2 Activity Data

Summary activity data collected from the industrial questionnaires for waste disposal (application to land) is presented in Table 3-393.

3. Data Sources and Results

Table 3-393: Summary activity data for waste disposal (application to land)

Parameter	Value	Unit
Amount of waste received	5,685,343	tonne/year
Amount of material composted	178,863	tonne/year
Amount of electricity consumed	3,775	MWh/year

3.69.3 Emission and Speciation Factors

The emission and speciation factors for all substances from waste disposal (application to land) sources are detailed in Table 3-394.

Table 3-394: Emission and speciation factors for all substances from waste disposal (application to land)

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Composting (100% green wastes)	Emission Inventory Improvement Program, 2004, Estimating Ammonia Emissions from Non-Agricultural Sources – Draft Final Report (Pechan, 2004)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (fuel oil)	
	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (DEWHA, 2010).
	Surface coating (thinner)	Table 26, VOCs from Surface Coatings Final Report (ENVIRON, 2009)
	Wastewater treatment	NGGIC Workbook for Waste (NGGIC, 1996)
PM _{2.5} , PM ₁₀ & TSP	Bulldozers (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	
	Graders	
	Loaders (overburden)	
	Material transfer	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Primary crushing (M < 4%)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Scrapers (overburden)	
	Screening	
	Secondary crushing (M < 4%)	
	Tertiary crushing (M < 4%)	
	Trucks (dumping overburden)	
	Trucks (dumping sandstone)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
Wind erosion (sandstone)		
Speciated organics (including methane)	Composting (100% green wastes)	Site specific emission test reports
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (fuel oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)
	Landfill (digestion)	Calculated using the first order decay model, NPI EET

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
		Manual for Municipal Solid Waste Landfills (DEWHA, 2010).
	Surface coating (thinner)	SPECIATEv4.2 (Profile ID=1016) (USEPA, 2008e)
	Wastewater treatment	CEIDARS Organic Gas Speciation Profiles (Profile ID=1402) (assuming that unidentified portion is methane) (CARB, 2005)
Speciated particulate matter	Bulldozers (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Exposed area (wind erosion)	
	Graders	
	Loaders (overburden)	
	Primary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Scrapers (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Screening	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock screening (CARB, 2007)
	Secondary crushing (M < 4%)	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock crushing (CARB, 2007)
	Tertiary crushing (M < 4%)	
	Trucks (dumping overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping sandstone)	
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Wind erosion (sandstone)		
Ammonia	Composting (100% green wastes)	Estimating Ammonia Emissions from Anthropogenic Non-agricultural Sources - Draft Final Report (Pechan, 2004)
	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (EA, 2010).
	Wastewater treatment	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	Landfill (digestion)	Calculated using the first order decay model, NPI EET Manual for Municipal Solid Waste Landfills (DEWHA, 2010).

3.69.4 Emission Estimates

Total estimated annual emissions (for selected substances) from waste disposal (application to land) for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-395. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-395: Total estimated annual emissions from waste disposal (application to land)

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	5,290	838	415	1,310	7,850
CARBON MONOXIDE	29,100	4,590	2,300	7,190	43,200
FORMALDEHYDE	0.02	0	9.32	0	9.34
ISOMERS OF XYLENE	7,950	1,260	678	1,960	11,800
LEAD AND COMPOUNDS	184	24	6.56	16.5	231
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	1,220,000	158,000	32,300	177,000	1,590,000
PARTICULATE MATTER ≤ 2.5 µm	226,000	29,400	5,950	35,500	297,000
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	2,650	419	273	653	3,990
TOLUENE	92,700	14,700	7,290	22,800	137,000
TOTAL SUSPENDED PARTICULATE	3,610,000	433,000	123,000	446,000	4,610,000
TOTAL VOLATILE ORGANIC COMPOUNDS	578,000	52,800	80,100	120,000	831,000
TRICHLOROETHYLENE	0.02	0	9.32	0	9.34

3.69.5 Emission Projection Methodology

Projection factors for waste disposal (application to land) have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.70 Waste Storage 84

3.70.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-396.

Table 3-396: Waste storage facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
DIONYS, CON	4868	1 BRADFORD STREET	BEACONSFIELD	2015
TRANSPACIFIC INDUSTRIES PTY. LTD.	6091	6-8 RAYBEN STREET	GLENDEENING	2761
VEOLIA ENVIRONMENTAL SERVICES (AUSTRALIA) PTY LTD	6179	LOT 21 MILITARY ROAD	MATRAVILLE	2036
TRANSGRID	7119	200 OLD WALLGROVE ROAD	EASTERN CREEK	2766
BALLAST RECYCLING DEPOT	7515	WORTH STREET GATE1	CHULLORA	2190
BULBECK	10037	UNIT 6/38 WYONG ROAD	LAMBTON	2299

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ENVIROSOLUTIONS PTY LTD				
TULLOCH AUSTRALIA PTY LIMITED	11304	61 TURRELLA STREET	TURRELLA	2205
TRANSPACIFIC INDUSTRIES PTY. LTD.	11383	99 KYLE STREET	RUTHERFORD	2320
HOMEBUSH DEPOT	11426	25-27 POMEROY STREET	HOMEBUSH	2140
CLYDE TRANSFER TERMINAL	11763	PARRAMATTA ROAD	CLYDE	2142
AUSTRALIAN PHARMACEUTICALS INDUSTRIES LIMITED	11849	11 GRAND AVENUE	CAMELLIA	2142
ENERGY AUSTRALIA WEST GOSFORD DEPOT	11982	CNR FAUNCE STREET & RACECOURSE ROAD	GOSFORD WEST	2250
ENERGY AUSTRALIA WALLSEND DEPOT	11984	80 ABBOTT ST	WALLSEND	2287
ENERGY AUSTRALIA MAITLAND DEPOT	12092	35 GREEN STREET	RUTHERFORD	2320
CLEANAWAY	12367	19 EGRET STREET	KOORAGANG	2304
LEX ENVIRO SERVICES	12674	6 SUNBLEST CRESCENT	MOUNT DRUITT	2770
KLF HOLDINGS PTY LTD	12700	16 GRAND AVENUE	CAMELLIA	2142
TAK SON RECYCLING PTY LTD	12714	UNIT 8/9 WORDIE PLACE	PADSTOW	2211
SIEL RECYCLING	12727	9/1-3 DURSLEY ROAD	YENNORA	2161
LOD CO-OPERATIVE HAULAGE & TRANSPORT LIMITED	12818	190 SHELLHARBOUR ROAD	KEMBLAWARRA	2505
ROCHE PRODUCTS PTY LIMITED	12988	4-10 INMAN ROAD	DEE WHY	2099
NARELLAN FIELD SUPPORT CENTRE	13025	17 & 19A MCPHERSON ROAD	SMEATON GRANGE	2567

The emission sources and associated releases to air from waste storage facilities are presented in Table 3-397.

Table 3-397: Waste storage - emission sources

Source	Emissions to Air
Boiler (natural gas)	Combustion products
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Fuel storage (fuel oil)	VOC
Fuel storage (petrol)	VOC
Internal combustion engine (diesel, P<450kW)	Combustion products
Loaders (overburden)	PM
Material transfer	PM
Organic liquid storage (tetrachloroethylene)	VOC
Screening	PM
Trucks (dumping overburden)	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3. Data Sources and Results

Source	Emissions to Air
Wind erosion (overburden)	PM

3.70.2 Activity Data

Summary activity data collected from the industrial questionnaires for waste storage is presented in Table 3-398.

Table 3-398: Summary activity data for waste storage

Parameter	Value	Unit
Amount of natural gas combusted	4,136	GJ/year
Amount of electricity consumed	9,501	MWh/year

3.70.3 Emission and Speciation Factors

The emission and speciation factors for all substances from waste storage sources are detailed in Table 3-399.

Table 3-399: Emission and speciation factors for all substances from waste storage

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (fuel oil)	
	Fuel storage (petrol)	
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
	Organic liquid storage (tetrachloroethylene)	TANKS 4.09D software (USEPA, 2006e)
PM _{2.5} , PM ₁₀ & TSP	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a) and CEIDARS PM size profile 114 for Stat I.C. Engine - Distillate (CARB, 2008)
	Loaders (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Screening	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Trucks (dumping overburden)	
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (overburden)	NPI EET Manual for Mining v2.3 (EA, 2003b)
Speciated organics (including methane)	Boiler (natural gas)	SPECIATEv4.2 (Profile ID=0003) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
	Fuel storage (fuel oil)	SPECIATEv4.2 (Profile ID=0297) (USEPA, 2008e)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Internal combustion engine (diesel, P<450kW)	SPECIATEv4.2 (Profile ID=0008) (USEPA, 2008e)
	Organic liquid storage (tetrachloroethylene)	Mass balance (100% tetrachloroethylene)
Speciated particulate matter	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Exposed area (wind erosion)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Internal combustion engine (diesel, P<450kW)	CEIDARS PM profile 114 for speciated metals (CARB, 2007)
	Loaders (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Screening	CEIDARS Particulate Matter (PM) Speciation Profiles - Rock screening (CARB, 2007)
	Trucks (dumping overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (overburden)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	NA	NA
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (natural gas)	AP42 Chapter 1.4 Natural Gas Combustion (USEPA, 1998b)
	Internal combustion engine (diesel, P<450kW)	AP42 Chapter 3.3 Gasoline and Diesel Industrial Engines (USEPA, 1996a)
PCDD/PCDF	Boiler (natural gas)	Technical Report Number 3, Inventory of Dioxin Emissions in Australia, 2004 (Bawden et al, 2004)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (natural gas)	National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)
	Internal combustion engine (diesel, P<450kW)	

3.70.4 Emission Estimates

Total estimated annual emissions (for selected substances) from waste storage for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-400. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-400: Total estimated annual emissions from waste storage

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0.42	0	0	0	0.42
ACETALDEHYDE	0	0	0	0	0
BENZENE	8.17	0	0	0	8.17
CARBON MONOXIDE	161	0	0	0	161
FORMALDEHYDE	1.73	0	0	0	1.73
ISOMERS OF XYLENE	4.38	0.14	0	0.08	4.61

3. Data Sources and Results

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
LEAD AND COMPOUNDS	4.59	0.04	1.55	0	6.18
OXIDES OF NITROGEN	245	0	0	0	245
PARTICULATE MATTER ≤ 10 µm	16,100	65.7	3,390	0	19,600
PARTICULATE MATTER ≤ 2.5 µm	3,250	15.9	339	0	3,600
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0.99	0	0	0	0.99
TETRACHLOROETHYLENE	23.9	0	0	0	23.9
TOLUENE	14.9	0.04	0	0.03	15
TOTAL SUSPENDED PARTICULATE	51,500	342	11,900	0	63,700
TOTAL VOLATILE ORGANIC COMPOUNDS	784	1.57	0	0.93	787
TRICHLOROETHYLENE	0	0	0	0	0

3.70.5 Emission Projection Methodology

Projection factors for waste storage have been derived based on final energy consumption projections for commercial and services in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-90 and illustrated in Figure 3-6.

3.71 Water-based Extractive Activity 35

3.71.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-401.

Table 3-401: Water-based extractive activity facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
ROCLA PTY LIMITED	414	WILBERFORCE ROAD	WINDSOR	2756
WYONG SHIRE COUNCIL	3200	TUGGERAH LAKES - WYONG SHIRE	WYONG	2259
HAWKESBURY RIVER MARINA PTY LTD	3340	9 DANGAR ROAD	BROOKLYN	2083
MAINTENANCE DREDGING PORT OF NEWCASTLE	3373	PORT OF NEWCASTLE	NEWCASTLE	2300
DUNMORE LAKES SAND QUARRY	11147	SWAMP ROAD	DUNMORE	2529
TOLLBULKSANDS	11300	LAVIS LANE	WILLIAMTOWN	2318
TINDA PARK	12007	6102 SINGLETON ROAD	COLO HEIGHTS	2756
EASTERN BASIN BERTH NO 103 - PORT KEMBLA	12720	TOM THUMB ROAD	PORT KEMBLA	2505
NEWCASTLE COAL INFRASTRUCTURE GROUP PTY LTD	12740	CORMORANT ROAD	KOORAGANG	2304
DESALINATED WATER PUMPING STATION AT	12858	VARIOUS STREETS FROM KURNELL TO	KURNELL	2231

3. Data Sources and Results

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
KURNELL - AND DESALINATED WATER PIPELINE		ERSKINEVILLE		
PORT BOTANY EXPANSION PROJECT	12923	PENRHYN ROAD	BOTANY	2019

The emission sources and associated releases to air from water-based extractive activity facilities are presented in Table 3-402.

Table 3-402: Water-based extractive activity – emission sources

Source	Emissions to Air
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Fuel storage (petrol)	VOC
Material transfer (sandstone)	PM
Surface coating (degreaser)	VOC
Wheel generated dust (unpaved roads)	PM
Wind erosion (sandstone)	PM

3.71.2 Activity Data

Summary activity data collected from the industrial questionnaires for water-based extractive activity is presented in Table 3-403.

Table 3-403: Summary activity data for water-based extractive activity

Parameter	Value	Unit
Amount of electricity consumed	1,332	MWh/year

3.71.3 Emission and Speciation Factors

The emission and speciation factors for all substances from water-based extractive activity sources are detailed in Table 3-404.

Table 3-404: Emission and speciation factors for all substances from water-based extractive activity

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
	Fuel storage (petrol)	
	Surface coating (degreaser)	Mass balance
PM _{2.5} , PM ₁₀ & TSP	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (sandstone)	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
	Wind erosion (sandstone)	NPI EET Manual for Mining v2.3 (EA, 2003b)
Speciated organics	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)

3. Data Sources and Results

Substance	Emission Source	Emission Factor Source
(including methane)	Fuel storage (petrol)	Average petrol vapour concentration from petrol produced at BP refineries around Australia (BP, 2001b)
	Surface coating (degreaser)	SPECIATEv4.2 (Profile ID=1195) (USEPA, 2008e)
Speciated particulate matter	Exposed area (wind erosion)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer (sandstone)	
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
	Wind erosion (sandstone)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
Ammonia	NA	NA
Sulfuric or hydrochloric acid	NA	NA
PAH	NA	NA
PCDD/PCDF	NA	NA
Greenhouse gases (CO ₂ and N ₂ O)	NA	NA

3.71.4 Emission Estimates

Total estimated annual emissions (for selected substances) from water-based extractive activity for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-405. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-405: Total estimated annual emissions from water-based extractive activity

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0	0
BENZENE	2.33	0	0	1.08	3.41
CARBON MONOXIDE	0	0	0	0	0
FORMALDEHYDE	0	0	0	0	0
ISOMERS OF XYLENE	1.65	0.09	0.01	4.2	5.95
LEAD AND COMPOUNDS	0.04	0.06	0	1.16	1.27
OXIDES OF NITROGEN	0	0	0	0	0
PARTICULATE MATTER ≤ 10 µm	91.8	891	0	9,360	10,300
PARTICULATE MATTER ≤ 2.5 µm	9.18	177	0	1,660	1,840
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	0	0
SULFUR DIOXIDE	0	0	0	0	0
TETRACHLOROETHYLENE	0	0	0	7.99	7.99
TOLUENE	5.67	0.03	0	8.98	14.7
TOTAL SUSPENDED PARTICULATE	322	1,780	0	22,100	24,200
TOTAL VOLATILE ORGANIC COMPOUNDS	288	0.96	0.15	109	398
TRICHLOROETHYLENE	0	0	0	22.8	22.8

3.71.5 Emission Projection Methodology

Projection factors for water-based extractive activity have been derived based on final energy consumption projections for mining in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-75 and illustrated in Figure 3-5.

3.72 Wood or Timber Milling or Processing and Wood Preservation 86, 87

3.72.1 Emission Sources and Associated Releases to Air

Industrial facilities within the GMR that are included in the emissions inventory under this category are outlined in Table 3-406.

Table 3-406: Wood or timber milling or processing and wood preservation facilities included in the inventory

Facility	EPL No.	Facility Street	Facility Suburb	Facility Post Code
HIGHLAND PINE SAW MILL	887	LOWES MOUNT ROAD	OBERON	2787
BORAL TIMBER	3877	LOT 1 PINDIMAR ROAD	TEA GARDENS	2324
MAXWELLS CREEK BOARD PLANT	4879	WALLAROBBA ROAD VIA	DUNGOG	2420
KOPPERS WOOD PRODUCTS PTY LTD	11246	53 WEAKLEYS DRIVE	BERESFIELD	2322

The emission sources and associated releases to air from wood or timber milling or processing facilities are presented in Table 3-407.

Table 3-407: Wood or timber milling or processing – emission sources

Source	Emissions to Air
Boiler (wood)	Combustion products
Exposed area (wind erosion)	PM
Fuel storage (diesel)	VOC
Material transfer	PM
Wheel generated dust (paved roads)	PM
Wheel generated dust (unpaved roads)	PM

3.72.2 Activity Data

Summary activity data collected from the industrial questionnaires for wood or timber milling or processing is presented in Table 3-403.

Table 3-408: Summary activity data for wood or timber milling or processing

Parameter	Value	Unit
Amount of wood combusted	1,500	tonne/year
Amount of electricity consumed	2,721	MWh/year

3.72.3 Emission and Speciation Factors

The emission and speciation factors for all substances from wood or timber milling or processing sources are detailed in Table 3-409.

Table 3-409: Emission and speciation factors for all substances from wood or timber milling or processing

Substance	Emission Source	Emission Factor Source
CO, NO _x , SO ₂ & VOC	Boiler (wood)	AP42 Chapter 1.6 Wood Residue Combustion in Boilers (USEPA, 2003a)
	Fuel storage (diesel)	TANKS 4.09D software (USEPA, 2006e)
PM _{2.5} , PM ₁₀ & TSP	Boiler (wood)	AP42 Chapter 1.6 Wood Residue Combustion in Boilers (USEPA, 2003a)
	Exposed area (wind erosion)	NPI EET Manual for Mining v2.3 (EA, 2003b)
	Material transfer	AP42 Chapter 13.2.4 Aggregate Handling and Storage Piles (USEPA, 2006d)
	Wheel generated dust (paved roads)	AP42 Chapter 13.2.1 Paved Roads (USEPA, 2011a)
	Wheel generated dust (unpaved roads)	AP42 Chapter 13.2.2 Unpaved Roads (USEPA, 2006c)
Speciated organics (including methane)	Boiler (wood)	SPECIATEv4.2 (Profile ID=1167) (USEPA, 2008e)
	Fuel storage (diesel)	Average diesel vapour concentration from diesel produced at BP refineries around Australia (BP, 2001a)
Speciated particulate matter	Boiler (wood)	AP42 Chapter 1.6 Wood Residue Combustion in Boilers (USEPA, 2003a)
	Exposed area (wind erosion)	Appendix B, NPI EET Manual for Mining v2.3 (EA, 2003b)
	Wheel generated dust (paved roads)	California Emissions Inventory and Reporting System - Paved Road Dust, 1997 (CARB, 2007)
	Wheel generated dust (unpaved roads)	California Emissions Inventory and Reporting System - Unpaved Road Dust, 1997 (CARB, 2007)
Ammonia	Boiler (wood)	Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources - Draft Final Report (Pechan, 2004)
Sulfuric or hydrochloric acid	NA	NA
PAH	Boiler (wood)	AP42 Chapter 1.6 Wood Residue Combustion in Boilers (USEPA, 2003a)
PCDD/PCDF	Boiler (wood)	Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP, 2005)
Greenhouse gases (CO ₂ and N ₂ O)	Boiler (wood)	AP42 Chapter 1.6 Wood Residue Combustion in Boilers (USEPA, 2003a) and National Greenhouse Accounts (NGA) Factors June 2009, (DCC, 2009b)

3.72.4 Emission Estimates

Total estimated annual emissions (for selected substances) from wood or timber milling or processing for the GMR, Sydney, Newcastle, Wollongong and Non Urban regions are presented in Table 3-410. Total estimated annual emissions of all substances are presented in Appendix A.

Table 3-410: Total estimated annual emissions from wood or timber milling or processing

Substance	Emissions (kg/year)				
	Sydney	Newcastle	Wollongong	Non Urban	GMR
1,3 BUTADIENE	0	0	0	0	0
ACETALDEHYDE	0	0	0	0.41	0.41
BENZENE	0	0	0	0	0
CARBON MONOXIDE	0	0	0	30,800	30,800
FORMALDEHYDE	0	0	0	1.12	1.12
ISOMERS OF XYLENE	0	0	0	0.01	0.01
LEAD AND COMPOUNDS	0	0	0	0.7	0.7
OXIDES OF NITROGEN	0	0	0	1,600	1,600
PARTICULATE MATTER ≤ 10 µm	0	0	0	7,810	7,810
PARTICULATE MATTER ≤ 2.5 µm	0	0	0	2,920	2,920
POLYCYCLIC AROMATIC HYDROCARBONS	0	0	0	2.85	2.85
SULFUR DIOXIDE	0	0	0	7.5	7.5
TETRACHLOROETHYLENE	0	0	0	0	0
TOLUENE	0	0	0	0	0
TOTAL SUSPENDED PARTICULATE	0	0	0	13,800	13,800
TOTAL VOLATILE ORGANIC COMPOUNDS	0	0	0	165	165
TRICHLOROETHYLENE	0	0	0	0	0

3.72.5 Emission Projection Methodology

Projection factors for wood or timber milling or processing and wood have been derived based on final energy consumption projections for wood, paper in NSW published by ABARE (ABARE, 2006).

Derived projection factors are provided in Table 3-277 and illustrated in Figure 3-15.

4 RESULTS SUMMARY

4.1 Source Summary

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 4-1 presents the number and type of emission sources included in the industrial emissions inventory for each area considered.

Table 4-1: 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, air toxics associated with the National Pollutant Inventory and the Air Toxics NEPMs and any other pollutants associated with state specific programs, i.e. Load Based Licensing (Protection of the Environment Operations (General) Regulation 1998 (DEC, 2002 & PCO, 1998)) and Protection of the Environment Operations (Clean Air) Regulation 2010 (PCO, 2011).

4. Results Summary

The location of each emission source included in the industrial air emissions inventory is shown in Figure 4-1.

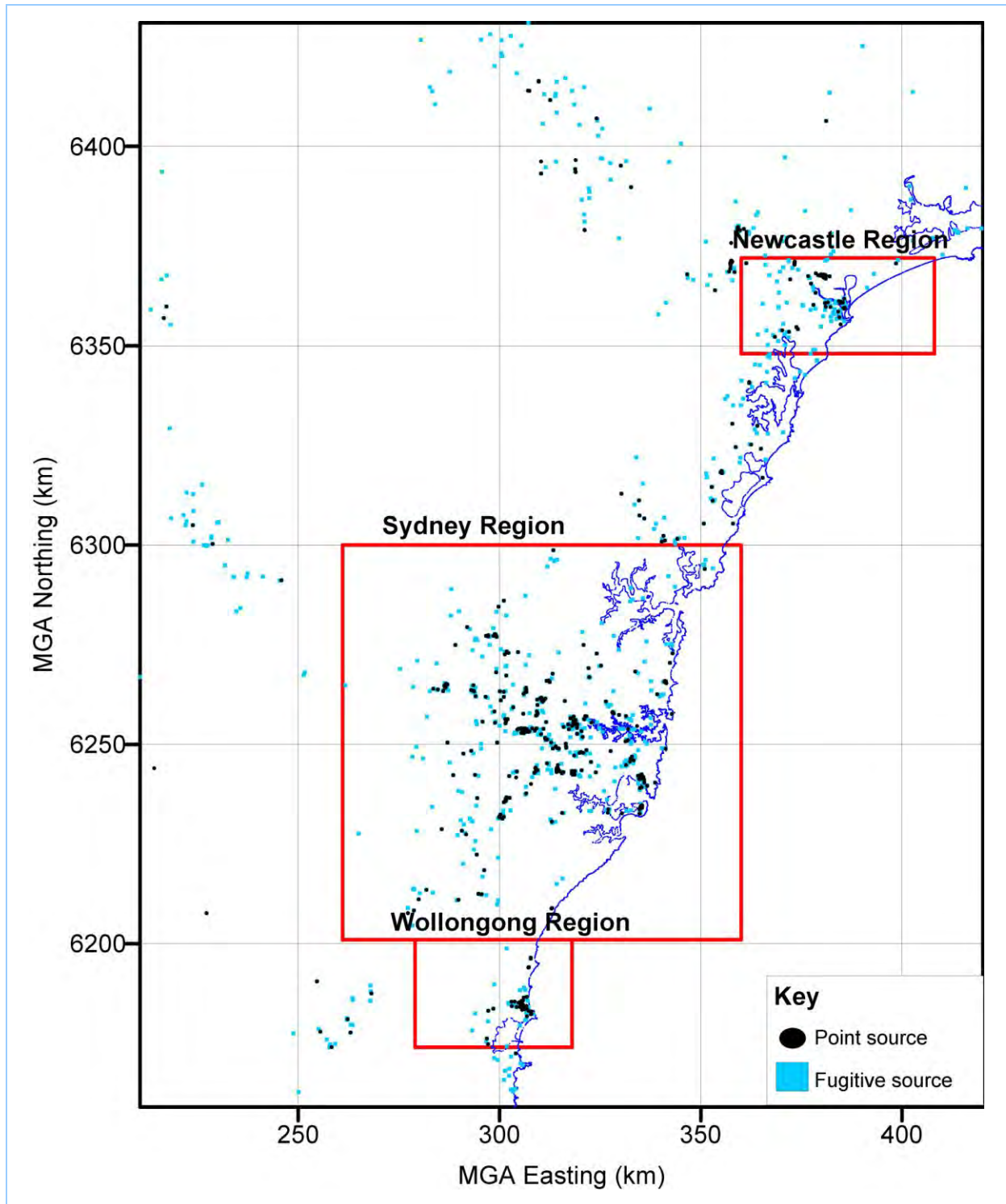


Figure 4-1: Industrial emission sources in the GMR

4. Results Summary

Information on equipment age or ‘vintage’ was also collected as part of the industrial survey. For each point source at industrial facilities, the date the source was first commissioned and date that the source was significantly modified, upgraded or replaced was collected during the industrial survey. A summary of equipment age for point sources included in the industrial air emissions inventory is provided in Figure 4-2.

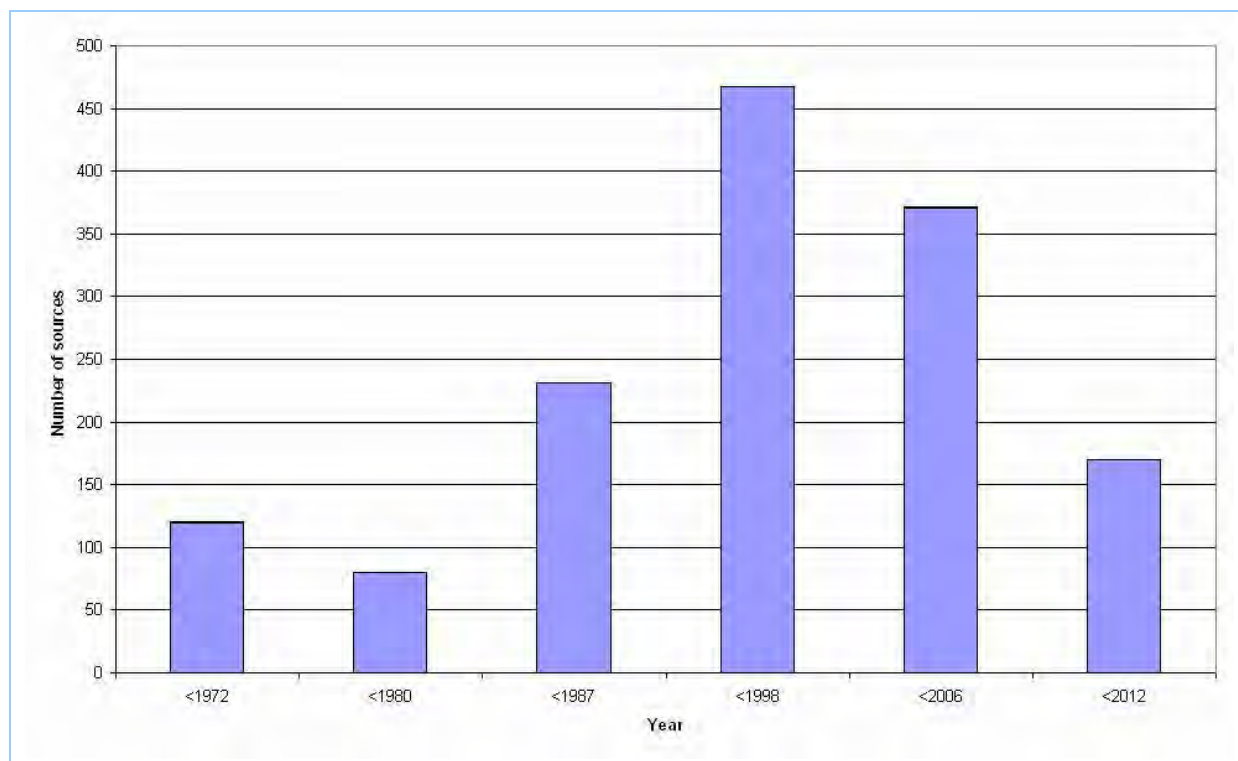


Figure 4-2: Summary of point source age included in the inventory

4.2 Activity Summary

4.2.1 Electricity consumption

Table 4-2 shows annual electricity consumption by industrial activity type for the 2008 calendar year.

Table 4-2: Annual electricity consumption by industrial activity

Activity	Electricity consumed (MWh/year)
Animal accommodation	0
Battery production	4,680
Bird accommodation	9,990
Bitumen mixing	8,620
Boat construction/maintenance (dry/float)	3,330
Boat construction/maintenance (general)	4,950
Boat mooring and storage	3,910
Brewing and distilling	33,300
Cement or lime handling	48,600
Cement or lime production	107,000
Ceramics production	85,000

4. Results Summary

Activity	Electricity consumed (MWh/year)
Chemical production	400,000
Chemical storage	1,420
Coal washery reject or slag landfilling	20
Coal works and coke production	2,350
Composting	13,600
Concrete works	27,800
Container reconditioning	1,230
Contaminated soil treatment	1,810
Crushing, grinding or separating	28,900
Dairy animal accommodation	1,850
Dairy processing	71,600
Explosives production	167
Fertiliser production (phosphate and ammonium nitrate)	97,200
General agricultural processing	142,000
General animal products production	68,300
General chemicals storage	22,100
Generation of electrical power from coal	3770,000
Generation of electrical power from gas	97,500
Generation of electricity not coal or gas	6,400
Glass production (container and float)	149,000
Hazardous, industrial or group A waste disposal	0
Hazardous, industrial or group A waste generation	137
Helicopter-related activity	88.3
Inert waste landfilling	0
Land-based extractive activity	28,800
Metal plating or coating	253,000
Metal processing	215,000
Metal production (primary)	11,500,000
Metal production (secondary)	595,000
Mining for coal	1,830,000
Mining for minerals	2,240
Miscellaneous licensed discharges to water	39,800
Non-thermal treatment of waste	101,000
Other land-based extraction	7,530
Paints/polishes/adhesives production	29,300
Paper or pulp production	125,000
Pesticides and related products production	2,660
Petrochemical production	185,000
Petroleum products and fuel production	303,000
Petroleum products storage	68,200
Pharmaceutical and veterinary products production	72,800
Pig accommodation	0
Plastics resins production	68,200
Printing, packaging and visual media production	58,600
Railway systems activities	2,680
Recovery of waste	5,600
Rendering or fat extraction	18,600
Road construction	120

4. Results Summary

Activity	Electricity consumed (MWh/year)
Rubber products/tyre production and recovery of waste oil and tyres	10,000
Scrap metal processing	21,800
Sewage treatment - large plants	172,000
Sewage treatment - small plants	59,400
Shipping in bulk	30,100
Slaughtering or processing of animals	18,600
Soap and detergent production	43,200
Solid waste landfilling	123
Sterilisation activities	3,780
Waste disposal (application to land)	60,100
Waste storage	9,500
Water based extractive activity	1,330
Wood or timber milling or processing and wood preservation facilities	2,720
Total electricity consumption	21,200,000

Figure 4-3 shows the proportion of total annual electricity consumption consumed by each industrial activity type.

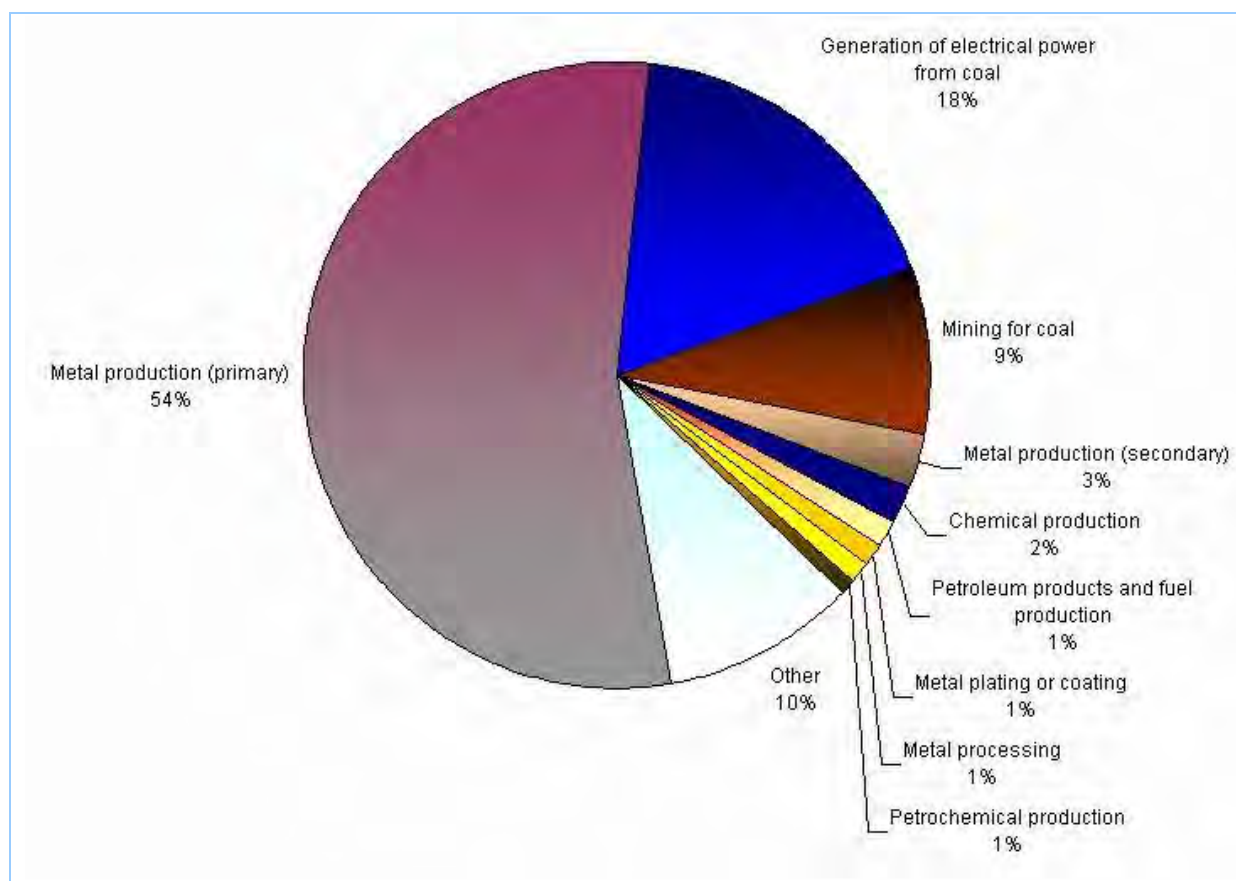


Figure 4-3: Proportion of total electricity consumption by industrial activity type in the GMR

4. Results Summary

4.2.2 Fuel consumption

Table 4-3 shows annual fuel consumption by industrial activity type for the 2008 calendar year.

Table 4-3: Annual fuel consumption by industrial activity

Activity	Fuel consumed (TJ/year)										
	Diesel	Natural gas	LPG	Coal/coke	Biogas	Heavy fuel oil	Coal seam methane	Landfill gas	Syngas	Wood	Total
Animal accommodation	0.0228	0	0	0	0	0	0	0	0	0	0.0228
Battery production	0	0	0	0	0	0	0	0	0	0	0
Bird accommodation	0	70.3	29.8	0	0	0	0	0	0	0	100
Bitumen mixing	27	368	0.411	0	0	0	0	0	0	0	395
Boat construction/maintenance (dry/float)	0	0	0.573	0	0	0	0	0	0	0	0.573
Boat construction/maintenance (general)	0	0	0	0	0	0	0	0	0	0	0
Boat mooring and storage	0	0	0	0	0	0	0	0	0	0	0
Brewing and distilling	0	235	0	0	0	0	0	0	0	0	235
Cement or lime handling	0	136	0	0	0	0	0	0	0	0	136
Cement or lime production	2.82	0	11.7	9,740	0	8.32	0	0	0	0	9,760
Ceramics production	0	2,720	0	0	0	0	0	0	0	0	2,720
Chemical production	28.2	1,540	0	5.15	0	0	0	0	0	0	1,570
Chemical storage	0	3.64	0	0	0	0	0	0	0	0	3.64
Coal washery reject or slag landfilling	0	0	0	0	0	0	0	0	0	0	0
Coal works and coke production	0.00077	0	0	0	0	0	0	0	0	0	0.00077
Composting	0	1.08	0	0	177	0	0	0	0	0	178
Concrete works	0	215	4.7	0	0	0	0	0	0	0	220
Container reconditioning	0.54	48.2	2.57	0	0	0	0	0	0	0	51.3
Contaminated soil treatment	0	506	0	0	0	0	0	0	0	0	506
Crushing, grinding or separating	0	22.4	0	0	0	0	0	0	0	0	22.4
Dairy animal accommodation	0	0	0	0	0	0	0	0	0	0	0
Dairy processing	0	284	0	0	0	0	0	0	0	0	284
Explosives production	0.0772	0	0	0	0	0	0	0	0	0	0.0772

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

4. Results Summary

Activity	Fuel consumed (TJ/year)										
	Diesel	Natural gas	LPG	Coal/coke	Biogas	Heavy fuel oil	Coal seam methane	Landfill gas	Syngas	Wood	Total
Fertiliser production (phosphate and ammonium nitrate)	0	4,240	0	0	0	0	0	0	0	0	4,240
General agricultural processing	0	1,050	0	0	0	0	0	0	0	0	1,050
General animal products production	0	836	0	0	0	0	0	0	0	0	836
General chemicals storage	0	89.5	0	0	0	0	0	0	0	0	89.5
Generation of electrical power from coal	971	0	0	704,000	0	16.2	0	0	0	0	705,000
Generation of electrical power from gas	0	23,500	0	0	0	0	4,400	2,150	0	0	30,050
Generation of electricity not coal or gas	11.7	5.63	0	0	0	0	0	635	0	0	652
Glass production (container and float)	0	3230	0	0	0	0	0	0	0	0	3,230
Hazardous, industrial or group A waste disposal	0	0	0	0	0	0	0	0	0	0	0
Hazardous, industrial or group A waste generation	0	0	0	0	0	0	0	0	0	0	0
Helicopter-related activity	0	0	0	0	0	0	0	0	0	0	0
Inert waste landfilling	0	0	0	0	0	0	0	0	0	0	0
Land-based extractive activity	27.2	0	0	0	0	0	0	0	0	0	27.2
Metal plating or coating	0.0579	1,750	4.11	0	0	0	0	0	0	0	1,754
Metal processing	0	1,500	0	0	0	0	0	0	0	0	1,500
Metal production (primary)	0	7,560	0	111,000	0	0	0	0	0	0	118,560
Metal production (secondary)	0	2,810	0	0	0	0	0	0	0	0	2,810
Mining for coal	929	4.1	0	0	0	0	697	0	0	0	1,630
Mining for minerals	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous licensed discharges to water	0	0	0	0	0	0	0	0	0	0	0
Non-thermal treatment of waste	0.0154	177	0	0	0	21.2	0	0	0	0	198
Other land-based extraction	0	0.046	7.56	0	0	0	0	0	0	0	7.61
Paints/polishes/adhesives production	0.463	60.1	0	0	0	0	0	0	0	0	60.6
Paper or pulp production	0	1,850	0	0	0	0	0	0	0	0	1,850
Pesticides and related products production	0	6.54	1.7	0	0	0	0	0	0	0	8.24
Petrochemical production	0	6,060	0	847	0	0	0	0	0	0	6,907
Petroleum products and fuel production	0	1,990	0	433	0	406	0	0	15,800	0	18,629

2008 Calendar Year Industrial Emissions: Results

4. Results Summary

Activity	Fuel consumed (TJ/year)										
	Diesel	Natural gas	LPG	Coal/coke	Biogas	Heavy fuel oil	Coal seam methane	Landfill gas	Syngas	Wood	Total
Petroleum products storage	0	1,700	34.4	0	0	0	0	0	0	0	1,734
Pharmaceutical and veterinary products production	0.0239	294	0	0	0	0	0	0	0	0	294
Pig accommodation	0	0	0	0	0	0	0	0	0	0	0
Plastics resins production	0.0888	38.7	0	0	0	0	0	0	0	0	38.8
Printing, packaging and visual media production	0.309	133	0	0	0	0	0	0	0	0	133
Railway systems activities	0	0	0	0	0	0	0	0	0	0	0
Recovery of waste	0	17.5	0	0	0	0	0	0	0	0	17.5
Rendering or fat extraction	0	611	0	0	0	0	0	0	0	0	611
Road construction	0.502	0	0	0	0	0	0	0	0	0	0.502
Rubber products/tyre production and recovery of waste oil and tyres	131	148	0	0	0	0	0	0	0	0	279
Scrap metal processing	0	0	0	0	0	0	0	0	0	0	0
Sewage treatment - large plants	1	0	1.21	0	603	0	0	0	0	0	605
Sewage treatment - small plants	0.0772	0	3.98	0	52.4	0	0	0	0	0	56.5
Shipping in bulk	0.0347	0	0	0	0	0	0	0	0	0	0.0347
Slaughtering or processing of animals	0.0772	186	5.89	152	0	17.9	0	0	0	0	362
Soap and detergent production	0.0193	128	0	0	0	0	0	0	0	0	128
Solid waste landfilling	0	0	0	0	0	0	0	0	0	0	0
Sterilisation activities	0	30.1	0	0	0	0	0	0	0	0	30.1
Waste disposal (application to land)	0	0	0	0	0	0	0	0	0	0	0
Waste storage	0.0386	4.14	0	0	0	0	0	0	0	0	4.18
Water based extractive activity	0	0	0	0	0	0	0	0	0	0	0
Wood or timber milling or processing and wood preservation facilities	0	0	0	0	0	0	0	0	0	24.3	24.3
Grand Total	2,130	66,200	109	826,000	832	470	5,100	2,780	15,800	24.3	920,000

a Energy values used: Diesel: 38.6 MJ/L; Natural gas: 38.3 MJ/m³; LPG: 25.7 MJ/L; Black coal (electricity consumption): 23.4 GJ/t; Black coal (primary metals): 30 GJ/t; Coke: 27 GJ/t; Heavy fuel oil: 40 MJ/L; Wood (dry): 16.2 GJ/t (ABARE, 2009)

4. Results Summary

Figure 4-4 shows the proportion of total fuel consumption by each industrial activity type.

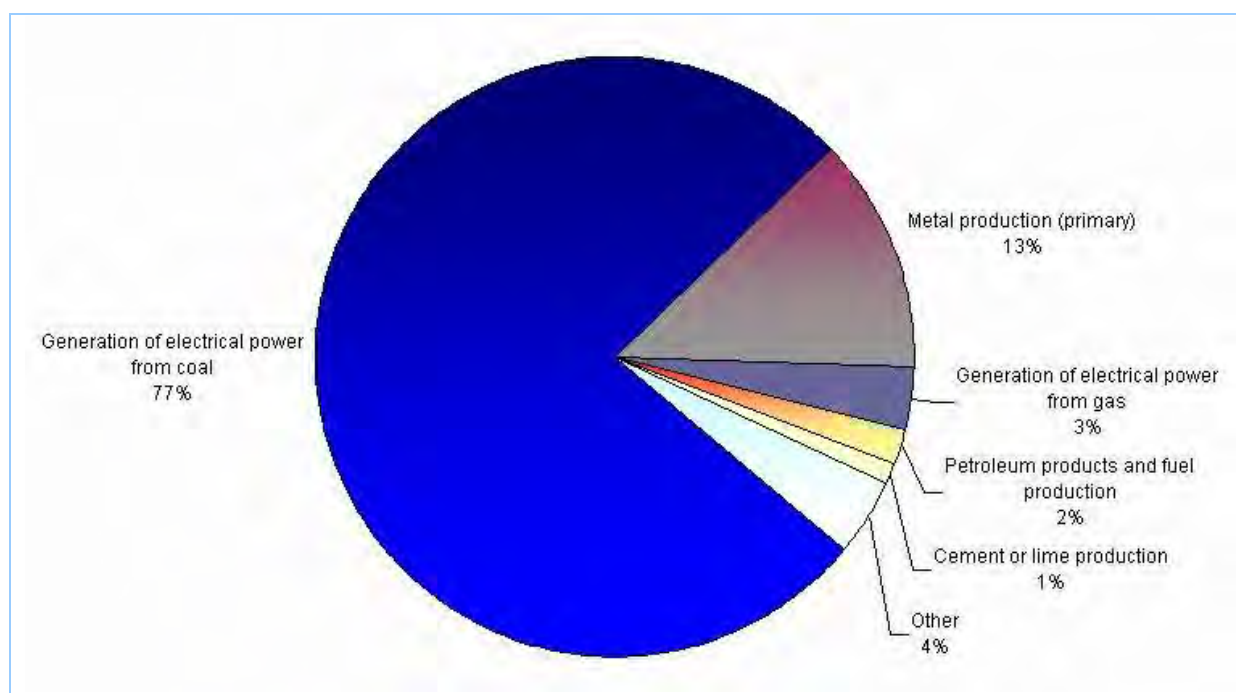


Figure 4-4: Proportion of total fuel consumption by industrial activity type in the GMR

4.3 Emission Summary

Table 4-4 shows the total estimated annual emissions (for selected substances) from all industrial sources in the GMR, Sydney, Newcastle, Wollongong and Non Urban regions.

Table 4-4: 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 $\leq 10 \mu\text{m}$	6,210	3,740	2,100	61,200	73,200
PARTICULATE MATTER $\leq 2.5 \mu\text{m}$	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

4. Results Summary

Figure 4-5 shows the proportion of total estimated annual emissions (for selected substances) from all industrial sources in the GMR, Sydney, Newcastle, Wollongong and Non Urban regions.

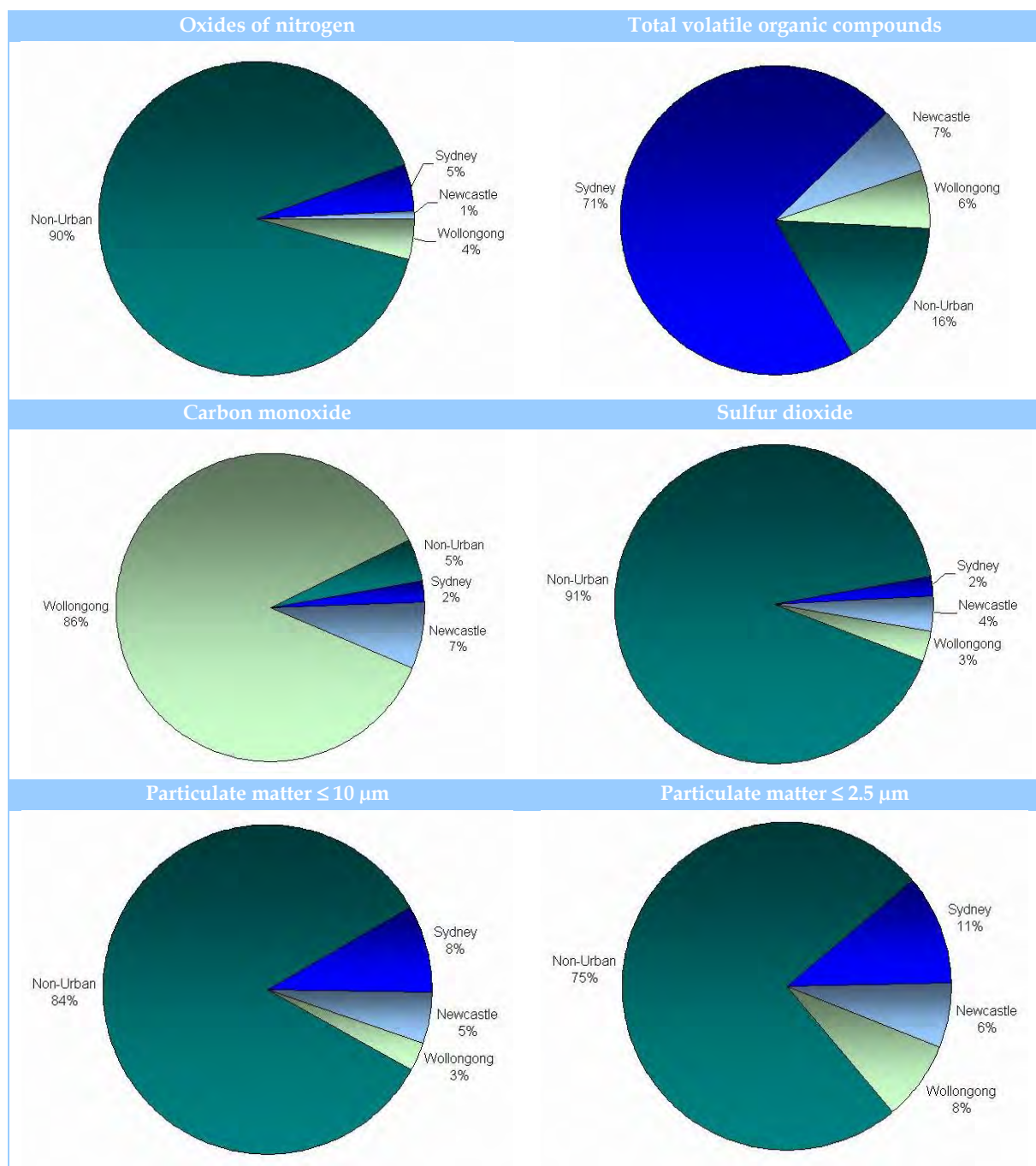


Figure 4-5: Proportion of total estimated annual emissions from industrial sources in each region

4. Results Summary

Table 4-5 shows total estimated annual emissions (for selected substances) from each industrial source type in the GMR.

Table 4-5: 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

4. Results 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

4. Results 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

4. Results Summary

The proportion of total estimated annual emissions (for selected substances) from each industrial source type in the GMR are shown in Figure 4-6 to Figure 4-11.

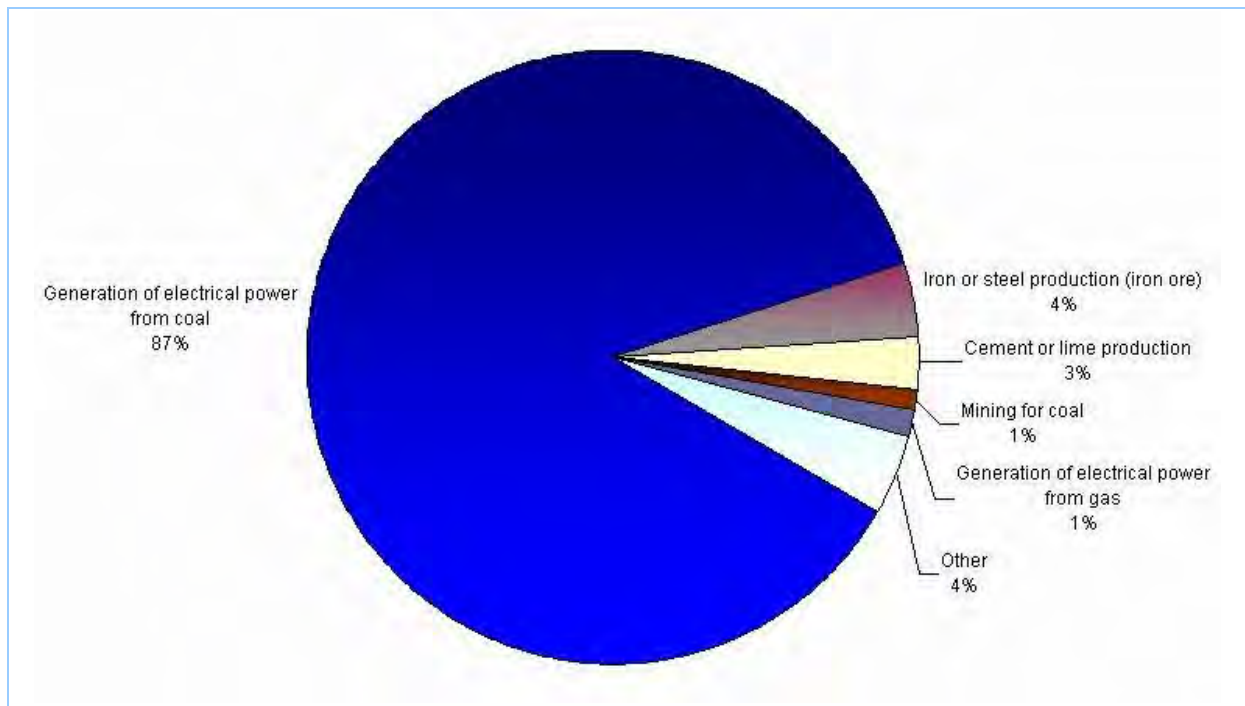


Figure 4-6: Proportion of total NO_x emissions by industrial activity type in the GMR

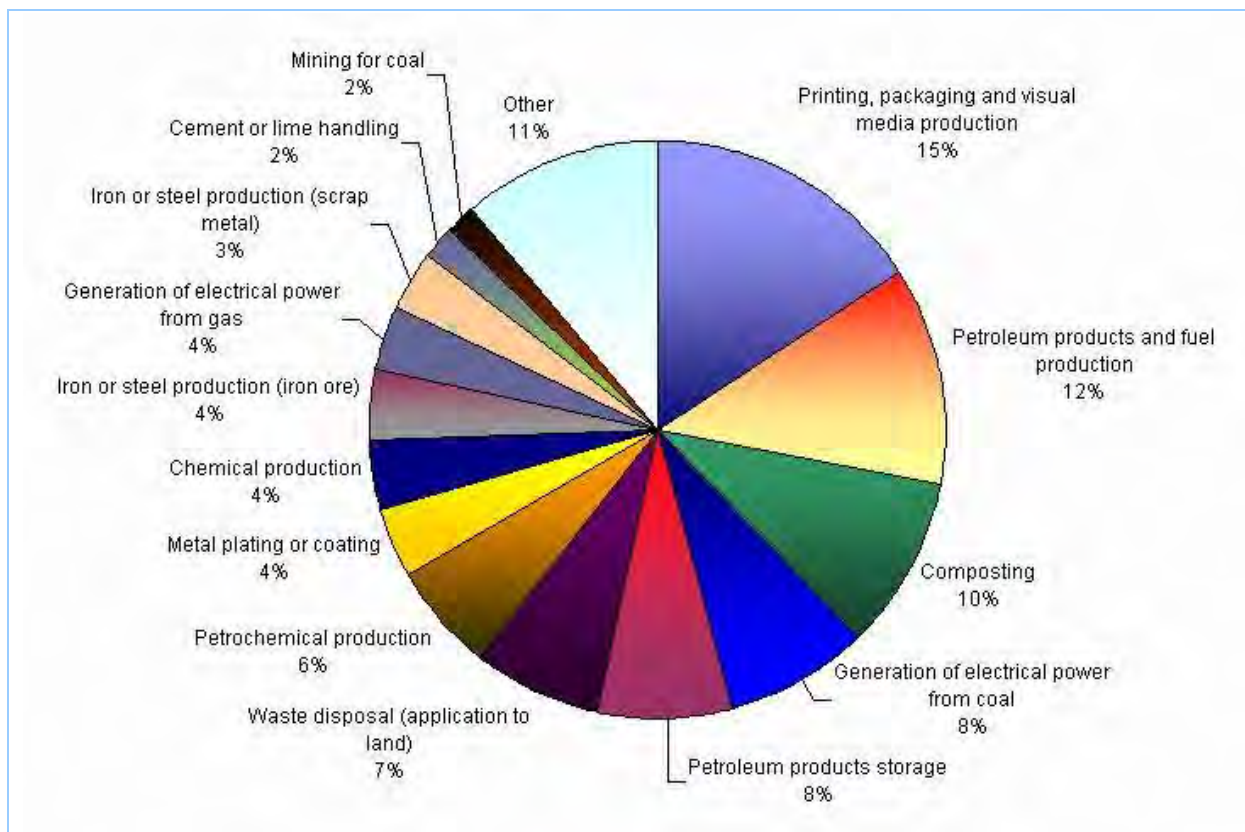


Figure 4-7: Proportion of total VOC emissions by industrial activity type in the GMR

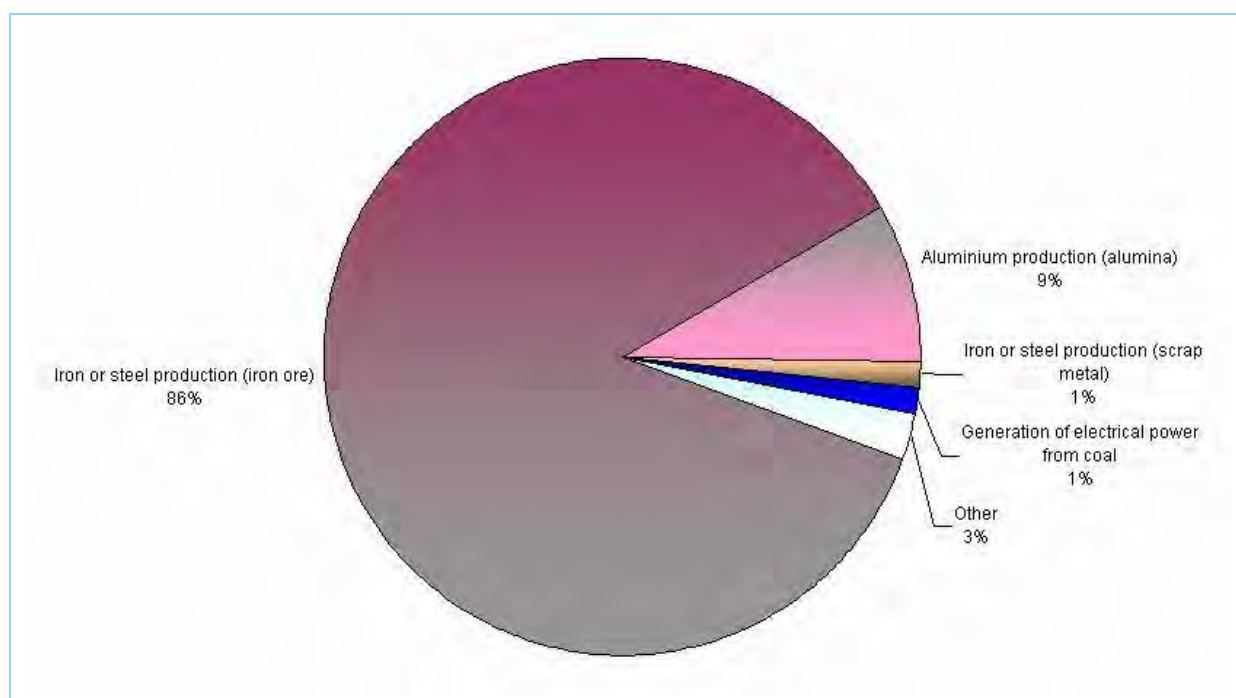


Figure 4-8: Proportion of total CO emissions by industrial activity type in the GMR

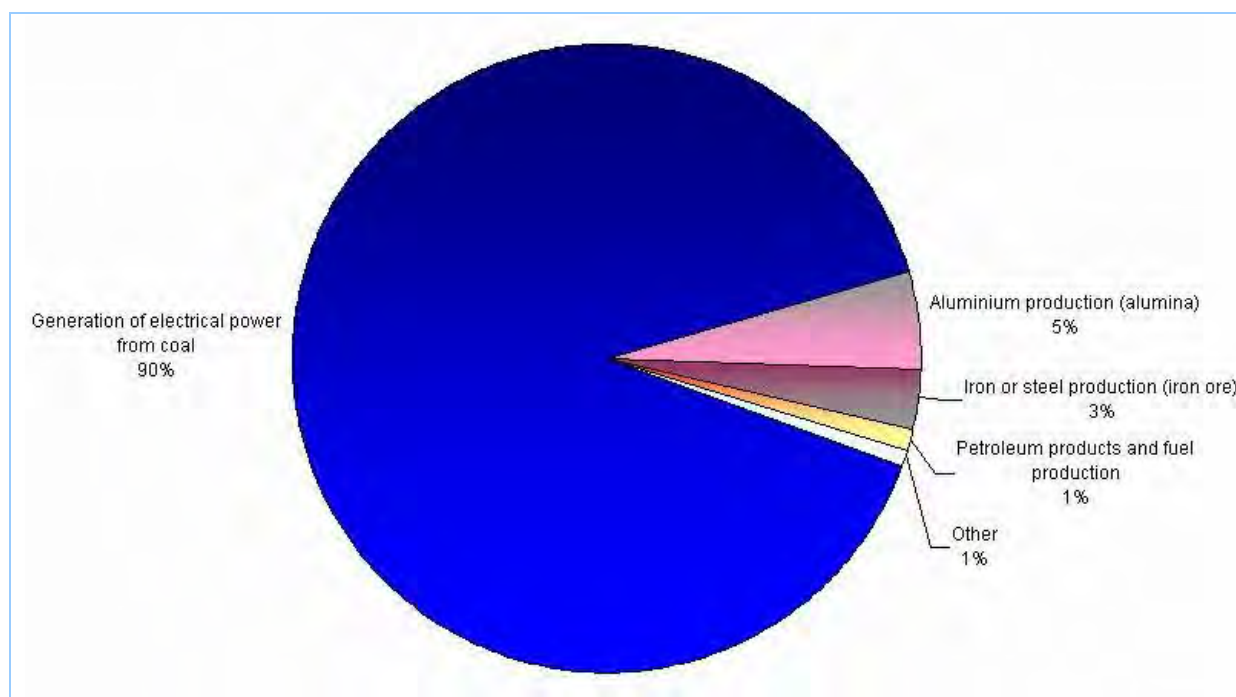


Figure 4-9: Proportion of total SO₂ emissions by industrial activity type in the GMR

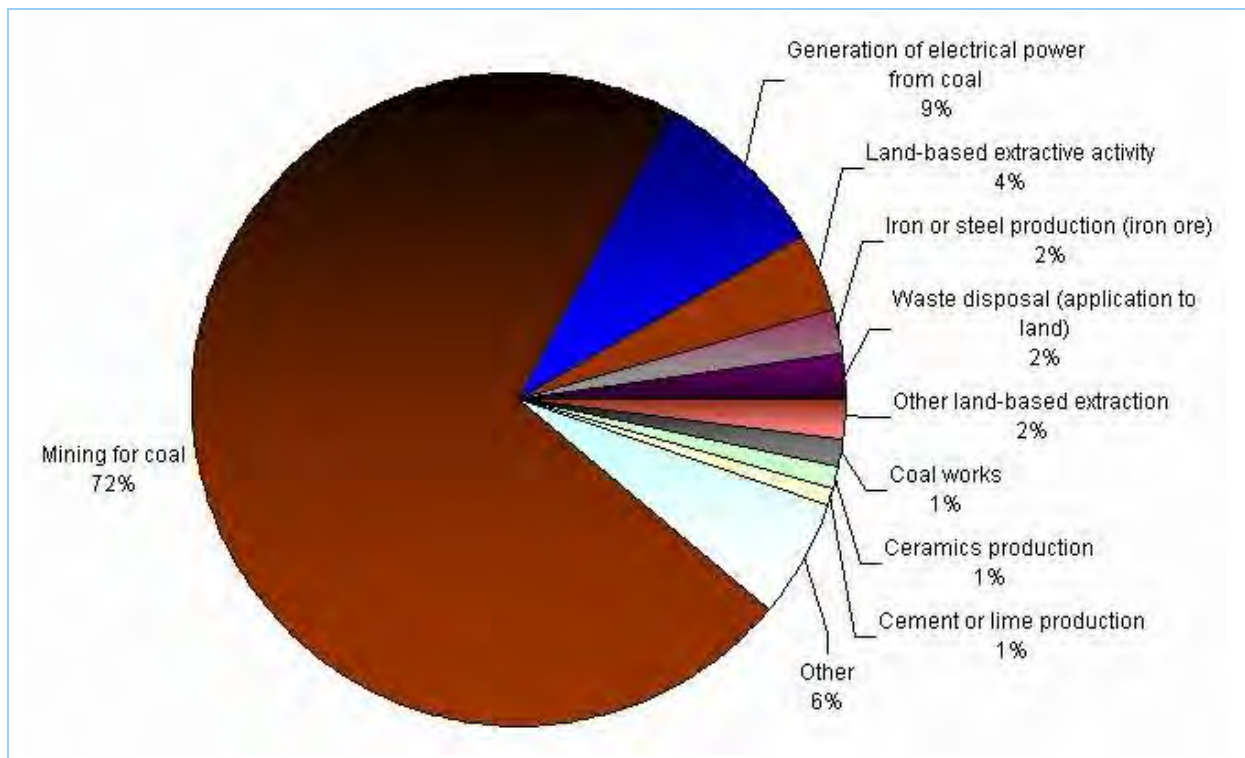


Figure 4-10: Proportion of total PM₁₀ emissions by industrial activity type in the GMR

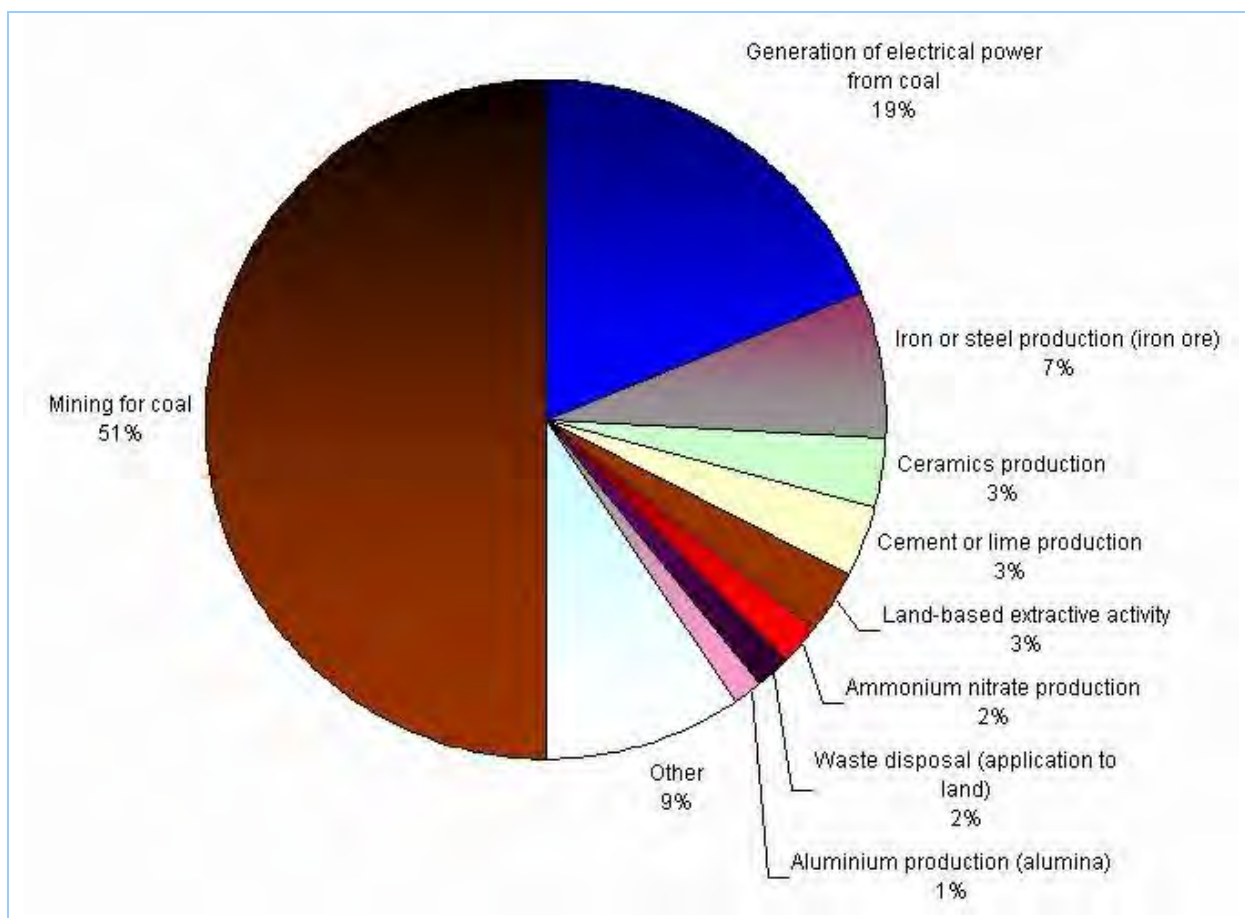


Figure 4-11: Proportion of total PM_{2.5} emissions by industrial activity type in the GMR

4. Results Summary

Table 4-6 shows total estimated annual emissions (for selected substances) from each industrial source type in the Sydney region.

Table 4-6: 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 disposal	0	0	74.2	21.1	2.11	0	0

2008 Calendar Year Industrial Emissions: Results

4. Results Summary

Activity	Emissions (tonne/year)						
	CO	NO _x	TSP	PM ₁₀	PM _{2.5}	SO ₂	VOC
Hazardous, industrial or group A waste generation	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

4. Results 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

4. Results Summary

The proportion of total estimated annual emissions (for selected substances) from each industrial source type in the Sydney region are shown in Figure 4-12 to Figure 4-17.

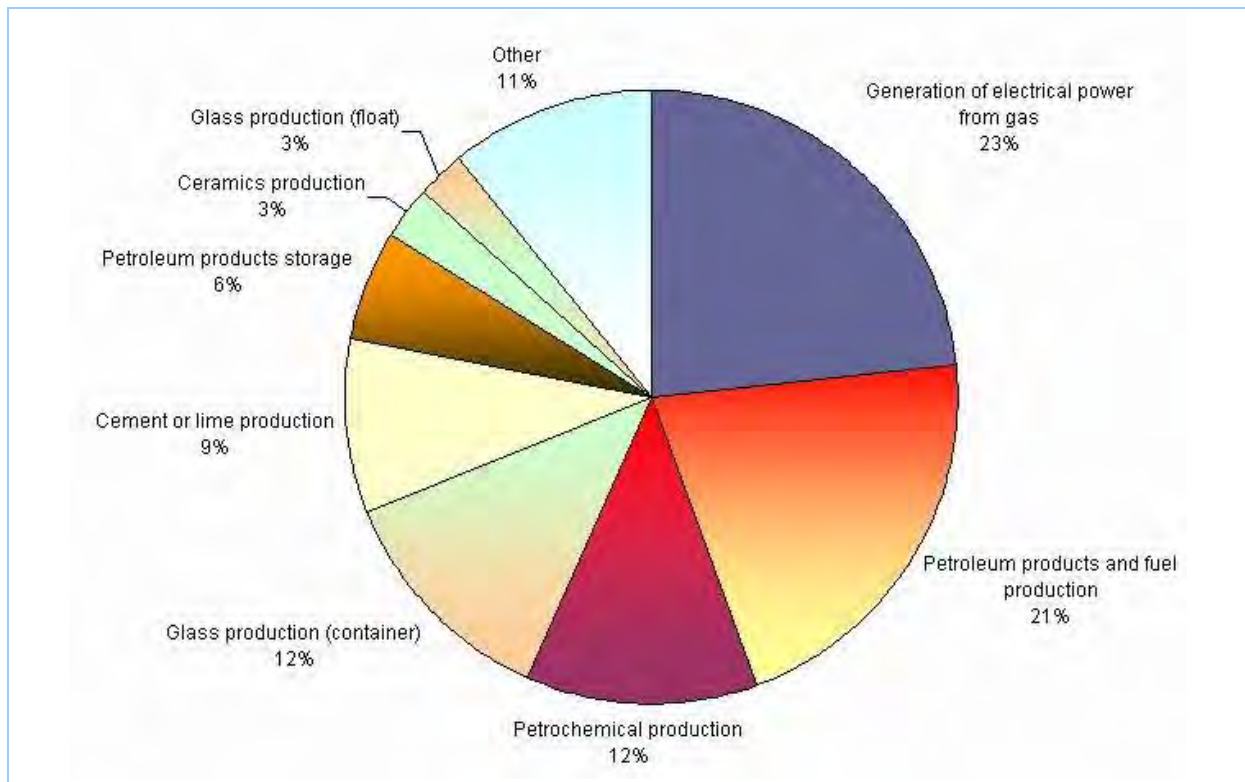


Figure 4-12: Proportion of total NO_x emissions by industrial activity type in the Sydney region

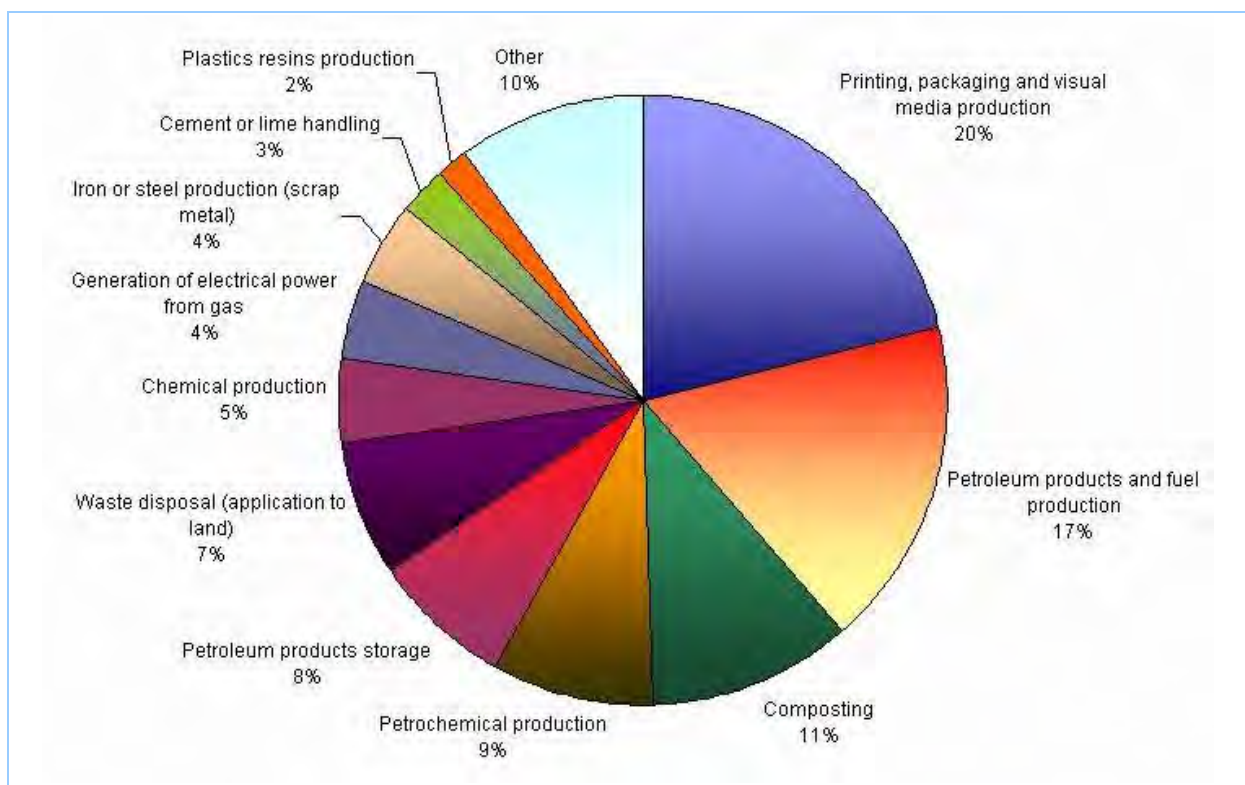


Figure 4-13: Proportion of total VOC emissions by industrial activity type in the Sydney region

4. Results Summary

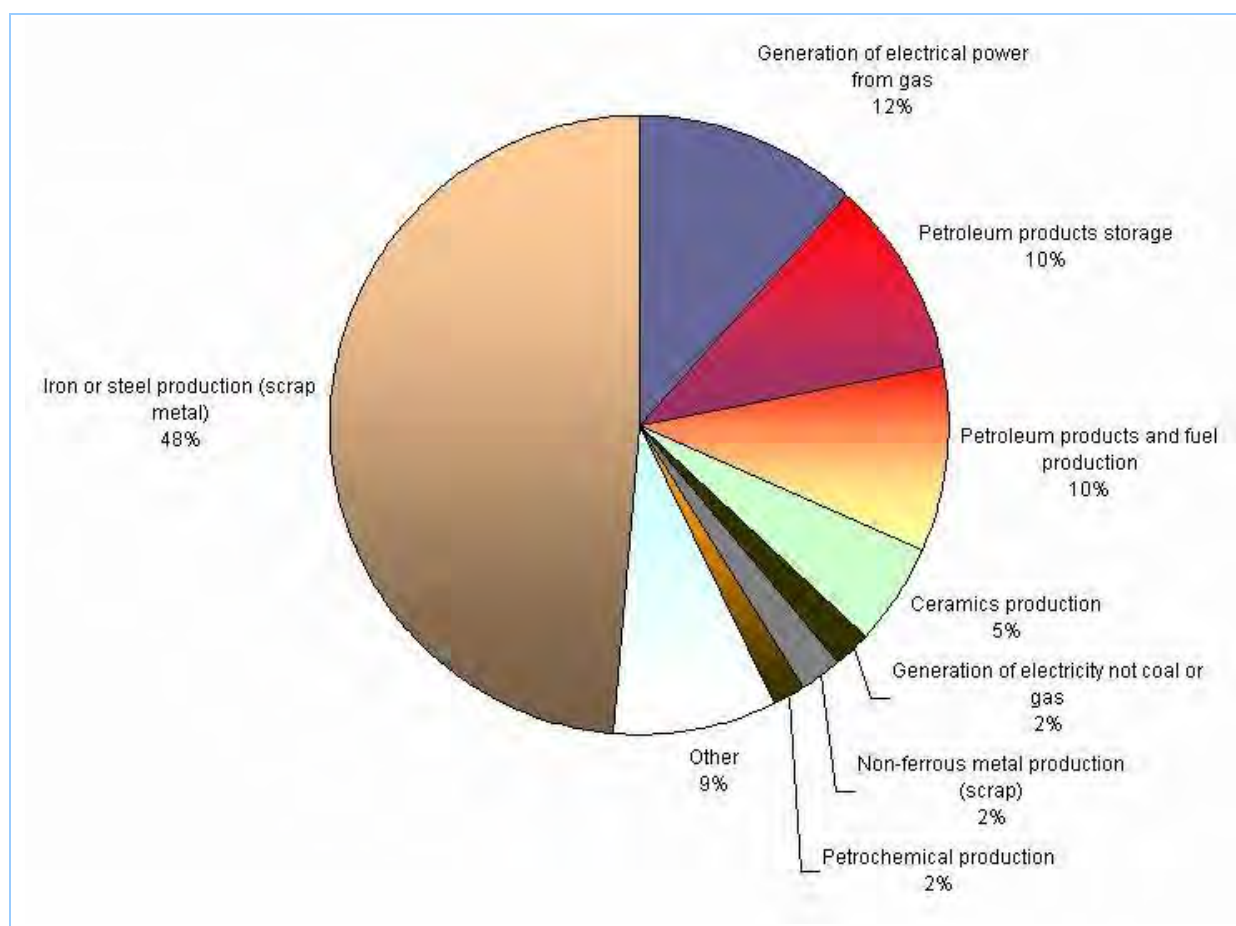


Figure 4-14: Proportion of total CO emissions by industrial activity type in the Sydney region

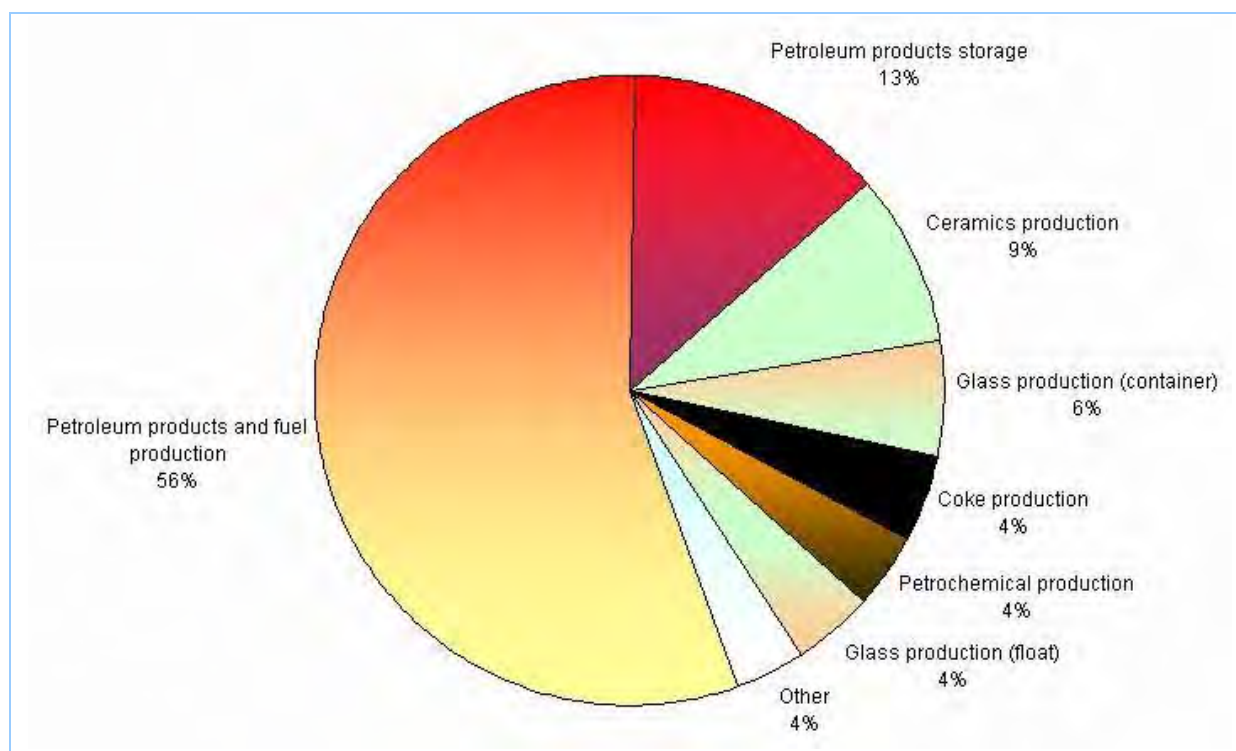


Figure 4-15: Proportion of total SO₂ emissions by industrial activity type in the Sydney region

4. Results Summary

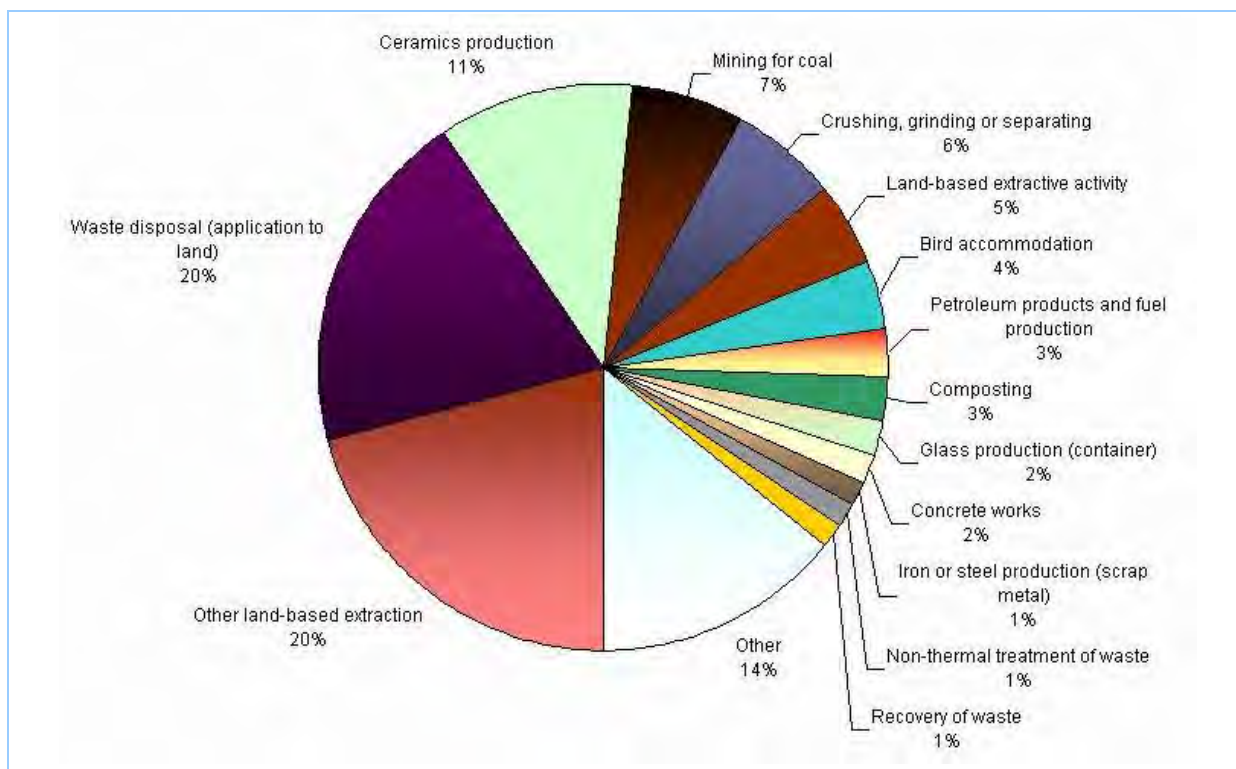


Figure 4-16: Proportion of total PM₁₀ emissions by industrial activity type in the Sydney region

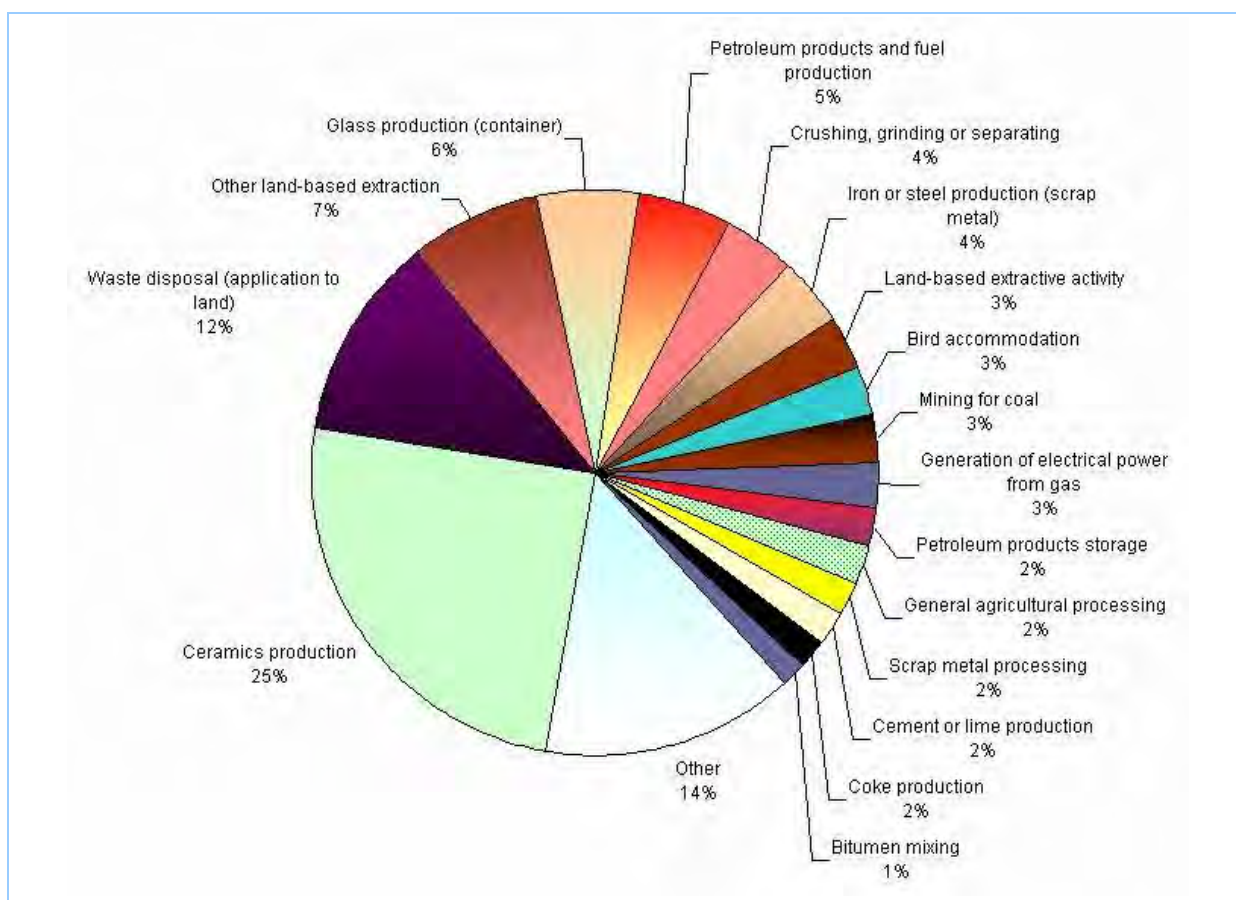


Figure 4-17: Proportion of total PM_{2.5} emissions by industrial activity type in the Sydney region

4. Results Summary

Table 4-7 shows total estimated annual emissions (for selected substances) from each industrial source type in the Newcastle region.

Table 4-7: Total estimated annual emissions by industry source type in the Newcastle region

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)	39,200	347	482	186	119	10,100	11.4
Ammonium nitrate production	258	844	337	323	316	0.923	132
Bitumen mixing	16.5	6.78	13.6	9.03	5.57	4.42	4.85
Boat construction/maintenance (dry/float)	0.0201	0.0402	84.1	57.3	48.8	0.00029	12.2
Boat construction/maintenance (general)	0	0.578	0.61	0.256	0.183	0	8.31
Boat mooring and storage	0	0	0	0	0	0	0.0213
Cement or lime handling	0.353	0.421	4.16	2.38	0.547	0.0022	0.138
Chemical production	38.3	147	5.08	4.11	3.8	64.5	68
Coal works	0	0	2,320	753	93.4	0	0.111
Concrete works	0	0	16.7	6.71	1.04	0	0.533
Contaminated soil treatment	0.0078	0.0363	20.8	7.8	1.28	0.00004	0.0109
Crushing, grinding or separating	0	0	34.6	11.9	2.35	0	0.664
Dairy processing	2.82	3.36	2.14	0.616	0.343	0.0176	0.814
General agricultural processing	12.8	15.2	17.4	9.17	3.56	0.0794	2.84
General chemicals storage	0	0	0.66	0.127	0.0307	0	0.0001
Generation of electrical power from gas	86	61.6	0.0209	0.0209	0.0209	0.159	32.1
Hazardous, industrial or group A waste generation	0	0	0.0055	0.00106	0.00026	0	0
Helicopter-related activity	0	0	0	0	0	0	0.00078
Inert waste landfilling	0	0	52.8	26.4	5.27	0	0
Iron or steel production (scrap metal)	2,210	142	89.3	58.8	52.6	8.91	34.8
Land-based extractive activity	0	0	715	207	44.6	0	0.00237
Metal plating or coating	5.76	7.04	18.9	5.5	2.97	0.0358	1.82
Metal processing	35.6	64	9.51	8.6	8.42	0.932	59.3
Mining for coal	70.4	147	4,820	1,750	302	1.36	17.2
Non-thermal treatment of waste	0.0417	0.0496	8.85	3.25	0.532	0.00026	0.183
Other land-based extraction	0.264	0.529	83.8	25.5	2.86	0.00385	0.0328
Petroleum products storage	0	0	0.0988	0.0215	0.0041	0	233
Printing, packaging and visual media production	0	0	0.0101	0.00195	0.00047	0	86.2
Recovery of waste	0	0	19.8	6.99	1.4	0	0
Scrap metal processing	0	3.11	0.977	0.187	0.0454	0	0.00292
Sewage treatment - large plants	0	0	1.53	0.308	0.068	0	10.6
Sewage treatment - small plants	0	0	14.8	3.37	0.588	0	0.0106
Shipping in bulk	0	0	58.1	32.7	12.7	0	0.00117
Slaughtering or processing of animals	3.59	41.9	110	48.6	12.4	65.5	1.59
Waste disposal (application to land)	4.59	0	433	158	29.4	0	52.8
Waste storage	0	0	0.342	0.0657	0.0159	0	0.00157
Water-based extractive activity	0	0	1.78	0.891	0.177	0	0.00096
Grand Total	41,900	1,830	9,820	3,740	1,110	10,300	771

4. Results Summary

The proportion of total estimated annual emissions (for selected substances) from each industrial source type in the Newcastle region are shown in Figure 4-18 to Figure 4-23.

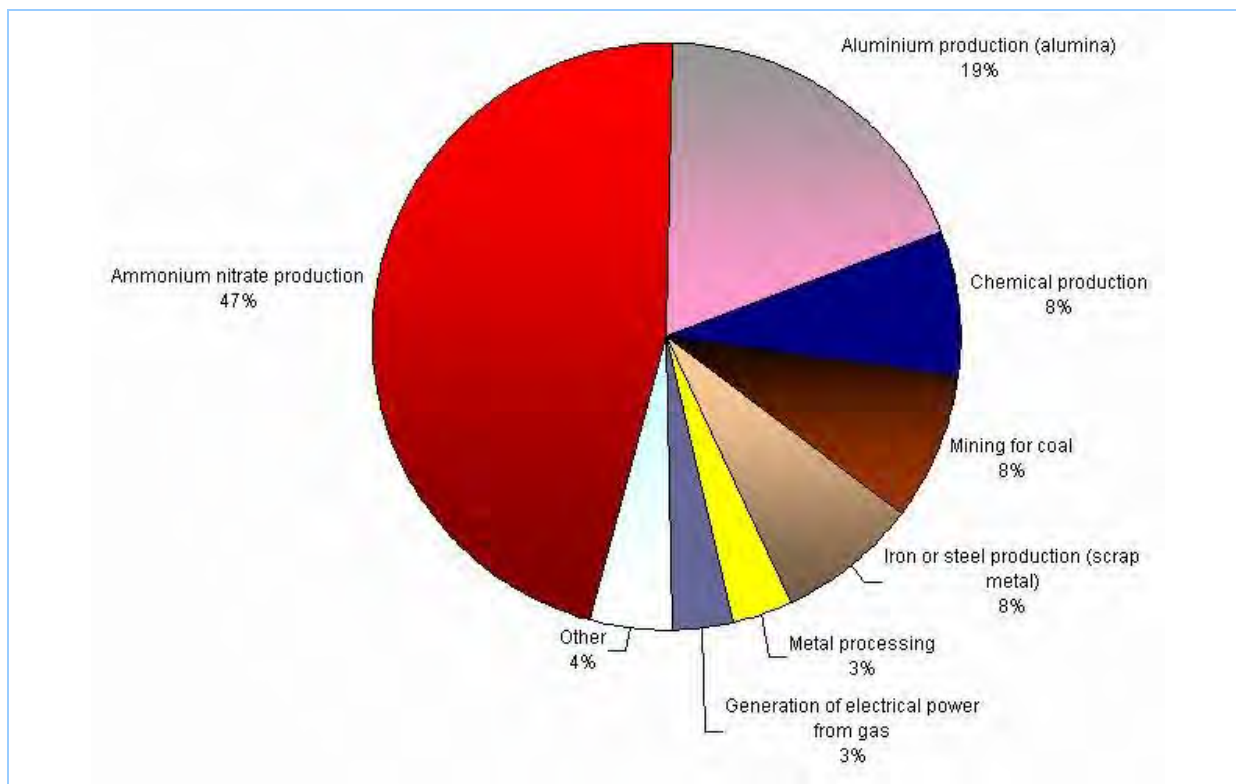


Figure 4-18: Proportion of total NO_x emissions by industrial activity type in the Newcastle region

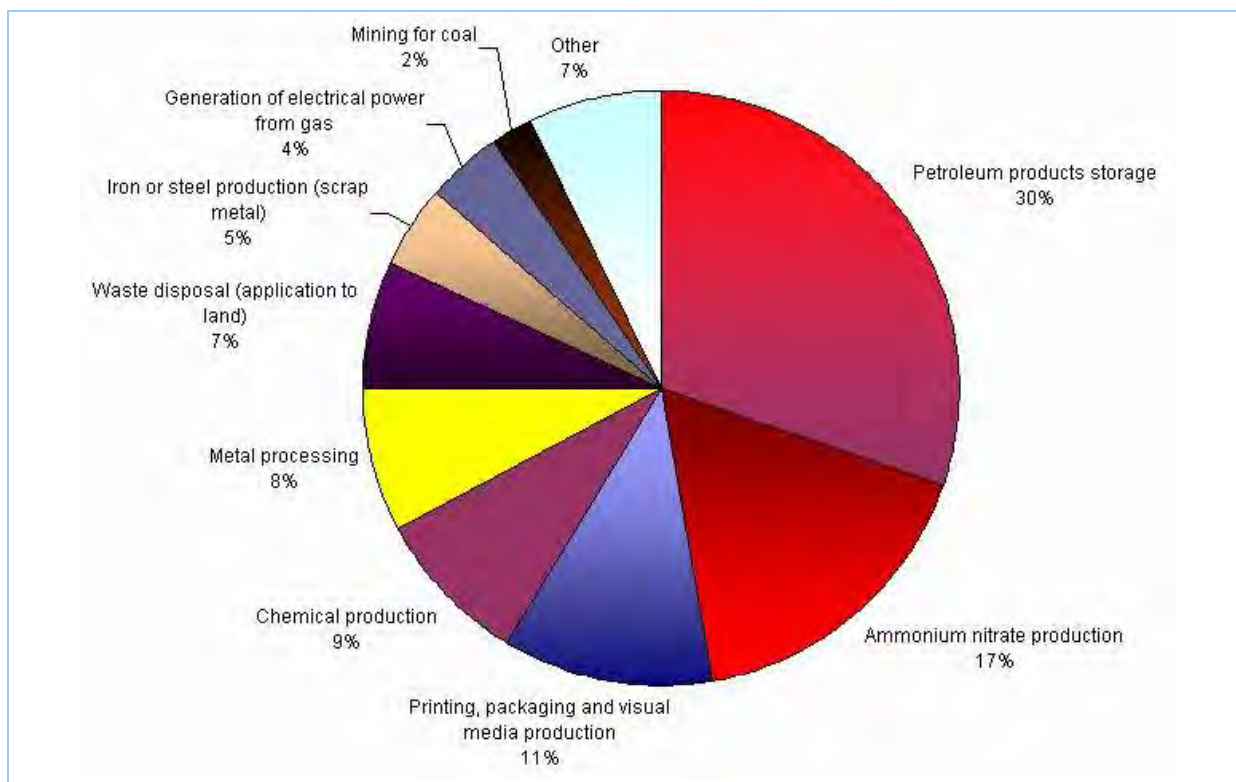


Figure 4-19: Proportion of total VOC emissions by industrial activity type in the Newcastle region

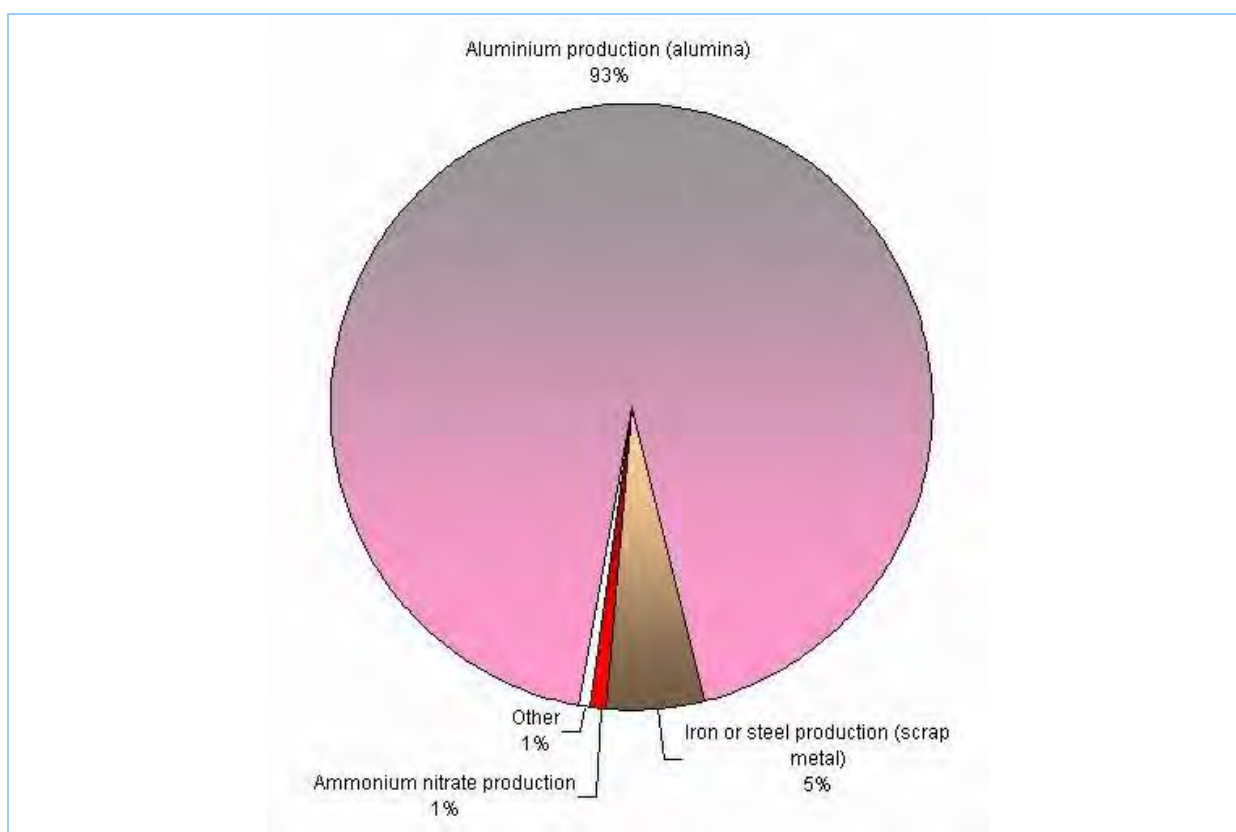


Figure 4-20: Proportion of total CO emissions by industrial activity type in the Newcastle region

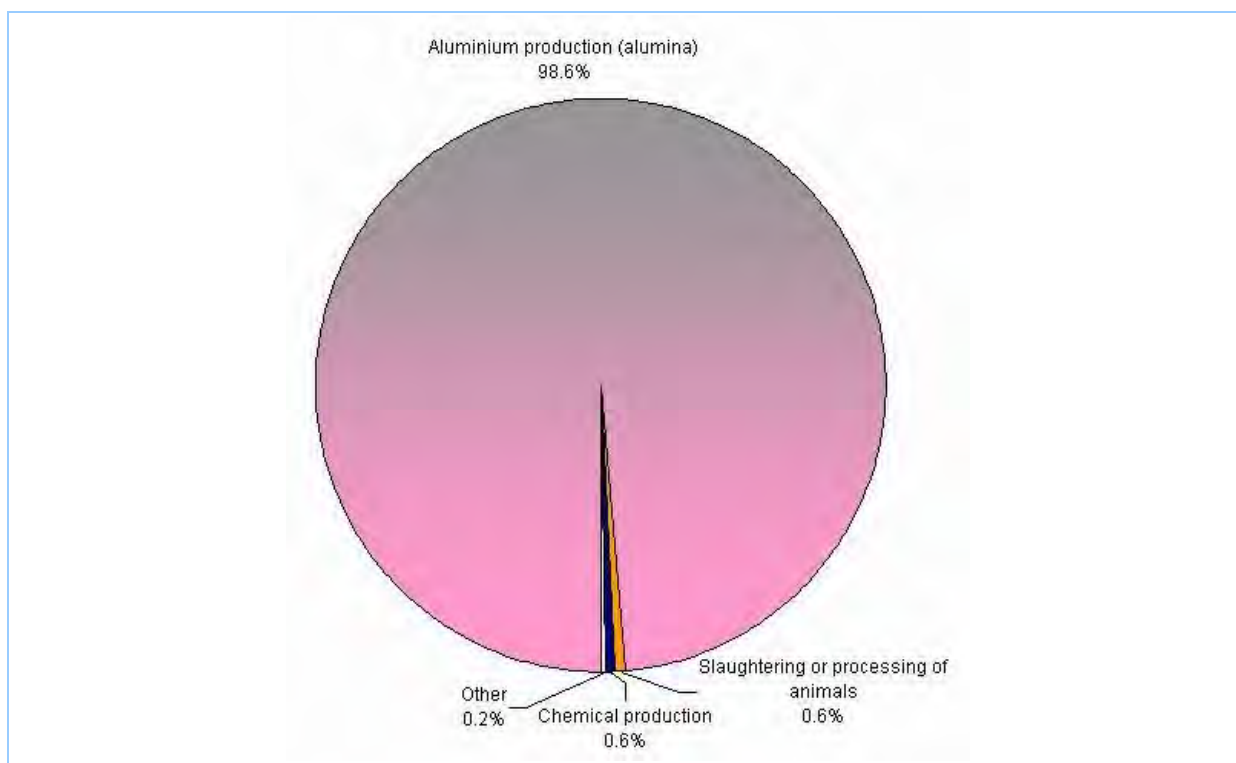


Figure 4-21: Proportion of total SO₂ emissions by industrial activity type in the Newcastle region

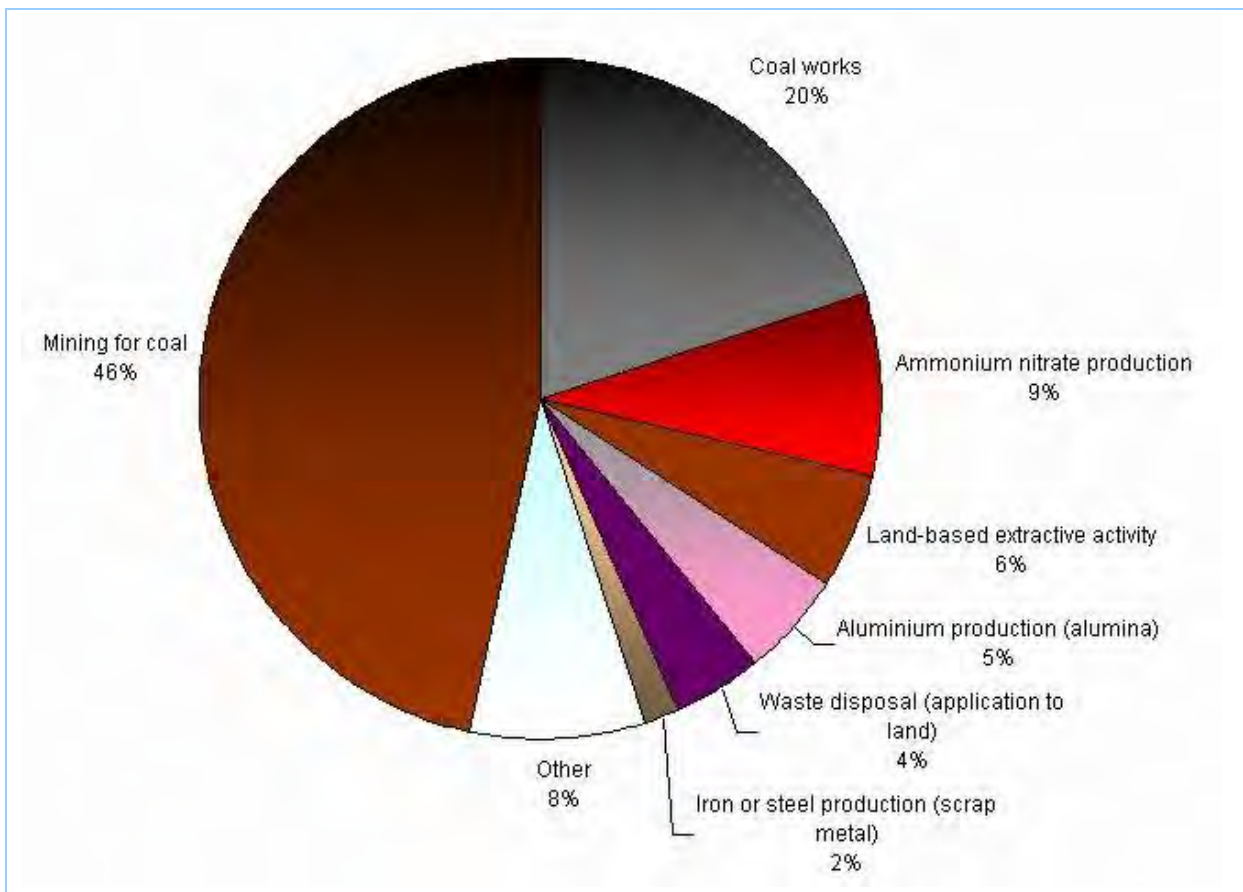


Figure 4-22: Proportion of total PM₁₀ emissions by industrial activity type in the Newcastle region

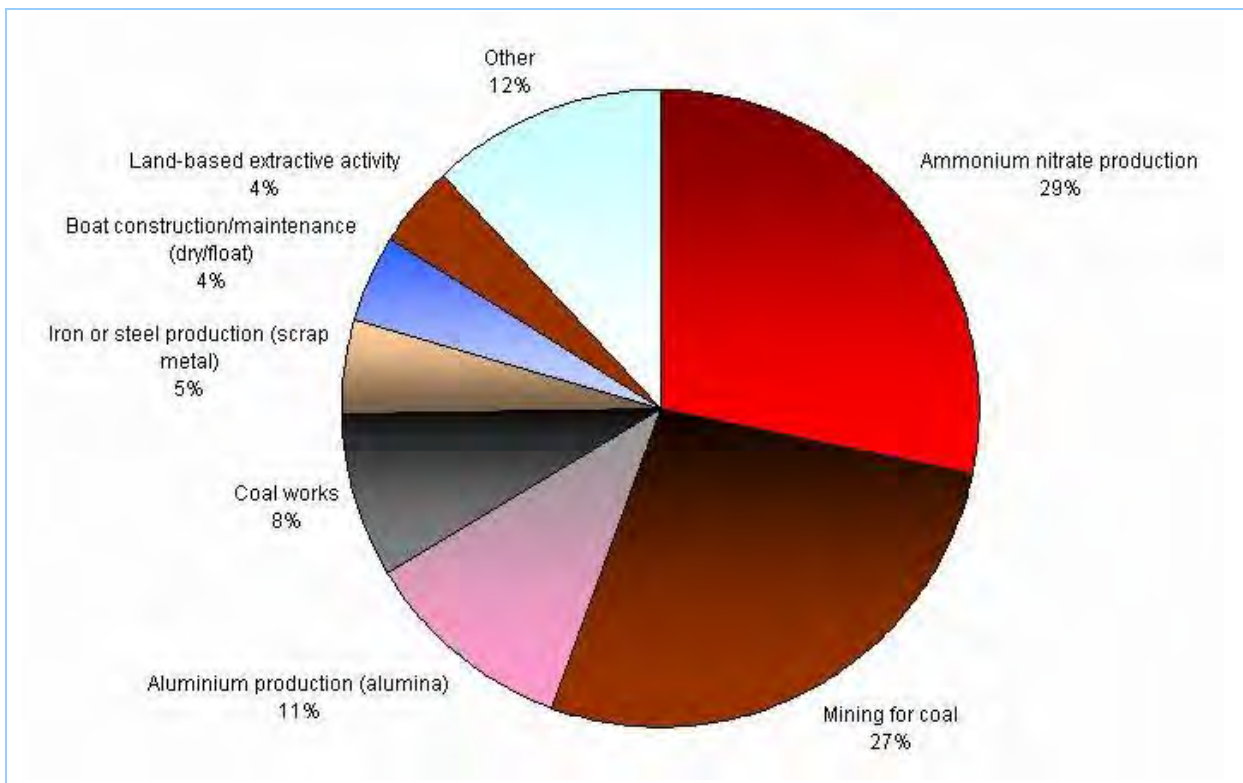


Figure 4-23: Proportion of total PM_{2.5} emissions by industrial activity type in the Newcastle region

4. Results Summary

Table 4-8 shows total estimated annual emissions (for selected substances) from each industrial source type in the Wollongong region.

Table 4-8: Total estimated annual emissions by industry source type in the Wollongong region

Activity	Emissions (tonne/year)						
	CO	NO _x	TSP	PM ₁₀	PM _{2.5}	SO ₂	VOC
Bitumen mixing	37.3	2.85	12.6	10.8	9.32	1.03	2.34
Boat construction/maintenance (general)	0	0	0	0	0	0	0.00072
Cement or lime handling	0	0	3.37	0.992	0.116	0	0.0561
Cement or lime production	0	0	2.24	1.37	0.225	0	0
Chemical production	1.16	1.38	0.106	0.105	0.105	0.00723	1.54
Coal washery reject or slag landfilling	0	0	33.7	16.6	3.29	0	0
Coal works	0	0	173	73.7	11.4	0	0.0312
Coke production	3.1	11.8	54	28.4	27.6	219	0.351
Concrete works	0	0	8.07	3.29	0.506	0	0.23
Container reconditioning	0.00192	0.00768	0.0932	0.0182	0.00472	0.00027	3.59
Contaminated soil treatment	0	0	0.133	0.0594	0.0114	0	0.0108
Crushing, grinding or separating	0	0	6.07	1.53	0.268	0	0
General chemicals storage	3.12	3.84	0.339	0.293	0.285	31.2	0.233
Generation of electrical power from gas	445	178	35.6	35.6	35.6	2.76	11.6
Iron or steel production (iron ore)	528,000	7,510	4,590	1,750	1,220	8,220	452
Metal plating or coating	1,050	58.6	43.7	18.5	10.6	24.2	132
Metal processing	10.3	12.9	68.9	21.4	9.63	0.0643	6.94
Mining for coal	0	0	239	85.8	11.7	0	0.00617
Non-thermal treatment of waste	0.47	0.56	0.503	0.131	0.0639	0.00293	0.0308
Petroleum products storage	0	0	0	0	0	0	1.39
Road construction	0	0	38.2	5.9	1.27	0	0
Scrap metal processing	0	0	0.00181	0.00035	0.00008	0	0.00061
Sewage treatment - large plants	0.819	0.777	0.212	0.212	0.212	0.00487	1.02
Shipping in bulk	0	0	33.2	9.84	1.95	0	22.5
Waste disposal (application to land)	2.3	0	123	32.3	5.95	0	80.1
Waste storage	0	0	11.9	3.39	0.339	0	0
Water-based extractive activity	0	0	0	0	0	0	0.00015
Grand Total	529,000	7,780	5,480	2,100	1,350	8,490	716

4. Results Summary

The proportion of total estimated annual emissions (for selected substances) from each industrial source type in the Wollongong region are shown in Figure 4-24 to Figure 4-29.

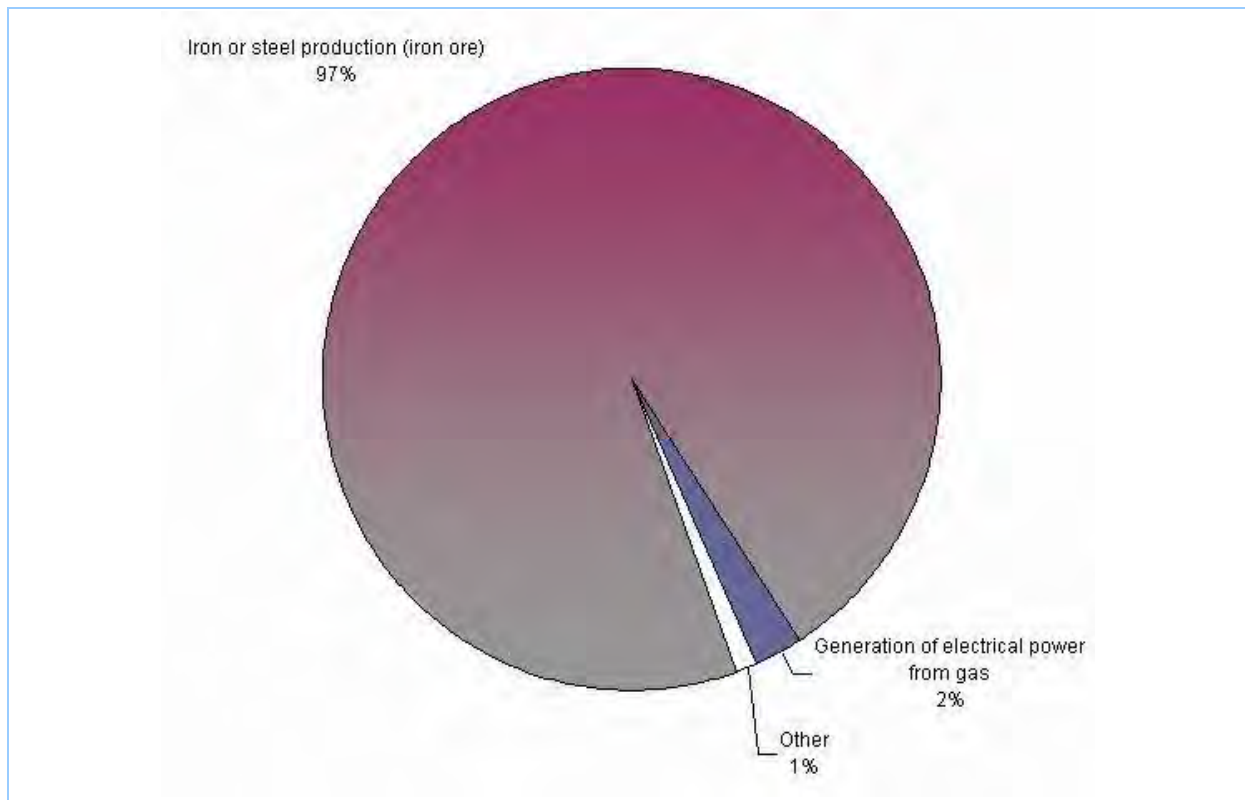


Figure 4-24: Proportion of total NO_x emissions by industrial activity type in the Wollongong region

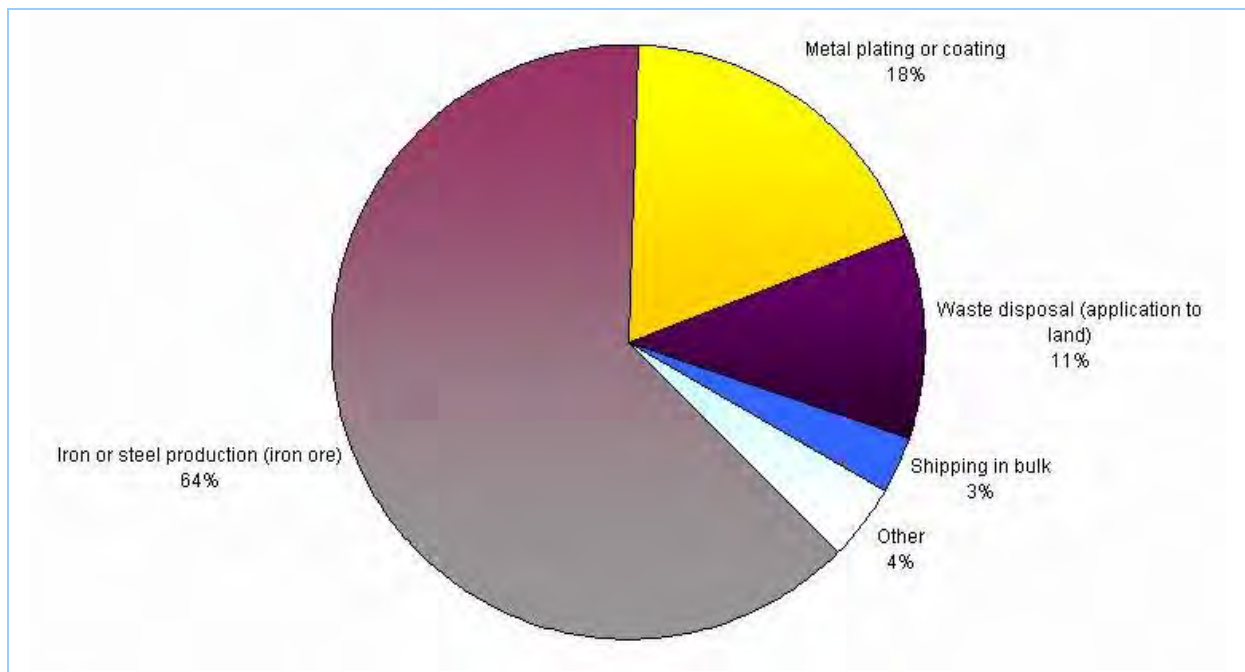


Figure 4-25: Proportion of total VOC emissions by industrial activity type in the Wollongong region

4. Results Summary

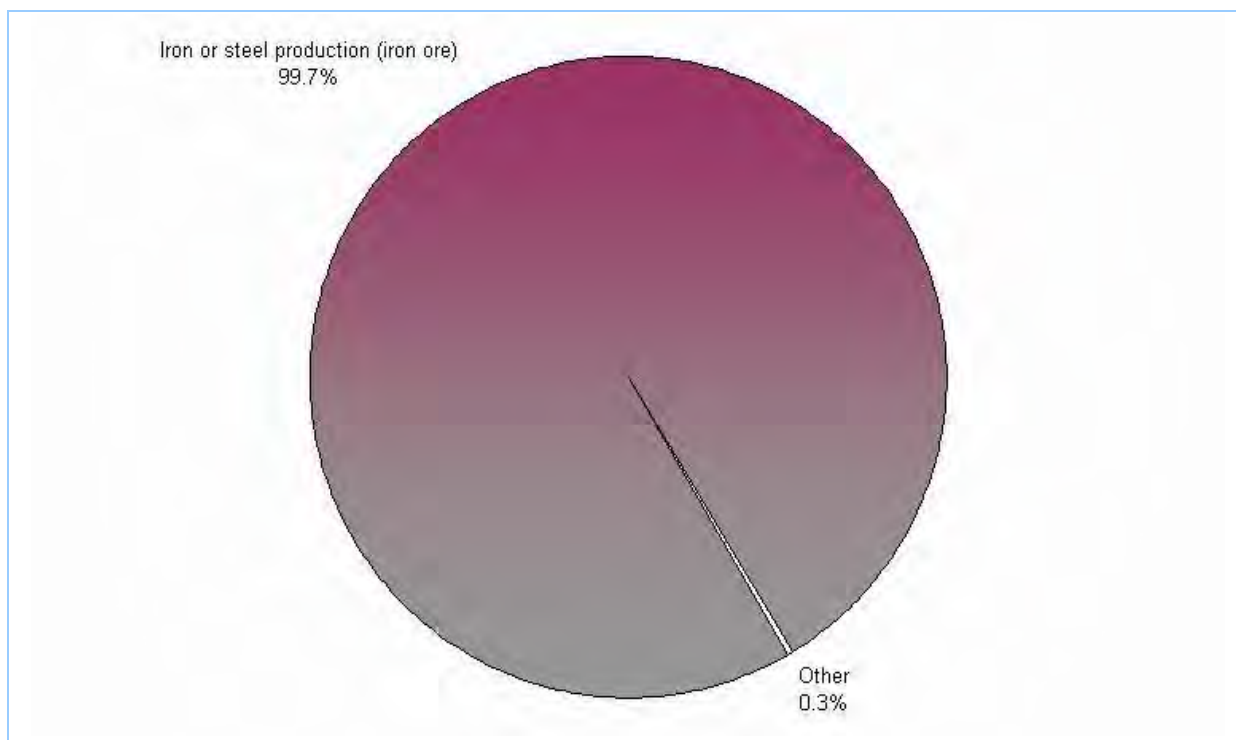


Figure 4-26: Proportion of total CO emissions by industrial activity type in the Wollongong region

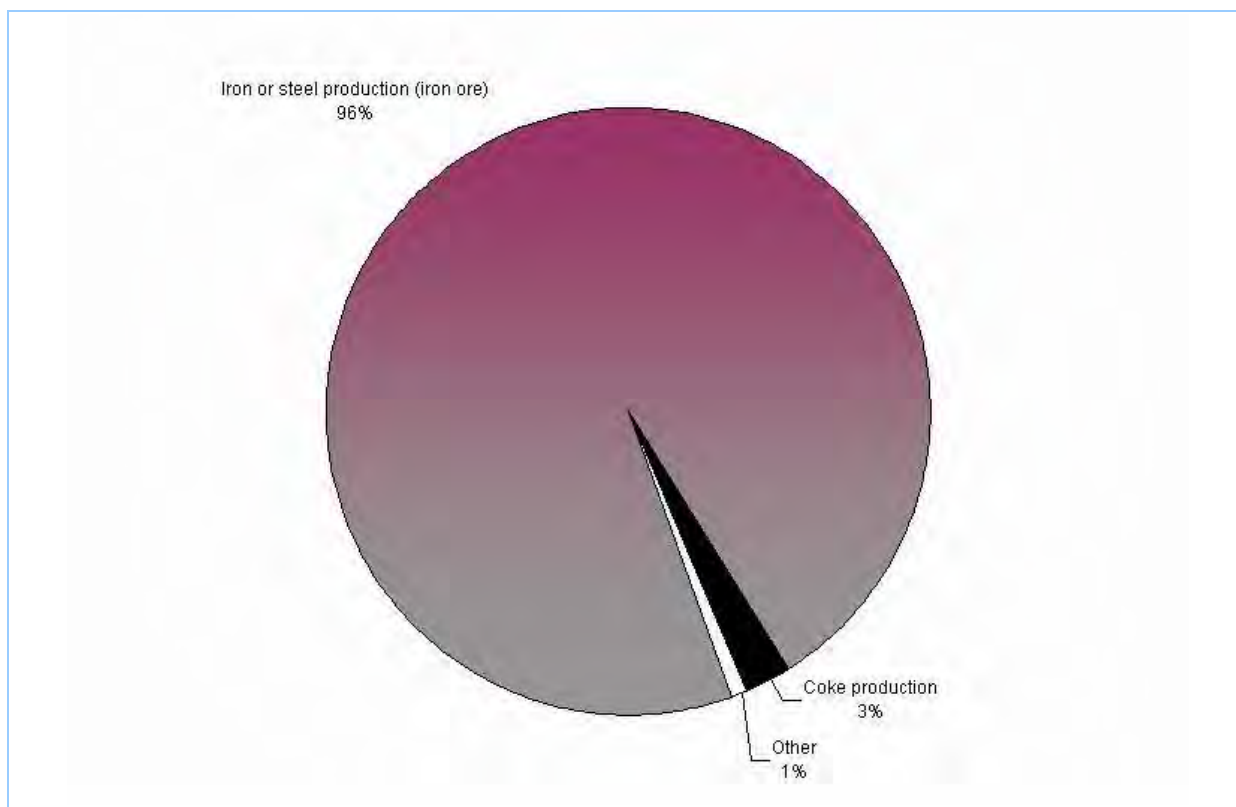


Figure 4-27: Proportion of total SO₂ emissions by industrial activity type in the Wollongong region

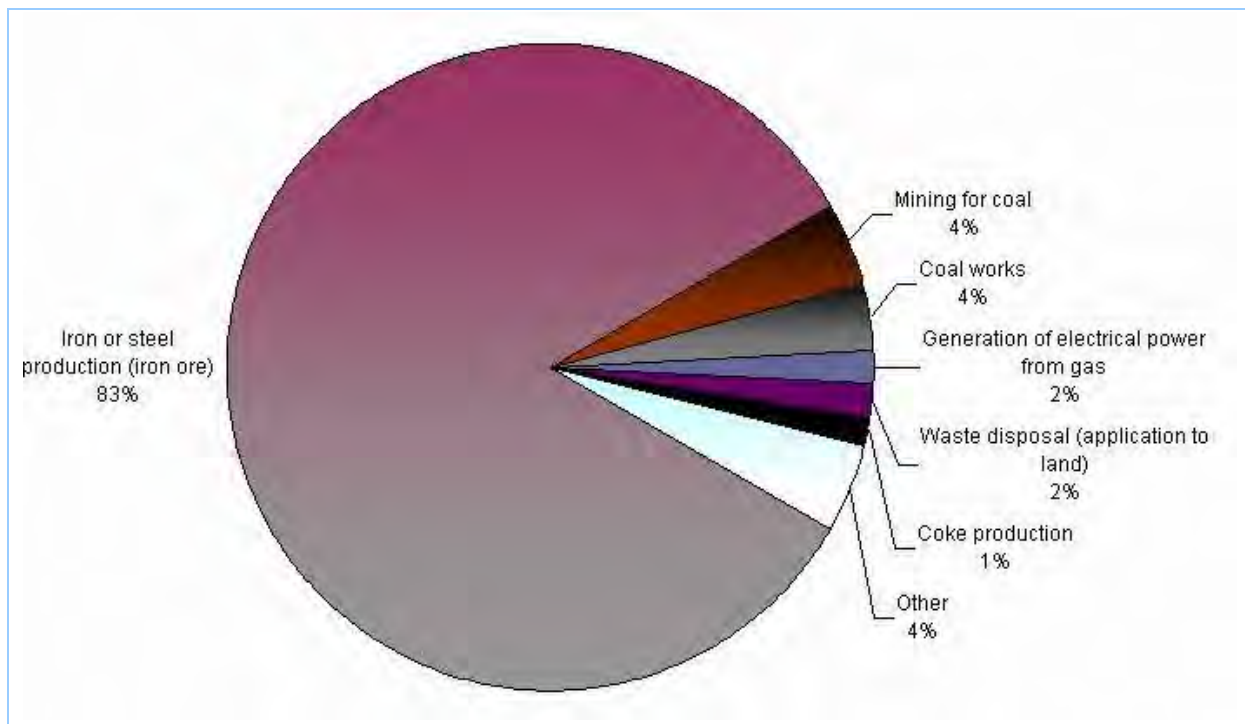


Figure 4-28: Proportion of total PM₁₀ emissions by industrial activity type in the Wollongong region

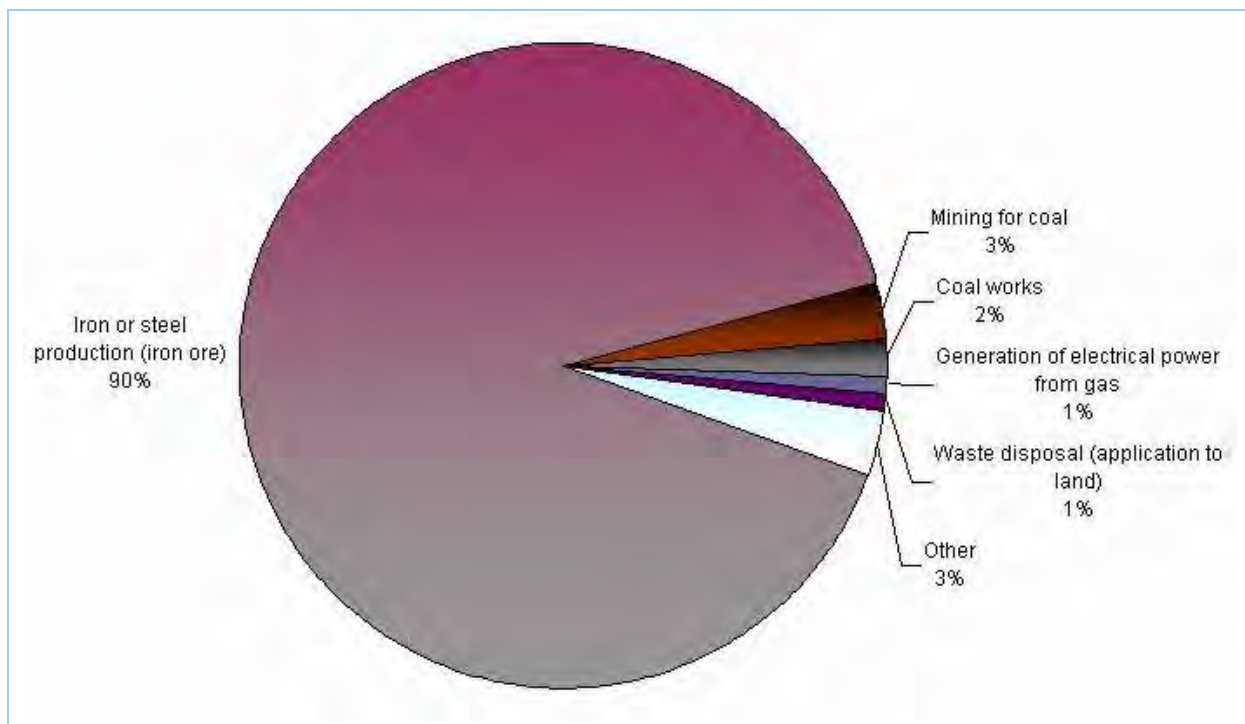


Figure 4-29: Proportion of total PM_{2.5} emissions by industrial activity type in the Wollongong region

4. Results Summary

Table 4-9 shows total estimated annual emissions (for selected substances) from each industrial source type in the Non Urban region.

Table 4-9: Total estimated annual emissions by industry source type in the Non Urban region

Activity	Emissions (tonne/year)						
	CO	NO _x	TSP	PM ₁₀	PM _{2.5}	SO ₂	VOC
Aluminium production (alumina)	13,800	164	380	205	135	3,740	4.4
Aluminium production (scrap metal)	22.5	10.8	21.8	14.3	10.2	5.08	0.951
Animal accommodation	0.00922	0.0428	21.9	10.5	1.35	0.00005	0.0287
Bird accommodation	0.574	1.15	187	81	17.6	0.00837	0.0696
Bitumen mixing	8.94	2.12	15.5	12.3	9.75	1.23	1.94
Boat construction/maintenance (general)	0	0	0	0	0	0	1.56
Boat mooring and storage	0	0	0.39	0.0748	0.0181	0	0.444
Cement or lime handling	0	0	13.7	5.71	0.856	0	0
Cement or lime production	1,620	4,210	1,180	637	544	371	5.56
Ceramics production	168	68.8	390	174	115	76.5	3.02
Chemical production	0.758	2.31	36.9	12.6	2.91	0.0639	12.5
Coal works	0.00031	0.00145	478	173	21.5	0	0.261
Composting	0	0	46.5	20	3.58	0	220
Concrete works	3.1	3.7	61.5	19.1	3.45	0.0193	2.93
Crushing, grinding or separating	0.417	0.496	65.5	19.4	3.38	0.00259	0.0275
Explosives production	0.173	0.177	0.834	0.199	0.0315	0.00017	0.161
General agricultural processing	4.97	5.91	11.4	5.69	1.92	0.0309	0.358
General animal products production	2.42	3.12	1.09	0.386	0.26	0.0176	0.25
General chemicals storage	0.0175	0.0208	0.025	0.00608	0.00267	0.00011	0.00114
Generation of electrical power from coal	7530	166000	8280	6520	3340	251000	904
Generation of electrical power from gas	40.3	47.1	0.0098	0.0098	0.0098	0.0747	15
Generation of electricity not coal or gas	0.424	0.797	0.0509	0.0497	0.0491	0.0256	0.0426
Helicopter-related activity	0	0	0	0	0	0	0.00013
Inert waste landfilling	1.61	0	19	9.15	1.8	0	18.3
Land-based extractive activity	16.7	52.5	8570	2300	463	0.227	6.1
Metal plating or coating	0.00296	0.00352	0.431	0.21	0.0432	0.00002	222
Mining for coal	4,500	2,310	139,000	50,200	8,470	495	177
Mining for minerals	0	0	1330	441	79	0	0.0591
Miscellaneous licensed discharges to waters (at any time)	0	0	0	0	0	0	0.019
Non-thermal treatment of	0.325	0.568	0.885	0.384	0.293	0.996	4.4

2008 Calendar Year Industrial Emissions: Results

4. Results Summary

Activity	Emissions (tonne/year)						
	CO	NO _x	TSP	PM ₁₀	PM _{2.5}	SO ₂	VOC
waste							
Other land-based extraction	0	0	124	37	4.19	0	0.00083
Pesticides and related products production	0	0	0.478	0.107	0.0406	0	0.0002
Petroleum products and fuel production	2.88	8.52	1.53	0.69	0.655	7.62	2.53
Pharmaceutical and veterinary products production	0	0	0.0007	0.00013	0.00003	0	0
Pig accommodation	0	0	0	0	0	0	0.0179
Recovery of waste	0.614	0.731	1.7	0.447	0.17	0.00382	5.11
Recovery of waste oil	2.08	8.2	0.229	0.216	0.212	6.11	0.337
Rendering or fat extraction	4.05	7.1	0.69	0.453	0.406	0.0252	0.365
Sewage treatment - large plants	0.507	0.471	1.81	0.48	0.218	0.00308	21.2
Sewage treatment - small plants	1.19	1.29	8.82	2	0.655	0.0083	29.8
Slaughtering or processing of animals	0	0	0.298	0.085	0.0085	0	0.00394
Solid waste landfilling	1.91	0	100	42.1	8.05	0	44.8
Waste disposal (application to land)	7.19	0	446	177	35.5	0	120
Waste storage	0	0	0	0	0	0	0.00093
Water-based extractive activity	0	0	22.1	9.36	1.66	0	0.109
Wood or timber milling or processing	30.8	1.6	13.8	7.81	2.92	0.0075	0.165
Grand Total	27,800	173,000	161,000	61,200	13,300	256,000	1,830

4. Results Summary

The proportion of total estimated annual emissions (for selected substances) from each industrial source type in the Non Urban region are shown in Figure 4-30 to Figure 4-35.

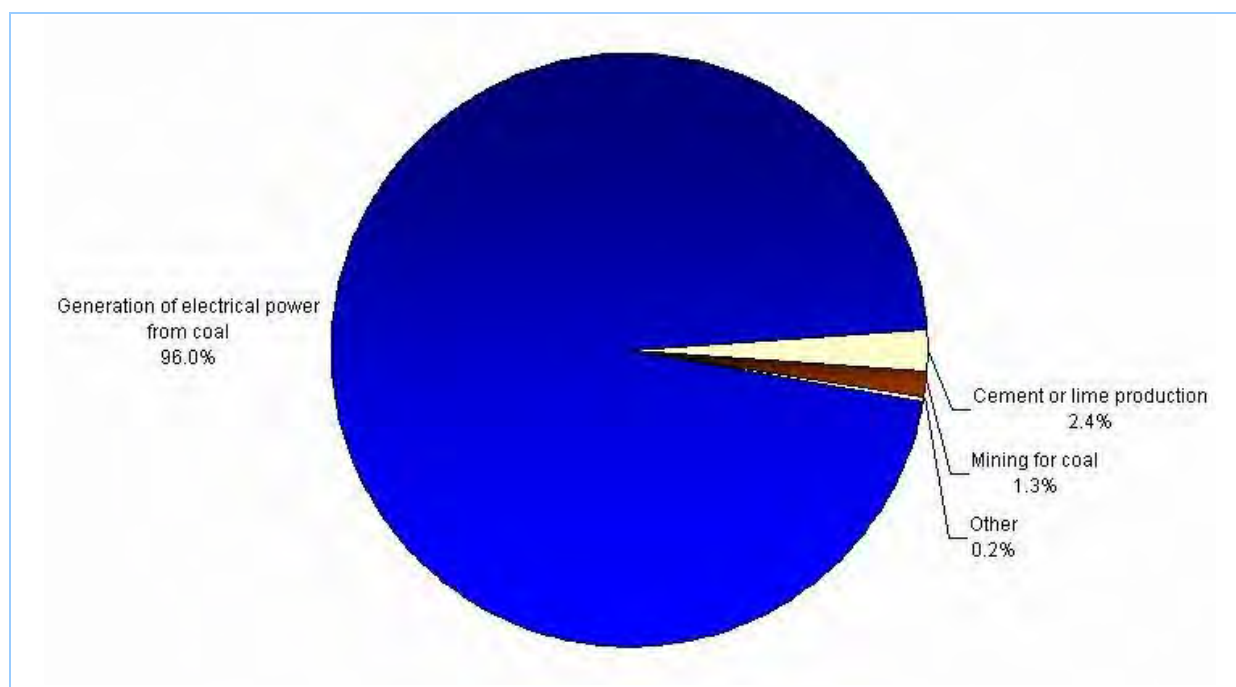


Figure 4-30: Proportion of total NO_x emissions by industrial activity type in the Non Urban region

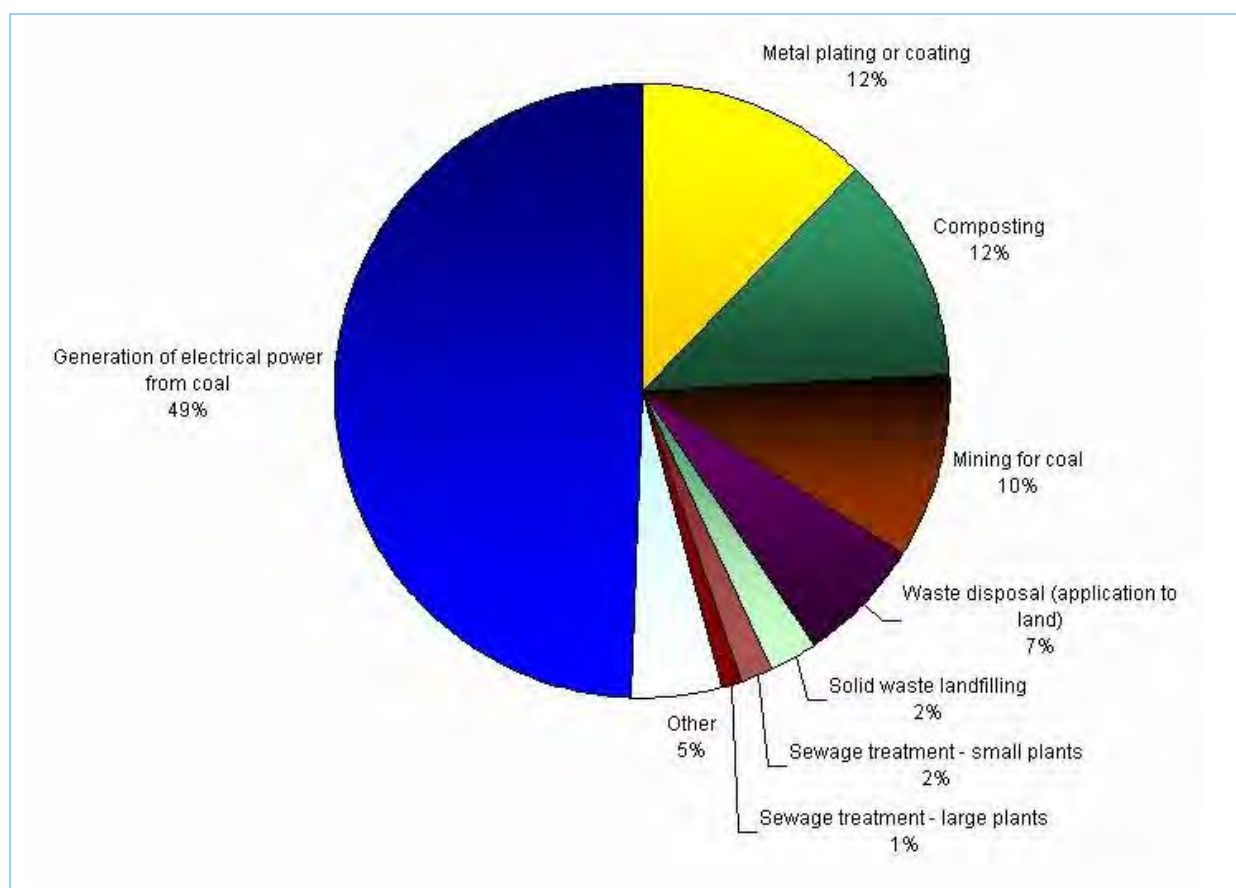


Figure 4-31: Proportion of total VOC emissions by industrial activity type in the Non Urban region

4. Results Summary

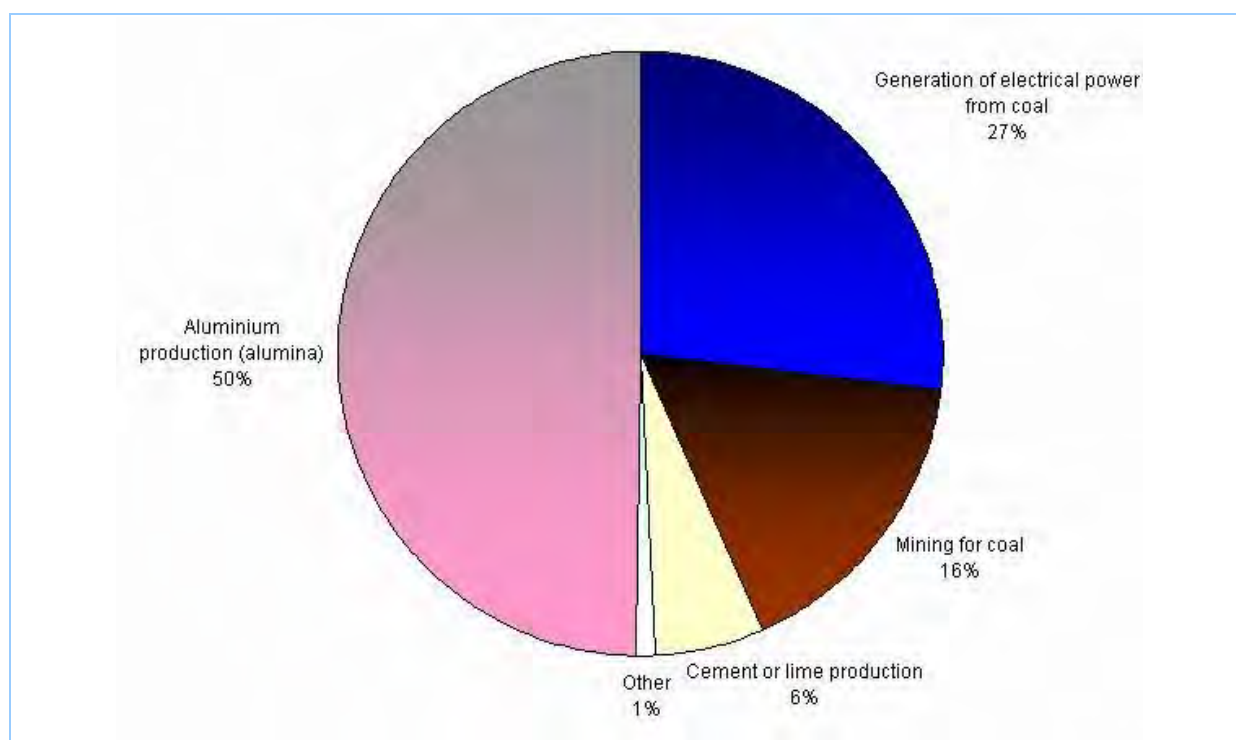


Figure 4-32: Proportion of total CO emissions by industrial activity type in the Non Urban region

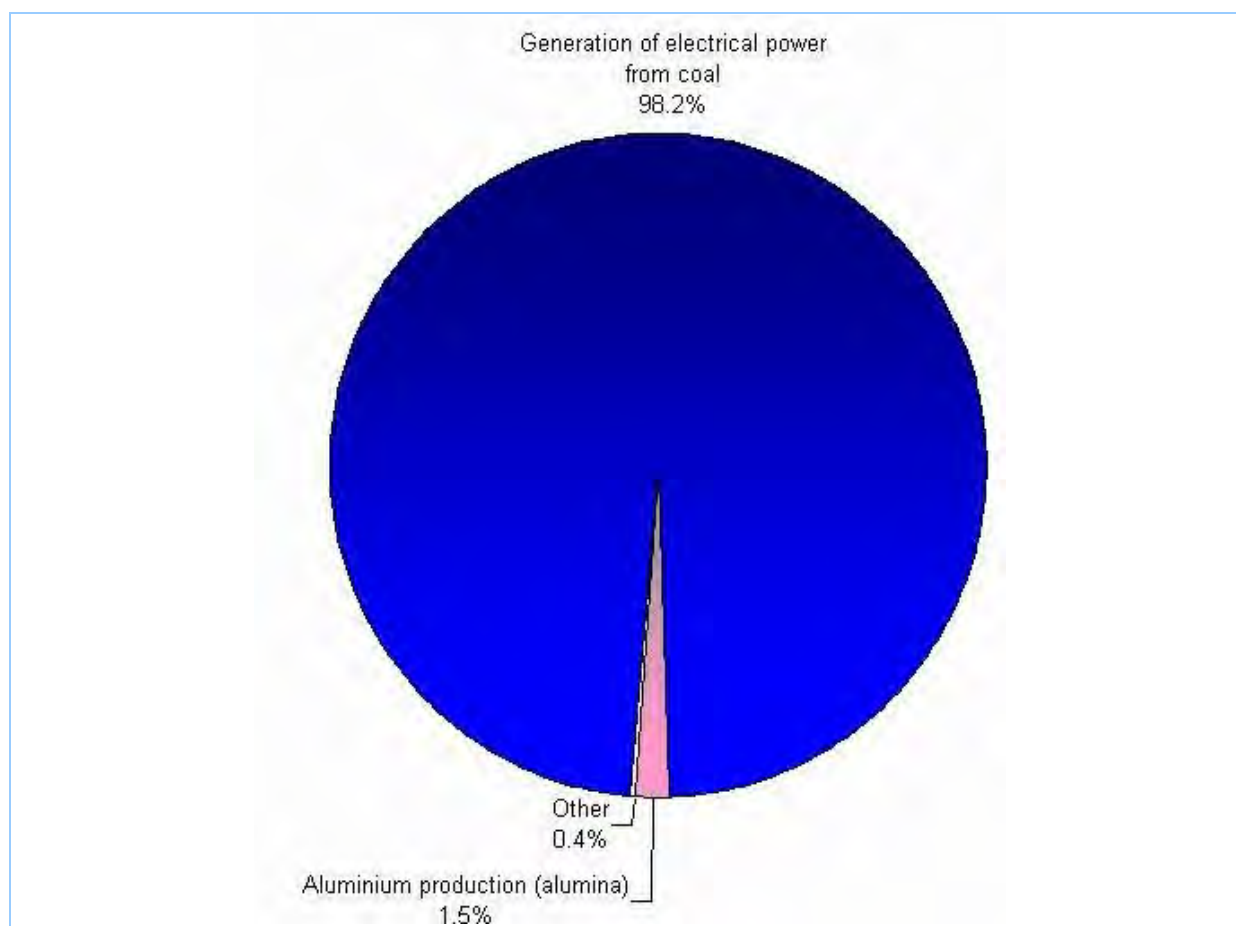


Figure 4-33: Proportion of total SO₂ emissions by industrial activity type in the Non Urban region

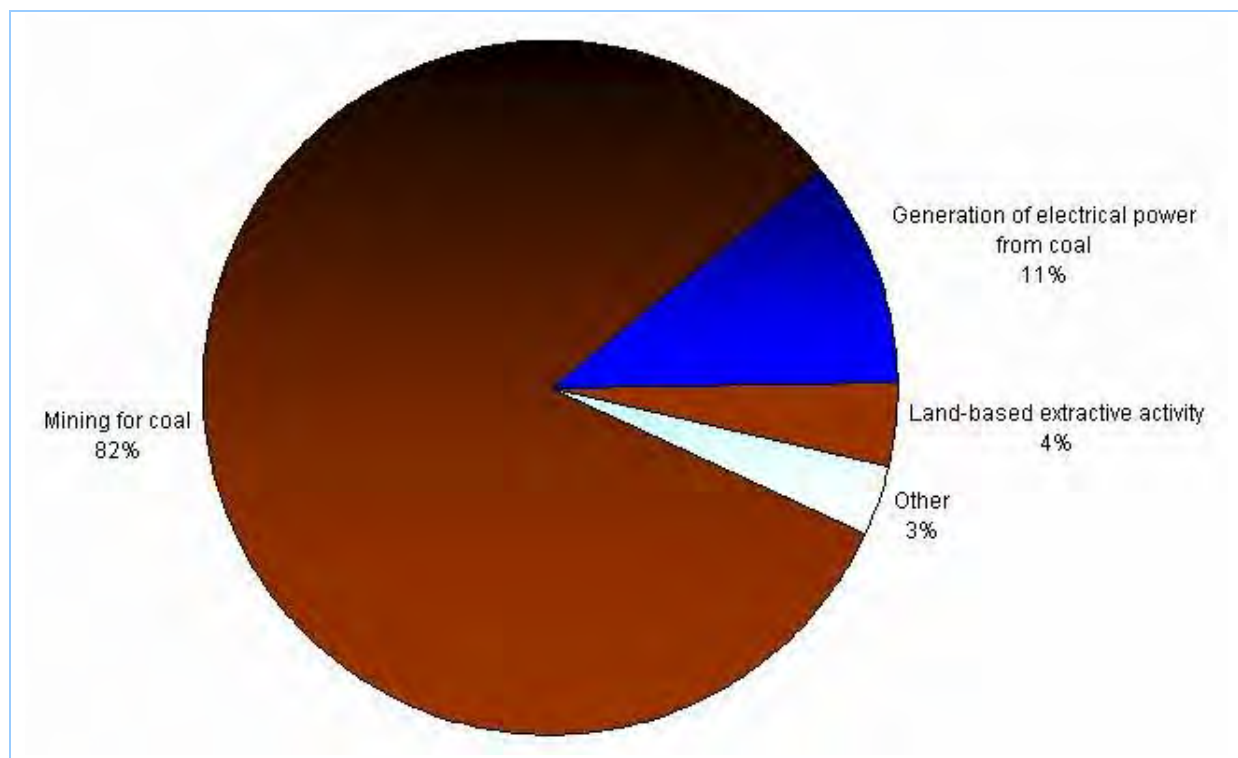


Figure 4-34: Proportion of total PM₁₀ emissions by industrial activity type in the Non Urban region

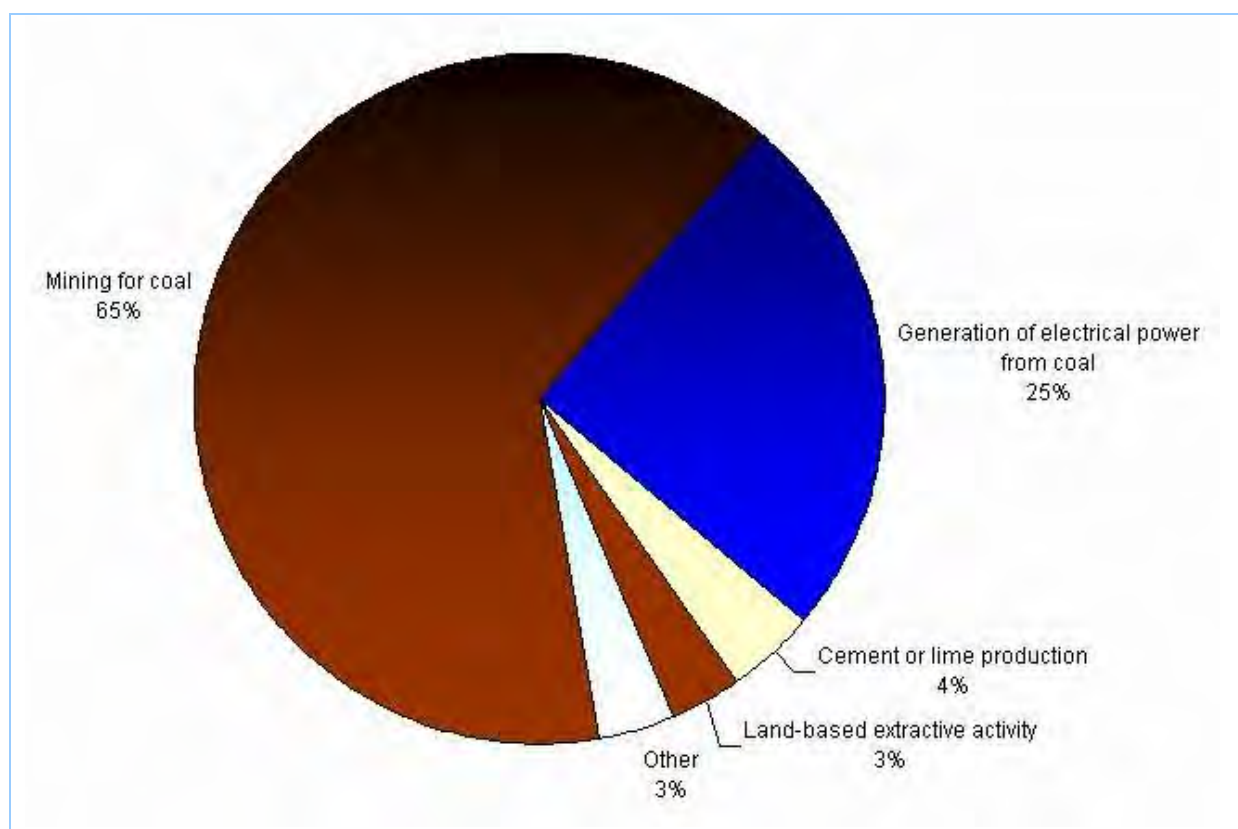


Figure 4-35: Proportion of total PM_{2.5} emissions by industrial activity type in the Non Urban region

5 DATA QUALITY ASSURANCE

Emissions estimated as part of the 2008 air emissions inventory were cross-checked against reported NPI emission estimates (for those facilities that trigger NPI reporting). Emission estimation cross-checks were performed for the criteria pollutants (PM₁₀, SO₂, NO_x, VOC and CO).

Facilities were permitted to report activity data on returned questionnaires corresponding to any of the following annual periods:

- 2007/2008 financial period;
- 2008 calendar year; or
- 2008/2009 financial period.

Furthermore, facilities that report to load based licensing (LBL) on a different annual period (e.g. May 2008 to April 2009) were also permitted to complete the questionnaire so that data requested were consistent with other existing reporting frameworks.

Therefore, when comparing emission estimates performed for the emissions inventory to reported NPI emissions, the closest match has been taken between the inventory time periods.

Comparisons are shown for all five criteria pollutants (PM₁₀, SO₂, NO_x, VOC and CO) in the following charts (Figure 5-1 to Figure 5-12). Comparisons are presented as a bar chart for the top emitters of each pollutant and as a scatter plot comparing NPI emission estimates (y-axis) versus inventory estimates (x-axis) for each pollutant (all facilities that report to the NPI included).

On each scatter plot, the equation of the line is provided and the R² linear regression statistic is shown. An exact match between NPI emission estimates and estimates in the inventory would provide an equation of $y = x$ (NPI = EI) and an R² of 1.0000, indicating that the estimates performed for the different programs are the same. The results of the statistical analysis are summarised in Table 5-1.

Table 5-1: Summary of quality assurance statistics for criteria pollutants

Pollutant	Linear Regression Equation	R ²
PM ₁₀	NPI=1.0121×EI	0.9745
SO ₂	NPI=1.0023×EI	0.9999
NO _x	NPI=EI	0.9994
VOC	NPI=0.9222×EI	0.9169
CO	NPI=0.9998×EI	1.0000

a NPI: National Pollutant Inventory
 b EI: Emissions inventory

The results indicate that the emissions estimated as part of the emissions inventory are generally consistent with emissions reported by industry to the NPI. This indicates that emission estimates included in the industrial inventory are generally consistent with the current understanding of air emissions from each industrial facility. Discrepancies in emission estimates are more apparent when focusing on relatively low emitters due to differences in reporting frameworks. For example, vehicle exhaust emissions from industrial facilities are included in the off-road mobile emissions inventory and not the industrial emissions inventory. Therefore, as emissions from vehicles become a larger

5. Data Quality Assurance

proportion of a facility's emissions, the greater the discrepancy between emissions included in the industrial emissions inventory and the NPI.

A guide to quality assurance charts presented in this section is provided as Table 5-2.

Table 5-2: Guide to quality assurance charts

Pollutant	Chart	Details
PM ₁₀	Bar chart (Figure 5-1)	<ul style="list-style-type: none"> - Largest 20 facilities of PM₁₀ emissions in the GMR. - Largest 20 facilities represent 85% of industrial PM₁₀ emissions in the GMR.
	Scatter plot (Figure 5-2)	<ul style="list-style-type: none"> - Includes all NPI reporters of PM₁₀ in the GMR and presents a comparison between reported emissions to the NPI and emissions included in the inventory
SO ₂	Bar chart (Figure 5-3)	<ul style="list-style-type: none"> - Largest 14 facilities of SO₂ emissions in the GMR. - Largest 14 facilities represent >90% of industrial SO₂ emissions in the GMR.
	Scatter plot (Figure 5-4)	<ul style="list-style-type: none"> - Includes all NPI reporters of SO₂ in the GMR and presents a comparison between reported emissions to the NPI and emissions included in the inventory
NO _x	Bar chart (Figure 5-5)	<ul style="list-style-type: none"> - Largest 14 facilities of NO_x emissions in the GMR. - Largest 14 facilities represent > 90% of industrial NO_x emissions in the GMR
	Scatter plot (Figure 5-6)	<ul style="list-style-type: none"> - Includes all NPI reporters of NO_x in the GMR and presents a comparison between reported emissions to the NPI and emissions included in the inventory
VOC	Bar chart (Figure 5-7)	<ul style="list-style-type: none"> - Largest 26 facilities of VOC emissions in the GMR - Largest 26 facilities represent > 70% of industrial VOC emissions in the GMR
	Scatter plot (Figure 5-8)	<ul style="list-style-type: none"> - Includes all NPI reporters of VOC in the GMR and presents a comparison between reported emissions to the NPI and emissions included in the inventory
CO	Bar chart (Figure 5-9)	<ul style="list-style-type: none"> - Largest three facilities of CO emissions in the GMR (i.e. Port Kembla Steelworks, Tomago Aluminium and Hydro Aluminium Kurri Kurri Smelters) - Largest three facilities represent >95% of industrial CO emissions in the GMR
	Bar chart 2 (Figure 5-10)	<ul style="list-style-type: none"> - Largest 21 facilities of CO emissions in the GMR (excluding Port Kembla Steelworks, Tomago Aluminium and Hydro Aluminium Kurri Kurri Smelters) - Largest 21 facilities of CO emissions excluding metal production (primary) facilities represent ~5% of industrial CO emissions in the GMR
	Scatter plot (Figure 5-11)	<ul style="list-style-type: none"> - Includes all NPI reporters of CO in the GMR and presents a comparison between reported emissions to the NPI and emissions included in the inventory
	Scatter plot (Figure 5-12)	<ul style="list-style-type: none"> - Includes all NPI reporters of CO (excluding metal production (primary) facilities) in the GMR and presents a comparison between reported emissions to the NPI and emissions included in the inventory

5. Data Quality Assurance

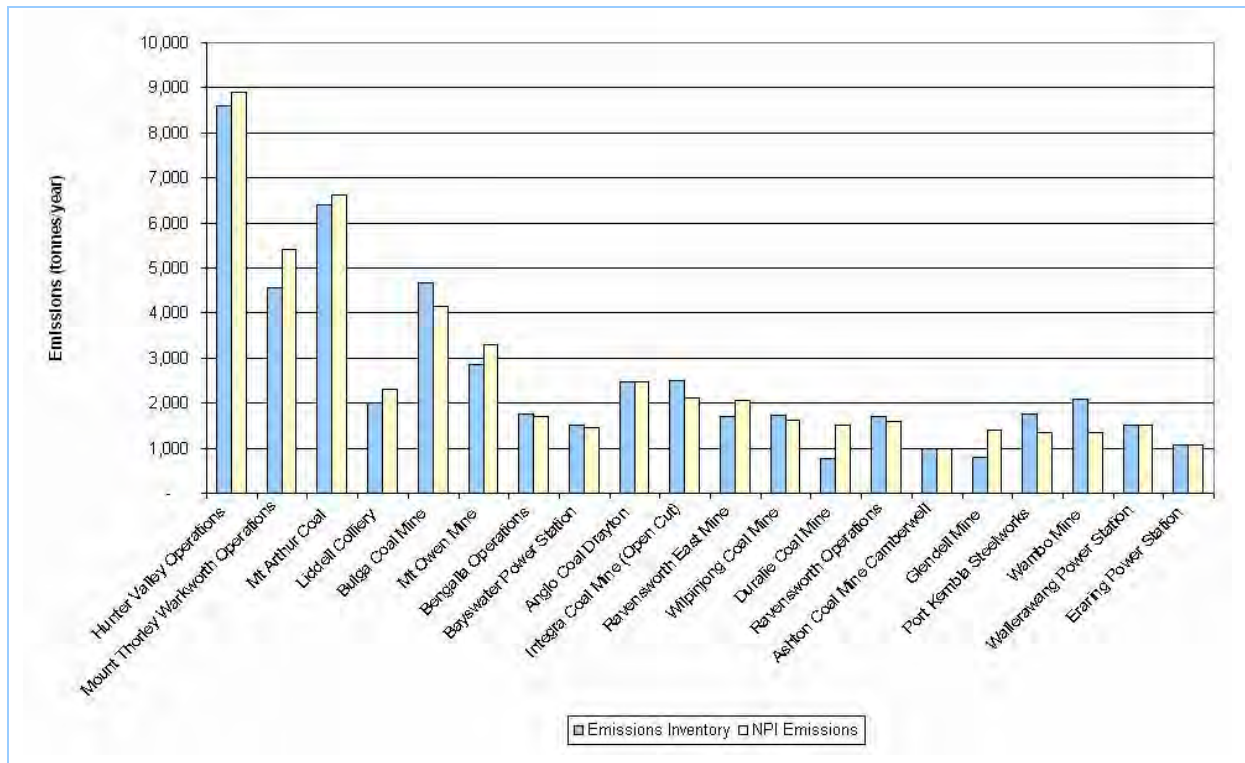


Figure 5-1: PM₁₀ top emitters - comparison of emission estimates - inventory and NPI

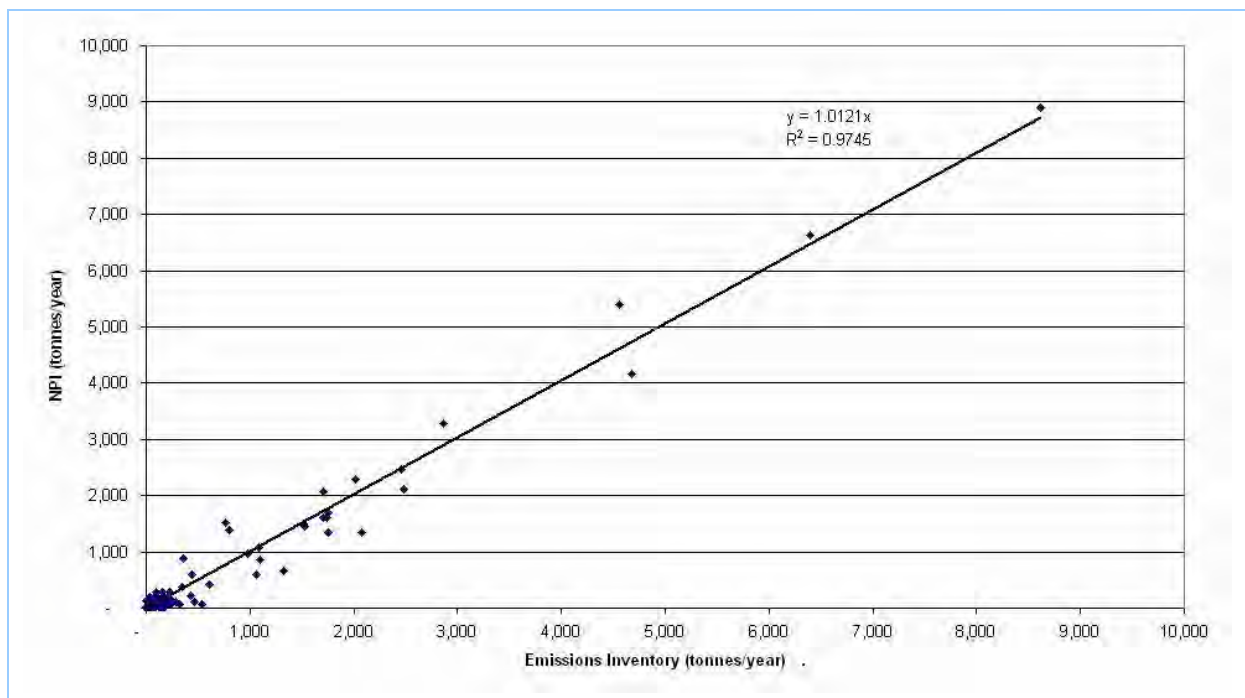


Figure 5-2: PM₁₀ - comparison of emission estimates - inventory and NPI

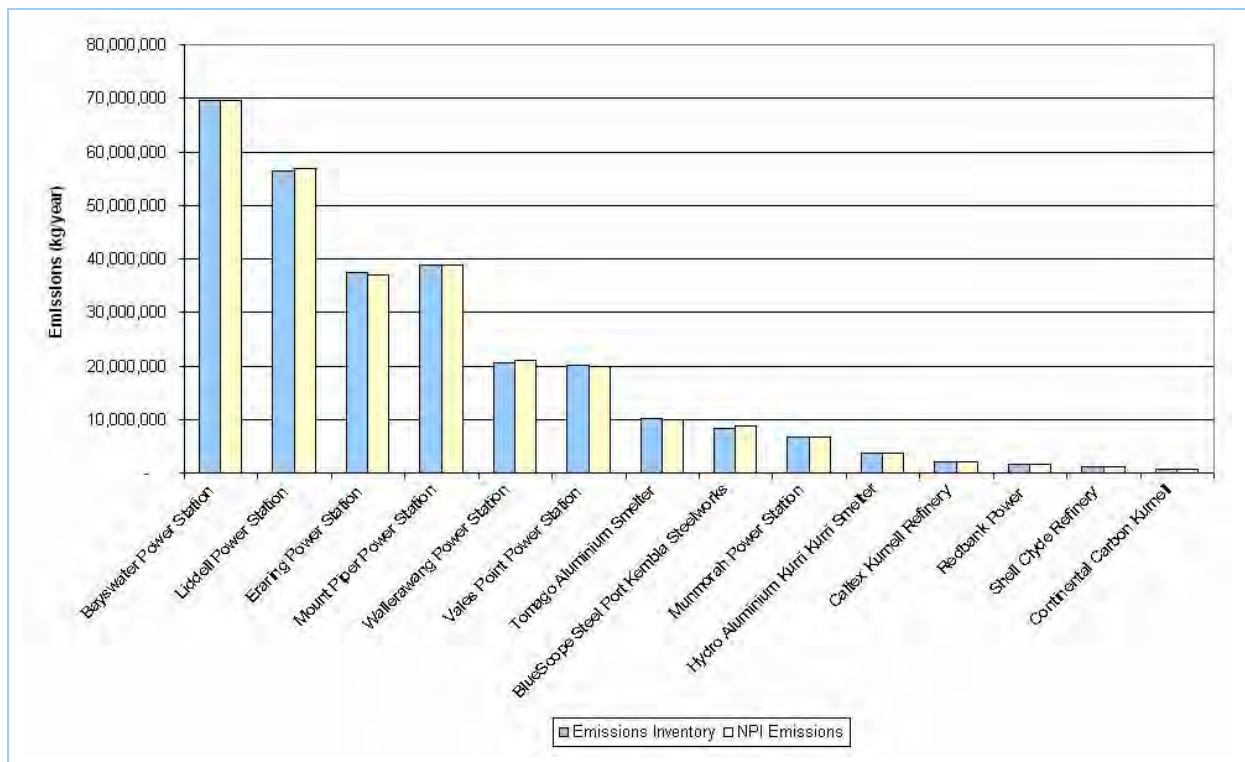


Figure 5-3: SO₂ top emitters - comparison of emission estimates - inventory and NPI

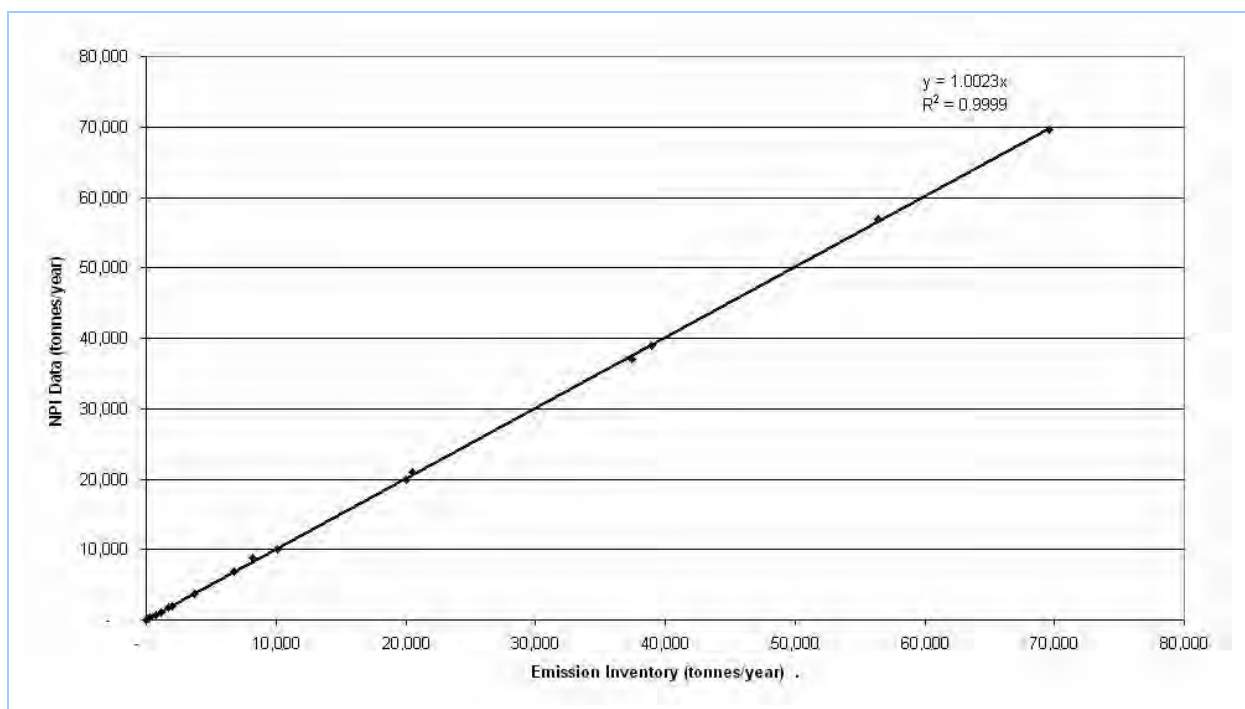


Figure 5-4: SO₂ - comparison of emission estimates - inventory and NPI

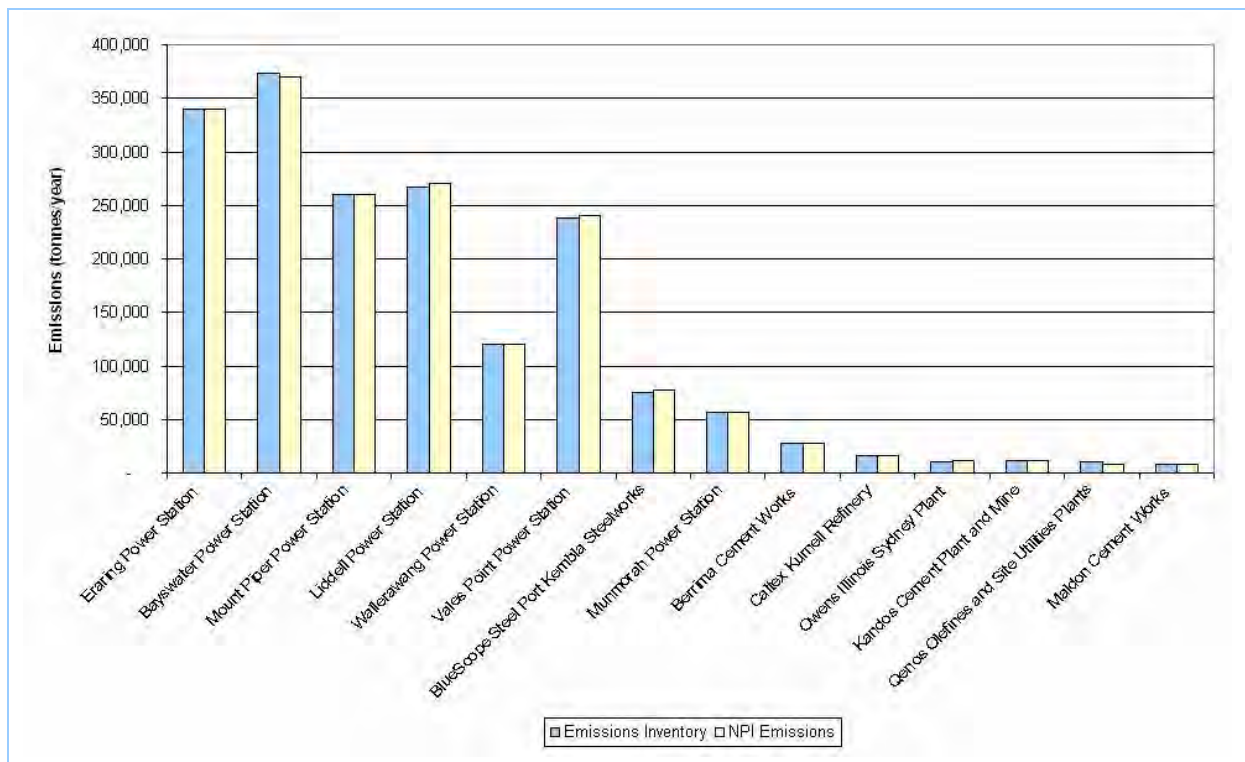


Figure 5-5: NO_x top emitters - comparison of emission estimates - inventory and NPI

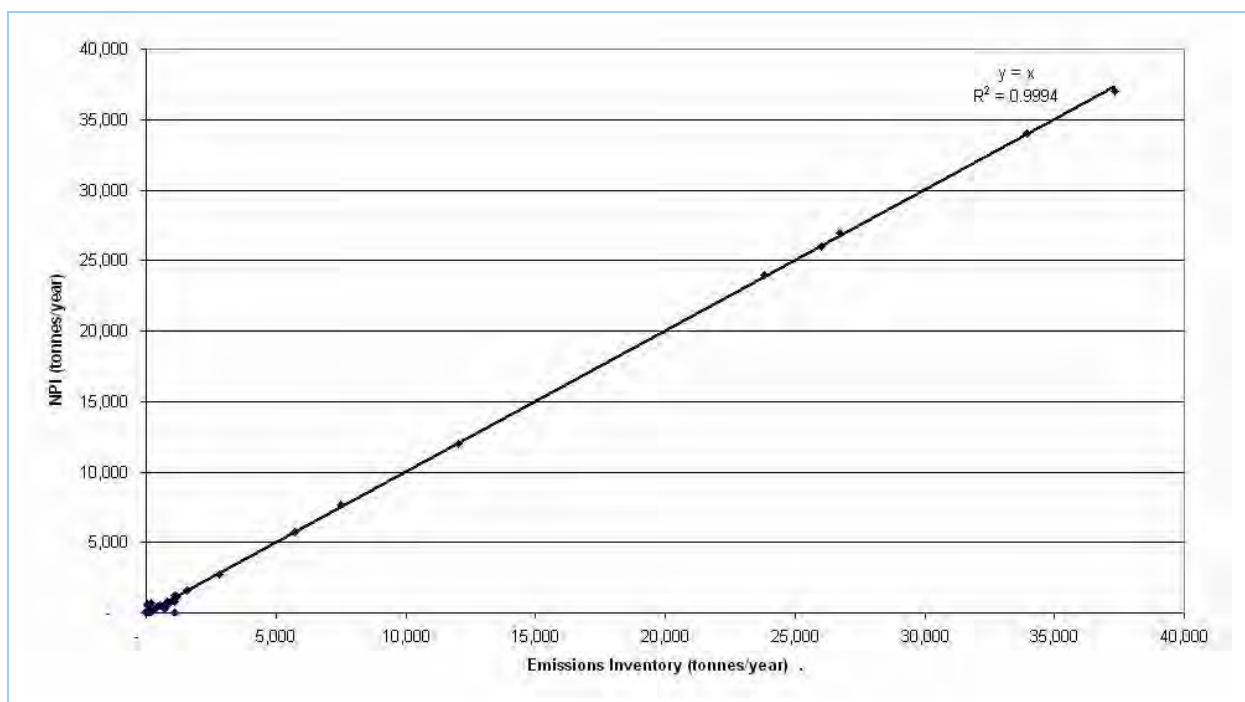


Figure 5-6: NO_x- comparison of emission estimates - inventory and NPI

5. Data Quality Assurance

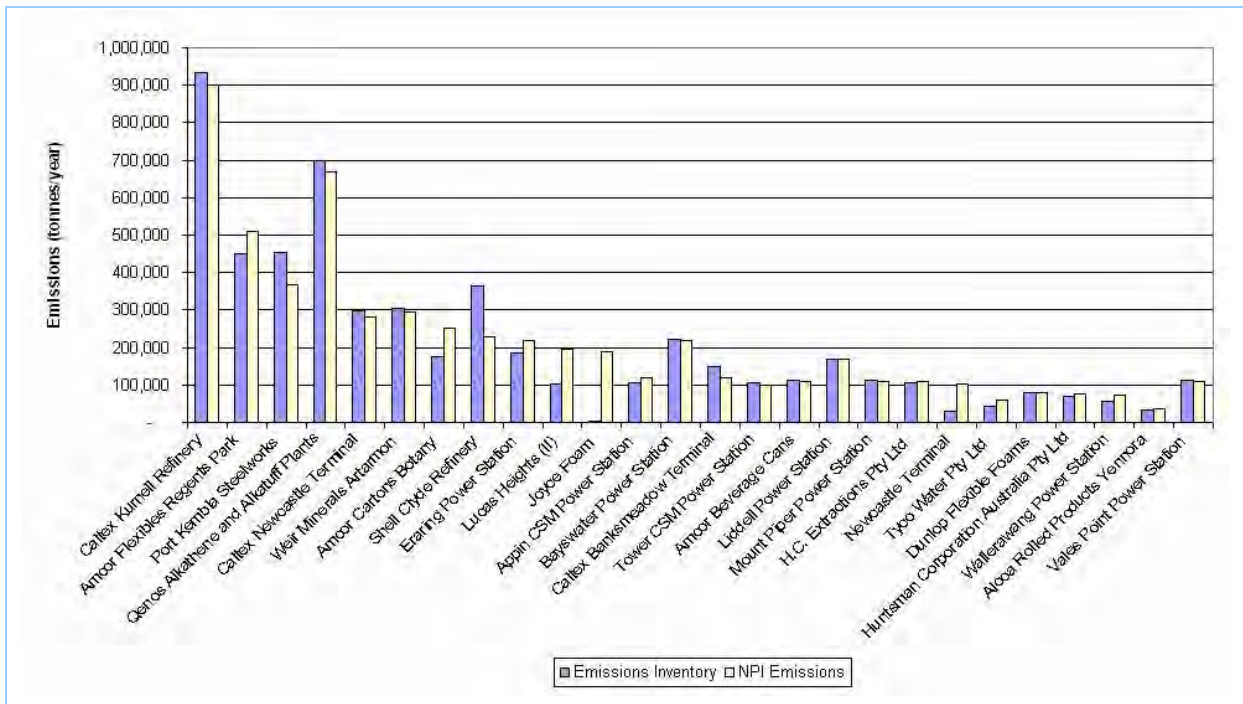


Figure 5-7: VOC top emitters - comparison of emission estimates - inventory and NPI

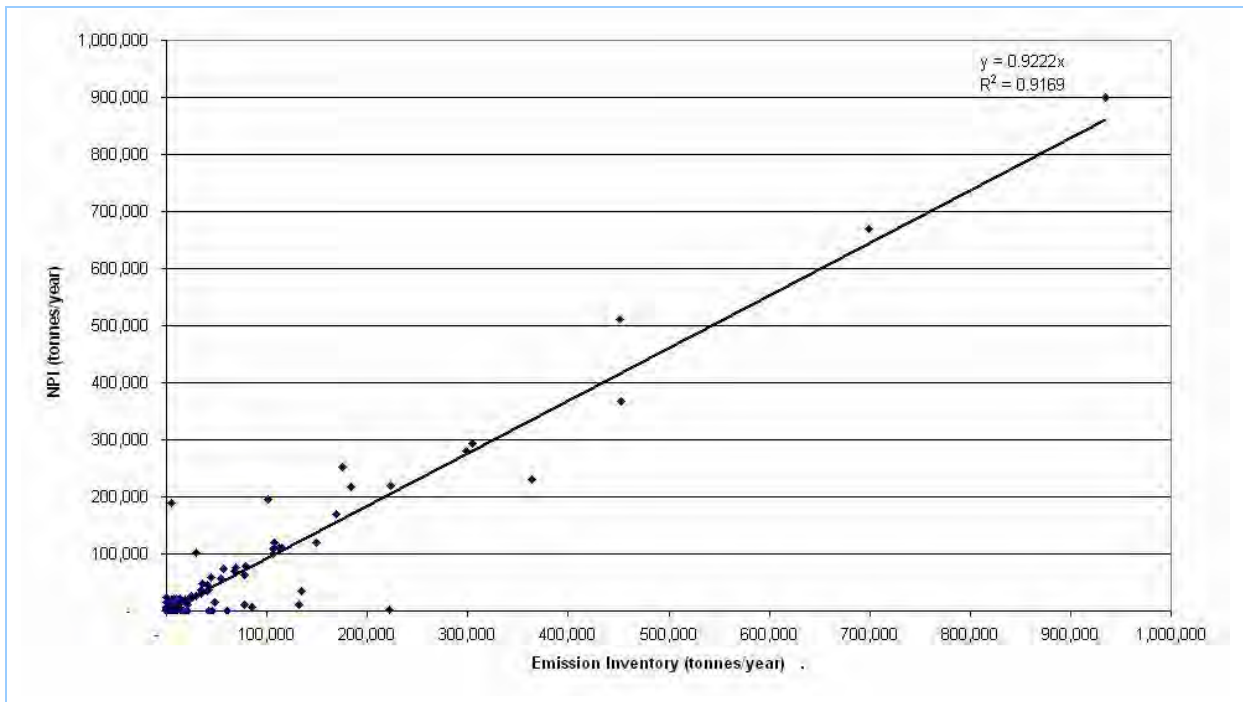


Figure 5-8: VOC- comparison of emission estimates - inventory and NPI

5. Data Quality Assurance

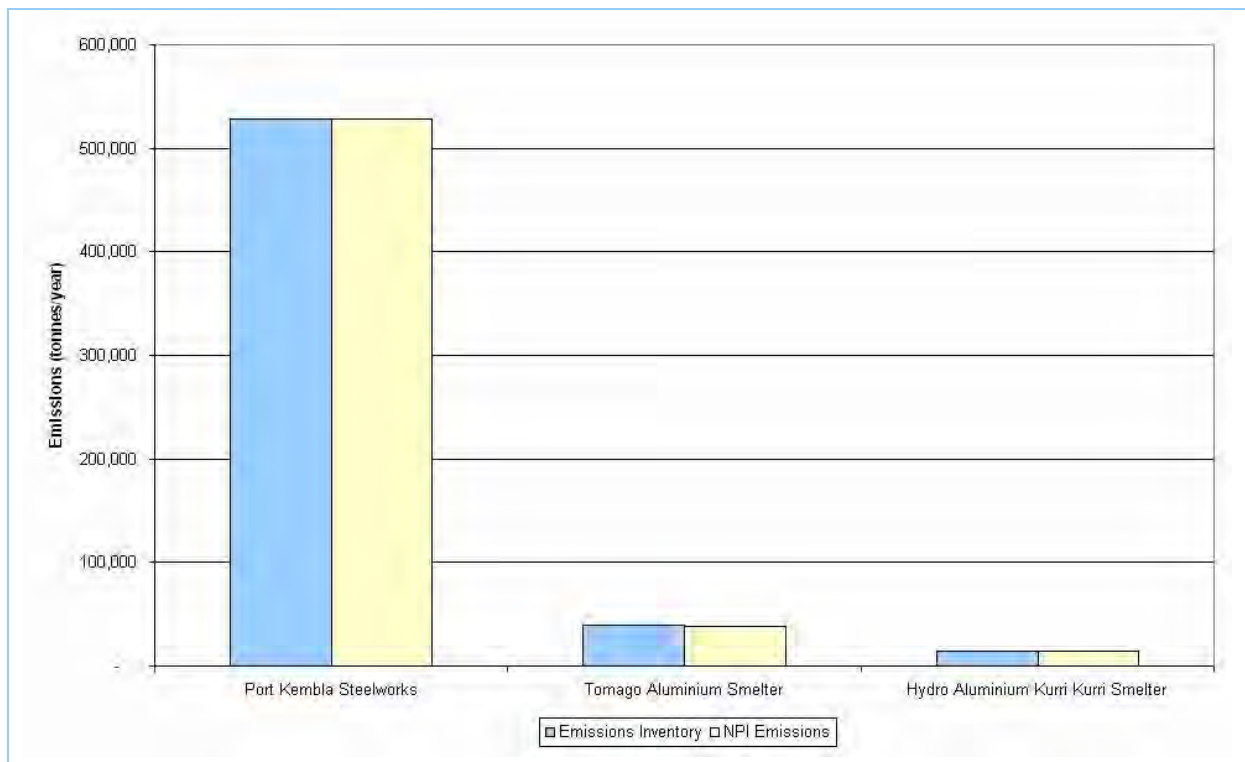


Figure 5-9: CO top emitters (1) - comparison of emission estimates - inventory and NPI

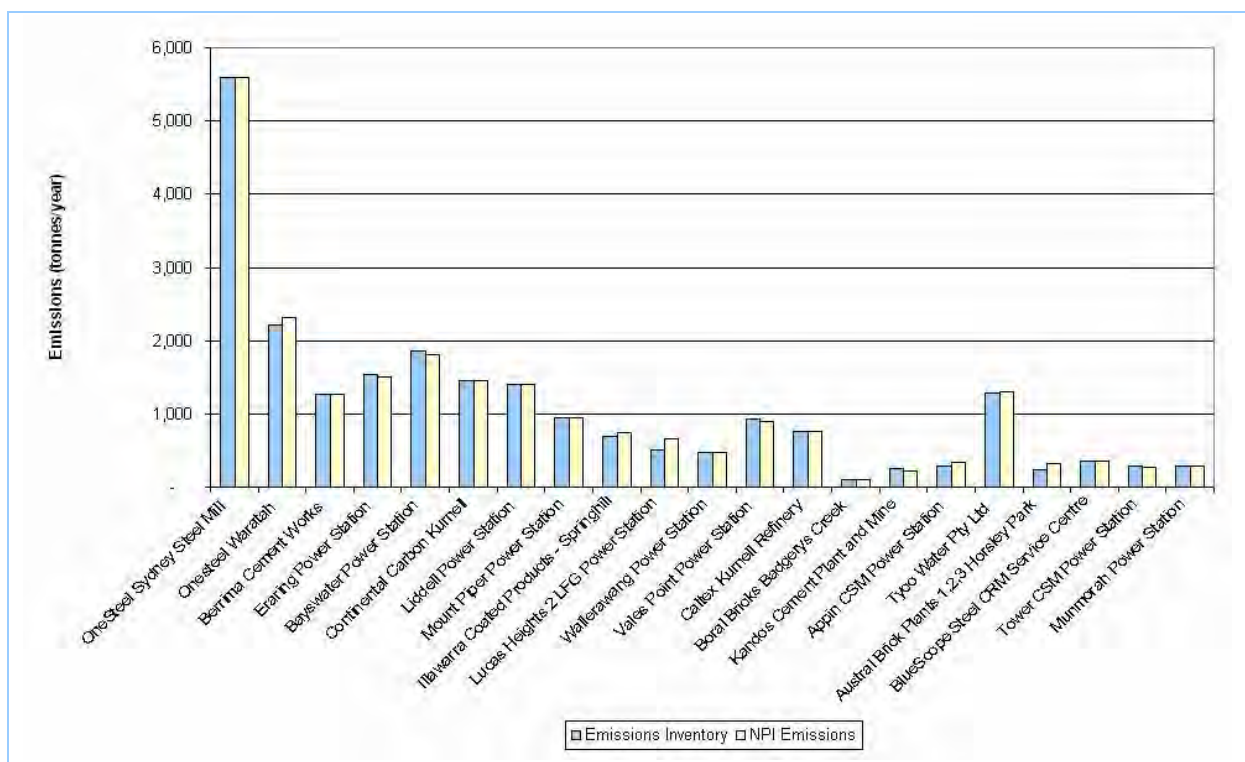


Figure 5-10: CO top emitters (2) - comparison of emission estimates - inventory and NPI

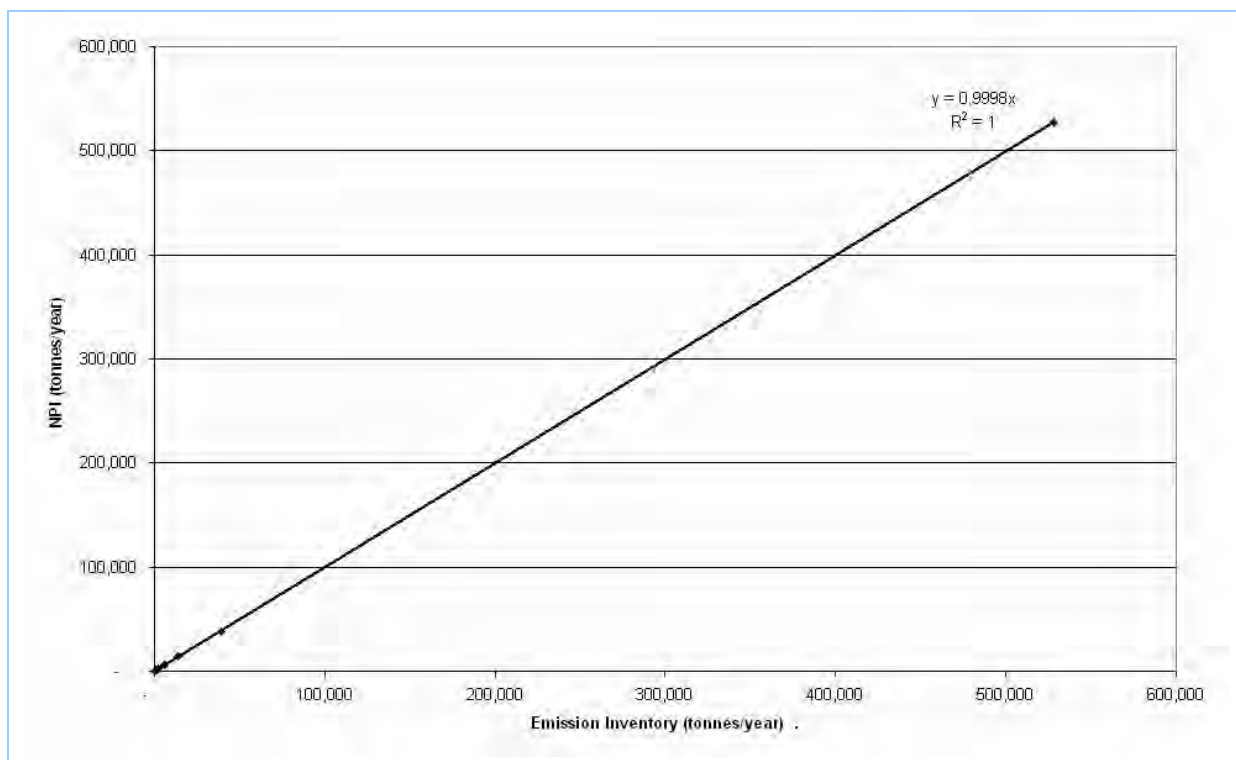


Figure 5-11: CO (1) - comparison of emission estimates - inventory and NPI

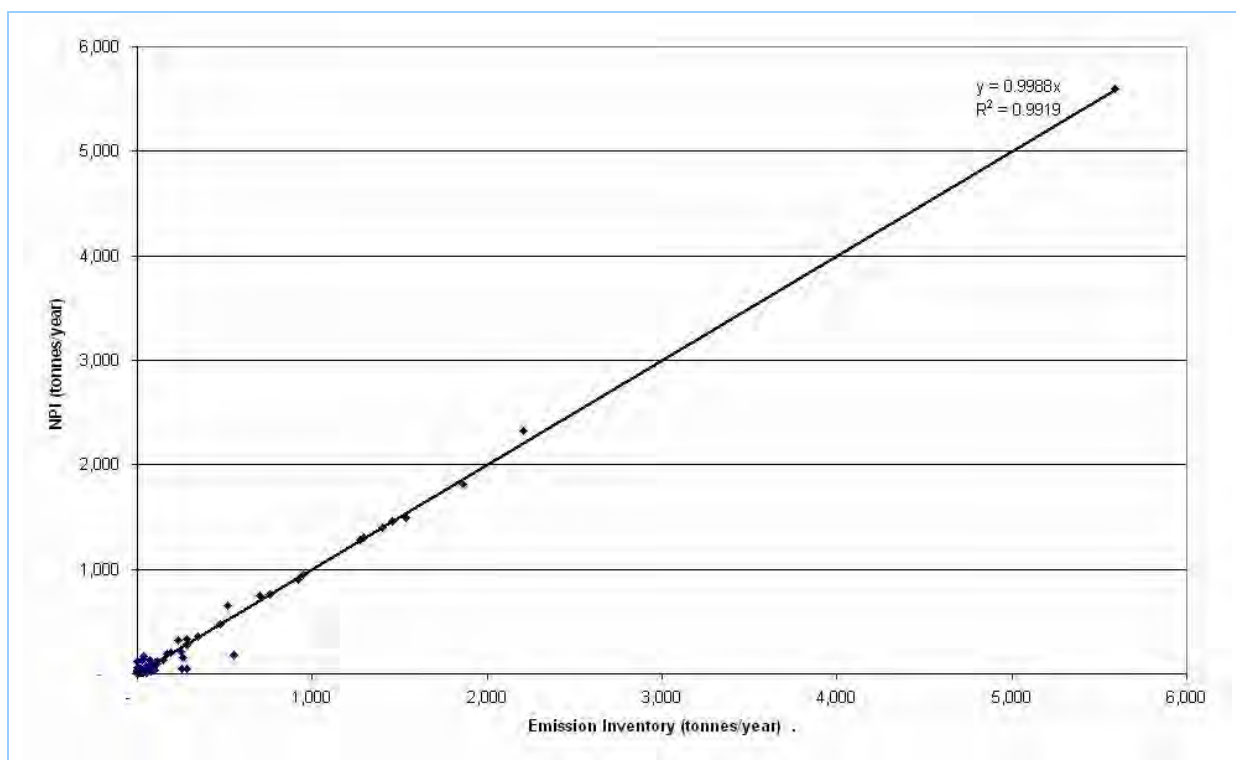


Figure 5-12: CO (2) - comparison of emission estimates - inventory and NPI

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