32 Air quality

32.1 Introduction

This chapter considers the potential local and regional air quality impacts and the anticipated greenhouse gas emissions associated with the long term development of the proposed airport. It builds on the consideration of potential air quality impacts of the Stage 1 development presented in Chapter 12 (Volume 2a) and is based on technical assessments of local air quality and greenhouse gas emissions (see Appendix F1 (Volume 4)) and regional air quality (see Appendix F2 (Volume 4)).

Local air quality is concerned with the emission of pollutants directly from activities associated with the proposed airport (primary emissions). Regional air quality, on the other hand, considers the formation of ozone (O^3) through photochemical reactions involving primary emissions from the proposed airport.

Both assessments were undertaken at a spatial scale appropriate to the emissions being assessed and the spatial extent over which impacts would be evident. Air emissions in the local air quality assessment were modelled up to around five kilometres from the airport site, while ozone was modelled for the NSW Greater Metropolitan Region, equalling about 55,000 square kilometres.

32.2 Methodology

The air quality and greenhouse gases assessment includes a review of climatic data obtained from the airport site and an analysis of ambient air quality data collected from monitoring stations in the vicinity of the airport site. Air quality impacts associated with the operation of the airport were modelled at representative sensitive receivers located in the vicinity of the airport site.

Air quality parameters that were assessed include nitrogen oxides (NO_x), particulate matter (known as PM_{10} and $PM_{2.5}$), carbon monoxide (CO), sulfur oxides (SO_x), air toxics and greenhouse gases (CO_2-e). odour (from aircraft exhaust and the on-site wastewater treatment plant), regional air quality impacts (ozone) and greenhouse gas emissions.

The adoption of a worst case for assumed operations at the long term development means that actual air emissions from the operating long term development may be lower than predicted. The worst case includes the assumed use of on-board auxiliary power units (instead of mains power at airport gates) and the exclusion of emissions reductions that could be expected from use of proposed rail connections and improvements in aircraft technology.

The assessment of the long term development forecasts emissions approximately 50 years into the future and also assumes no improvement in background air quality conditions. Given the assumed worst case operations at the long term development and the adopted background air quality, it can be concluded that the emission estimates are conservative.

The methodology for the air quality assessment is discussed in greater detail in Chapter 12 (Volume 2a) and Appendix F (Volume 4).

32.3 Existing environment

Existing meteorology was characterised from climatic data collected over five years (2010–2014) at an automatic weather station situated at Badgerys Creek operated by the Bureau of Meteorology. The collected data indicate the following:

- average wind speed of 2.6 metres per second;
- wind predominantly from the south-west;
- annual average temperature of 17°C;
- hottest month is January (average 23°C);
- coldest months are June/July (average 10 –11°C); and
- average annual relative humidity of 73 per cent.

Existing air quality was characterised from air quality monitoring data collected over ten years (2005–2014) at monitoring stations operated by the NSW Office of Environment and Heritage. Monitoring stations include Bringelly, Macarthur/Campbelltown West, Liverpool and Richmond. The collected data indicate the following:

- nitrogen oxides (including nitrogen dioxide) was well below the relevant criteria;
- particulate matter occasionally exceeded the relevant criteria, likely to be associated with surrounding population centres or events such as bushfire; and
- ozone exceeded the relevant criteria on multiple occasions.

Further information on the existing meteorology and air quality in the region of the airport site is provided in the air quality assessment for the Stage 1 development presented in Chapter 12 (Volume 2a).

32.4 Assessment of impacts during operation

This section describes the results of the emission calculations and air dispersion modelling for the operation of the long term development.

32.4.1 Emissions

The emissions of criteria pollutants (as defined in Chapter 12 (Volume 2a)) from the long term development are presented in Figure 32–1. Incremental emissions comprise emissions solely from the airport site, namely emissions from aircraft, auxiliary power units, ground support equipment, parking facilities, terminal traffic, stationary sources and training fires. Cumulative emissions include background pollutant concentrations, modelled emissions from the airport and other projects in addition to vehicular emissions from external roadways in the study area.

The emissions inventory for the long term development in 2063 is presented by source type in Table 32–1. The anticipated percentage contribution of each source category is shown alongside the emission value. Emissions totals have been provided with and without the cumulative contributions from external roadways within the study area.

Review of the incremental emissions show that aircraft engines would generally be the most significant source of emissions. Aircraft would generate approximately 56 per cent of carbon monoxide emissions and approximately 92 and 93 per cent respectively of nitrogen oxides and sulfur oxides emissions on the airport site. Auxiliary power units, ground support equipment, parking facilities and terminal traffic would also be significant emissions sources.

Figure 32–2 shows the proposed airport emissions and emissions from traffic on external roads as a percentage of the total modelled emissions within the study area. The cumulative contributions from background traffic on the external roadways account for an estimated 65 per cent of PM_{10}, 59 per cent of $PM_{2.5}$, 53 percent of carbon monoxide and 29 per cent of nitrogen oxides emissions.

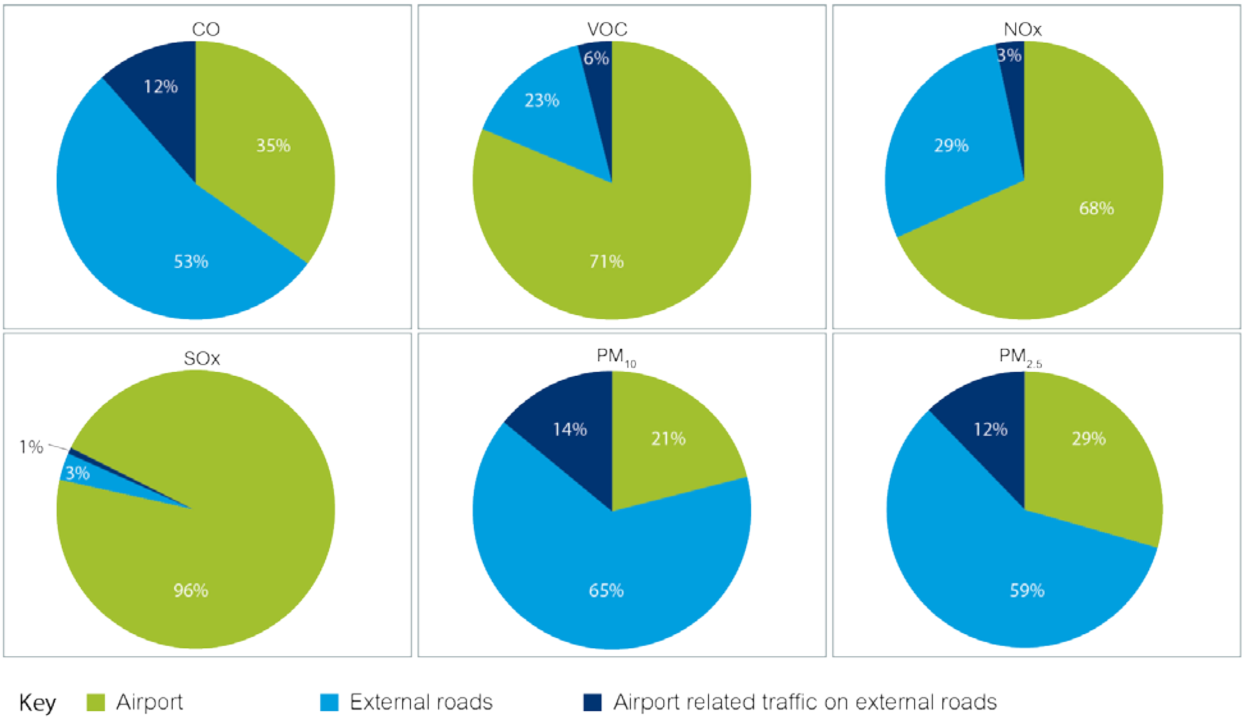
The relative contribution of nitrogen oxides and volatile organic compounds from airport sources increases significantly in comparison to the Stage 1 development and in comparison to the growth in vehicles on the surrounding road network.

Figure 32–1 Airport and external road emissions (incremental and cumulative) for the long term development

Table 32–1 Proposed airport emission inventory for criteria pollutants (long term development)

Category	Emissions (tonnes per year)											
	CO		VOC		NO_x		SO_2		PM_{10}		$PM_{2.5}$	
Proposed airport	1,290	35%	681	71%	1,902	68%	126	96%	38	20%	34	28%
Aircraft engines	729	56%	132	19%	1,756	92%	116	93%	8	21%	8	23%
Ground support equipment	159.2	12%	7.2	1%	15.0	1%	1.7	1%	1.0	3%	1.0	3%
Auxiliary power units	17.8	1%	1.8	0%	64.4	3%	6.6	5%	3.9	10%	3.9	11%
Parking facilities	126.8	10%	13.7	2%	5.7	0%	0.1	0%	0.3	1%	0.2	0%
Terminal traffic	181.6	14%	17.8	3%	38.1	2%	0.4	0%	8.3	22%	4.7	14%
Stationary sources	15.3	1%	507.0	43%	21.6	1%	0.4	0%	1.6	4%	1.6	5%
Boilers	14.5	1%	1.0	0%	17.8	1%	0.1	0%	1.3	4%	1.3	4%
Engine tests	0.0	0%	1.2	0%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
Fuel tanks	0.0	0%	441.4	65%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
Generators	0.8	0%	0.2	0%	3.8	0%	0.3	0%	0.3	1%	0.3	1%
Paint and Solvent	0.0	0%	63.2	9%	0.0	0%	0.0	0%	0.0	0%	0.0	0%
Training Fires	61.1	5%	2.0	0%	0.5	0%	0.1	0%	14.9	39%	14.9	44%
Airport traffic on road network	430	12%	59	6%	94	3%	1	1%	27	14%	15	12%
Background traffic on road network	1,987	54%	218	23%	807	29%	4	3%	122	65%	71	59%
Total	3,708	100%	959	100%	2,802	100%	131	100%	186	100%	120	100%

Note: CO = Carbon monoxide, VOC = Volatile organic compounds, NO_x = Nitrogen oxides, SO_X= Sulfur oxides, PM_{10} = Particulate matter with a diameter less than 10 μm, $PM_{2.5}$ = Particulate matter with a diameter less than 2.5 μm

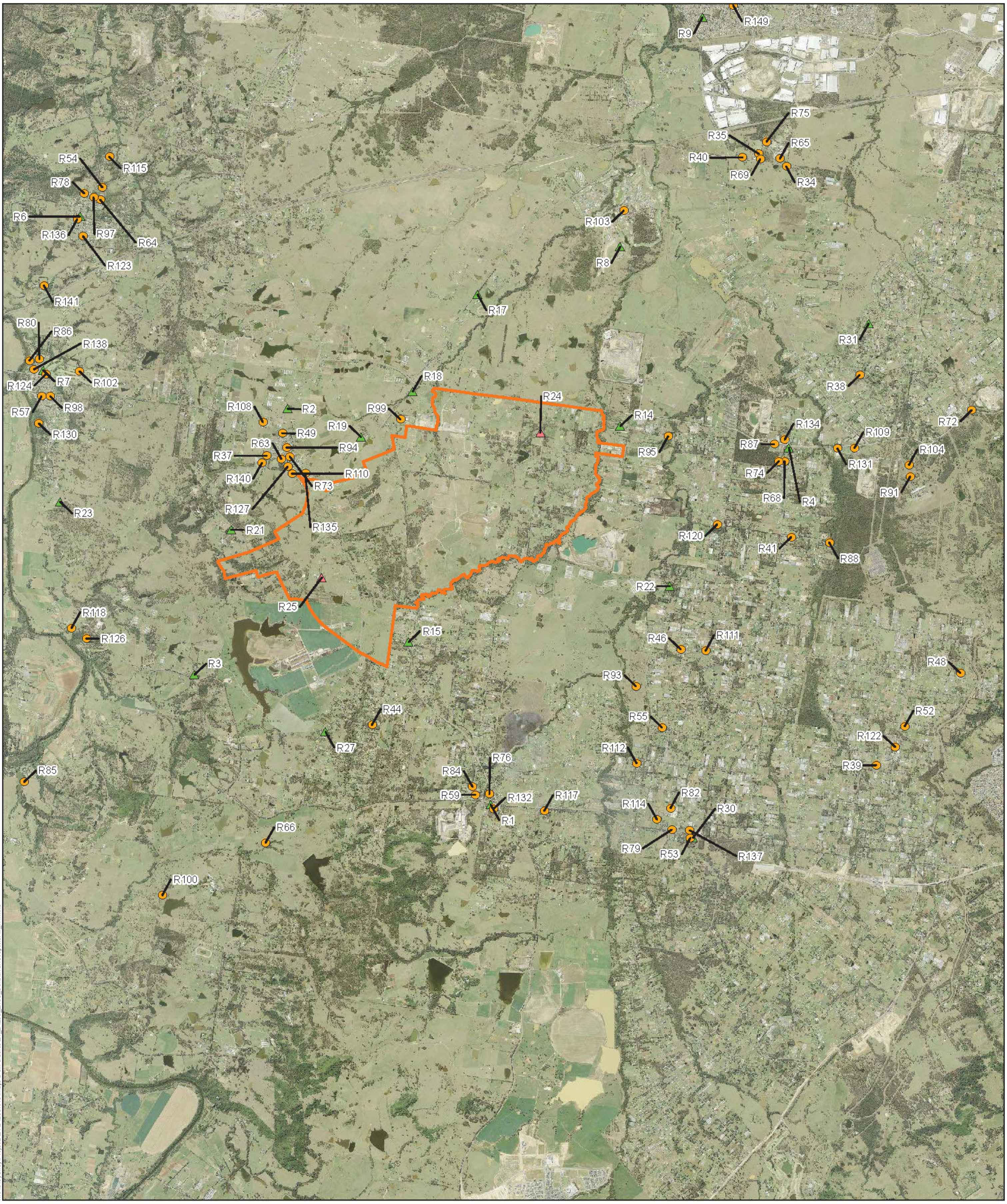


Note: CO = Carbon monoxide, VOC = Volatile organic compounds, NOx = Nitrogen oxides, SOx = Sulfur oxides, PM_{10} and $PM_{2.5}$ = Particulate matter

Figure 32–2 Proportion of emissions from airport and external roads for the long term development

32.4.2 Dispersion modelling results

Given the uncertainty regarding the future reduction in vehicular and aircraft engine emissions and the anticipated general reduction in background emissions over time, ground level concentration predictions were assessed only for the key criteria pollutants such as nitrogen dioxide and particulate matter (PM10 and PM2.5) for the long term development. Figure 32–3 shows the location of representative sensitive receptors in the vicinity of the airport site.



LEGEND

- Airport site
- Community
- Residential
- Airport site

Data Source: Please refer to "Digital Data Sources" on the second page of the EIS

Figure 32-3 - Location of sensitive receptors in the vicinity of the airport site

32.4.2.1 Oxides of nitrogen

The dispersion modelling results for maximum one-hour and annual average nitrogen dioxide are presented in Table 32–2. Exceedances of the air quality assessment criteria are shown in bold.

The results of the dispersion modelling show predicted nitrogen dioxide concentrations are expected to be below the annual criteria at all assessed sensitive receptors.

Exceedances of the one-hour average air quality assessment criteria may be experienced at eight of the 20 selected sensitive residential and onsite receptors. These elevated concentrations are predicted to occur for between one and two hours per year.

Table 32–2 Predicted incremental and cumulative nitrogen dioxide concentrations (long term development)

Receptor	Receptor description	Airport (µg/m³)			Cumulative (µg/m³)		
		One-hour		Annual	One-hour		Annual
Assessment criteria		320	*Hours > 320*	62	320	*Hours > 320*	62
R1	Bringelly	237	0	17	243	0	23
R2	Luddenham	111	0	22	119	0	28
R3	Greendale, Greendale Road	347	1	22	367	1	24
R4	Kemps Creek	223	0	17	234	0	26
R6	Mulgoa	188	0	18	205	0	19
R7	Wallacia	241	0	17	247	0	18
R8	Twin Creeks	155	0	21	178	0	27
R14	Lawson Road, Badgerys Creek	517	1	34	538	1	43
R15	Mersey Rd, Greendale	343	2	31	350	2	34
R17	Luddenham Road	310	0	22	312	0	27
R18	Adams & Elizabeth Drive	229	0	38	231	0	49
R19	Adams & Anton Road	211	0	47	212	0	51
R21	Willowdene Ave and Vicar Park Lane	408	1	24	440	1	30
R22	Rossmore, Victor Ave	242	0	18	253	0	23
R23	Wallacia, Greendale Rd	342	1	15	347	1	17
R24	Badgerys Creek 1 NE	335	1	55	365	2	52
R25	Badgerys Creek 2 SW	281	0	23	284	0	26
R27	Greendale, Dwyer Rd	116	0	14	118	0	16
R30	Rossmore residential	312	0	14	326	1	20
R31	Mt Vernon residential	345	1	22	349	1	27

32.4.2.2 Particulate matter (PM_{10})

The dispersion modelling results for maximum 24-hour average and annual average PM_{10} are presented in Table 32–3. As shown, predicted concentrations of PM_{10} comply with the 24-hour and annual criteria at all assessed sensitive receptors.

Table 32–3 Predicted incremental and cumulative PM_{10} concentrations (long term development)

Receptor	Receptor description	Airport (µg/m³)		Airport + external roadways (µg/m³)		Cumulative – airport + external roadways + existing background (µg/m³)	
		24-hour	Annual	24-hour	Annual	24-hour	Annual
Assessment criteria		n/a	n/a	n/a	n/a	50	25
R1	Bringelly	3.7	0.1	5.6	1.3	46	18
R2	Luddenham	1.7	0.3	6.0	1.4	45	18
R3	Greendale, Greendale Road	5.7	0.3	7.4	0.6	43	18
R4	Kemps Creek	2.6	0.2	8.8	1.6	46	19
R6	Mulgoa	1.8	0.1	3.5	0.4	43	17
R7	Wallacia	1.3	0.1	3.1	0.4	43	17
R8	Twin Creeks	2.2	0.2	4.4	1.1	44	18
R14	Lawson Road, Badgerys Creek	9.6	0.7	13.6	2.4	46	19
R15	Mersey Rd, Greendale	6.1	0.5	11.7	1.3	46	18
R17	Luddenham Road	3.4	0.2	5.5	1.3	45	18
R18	Adams & Elizabeth Drive	5.3	0.6	11.2	2.8	46	20
R19	Adams & Anton Road	5.3	0.8	9.0	1.6	45	19
R21	Willowdene Ave and Vicar Park Lane	5.9	0.3	7.6	1.4	44	18
R22	Rossmore, Victor Ave	4.1	0.2	8.0	1.2	45	18
R23	Wallacia, Greendale Rd	2.3	0.1	3.8	0.4	43	17
R24	Badgerys Creek 1 NE	31.6	8.9	18.2	3.8	46	21
R25	Badgerys Creek 2 SW	3.6	0.5	4.9	1.1	44	18
R27	Greendale, Dwyer Rd	1.4	0.1	3.0	0.5	43	17
R30	Rossmore residential	1.7	0.1	4.8	1.3	45	18
R31	Mt Vernon residential	4.2	0.2	6.4	1.0	44	18

32.4.2.3 Particulate matter ($PM_{2.5}$)

The dispersion modelling results for maximum 24-hour average and annual average $PM_{2.5}$ are presented in Table 32–4. Exceedances of the air quality assessment criteria are shown in bold.

The results of the dispersion modelling show predicted $PM_{2.5}$ concentrations are expected to be below the 24-hour at all assessed sensitive receptors.

Predicted $PM_{2.5}$ concentrations were predicted exceed the current annual criteria (8 µg/m^3) at three sensitive receptors. All receptors were predicted to exceed the planned 2025 annual criteria (7 µg/m^3), however this was attributable to predicted background levels.

Table 32–4 Predicted incremental and cumulative $PM_{2.5}$ concentrations (long term development)

Receptor	Receptor description	Airport (µg/m^3)		Airport + external roadways (µg/m^3)		Cumulative – airport + external roadways + existing background (µg/m^3)	
		24-hour	Annual	24-hour	Annual	24-hour	Annual
Assessment criteria		n/a	n/a	n/a	n/a	25 (20[a])	8 (7[a])
R1	Bringelly	2.4	0.1	3.5	0.8	16	8
R2	Luddenham	1.5	0.2	3.5	0.9	15	8
R3	Greendale, Greendale Road	4.3	0.2	5.4	0.4	14	7
R4	Kemps Creek	2.0	0.1	5.6	1.0	16	8
R6	Mulgoa	1.6	0.1	2.5	0.3	14	7
R7	Wallacia	1.1	0.1	1.8	0.3	14	7
R8	Twin Creeks	1.6	0.2	2.9	0.7	14	8
R14	Lawson Road, Badgerys Creek	6.8	0.6	9.0	1.5	18	9
R15	Mersey Rd, Greendale	4.6	0.5	8.1	0.9	16	8
R17	Luddenham Road	2.8	0.2	4.0	0.8	15	8
R18	Adams & Elizabeth Drive	3.8	0.5	7.2	1.7	16	9
R19	Adams & Anton Road	4.0	0.6	6.1	1.1	15	8
R21	Willowdene Ave and Vicar Park Lane	4.0	0.2	5.2	0.9	15	8
R22	Rossmore, Victor Ave	2.9	0.2	5.1	0.8	15	8
R23	Wallacia, Greendale Rd	1.7	0.1	2.6	0.3	14	7
R24	Badgerys Creek 1 NE	18.6	5.3	11.8	2.4	19	9
R25	Badgerys Creek 2 SW	2.3	0.4	3.2	0.8	14	8
R27	Greendale, Dwyer Rd	1.1	0.1	1.8	0.3	14	7
R30	Rossmore residential	1.2	0.1	3.2	0.7	15	8
R31	Mt Vernon residential	2.9	0.2	4.6	0.6	14	8

[a]NEPM-AAQ aim by 2025

32.4.3 Fuel jettisoning

Emergency fuel jettisoning refers to an emergency situation where an aircraft must jettison fuel in order to land safely – typically an emergency landing. Emergency fuel jettisoning is not a standard procedure and furthermore most domestic aircraft are incapable of doing it.

It is mandatory for fuel jettisoning events to be reported. In 2014, from around 698,856 registered civilian domestic air movements and 31,345 international air movements, there were 10 instances of fuel jettisoning. This equates to about 0.001 per cent of all aircraft movements.

Notwithstanding the rarity of fuel jettisoning events, the potential impacts on local air quality would be further limited by the rules in place for fuel jettisoning to occur. These rules demand that pilots take reasonable precautions to ensure the safety of people and property and, where possible, conduct a controlled jettison at an altitude of above 6,000 feet (approximately 1.8 kilometres).

Given the rarity of fuel jettisoning globally, the known low occurrence in Australian airspace, the standards in place, along with the high evaporation rates known to occur at high altitude, authorised fuel jettisoning associated with the operation of the proposed airport is unlikely to cause environmental or social impacts.

The operational conditions for emergency fuel jettisoning are discussed further in Chapter 7 (Volume 1).

32.4.4 Regional air quality (ozone)

International studies have shown that emissions from airport operations are small in the context of regional emissions inventories (Ratliff et al, 2009). This is supported by the *Air Emissions Inventory for the Greater Metropolitan Region in New South Wales* (EPA 2012) which shows that airport operations account or less than three per cent of emissions in the region.

Projected emissions for sources other than the proposed airport (such as commercial, industrial and on-road mobile sources) are not available for the 2063 scenario. The assessment therefore considered the long term development in the context of 2030 base case emissions.

Twelve days with high observed ozone (one-hour ozone concentrations greater than 70 parts per billion and four-hour ozone concentrations greater than 65 parts per billion) were selected for detailed modelling analysis, as described in Chapter 12 (Volume 2a).

Historical dates in January and February 2009 were selected to represent the meteorological conditions that have historically led to peak ozone formation. The model has effectively captured this peak ozone formation with the addition of future emissions.

Table 32–5 and Table 32–6 detail the one-hour and four-hour maximum ozone concentrations, respectively, in different modelling scenarios. They show the overall peak value predicted in the wider Sydney basin for the 2030 base case (no airport) and the overall peak value predicted in the wider Sydney basin for the 2063 airport case (airport emissions plus the 2030 base case) on the identified date. In both tables the right-hand column details the largest change, within the Sydney basin, in maximum daily ozone concentration between the 2063 airport case and the 2030 base case, as a result of the additional emissions from the longer term airport development.

For the modelled days, the largest change between the 2063 airport case and the 2030 base case does not occur at the same location as the peak value, hence the peak value does not increase by the amount of the largest difference.

Both the 2030 base case and the 2063 airport case exceeded the National Environment Protection Measure (NEPM) Ambient Air Quality (AAQ) criterion of 100 parts per billion for all but one day of analysis. The NEPM is a national monitoring and reporting protocol. The purpose of the NEPM AAQ is to evaluate trends in air quality over time across the general population and to guide air quality management strategies.

The maximum predicted one-hour ozone concentration was unchanged between the 2030 base case and the 2063 airport case for eight of the analysis days, while on four days the peak predicted one-hour ozone concentration increased by a maximum of 0.2 parts per billion (ppb).

Larger ozone increases were modelled for the 2063 airport case than for the 2030 airport case. The highest change in daily maximum one-hour ozone concentration, from the addition of 2063 airport emissions, was 12.5 parts per billion, while the second highest was 5.7 parts per billion. The average of the second to fourth highest increases in daily maximum one-hour ozone rose from 1.2 parts per billion for 2030 to 4.6 parts per billion for 2063.

Table 32–5 – Maximum daily predicted one-hour ozone concentration (long term development)

Date	2030 base case peak value (ppb)	2063 airport case peak value (ppb)	2063 airport case – 2030 base case largest difference (ppb)
06/01/2009	149.1	149.2	2.0
07/01/2009	129.8	130.0	12.5
14/01/2009	106.6	106.6	5.7
29/01/2009	124.1	124.1	1.6
30/01/2009	107.4	107.4	2.4
31/01/2009	109.4	109.4	2.2
04/02/2009	103.8	103.8	3.4
05/02/2009	119.6	119.6	1.7
06/02/2009	112.5	112.5	3.4
07/02/2009	133.7	133.7	1.7
08/02/2009	148.6	148.7	2.6
20/02/2009	98.3	98.4	4.6

The daily maximum predicted four-hour ozone concentrations are presented in Table 32–6. The peak predicted four-hour ozone concentration is unchanged in seven of the days analysed and increased in five of the days by a maximum of around 0.3 parts per billion. The highest change in daily maximum four-hour ozone concentration, from the addition of 2063 airport emissions, was 6.5 parts per billion, while the second highest was 5.9 parts per billion. The average of the second to fourth highest increases in daily maximum four-hour ozone is 3.8 parts per billion.

Increases in ozone occurring downwind of the airport site would be greater in 2063 than in 2030. However, there would also be reductions in daily maximum ozone, due to ozone suppression by nitrogen oxide emissions, in the vicinity of the airport site and on some days extending to the aircraft flight corridor and areas downwind of the airport site. Areas of ozone reduction would be more expansive for the 2063 airport case than for 2030 airport case because nitrogen oxide emissions from the proposed airport would be greater in 2063.

Some predicted increases in one-hour and four-hour ozone levels are substantially greater than the maximum allowable increment of one part per billion defined in the NSW tiered procedure for ozone assessment. However, the predicted increases occur under a hypothetical scenario of the long term airport development occurring within the context of 2030 background levels as 2063 background levels cannot be accurately predicted. This does not take into account the commercial, industrial and infrastructure development that would occur in the region up until 2063. Emissions data for operation of the long term development also assume a worst case (see Section 32.2).

Table 32–6 Maximum daily predicted four-hour ozone concentration (long term development)

Date	2030 future base case peak value (ppb)	2063 airport case peak value (ppb)	2063 airport case – 2030 future base case largest difference (ppb)
06/01/2009	126.2	126.5	1.9
07/01/2009	115.3	115.6	5.9
14/01/2009	98.7	98.9	1.7
29/01/2009	95.9	95.9	2.3
30/01/2009	78.2	78.2	2.5
31/01/2009	99.9	99.9	2.3
04/02/2009	97.3	97.3	3.1
05/02/2009	108.7	108.7	1.7
06/02/2009	92.4	92.4	1.7
07/02/2009	121.0	121.0	2.4
08/02/2009	129.9	130.0	2.3
20/02/2009	83.9	84.2	6.5

32.5 Greenhouse gas assessment

Greenhouse gas emissions that are forecast to be generated during the operation of the long term development are presented in Table 32–7.

As shown in Table 32–7, electricity consumption would account for around 80% of Scope 1 and 2 greenhouse gas emissions during the long term operation of the airport. As electricity is a Scope 2 emission, Scope 1 emissions would account for the remaining 20 per cent – primarily through fuel combustion and fugitive emissions at the airport site.

It is not commonplace to report Scope 3 emissions because of the potential of double counting greenhouse gas emissions. Nevertheless, as they are considered significant for the proposed airport, the most probable primary contributor (jet fuel), has been quantified in Table 32–7.

It must be noted that this quantity involves only those emissions from departing planes during their entire flight (those departing from the proposed airport). This method assumes the arriving planes emissions are accounted for by the airport of departure, as is common internationally. This method has been recommended by the Airport Cooperative Research Program (ACRP) (ACRP 2009).

Table 32–7 Summary of estimated annual Scope 1, 2 and 3 greenhouse gas emissions (long term development)

Scope	Source	Fuel type	Annual quantity	Units	Annual emissions (t CO_2 e)
Scope 1 and 2					816,430
Scope 1	Ground support equipment	Transport diesel oil	6	ML	16,910
		Transport gasoline	13	ML	30,728
	Auxiliary power unit	Stationary gasoline (jet fuel)	33	ML	88,566
	Boilers	Stationary natural gas	11,735,513	m^3	23,674
	Generators	Stationary diesel oil	0.05	ML	143
	Fire training	Stationary kerosene	0.03	ML	74
	Wastewater treatment plant	N/A	9,782	ML	6,092
	Fugitive emissions	Transport gasoline (jet fuel)	8030	ML	846
	Fugitive emissions	Transport diesel oil	6	ML	0.7
	Fugitive emissions	Transport gasoline	13	ML	1
Scope 2	Electricity	N/A	755,112,000	kWh	649,396
Scope 3	In flight aviation fuel	Transport gasoline (jet fuel)	8,030	ML	20,570,033

Note: Fuel type reflects the categories in DoE (2014b)
Assumptions made within the greenhouse gas calculations are provided within Appendix F1 (Volume 4).
Emissions factor was not available for jet fuel – emissions have been assumed to be the same as Avgas.

32.6 Considerations for future development stages

Air quality impacts and greenhouse gas emissions generated during construction and operation of the long term development would generally be managed in accordance with best management practices, similar to those outlined in Chapter 12 (Volume 2a).

Air quality matters associated with the proposed airport would also be regulated under the Airports (Environment Protection) Regulations 1997.

32.7 Summary of findings

Operation of the long term development would result in an increase in emissions of nitrogen dioxide, PM_{10}, $PM_{2.5}$, carbon monoxide, sulfur oxides and air toxics. Given the uncertainty regarding the future reduction in vehicular and aircraft engine emissions and the anticipated general reduction in background emissions over time, ground level concentrations were only predicted for the key criteria pollutants (nitrogen dioxide, PM_{10} and $PM_{2.5}$).

The results of the dispersion modelling for nitrogen dioxide found that there would be no exceedances of the annual average air quality assessment criteria at any of the assessed sensitive receptors. Eight assessed sensitive receptors were predicted to exceed the one-hour air quality assessment criteria for between one and two hours per year.

The results of the dispersion modelling for PM_{10} found that there would be no exceedances of the annual or 24-hour average air quality assessment criteria at the assessed sensitive receptors.

The results of the dispersion modelling for $PM_{2.5}$ found there would be no exceedances of the 24-hour average air quality assessment criteria. Predicted concentrations exceeded the annual criteria (8 $\mu g/m^3$) at three sensitive receptors. All receptors were predicted to exceed the planned 2025 annual criteria (7 $\mu g/m^3$), however this was attributable to predicted background levels.

The maximum predicted one-hour and four-hour ozone concentrations increased by a maximum of 0.2 to 0.3 parts per billion during the operation of the long term development. Both the predicted base case and the long term airport case were generally above the NEPM criteria. Larger ozone incremental increases in the surrounding localities were recorded for the long term development compared to the Stage 1 development, driven primarily by the increase in precursor emissions.

Actual air emissions from the operating long term development may be lower than predicted given the use of mains powered auxiliary power units at the airport gates (instead of on-board auxiliary power units), increased use and optimisation of proposed rail connections (instead of motor vehicles) and progressive improvements in aircraft technology.