2014 Annual Environmental Management Report

National Ceramic Industries Australia

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1.0 Introduction

National Ceramic Industries Australia Pty Ltd (NCIA) operates a tile manufacturing facility located in Rutherford, New South Wales. On 19 January 2012 NCIA was granted Project Approval (MP 09_0006), which rationalised and consolidated the development as approved under the previous Development Consent (DA 449-12-2002-i), and the proposed expansion of the facility. Subsequently, NCIA formally relinquished the previous Development Consent (DA 449-12-2002-i) with effect from 19 January 2013.

The NCIA facility is therefore currently operated under the conditions of Project Approval (MP 09_0006), issued by the Department of Planning and Environment (DP&E).

This Annual Environmental Management Report (AEMR) has been prepared by AECOM Australia Pty Ltd (AECOM) on behalf of NCIA in accordance with Schedule 4, Condition 60 of the Project Approval. The AEMR outlines the environmental compliance and performance of the NCIA facility in relation to the conditions of the Project Approval and NCIA's Environment Protection Licence (EPL) No. 11956. The AEMR is distributed to the DP&E.

The current reporting period for this AEMR is from 19 January 2014 to 18 January 2015 (hereafter referred to as the 2014 reporting period).

Due to the AEMR reporting timeline, there is some overlap in the timeline of environmental monitoring undertaken at NCIA. Environmental monitoring is undertaken in accordance with the EPL timeline requirements, which is from 1 August to 31 July of each year.

- Noise monitoring was last undertaken in May 2014 which covers both the AEMR and EPL timelines; and
- The stack emission testing commenced in September 2014 but this monitoring is still ongoing and the complete results are not yet available. The most recent complete set of stack testing results were for the 01 August 2013 to 31 July 2014 EPL reporting period. Notably a portion of this monitoring occurred between January and April 2014 which forms part of this AEMR reporting period. Therefore, this AEMR includes the stack emission testing results from the 2013-14 EPL reporting period. Importantly, all monitoring required by NCIA's EPL has been undertaken and is in accordance with EPL timeline requirements. NCIA intend to discuss with DP&E an alternative AEMR reporting timeline, in order to align it with the EPL timeline and avoid this issue of overlapping timeframes for future AEMRs.

The requirements of Condition 60 of the Project Approval and the cross-reference to the AEMR section where the requirement is addressed are provided in Table 1.

Table 1 Schedule 4, Condition 60 of Project Approval (MP 09_0006)

Condition	Requirement	AEMR Section
60	Every year from the date of this approval, unless the Director-General agrees otherwise, the Proponent shall submit an AEMR to the Director-General and relevant agencies. The AEMR shall:	This AEMR
60 (a)	be conducted by suitably qualified and independent team of whose appointment has been endorsed by the Director- General;	Quality Information
60 (b)	be submitted within 3 months of the period being assessed by the AEMR;	AEMR to be submitted by 18 April 2015
60 (c)	identify the standards and performance measures that apply to the development;	Section 2.0
60 (d)	include a summary of the complaints received during the past year, and compare this to the complaints received in previous years;	Section 3.0
60 (e)	include a summary of the monitoring results for the development during the past year;	Section 4.0
60 (f)	include an analysis of these monitoring results against the relevant: - impact assessment criteria; - monitoring results from previous years; and - predictions in the EA;	Section 5.0
60 (g)	identify any trends in the monitoring;	Section 5.0
60 (h)	identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies;	Section 5.0
60 (i)	identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance; and	Section 6.0
60 (j)	identify continuous improvement measures, outlining new developments in air quality and noise control, and detailing practices that have been implemented on the site during the previous year, to reduce air quality and noise impacts.	Section 0

1.1 Overview of Operations

NCIA manufactures ceramic wall and floor tiles for the Australian market from a mixture of clay, white granite, rhyolite and glazes. The facility is located off Racecourse Road, Rutherford, within the Rutherford Industrial Estate. The facility operates 24 hours per day, 7 days per week, and 330 days over the reporting period.

The operation currently comprises one spray drier, a clay mill, two tile production lines and two kilns, representing the first two of eight approved operational stages. The timeline for construction of the remaining stages (i.e. stages three to eight) is dependent upon market demand and remains uncertain.

It is noted that many of the requirements of the current Project Approval are required prior to commencement of construction of the next stage of the approved operation (i.e. stages three to eight). As commencement of construction of the next stage of the approved operation has not yet commenced, these conditions have not yet been activated.

An Operation Environmental Management Plan (OEMP) was prepared in accordance with the previous Development Consent to provide an environmental management framework for the facility. The previous Development Consent has now been relinquished and the new Project Approval does not require an OEMP, but instead requires preparation of an Environmental Management Strategy prior to commencement of construction works as described above. As this condition is not yet activated, NCIA continues to operate in accordance with the OEMP. The OEMP was reviewed on a three yearly basis, and was last reviewed in June 2011. The OEMP has undergone a subsequent review and update through 2014 and was finalised in early 2015.

2.0 Standards and Performance Measures

The NCIA OEMP provides the environmental management framework to guide the operation of the tile manufacturing facility. The OEMP defines the environmental management practices, procedures and personnel responsibilities to ensure compliance with conditions of statutory approvals and licences.

Specific environmental standards and performance measures used to assess the achievement of environmental objectives are drawn from requirements, obligations and initiatives listed within:

- The Project Approval (MP 09_0006), granted by the Minister for Planning;
- EPL 11956, issued by the NSW Environment Protection Authority (EPA); and
- The *National Ceramic Industries Australia Expansion - Environmental Assessment* (AECOM, 5 July 2010) hereafter referred to as '2010 EA'.

Commitments made within the 2010 EA have been incorporated into the Project Approval and EPL for the facility as compliance criteria. These compliance criteria are used to assess the environmental performance of the facility and to monitor the environmental impact on the surrounding environment. Compliance criteria and the monitoring results for the reporting period are presented in Section 4.0 of this AEMR.

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3.0 Complaints

Condition 60(d) of the Project Approval requires that the AEMR include a summary of complaints received during the reporting period compared to complaints received in previous years.

The history of complaints received by NCIA is summarised in Table 2. No complaints were received during the reporting period.

Table 2 Historical Complaints received by NCIA

Year	Number of Complaints	Issue	Details
2014	Nil	Nil	None required.
2013	1	Air Quality	Complaint made via email on 24 July 2013 regarding air quality in Rutherford area.
2012-13	Nil	Nil	None Required.
2011-12	Nil	Nil	None Required.
2010-11	Nil	Nil	None Required.
2009-10	1	Air Quality	Complaint made from neighbouring Heritage Green Residential Estate regarding non-compliances identified in the Environment Audit.
2008-09	Nil	Nil	None Required.
2007-08	1	Air Quality	Anonymous complaint to EPA regarding visible black smoke. Report submitted to EPA on 25 March 2008. Visible black smoke unlikely to have originated from NCIA. No further action required.
2006-07	1	Odour	Anonymous complaint to EPA regarding odour. Discussed with EPA. Odour unlikely to have originated from NCIA. No further action required.
2005-06	2	Air Quality / Odour	Complaint made regarding visible plume. Complainant contacted and issue discussed. No further action required. Anonymous complaint to EPA regarding odour. Discussed with EPA. Odour unlikely to have originated from NCIA. No further action required.
2004-05	1	Air Quality	Complaint made regarding visible plume. Complainant contacted and issue discussed. No further action required.

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4.0 Environmental Monitoring Results

The following parameters are monitored for the facility in accordance with the conditions of the Project Approval and / or the EPL and / or for internal due diligence requirements:

- Ambient air monitoring (northwest and southeast of the facility):
  - Fine Particulates (PM_{10}); and
  - Fluoride (particulate, gaseous and total).
- Fluoride Impact on Vegetation:
  - Quarterly visual assessment of vegetation; and
  - Quarterly fluoride content in vegetation.
- Meteorological monitoring:
  - Wind speed at 10 metres;
  - Wind direction at 10 metres;
  - Temperature at 5 metres; and
  - Rainfall.
- Stack emission testing (all stacks):
  - Total particulates (TSP); and
  - Fine particulates (PM_{10}).
- Additionally, for the kiln stack:
  - Mercury (Hg);
  - Cadmium (Cd);
  - Nitrogen Oxides (NOx);
  - Hazardous substances (metals);
  - Hydrogen Fluoride (HF);
  - Sulfuric acid mist (H_2SO_4); and
  - Sulfur trioxide (SO_3).
- Noise testing:
  - L_{Aeq}(15 minute); and
  - L_{A1}(1 minute).

A summary of the monitoring results for these parameters is provided below.

4.1 Ambient Air Monitoring Results

The ambient air quality monitoring program commenced on 12 March 2004 to record background data prior to commencement of Stage 1 operations. The program was designed and implemented in accordance with the requirements of NCIA's EPL. The monitoring program also satisfies the requirements of the current Project Approval.

In accordance with EPL condition M2.1, PM_{10} (24-hour) and Fluoride (24-hour and weekly) are monitored at two locations: northwest and southeast of the facility (refer Figure 1).

For PM_{10} monitoring, two sampling locations have been established to determine concentrations at the NCIA property boundary, along the dominant southeast-northwest wind axis. The monitors are sited in accordance with *AS/NZS 3580.1.1:2007 Guide to siting air monitoring equipment*. Sampling and analyses of PM_{10} are undertaken as per *AS/NZS 3580.9.6:2003 Determination of suspended particulate matter*. Discrete 24-hour samples are collected every 6 days according to the NSW EPA schedule.

Two fluoride monitoring units (manual, double filter paper samplers) have been sited at each of the two locations identified for monitoring of PM_{10}, and are operated in accordance with *AS3580.13.2:2013 Determination of gaseous and acid-soluble particulate fluorides*. At each location, one monitor operates continuously over a 7-day period to provide weekly fluoride concentration averages. These units are designated 'Northwest HF_7' and 'Southeast HF_7'. The remaining unit at each site operates continuously for discrete 24-hour periods according to the NSW EPA 6-day cycle to provide 24-hour averages for sampler operation days. Units are designated 'Northwest HF' and 'Southeast HF'.

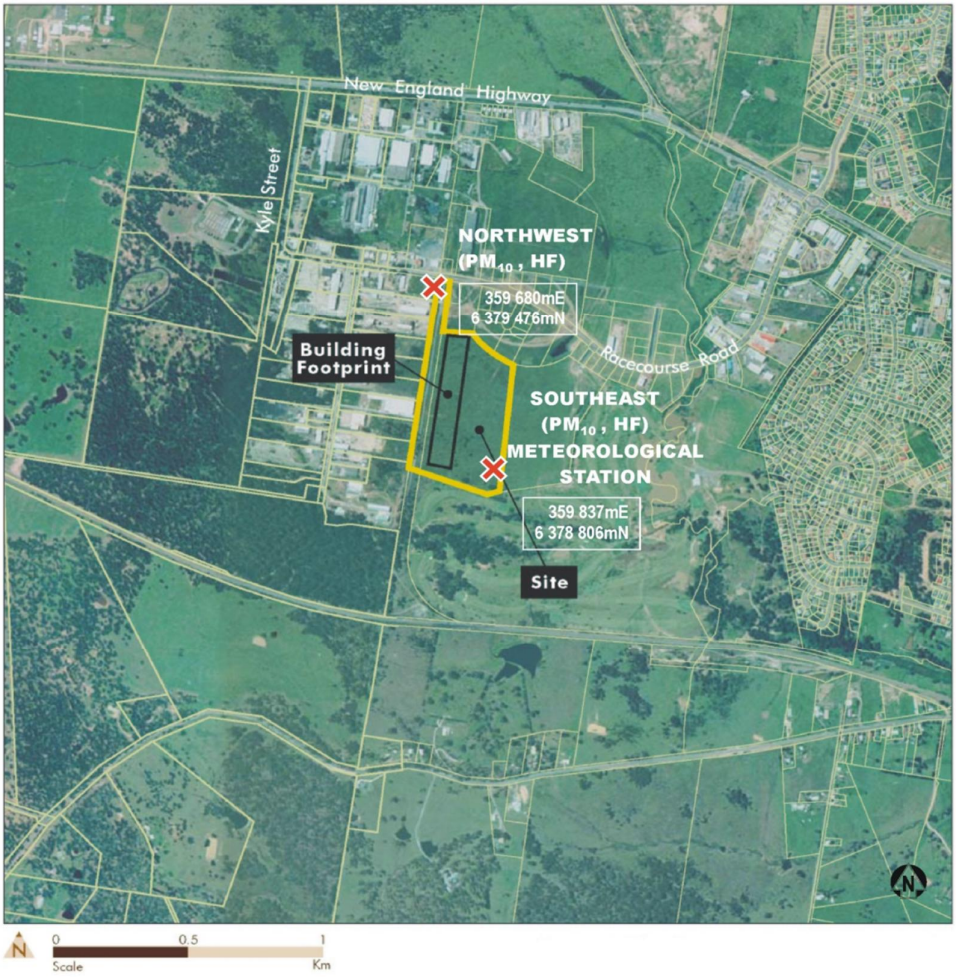

Figure 1 Ambient Air Monitoring Site Locations

4.1.1 PM_{10} – Monitoring Results

The EPL does not specify ambient air concentration limits, however Condition 15 of the Project Approval sets out criteria for PM_{10}. The criteria are the same as those set out in the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DECC, 2005).

A summary of PM_{10} monitoring results from both monitoring locations for the current reporting period is provided in Table 3, alongside the relevant criteria. The PM_{10} results for the NW and SE locations are also graphed in Figure 2 and Figure 3 respectively.

Table 3 Summary of Ambient Air Monitoring: PM_{10} Results

Parameter	Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	30.0	25.1	20.4
Standard Deviation (µg/m^3)	-	11.5	7.9
24-hour Minimum Concentration (µg/m^3)	-	8.4	8.5
24-hour Maximum Concentration (µg/m^3)	50.0	**63.7**	41.8

The 2014 PM_{10} monitoring results indicated that:

- One exceedance of the 24 hour PM_{10} criterion occurred at the NW location (on 22 May 2014 – 63.7 µg/m^3);
- No exceedance of the 24 hour PM_{10} criterion occurred at the SE location; and,
- The 2014 PM_{10} annual average concentration at both locations throughout the reporting period was below the PM_{10} annual average criterion.

Comparison to historical monitoring results and analysis of trends is discussed further in Section 5.1.

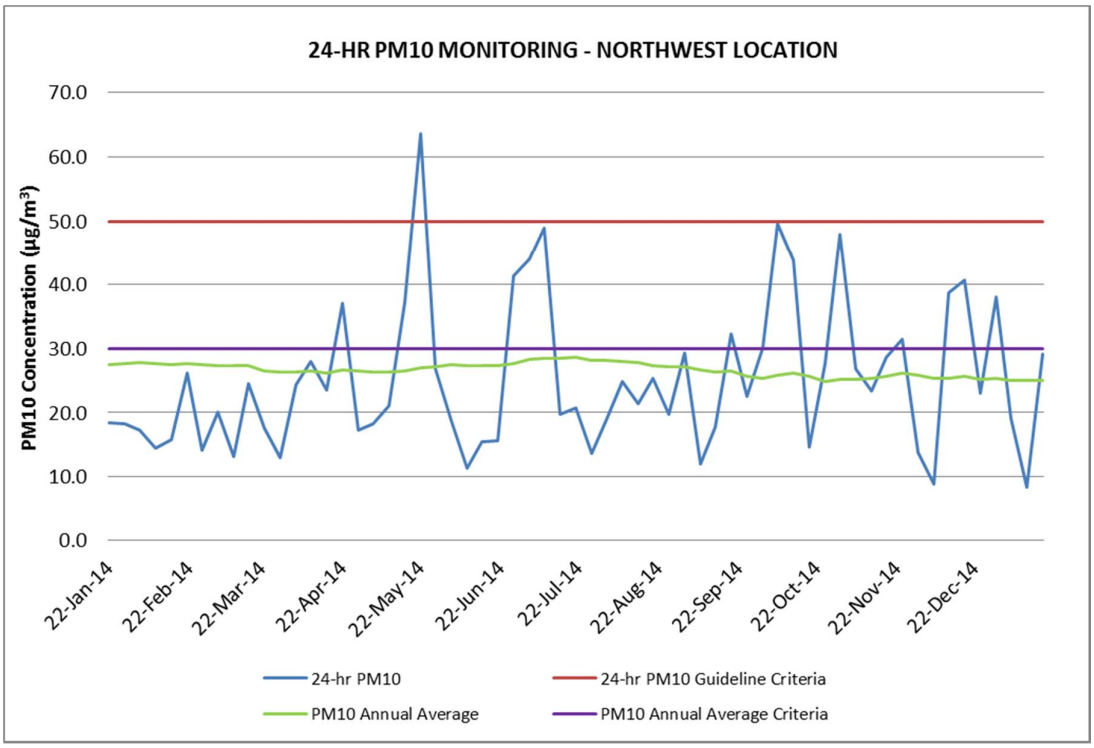

Figure 2 **PM_{10} Monitoring – Northwest Location**

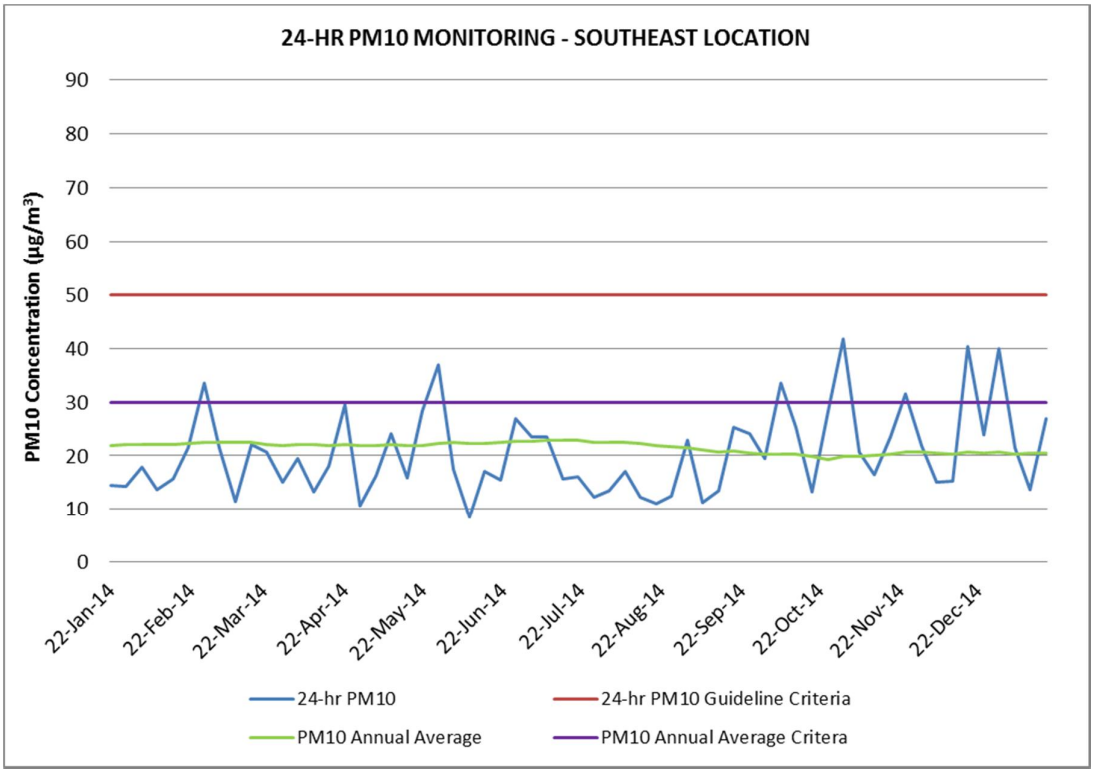

Figure 3 **PM_{10} Monitoring – Southeast Location**

4.1.2 Fluoride – 24 Hour Monitoring Results

There are no ambient air Fluoride concentration limits specified in the EPL or Project Approval. To provide context for the ambient air monitoring results, guideline levels have been taken from the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DECC, 2005).

A summary of 24-hour Fluoride monitoring results from both monitoring locations for the current reporting period is provided in Table 4. The 24-hour Fluoride monitoring results for the NW and SE locations are also graphed in Figure 4 and Figure 5 respectively.

Table 4 Summary of Ambient Air Monitoring: 24-hour Fluoride Results

Parameter	Guideline Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.4	0.5
Standard Deviation (µg/m^3)	-	0.5	0.5
24-hour Minimum Concentration (µg/m^3)	-	0.1	0.1
24-hour Maximum Concentration (µg/m^3)	2.9	**3.0**	**3.1**

The 2014 24-hour fluoride monitoring results indicated that on one occasion at each of the monitoring locations the 24-hour total fluoride emissions were marginally above the DECC (2005) guideline criterion, as follows:

- A reading of 3.0 µg/m^3 was taken at the NW location on 12 December 2014; and
- A reading of 3.1 µg/m^3 was taken at the SE location on 09 July 2014.

Comparison to historical monitoring results and analysis of trends is discussed further in Section 5.1.

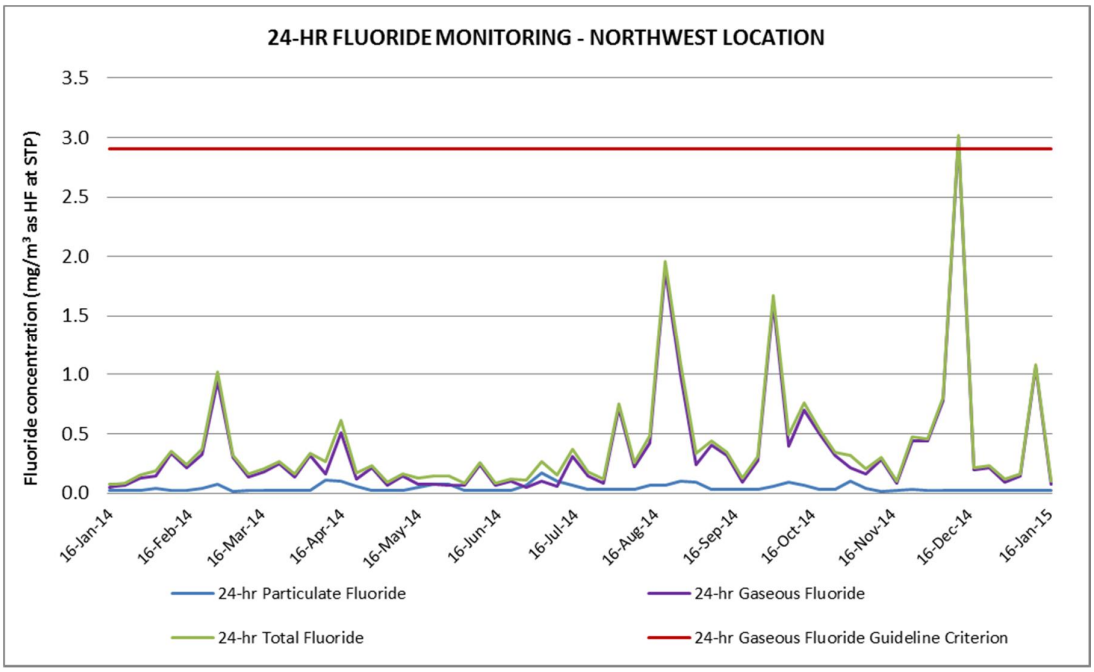

Figure 4 **24-hour Fluoride Monitoring – Northwest Location**

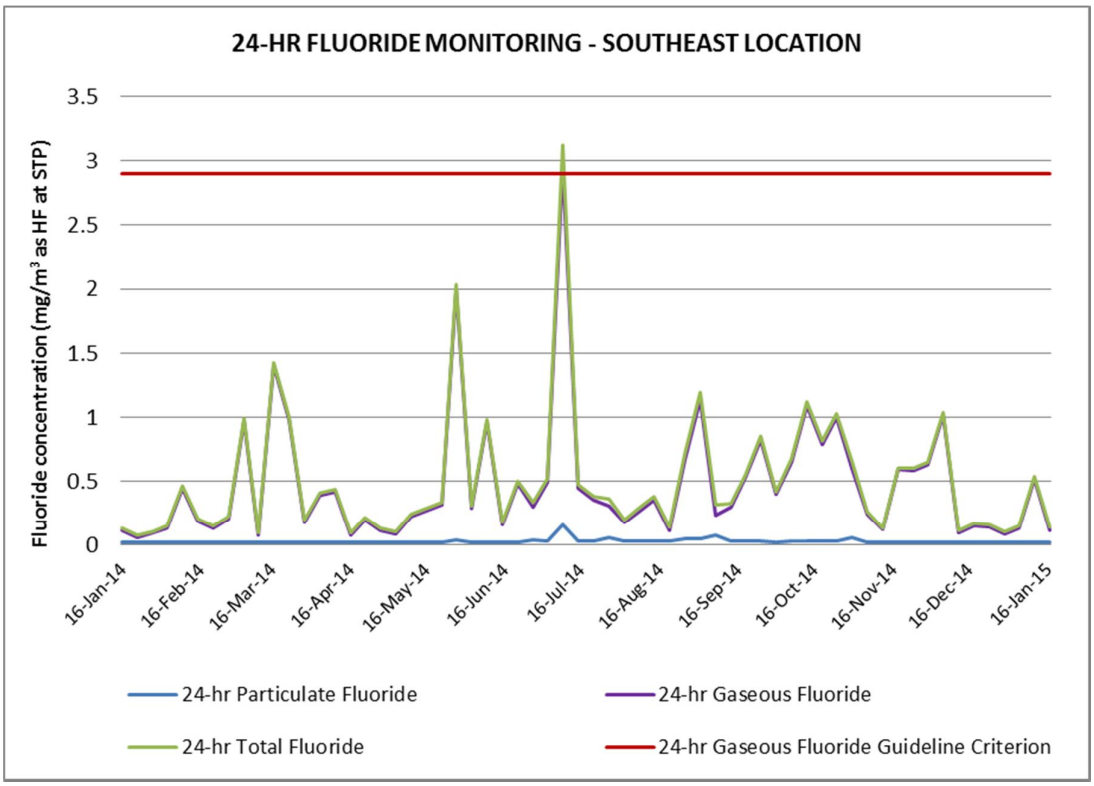

Figure 5 **24-hour Fluoride Monitoring – Southeast Location**

4.1.3 Fluoride – Weekly Monitoring Results

There are no ambient air Fluoride concentration limits specified in the EPL or Project Approval. To provide context for the ambient air monitoring results, guideline levels have been taken from the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW DECC, 2005).

A summary of Weekly Fluoride monitoring results from both monitoring locations for the current reporting period is provided in Table 5. The weekly Fluoride monitoring results for the NW and SE locations are also graphed in Figure 6 and Figure 7 respectively.

Table 5 Summary of Ambient Air Monitoring: Weekly Fluoride Results

Parameter	Guideline Criteria	NW Location	SE Location
Annual Average Concentration (µg/m^3)	-	0.4	0.1
Standard Deviation (µg/m^3)	-	0.3	0.1
Weekly Minimum Concentration (µg/m^3)	-	0.1	0.0
Weekly Maximum Concentration (µg/m^3)	1.7	1.3	0.5

Fluoride concentrations for all Weekly Fluoride monitoring events at both locations satisfied the DECC (2005) guideline levels for the 7-day Fluoride levels throughout the AEMR reporting period.

Comparison to historical monitoring results and analysis of trends is discussed further in Section 5.1.

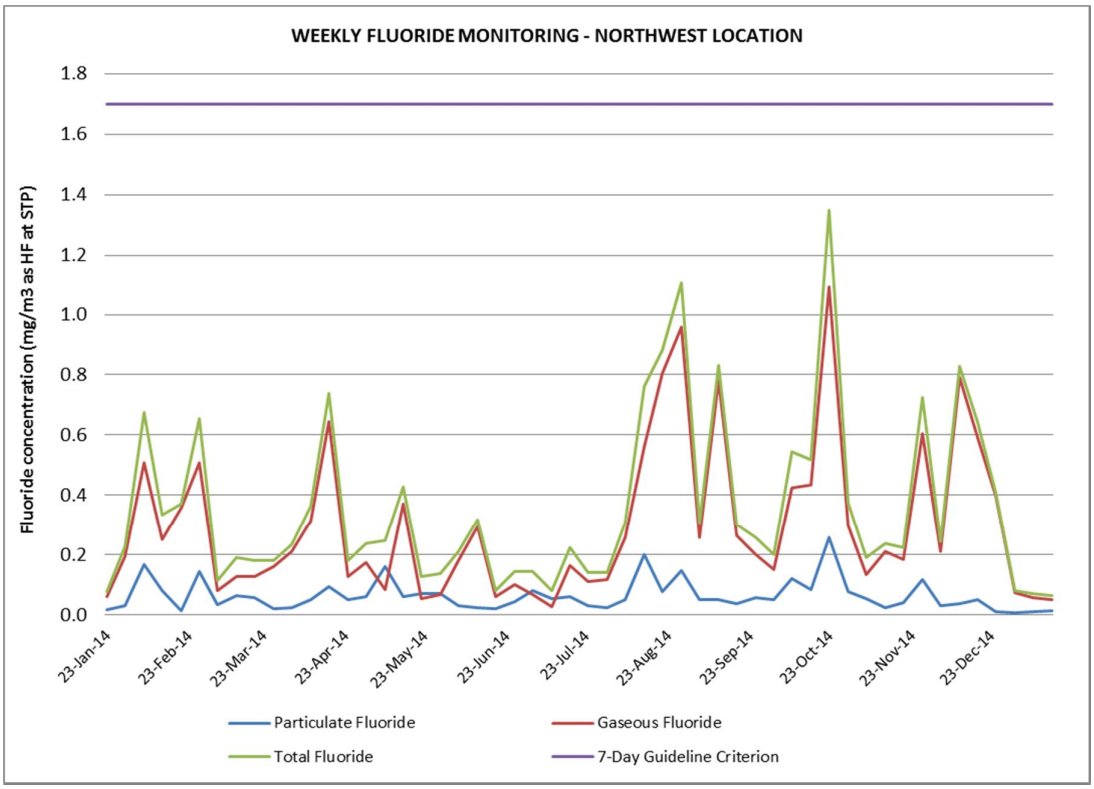

Figure 6 Weekly Fluoride Monitoring – Northwest Location

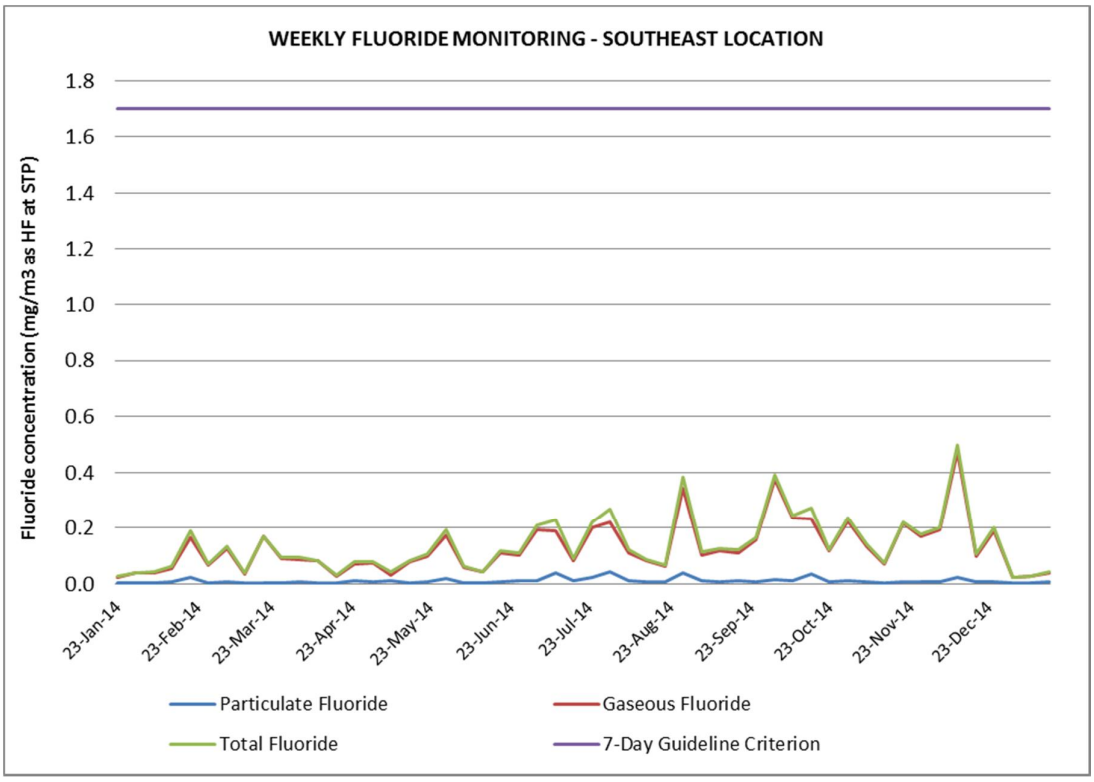

Figure 7 Weekly Fluoride Monitoring – Southeast Location

4.2 Fluoride Impact on Vegetation

In accordance with EPL condition M4.1, the potential impact of fluoride emissions on surrounding flora was monitored by undertaking visual inspection for flora condition and by foliage sampling for laboratory analysis of fluoride content.

AECOM conducted quarterly assessments during the reporting period as well as an Annual Vegetation Condition Assessment (December 2014). The quarterly surveys assess the condition of a shortlisted selection of fluoride sensitive species. The annual survey provides an opportunity to undertake a more comprehensive investigation and includes all specimens studied in the background survey. These assessments use the methodology developed by Dr David Doley of the University of Queensland.

Foliage samples were collected from locations and vegetation types defined by background surveys for subsequent analysis. Samples chosen for fluoride content analysis were selected on the basis of species sensitivity toward fluoride, representation of certain species and vegetation type (over storey, cultivated vegetation and forage crops).

The results of the quarterly and annual fluoride assessment for the reporting period are summarised below.

4.2.1 Flora Condition Assessment

Table 6 describes the injury categories used to define the assessment process. Vegetation was assessed at locations selected previously, including on the NCIA works site and at locations that could be viewed from public land, plus a control site on private property at 200 Anambah Road, Anambah (approximately 3km north of the NCIA site).

Table 6 Symptom Code for Visible Injury to Vegetation with Particular Reference to Fluoride

Category	Tip necrosis / chlorosis % length	Marginal necrosis / chlorosis % width / area	Undulation / cupping	Anthocyanin accumulation % area
0	nil	nil	nil	nil
1	very slight <2%	very slight <2%	very slight <2%	very slight <2%
2	slight <5%	slight <5%	slight <5%	slight <5%
3	distinct <10%	distinct <10%	distinct <10%	distinct <10%
4	marked <25%	marked <25%	marked <25%	marked <25%
5	severe <50%	severe <50%	severe <50%	severe <50%
6	very severe <75%	very severe <75%	very severe <75%	very severe <75%
7	extreme >75%	extreme >75%	extreme >75%	extreme >75%

The quarterly visual assessments found slight to severe emission related injury symptoms (i.e. chlorosis, necrosis, anthocyanin accumulation) in the foliage of a number of tree species occurring in the vicinity of the NCIA facility, which may be due to local industrial emissions, including:

- *Angophora floribunda* (Site 6);
- *Corymbia maculata* (Site 2, Site 3, Site 5, Site 7 and Site 8);
- *Eucalyptus acmenoides* (Site 2);
- *Eucalyptus amplifolia* (Site 5, Site 6 and Site 8);
- *Eucalyptus moluccana* (Site 1 and Site 8);
- *Eucalyptus paniculata* (Site 7); and
- *Eucalyptus resinifera* (Site 8).

Appendix A provides the tabulated results for the species that were assessed for visible injury during the Annual Vegetation Condition Assessment.

The annual survey includes a detailed assessment of the annual variation in visible injury expression in the foliage of three selected fluoride-sensitive specimens located at Site 5 (NCIA premises), Site 7 (Gillette Close) and Site 17 (Gardiner Road), respectively. These species were selected for the detailed assessment as they are located in and on either side of the NCIA facility along the axis of the prevailing wind directions (i.e. NW-SE). The results of the 2014 annual survey indicated that foliage health condition for these three specimens had either remained stable (specimens at Sites 5 and 7) or improved (specimen at Site 17) during the reporting period (i.e. since the previous annual survey), with the following impacts noted:

- The foliage of *E. moluccana* at Site 5 displayed very slight cupping and slight chlorosis injury symptoms, and very slight insect attack injury;
- The foliage of *C. maculata* at Site 7 displayed slight chlorosis and distinct cupping and tip necrosis symptoms; and
- The foliage of *C. maculata* at Site 17displayed very slight symptoms of chlorosis, cupping and necrosis (from distinct to marked symptoms recorded in 2013), as well as very slight insect attack injury.

Consistently with previous years observations, the distribution of emission injury in both current season and one year old foliage suggested a correlation between emission injury and proximity to the NCIA stacks. The data indicated an extension of the zones of impact towards the northwest and southeast from the centre of the site, which is consistent with the determination of the kiln stacks being an important source of fluoride emissions, as well as the occurrence of prevailing south-easterly winds during the growing season for fluoride sensitive species – principally eucalypts.

The data from the 2014 annual survey also provided evidence that the sensitivity of vegetation to fluoride impacts greatly varies between and within species, with individuals showing varying degrees of resistance and resilience to atmospheric fluoride.

The extent of leaf-chewing and sap-sucking insect injury recorded during the 2014 annual survey ranged from very slight to marked. The occurrence and prevalence of insect attack does not seem to be a function of location, species or foliage age, and no distinguishable pattern can be established between expressed injury and these variables.

It is noted that insect attack and/or weather conditions can cause injury symptoms in vegetation that mimic those of interactions with airborne pollution.

4.2.2 Fluoride Content Assessment

Foliage samples for fluoride content assessment were collected from various established locations during the 2014 annual survey. Where possible, both current and previous season leaves were collected for analysis and mixed to create a bulk sample for the site. Native grasses at Wollombi Road (Site11) were sampled in proportion to their representation or percentage ground cover at the sampling site and were collected at a height judged to be that at which cattle would graze (thereby avoiding the inclusion of soil).

Samples were sent to a NATA accredited laboratory for analysis, and the results are provided in Table 7. A comparison of these results to previous years is provided in Section 5.2 of this AEMR.

Table 7 Sites and Species within the Survey Area Selected for Foliage Fluoride Content Assessment

Site	Location	Species	Foliage Season Sampled	Fluoride Content (µg/g, dry)
5	NCIA – SE corner of site	*Eucalyptus moluccana*	Mixed	58.7
11	Hill-top – Wollombi Rd	Native grasses	Current	12.5
13	NCIA site entrance	*Corymbia maculata*	Mixed	132.0
13	NCIA site entrance	*Eucalyptus amplifolia*	Mixed	19.5
15	11 Gardiner Rd	*Corymbia maculata*	Mixed	92.2
19	200 Anambah Rd	*Vitis vinifera*	Current	14.9

4.3 Meteorological Monitoring

Meteorological data is recorded at the meteorological station established at the southeast air monitoring site. The station is sited and operated in accordance with approved methodologies (NSW EPA, 2001) for the continuous measurement of wind speed (10 m), wind direction (10 m), sigma theta (10 m) and temperature (5 m). A tipping bucket rain gauge is also located at the site to provide daily average rainfall rates.

The dominant function of meteorological monitoring at NCIA is to gain an understanding of the influence that NCIA operations and background pollutant sources have on the results of the ambient air quality monitoring program. This is particularly important in relation to the analysis of ambient air monitoring results which exceed the relevant criteria (refer to Section 4.1) and possible air quality complaints (refer to Section 3.0).

The monthly data for temperature and rainfall are provided in Figure 8. Monthly wind roses presenting the wind speed and direction for the reporting period are provided in Appendix B. A summary of the dominant wind patterns throughout the 2014 reporting period is provided below.

It is noted that for 10 days in March 2014 a loss of power issue occurred to the wind speed data logger, and as such wind data for this period were missing. In addition, a signal data issue occurred with the temperature data logger between March and June and temperature data were missing for this period. Both issues were resolved with all loggers operating correctly from June onwards. Where appropriate and for the purpose of this AEMR, the missing meteorological data has been substituted with data from the Bureau of Meteorology local monitoring stations (the Maitland Belmore Bridge station which is located approximately 2.5 km from Rutherford for rainfall data, and the Maitland Visitor Centre monitoring station which is located approximately 4 km from Rutherford for temperature).

Review of the monthly wind roses for the reporting period indicated the following:

- In January and February 2014 prevailing winds were largely from the south-southeast;
- In March 2014 prevailing winds were generally from the south-southeast, but with north-westerlies also commonly occurring;
- Between April and September 2014, prevailing winds were largely dominated by north-westerlies;
- In October 2014 wind patterns were variables, and winds came about equally from the west, north-west, south-southeast and southeast directions;
- In November and December 2014 prevailing winds were largely from the east-southeast and southeast; and
- In January 2015 wind were generally dominated variable. Although west-south westerly winds tended to be slightly dominant, winds also commonly came from the west, south-west, east and southeast directions;
- In November and December 2014 prevailing winds were largely from the east-northeast direction; and
- In January 2015 prevailing winds were generally from the east-southeast and south-east, but with west-north westerlies also commonly occurring.

Wind speeds recorded over the year from the NCIA on-site weather station were generally low to medium with an annual average wind speed of 1.9 m/s. The maximum hourly average wind gust was recorded at 12.0 m/s on 24 June 2014.

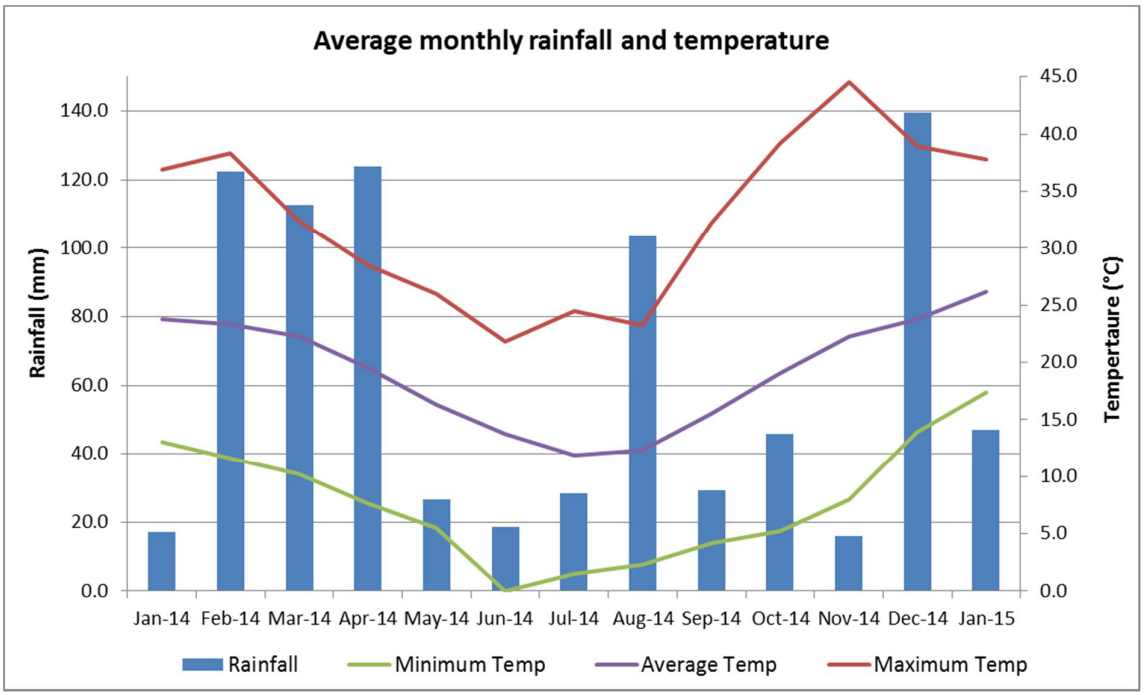

Figure 8 **Average Monthly Rainfall and Temperature Range (19 January 2014 – 18 January 2015)**

4.4 Stack Emissions Testing

As explained in Section 1.0, this AEMR presents the results of the stack emissions testing for the 01 August 2013 to 31 July 2014 EPL reporting period, which represent the most recent complete set of stack testing results available at the time this AEMR was being prepared. These results are from testing performed during October – November 2013 and January – April 2014. Notably, this includes data that was collected during this 2014 AEMR reporting period.

Emission sources assessed during the testing period were those defined in the EPL and listed in Table 8.

Table 8 **Emission Source Descriptions**

OEH Identification Number (EPL)	Emission Source Description
1	Clay Preparation (CP1)
2	Pressing and Drying (PD1)
5	Dryer (D1)
6	Dryer (D2)
9	Glaze Line
10	Selection Line (SL 1,2,3,4)
12	Spray Dryer (SD1)
14	Kiln 1 (KP1)
15	Kiln 2 (KP2)
18	Hot Air Cooler 1 (HAC1)
19	Hot Air Cooler 2 (HAC2)

All sources were tested for Total Particulate Matter and Fine Particulate (PM_{10}). Additional testing conducted on the Kiln 1 and Kiln 2 stacks measured concentrations of total fluoride (as HF), sulfuric acid mist (H_2SO_4 as SO_3), sulfur dioxide (SO_2 as SO_3), total hazardous substances (metals), oxides of nitrogen (NO, NO_2, NO_x), cadmium and mercury. All sampling was conducted in accordance with the applicable OEH test methods, with analyses conducted by a NATA-accredited laboratory.

The Project Approval does not specify pollutant concentration limits for the facility, however these are specified in Condition L3 of the EPL for the Site. Summaries of the emission testing results, along with the EPL pollutant discharge limits, are provided in Table 9 and Table 10.

All emission concentrations are converted to standard conditions of 0°C, dry gas and 1 atmosphere pressure for comparison with appropriate regulatory limits. The NOx, Total Particulate and Fine Particulate (PM_{10}) emission concentrations from the Kiln stack exhausts have been corrected to 18% O_2.

Concentrations of all pollutants were below the limits specified for each source in the EPL.

Table 9 Summary of Particulate Emission Monitoring Results (October – November 2013)

Source	Fine Particulate (PM_{10}) (mg/m^3)	Total Particulate (mg/m^3)	Regulatory Limit (mg/m^3) *
Clay Preparation (CP1) (EPL 1)	0.55	1.2	20.0
Pressing and Drying (PD1) (EPL 2)	2.8	12.0	20.0
Dryer (D1) (EPL 5)	0.97	2.3	20.0
Dryer (D2) (EPL 6)	0.9	2.2	20.0
Glaze Line (EPL 9)	<0.22	0.52	20.0
Selection Line (SL 1,2,3,4) (EPL 10)	0.69	1.1	20.0
Spray Dryer (SD1) (EPL 12)	6.3	13.0	20.0
Hot Air Cooler 1 (HAC1) (EPL 18)	0.35	0.6	5.0
Hot Air Cooler 2 (HAC2) (EPL 19)	0.25	0.5	5.0

** Note – Regulatory limit only applies to Total Particulate.*

Table 10 Summary of Emission Monitoring Results – Kiln 1 and Kiln 2 (January – April 2014)

Pollutant	Kiln 1 (EPL 14)	Kiln 2 (EPL 15)	Regulatory Limit (mg/m^3)
Fine Particulate (at 18% O_2) (PM_{10}) (mg/m^3)	2.0	13.0	N/A
Total Particulate (at 18% O_2) (mg/m^3)	8.0	18.0	20.0
Total Fluoride (as HF) (mg/m^3)	4.4	1.3	5.0
Sulfuric Acid Mist (H_2SO_4 as SO_3) (mg/m^3)	<2.1	29.0	100.0
Sulfur Dioxide (SO_2 as SO_3) (mg/m^3)	16.0	230.0	N/A
Total Hazardous Substances (Metals) (mg/m^3)	0.12	0.17	1.0
Total Oxides of Nitrogen (at 18% O_2) (as equivalent NO_2) (mg/m^3)	75.0	88.0	100.0
Cadmium (mg/m^3)	0.017	0.026	0.1
Mercury (mg/m^3)	<0.000022	0.0026	0.1

4.5 Noise Monitoring

Noise limits set out in NCIA's Project Approval are more stringent than those set out in the EPL and therefore the Project Approval limits are used to assess the Site's compliance with noise requirements. The Project Approval states that noise generated from NCIA should not exceed 35 dB(A), $L_{eq(15\ min)}$ during the day, evening or night periods, at the Kenvil Close and Wollombi Road noise monitoring locations. The Project Approval also sets a night time sleep disturbance criteria of 45 dB(A) L_{max}.

Noise levels are measured in accordance with NCIA's Project Approval, EPL, and the procedures in the *NSW Industrial Noise Policy* (INP) (NSW EPA, 2000). In accordance with the INP, the noise criteria apply under all meteorological conditions except during rain, wind speeds greater than 3m/s (at 10 m above ground level) and intense temperature inversions (greater than +3°/100) between 6 pm and 7 am. Data obtained during these meteorological conditions were omitted.

The noise monitoring was undertaken by Spectrum Acoustics on 14 May 2014. A series of attended noise measurements, of 15 minutes duration, were made in Kenvil Close and in Wollombi Road on Monday 12 May 2014 during the day, evening and night time periods. Measurements were also made during the day time period on the NCIA site. At the time of the monitoring activities at NCIA were being carried out under typical operating conditions.

The results of the attended noise measurements at each location and time are summarised in Table 11.

Table 11 Received Noise Levels during Attended Noise Monitoring (14 May 2014)

Location	Time	dB(A), $L_{eq\ (15\ min)}$	Wind speed / direction	Identified Noise Sources	dB(A), L_{max}
Kenvil Close	11:43 am (day)	43	2.5/S	Traffic (41), construction (36), birds (31), **NCIA not measureable**	N/A
Kenvil Close	9:06 pm (evening)	40	1.7/N	Traffic (38), **NCIA (32)**, frogs & insects (30)	N/A
Kenvil Close	10:06 pm (night)	40	Calm	Traffic (38), **NCIA (34)**, frogs & insects (30)	38
Wollombi Rd	12:01 pm (day)	67	3.1/SSE	Traffic (67), birds (30), **NCIA not measureable**	N/A
Wollombi Rd	9.32 pm (evening)	62	Calm	Traffic (62), frogs & insects (30), domestic (30), **NCIA faintly audible**	N/A
Wollombi Rd	10.25 pm (night)	64	Calm	Traffic (64), frogs & insects (34), **NCIA (27)**, domestic (26)	31

The results show that the received noise from the NCIA site was audible and measureable at each of the monitoring locations during the evening and night time periods. However the noise from NCIA did not exceed the relevant criterion at any time.

The measured noise emissions from NCIA were relatively steady state with little variation over time.

During the day time monitoring the acoustic environment at the Kenvil Close location was significantly impacted by noise from the construction of the subdivision on the land between the location and NCIA (old golf course site).

At Kenvil Close during each of the monitoring periods there was also significant contribution from noise from traffic on the New England Highway.

Noise from traffic on Wollombi Road was the most significant contributor to the measured noise. Analysis of data from those times when the traffic noise was low allowed for the determination of the contribution of other noise sources to the overall acoustic environment.

The noise emissions from NCIA are relatively constant and steady state with very few easily discernible L_{max} events. The measured L_{max} noise level attributed to NCIA is shown in Table 11. These show compliance with the sleep disturbance criterion.

L_{max} noise levels measured on the NCIA site (during the day) did not vary by more than 2-3 dB(A) from the measured L_{eq} noise levels. Based on the results in Table 11 this means that the L_{max} noise at the closest receivers in Kenvil Close and Wollombi Road would be significantly lower than the 45 dB(A) criterion for the site.

The noise assessment report concluded that noise levels were in compliance with the noise criteria for all time periods. Compliance with the sleep disturbance criterion was also demonstrated.

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5.0 Analysis of Monitoring Results and Environmental Impact

This section provides an assessment of the monitoring results for the 2014 reporting period against the criteria set out in the Project Approval and EPL, the predictions made in the 2010 EA, and the monitoring results from previous years. Any trends observed in the monitoring results or discrepancies between predicted and actual impacts are discussed.

5.1 Ambient Air Quality

The 2010 EA predicted that, with the exception of PM_{10}, emissions from NCIA would meet all of the ambient air criteria. The 2010 EA stated that existing background 24-hour PM_{10} concentrations already exceeded the EPA criterion. While it was predicted that the annual average PM_{10} criterion would be met, the 2010 EA indicated that the 24 hour average PM_{10} concentrations may exceed the criteria under worst case dispersion conditions. Specifically, predictions made in the 2010 EA for the project included the following:

- The maximum cumulative 24 hour average PM_{10} concentration at the closest existing private receptor was predicted to be 53.4 µg/m^3 (compared to the criterion of 50 µg/m^3);
- The maximum cumulative 24 hour average PM_{10} concentration for residential receptors within the Heritage Park (located at 99 Racecourse Road, Rutherford) was predicted to be 57.7 µg/m^3 (compared to the criterion of 50 µg/m^3);
- The cumulative impact of predicted maximum PM_{10} concentrations at all existing residential receptors was considered to be minor despite the predicted cumulative results being above the guidelines. It was not expected that the predicted PM_{10} impacts would be beyond levels already experienced due to the minor contribution of the project when compared to the elevated background PM_{10} levels;
- No exceedances of 24 hour or weekly Fluoride concentrations at existing residential receptors were predicted;
- The maximum cumulative 24 hour Fluoride concentration for residential receptors within the Heritage Park was predicted to be 3.2 µg/m^3 (compared to the criterion of 2.9 µg/m^3); and
- The predicted exceedances of the Fluoride criterion represent a worst case scenario with NCIA operating at its fluoride licence limit of 5 mg/m^3. Stack emission testing has demonstrated that NCIA operates at levels much lower than this limit.

Monitoring results from the current AEMR reporting period are generally consistent with these predictions.

The 24 hour PM_{10} criterion was exceeded at the site boundary once only during 2014 (at the MW monitoring location on 22nd May 2014, refer to Section 4.1.1), however the annual average PM10 concentration was well below the relevant criteria throughout the reporting period.

- With only one PM_{10} exceedance recorded, 2014 was the year experiencing the lowest number of exceedances of this criterion at the site boundary in a calendar year since the start of operations in 2004. In addition, a review of the meteorological data for the 22nd May 2014 indicated that the prevailing winds during that 24 hour period were almost entirely from the west and north-west. Under these conditions the NW monitoring station was upwind of the emission stacks and as such it is unlikely that the NCIA site operations contributed to that exceedance.

The 24-hour fluoride DECC (2005) guideline criterion was exceeded at the site boundary twice during 2014 (at the NW location on 12th December 2014 and at the SE location on 09th July 2014 (refer to Section 4.1.2), however the weekly fluoride concentrations were below the DECC (2005) guideline criterion throughout the reporting period. A review of the meteorological data (prevailing wind directions) for the two days where the exceedances were recorded indicated that on both occasions the monitoring stations were located downwind of the emission stacks, and as such the exceedances may be attributable to NCIA site operations. However:

- The two exceedances of the 24-hour fluoride guideline criterion were the first exceedances of this criterion recorded since 2012. Exceedances of this guideline criterion are not common but have occurred on several occasions in the past (i.e. five exceedances have been recorded since 2004). However, both exceedances recorded in 2014 were only marginal and although levels were above the DECC (2005) guideline criteria (2.9 µg/m^3); they were below the predictions made in the EA (i.e. 3.2 µg/m^3).

Historical ambient air monitoring results recorded since commencement of operations (15 March 2004 to current) are shown in Figure 9 to Figure 14. From these figures it seems that there are no discernible trends in PM_{10} concentrations, with variable results oscillating around a relatively stable annual average. There appears to be an increasing trend in gaseous fluoride concentrations at both locations, which can be observed in the 24-hour monitoring results (and as materialised by the two exceedances recorded during this reporting period) but is more apparent in the weekly monitoring results. However, the weekly fluoride concentrations during the 2014 reporting period remained well below the EPA guideline criterion. This apparent trend for increasing fluoride levels will be closely monitored in the next reporting periods to ensure levels remain below the guideline criterion.

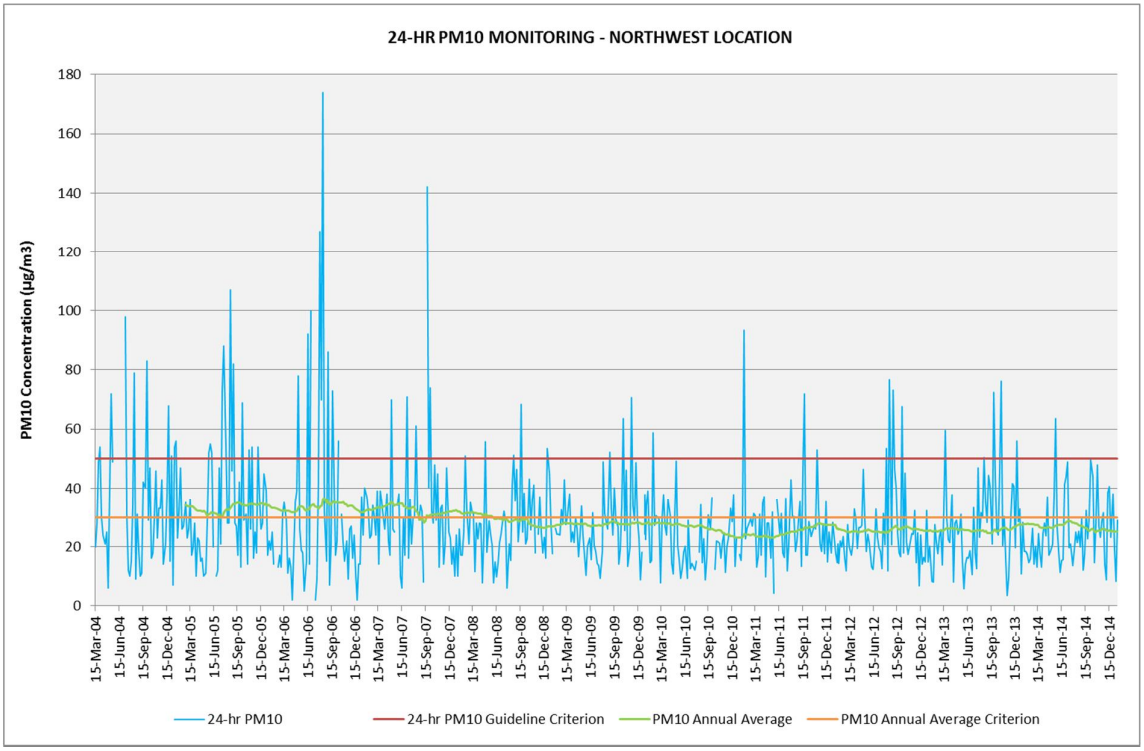

Figure 9 24-hour PM_{10} Monitoring – Northwest Location (2004 – 2014)

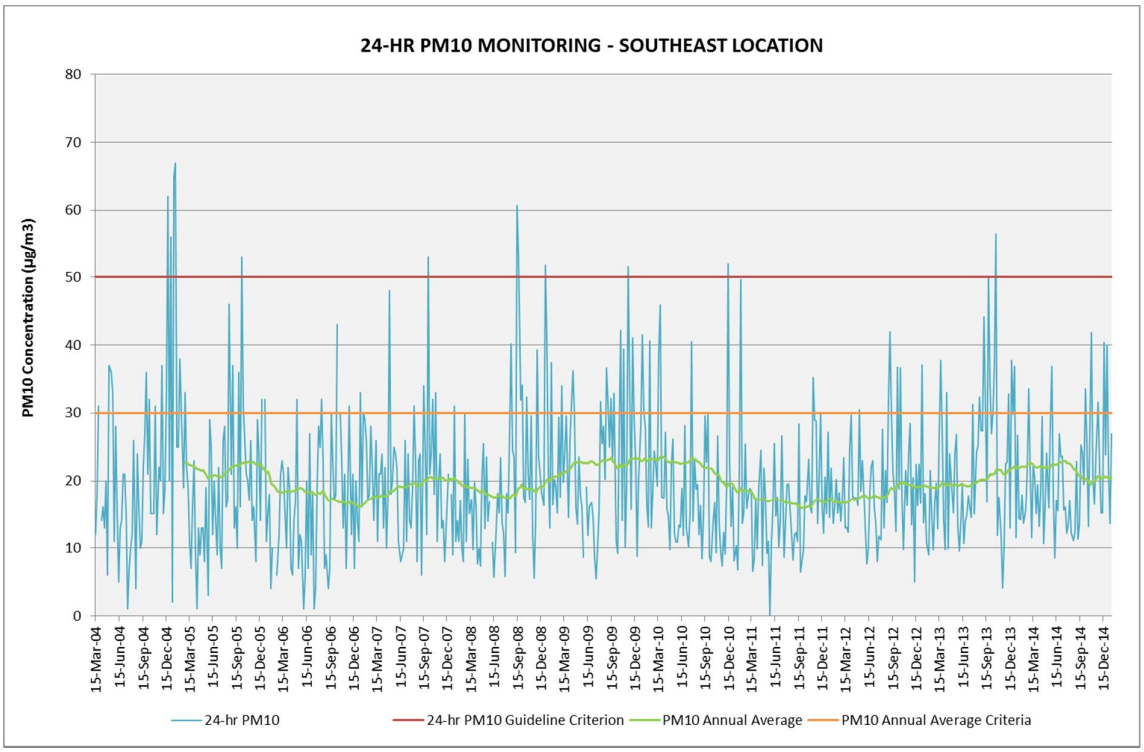

Figure 10 24-hour PM_{10} Monitoring – Southeast Location (2004 – 2014)

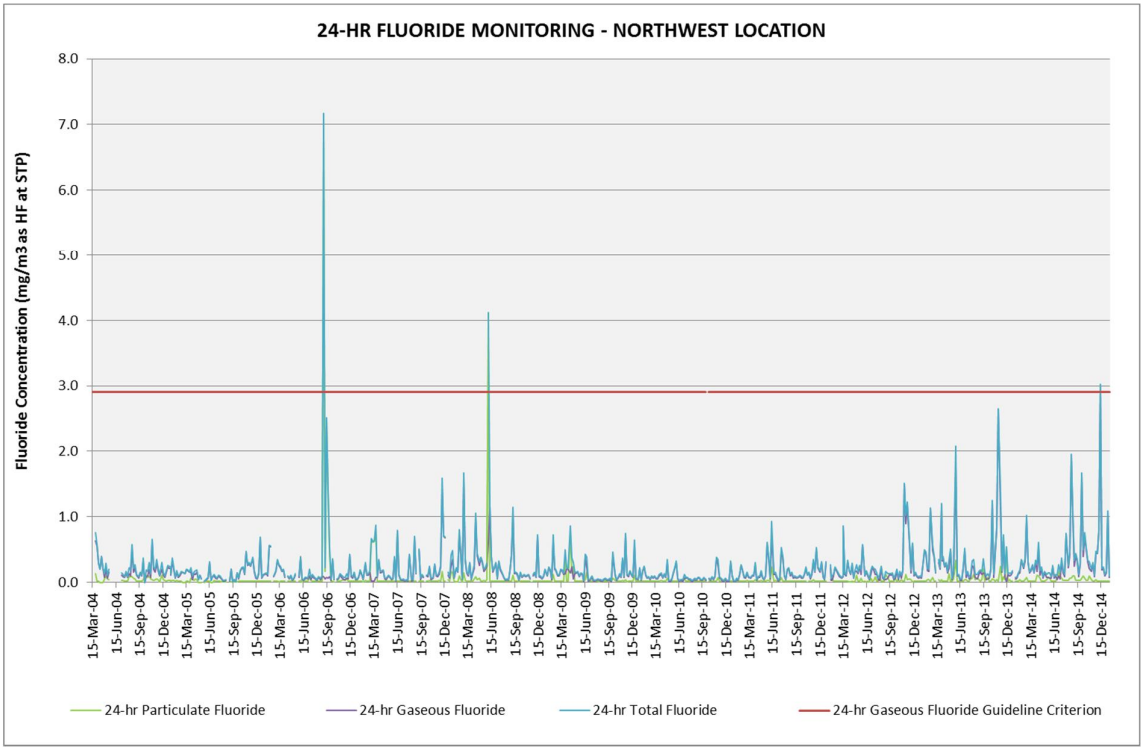

Figure 11 24-hour Fluoride Monitoring – Northwest Location (2004 – 2014)

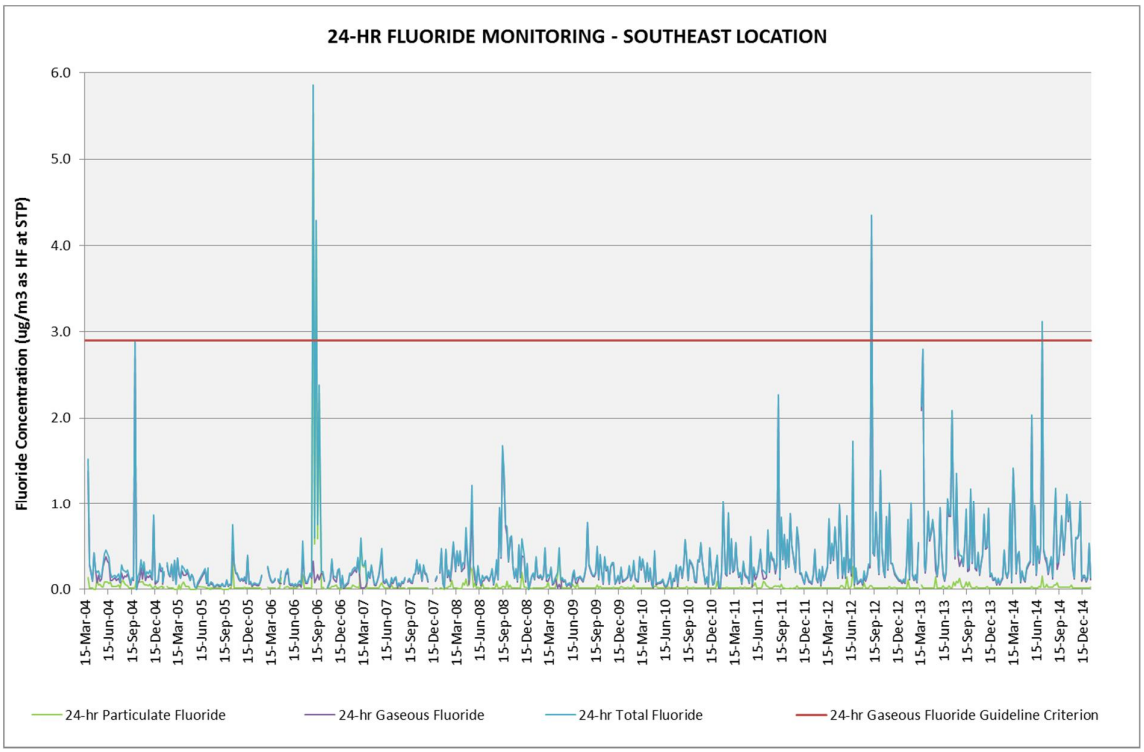

Figure 12 24-hour Fluoride Monitoring – Southeast Location (2004 – 2014)

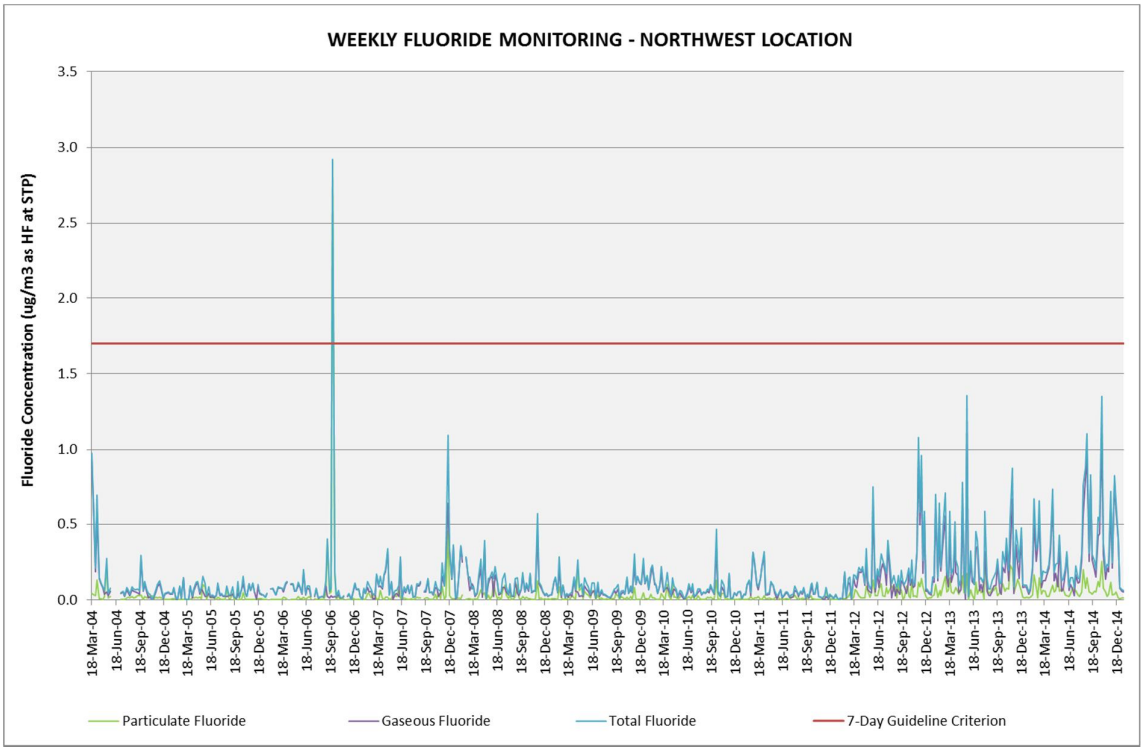

Figure 13 Weekly Fluoride Monitoring – Northwest Location (2004 – 2014)

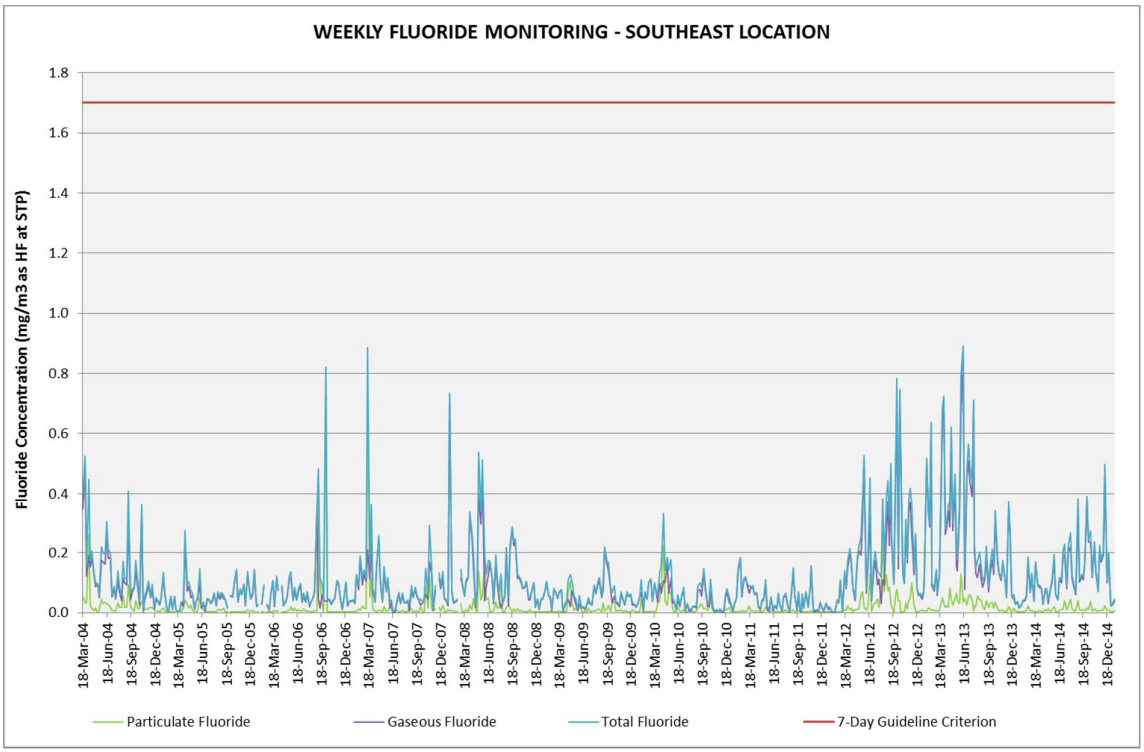

Figure 14 Weekly Fluoride Monitoring – Southeast Location (2004 – 2014)

5.2 Fluoride Impact on Vegetation

The 2010 EA concluded that the expansion project was unlikely to have a significant impact on threatened flora and fauna species. The site is highly modified and contains little habitat value for native species. The 2010 EA did not specifically discuss fluoride impact on vegetation and therefore no predictions are available for comparison.

As required by the EPL, the potential impact of NCIA's operations on vegetation surrounding the site is monitored through assessment of seasonal fluoride impacts on vegetation. There are no limits or criteria set out in the EPL or Project Approval by which to assess compliance. Instead the assessments are used to provide an indication of trends in fluoride injury at particular locations or in particular species.

5.2.1 Trends in Visual Impact on Vegetation

Amongst the full suite of individuals assessed during the 2014 annual survey, minor variations in foliage condition were reported in 2014 when compared to observations made in previous annual surveys, with some specimens studied experiencing either a slight deterioration or improvement in foliage condition – whilst others showed relatively consistent symptoms. However, none of the 2014 observations could be flagged as exceptional in the context of the long-term monitoring programme and associated historical data.

The annual variation in visible injury expression in the selected fluoride-sensitive tree species at Sites 5, 7 and 17 is presented in Table B 5 of Appendix A, which includes data collected since the commencement of monitoring at these respective locations. Long term data results show the expression of fluoride injury symptoms in the foliage of individual trees across years to be variable.

- The *E. moluccana* at Site 5 has consistently returned a slight to distinct emission injury since 2007. However the exhibited symptoms have changed over the years with chlorosis symptoms only becoming evident since 2013 while anthocyanin accumulation used to be prevalent between 2008 and 2012. Slight to marked insect attack injury has consistently been exhibited since 2007. The 2014 results for this species were overall consistent with the 2013 results;
- The *C. maculata* at Site 7 has consistently displayed slight to distinct emission injury since 2006, whereas emission related symptoms in its foliage were absent between 2003 and 2005. In 2006 and 2007 visible symptoms were generally limited to anthocyanin accumulation, whiles since 2008 symptoms of chlorosis, cupping and necrosis have regularly been noted. Slight to distinct insect attack injury has consistently been exhibited since 2003, with the exception of 2004 where only very slight impact was recorded. The condition of this tree's foliage in 2014 was also consistent with that recorded in 2013; and
- The *C. maculata* at Site 17 experienced a marked improvement in foliage condition since 2013, with only very slight symptoms observed in 2014 while marked and distinct symptoms of chlorosis, cupping and necrosis were present in 2013. This year's results are however in line with those noted in both 2011 and 2012. This tree appears very sensitive to atmospheric emissions and the expression of injury symptoms in its foliage has been highly variable since the start of the monitoring programme. Indeed, between 2003 and 2005 and in 2011, 2012 and 2014, fluoride related symptoms were absent or very slight, while between 2006 and 2010 and in 2013 distinct to marked symptoms were exhibited. Insect attack injury also appears variable in this species with very slight to marked impacts recorded across the surveys.

5.2.2 Trends in Fluoride Content in Vegetation

Historical fluoride concentrations in vegetation sampled during the annual surveys are presented in Table 12. For the purposes of comparison, historical vegetation fluoride levels from each of the quarterly and annual surveys are shown graphically in Figure 15 to Figure 18. It is noted that laboratory analyses no longer measure the precise fluoride content in leaves where it is lower than 10.0 µg/g, and instead provide a reading of <10.0 µg/g.

Table 12 Historical Analytical Results of Fluoride Content in Vegetation

Site	Species Sampled	Foliar fluoride measure (µg/g*)										
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
5	*Eucalyptus moluccana*	-	-	-	63.0	11.0	58.8	31.6	20.8	86.1	92.8	**58.7**
11	Native Grasses	<10.0	<1.0	11.0	7.0	10.0	10.0	<10.0	<10.0	12.7	<10.0	**12.5**
13	*Eucalyptus amplifolia*	-	-	-	132.0	22.0	150.0	54.1	114.0	33.5	136.0	**132.0**
13	*Corymbia maculata*	-	-	-	33.0	<10.0	24.6	<10.0	13.5	38.2	23.9	**19.5**
15	*Corymbia maculata*	12.0	2.0	40.0	103.0	73.0	75.0	16.8	48.9	142.0	40.3	**92.2**
19	*Vitis vinifera*	<10.0	<1.0	3.0	6.0	<10.0	15.0	<10.0	<10.0	<10.0	<10.0	**14.9**

* *µg/g are equivalent to mg/kg (as reported in the laboratory certificate of analysis)*

\- *indicates no sample was taken*

The results of the 2014 annual survey seemed to indicate a poor correlation between foliar fluoride content and the visible expression of injury symptoms in foliage. For instance, although the *E. amplifolia* at Site 13 returned the highest fluoride concentration (132.0 µg/g), its leaves showed very slight visible injury symptoms. Conversely, the foliage of *C. maculata* at Site 13 exhibited slight to distinct injury symptoms while the laboratory results showed that foliar fluoride concentration was the lowest of all tree species sampled (19.5 µg/g). This has already been noted in previous quarterly reports, and may be due to:

- A lag in the visible expression injury symptoms following exposure to atmospheric fluoride emissions; or
- Various sensitivity of individual specimens in exhibiting visible injury symptoms.

In conclusion, the following points are made from the collected long term data and monitoring program survey results:

- Historical data proves that it is not uncommon for fluoride concentrations to display episodic increases on a seasonal basis, usually reflecting the changing dominant wind patterns that occur with the change of season;
- Environmental and climatic conditions also seem to play a role in the expression of fluoride injury symptoms in vegetation foliage, with higher rainfall generally leading better foliage conditions as emission particulates deposited on leaves get quickly washed from the leaf surface, and are not therefore able to be absorbed and accumulate in the leaf tissue;
- Insect attack is evident at most locations monitored, and the relationship between insect attack and fluoride concentrations is difficult to determine; and
- There is an inherent level of unpredictability in the expression of visual symptoms and in foliar fluoride between monitoring events, as well as an obvious variability in sensitivity to fluoride impacts both inter and intra-species, with different individuals clearly being more resistant to emission related impacts than others.

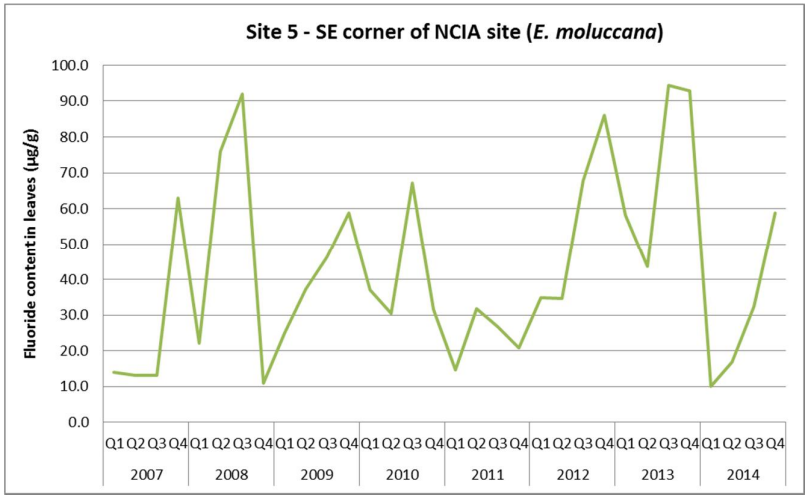

Figure 15 Fluoride Content in *E. moluccana* Foliage at Site 5 (Q1 2007 – Q4 2014)

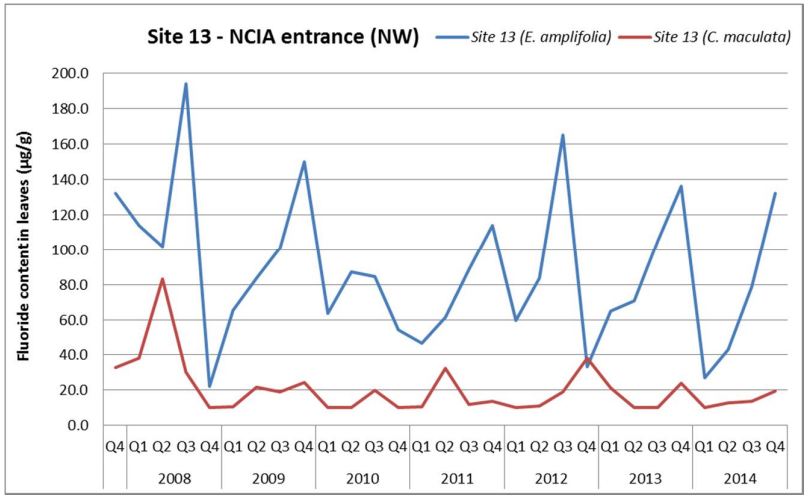

Figure 17 Fluoride Content in *E. amplifolia* and *C. maculate* Foliage at Site 13 (Q4 2007 – Q4 2014)

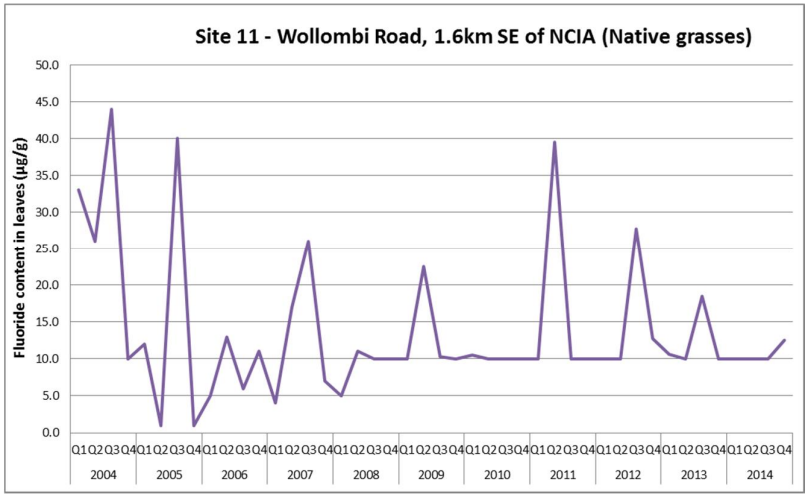

Figure 16 Fluoride Content in Native Grasses at Site 11 (Q1 2004 – Q4 2014)

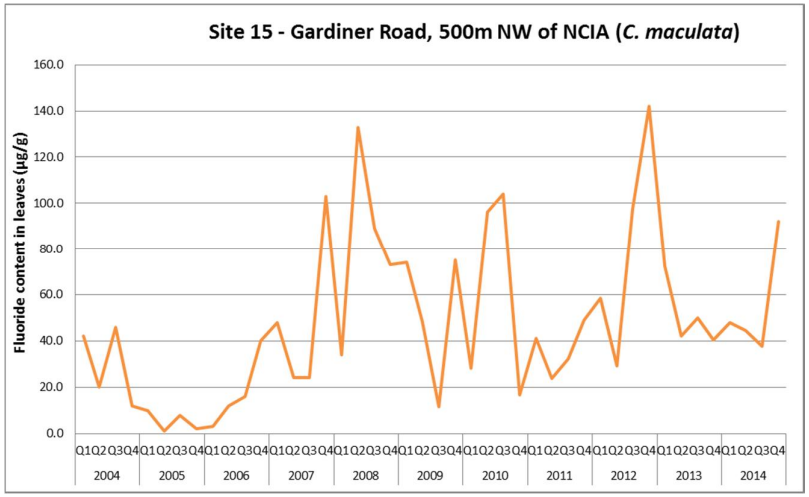

Figure 18 Fluoride Content in *C. maculate* Foliage at Site 15 (Q1 2004 – Q4 2014)

5.3 Air Pollutant Load Limits

The 2010 EA included dispersion modelling to predict ground level pollutant concentrations. No source emission predictions were made in the 2010 EA, so stack emission monitoring results are not directly comparable to air quality impact predictions.

In order to analyse trends in the air quality pollutants discharged to air as a result of NCIA operations, previous AEMRs have assessed the air pollutant loads reported to the EPA in the Annual Returns. The Annual Returns are provided in accordance with a reporting timeline of 1 August to 31 July of each year. The AEMR reporting timeline is 19 January to 18 January of each year, however for consistency in identifying trends in assessable pollutant loads, the AEMRs will continue to compare the information provided in the Annual Returns for each year.

The assessable pollutant loads discharged during the Annual Return reporting period are provided in Table 13, alongside the maximum load limits set out in both the EPL and Project Approval. Historical pollutant loads discharges have also been included for comparison purposes. The historical results are also presented graphically in Figure 19 to Figure 23. These graphs note the limits set out in the Project Approval.

Fine and coarse particulates, fluoride and nitrogen oxides loads were all within the pollutant load limits for 2013-2014. One exceedance of the EPL load limits was however recorded for the amount of Sulfur Oxides discharged in 2013-2014.

- The levels of fine and coarse particulates both showed a marginal increase from the previous reporting period, however levels remained relatively low and well below the load limits;
- The total amount of fluoride discharged in 2013-2014 was slightly lower than in the previous year, and about half the amount permitted in the EPL;
- The amount of nitrogen oxides discharged in 2013-2014 was markedly higher than in 2012-2013, yet relatively comparable to that discharged in the two years prior and much lower than quantities discharged in 2008-2009 and 2009-2010. This year's levels were also well below the permitted load limits; and
- For the second consecutive year the amount of sulphur oxides discharged to air in 2013-2014 exceeded the pollutant load limit specified in the EPL[1]. However the levels have decreased from last year, and were still much lower than those identified between 2008 and 2010 (refer to Figure 22).

It is noted that the levels of sulphur oxides discharged to air for the current reporting period were only marginally higher than those permitted in the EPL (~3% exceedance), and well below the levels stated in the Project Approval. Furthermore, the total loads discharged decreased from those reported in the previous Annual Return (2012-2013; ~15% exceedance), despite a moderate increase in production levels in 2013-2014. This indicates that the concentrations of sulphur oxides discharged in 2013-2014 were proportionally lower than those discharged in 2012-2013. However, this issue was being investigated at the time this AEMR was prepared, and any identified causes and potential ameliorative measures will be reported in the next AEMR. The levels of sulphur oxides emissions will also be closely monitored in the next year.

[1] It is noted that the reporting of this exceedance of was mistakenly omitted in Section C ('Statement of Compliance') of the 2013-2014 Annual Report. However the actual loads of sulphur oxides discharged were used for the purpose of Section D of the Annual Return ('Load-Based Fee Calculation Worksheet') and the correct and appropriate pollutant fee was paid by NCIA to the EPA.

Table 13 Maximum Pollutant Load Limits and Assessable Pollutant Loads

Pollutant	Current Maximum Load Limit (kg)		Actual Load (kg)								
	EPL	Project Approval	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010 *	2010-2011	2011-2012	2012-2013 #	2013-2014
Fine particulates	26,629	74,210	25,751	7,289	4,449	5,476	6,524	2,902	997	1,249	5,369
Coarse particulates	14,338	32,073	11,986	12,657	3,881	2,564	475	1,774	5,550	1,640	3,289
Fluoride	1,850	3,701	4,085	1,989	336	1,529	621	295	91	1,109	928
Sulfur oxides	36,828	110,000	13,239	15,850	16,633	62,426	86,704	7,699	26,946	42,235	37,974
Nitrogen oxides	36,828	73,657	12,422	12,423	18,073	70,565	79,375	18,322	20,306	4,704	25,059

* *2009-2010 marked the commencement of stage 2 of the development.*

The Project Approval came into effect on January 2013 and the previous Consent was relinquished.

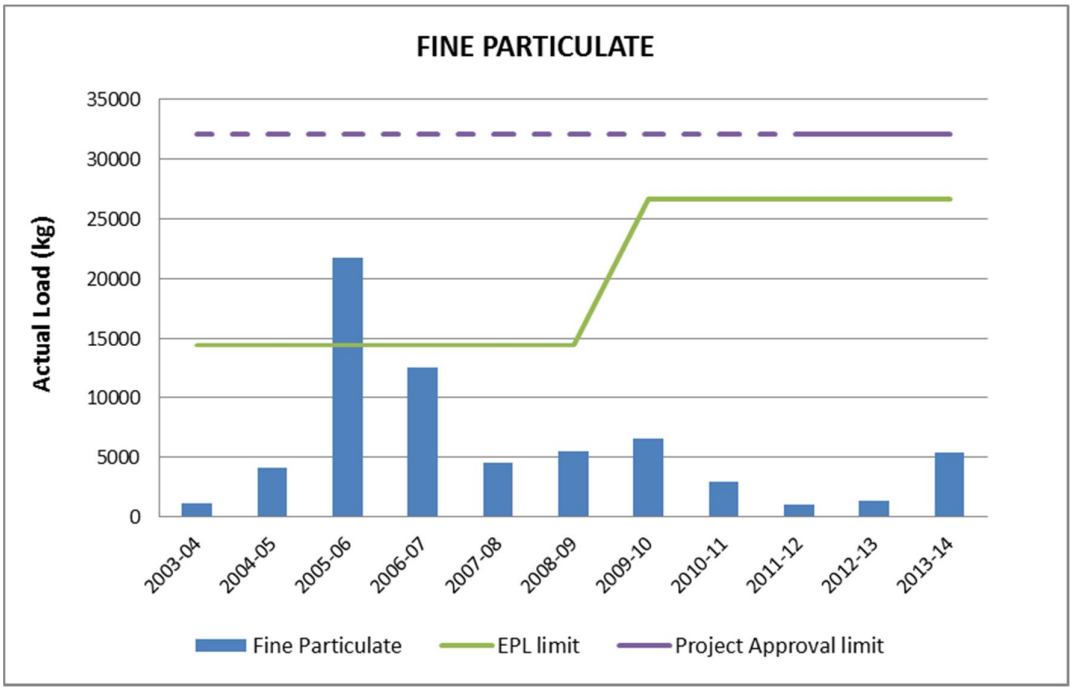

Figure 19 Fine Particulate Annual Load (2004 – 2014)

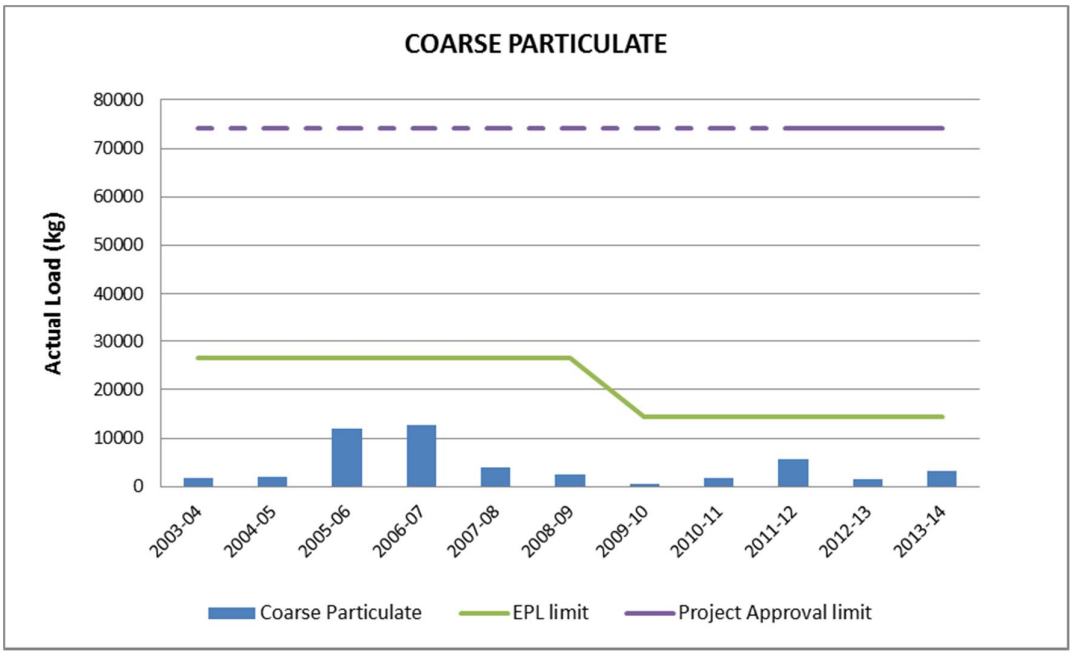

Figure 20 Coarse Particulate Annual Load (2004 – 2014)

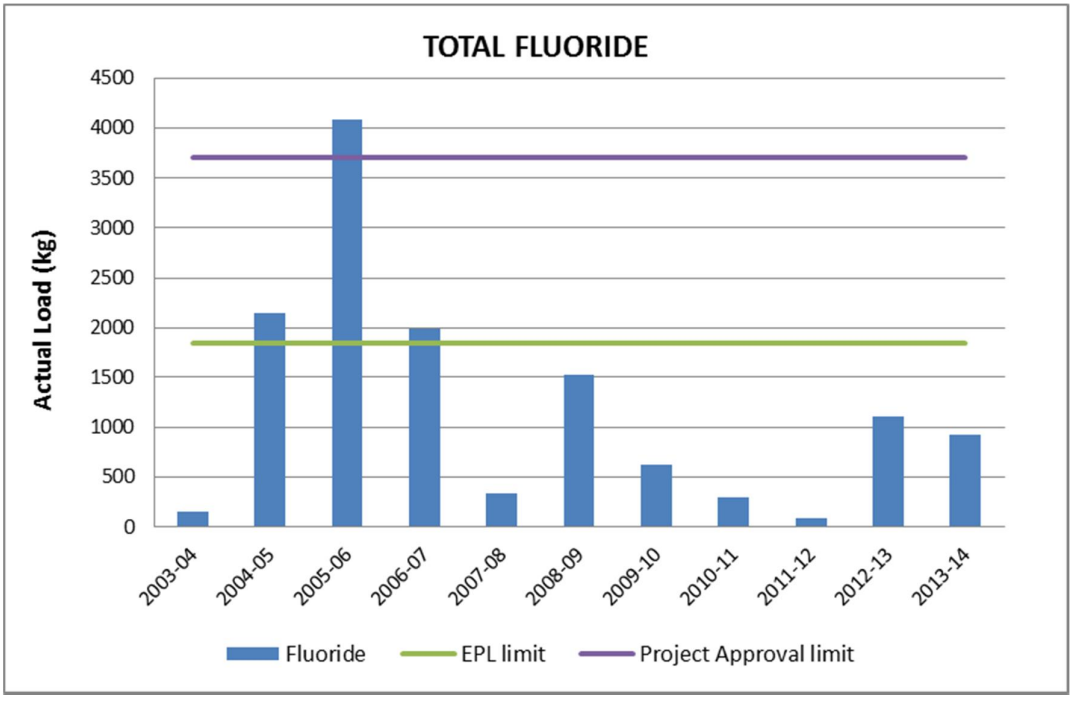

Figure 21 Fluoride Annual Load (2004 – 2014)

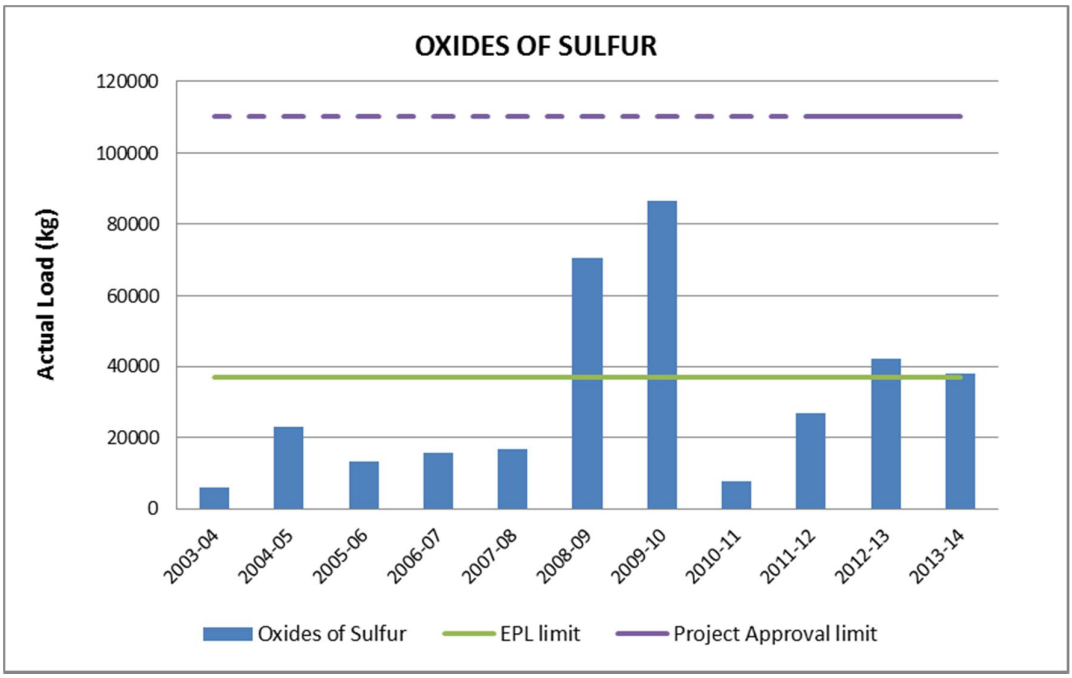

Figure 22 Sulfur Oxides Annual Load (2004 – 2014)

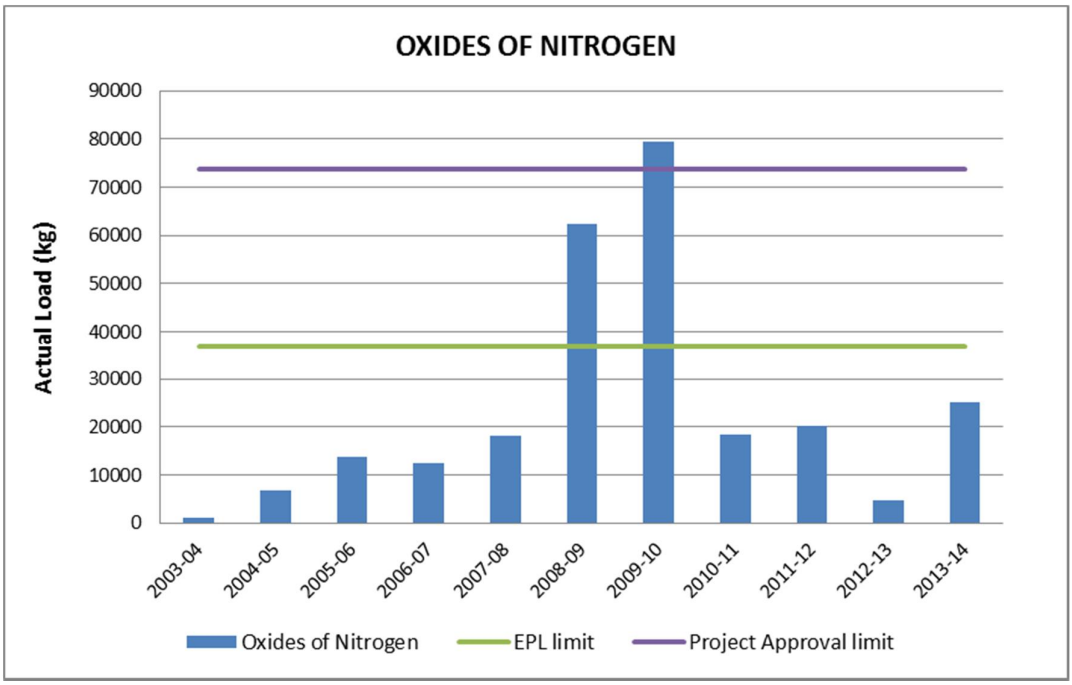

Figure 23 Nitrogen Oxides Annual Load (2004 – 2014)

5.4 Noise

The 2010 EA predicted that the operational noise levels from the expanded facility would not change significantly from that already approved, and would be significantly below the project specific noise criteria at all existing receptors under calm and prevailing weather conditions.

The Project Approval specifies more stringent noise limits than those set out in the EPL. Under the Project Approval, the noise generated from the facility must not exceed 35 dB(A) for the day, evening and night periods.

Monitoring results for the 2014 reporting period indicate that noise emissions from NCIA were in compliance with the EPL and Project Approval noise criteria for all time periods, including the sleep disturbance criteria.

Historical noise monitoring results at the closest sensitive residential receiver (Kenvil Close) are provided in Figure 24 – Figure 26. Noise levels from the facility for the day, evening and night periods were estimated based on operator notes taken during the noise survey and free field calculations. On many occasions the NCIA facility was not clearly audible over other dominant industrial and traffic noise sources nearby.

No trends in the noise monitoring are clearly discernible, with historical noise emissions generally complying with noise limits. During the daytime for the past six years, the NCIA noise contribution was audible but not measurable. The current noise monitoring report noted that the acoustic environment at the Kenvil Close monitoring locations was significantly impacted by noise from the construction of the subdivision on the old golf course site. Traffic noise on the New England Highway also contributes to the background noise levels. The 2010 EA indicated that the increase in background levels in the Rutherford region was likely to be due to the development of new industrial facilities in the Rutherford Industrial Estate.

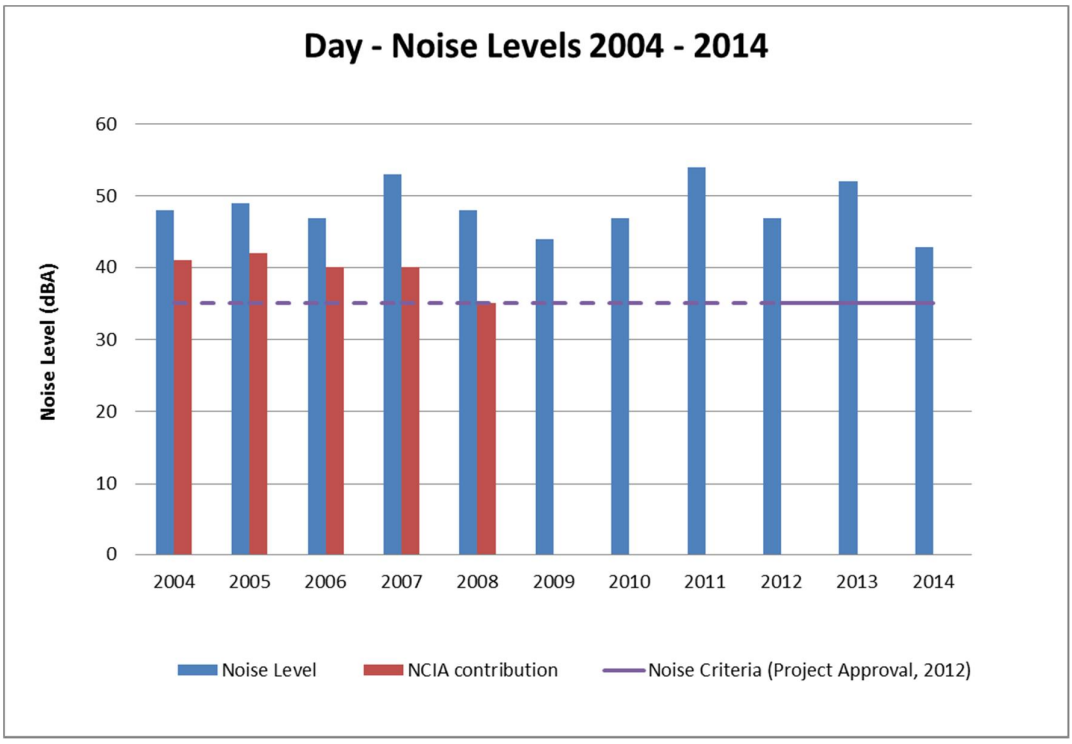

Figure 24 Day Noise Levels 2004 - 2014

Note 1: 2009, 2010, 2011, 2012, 2013 and 2014 – NCIA contribution audible but not measurable.

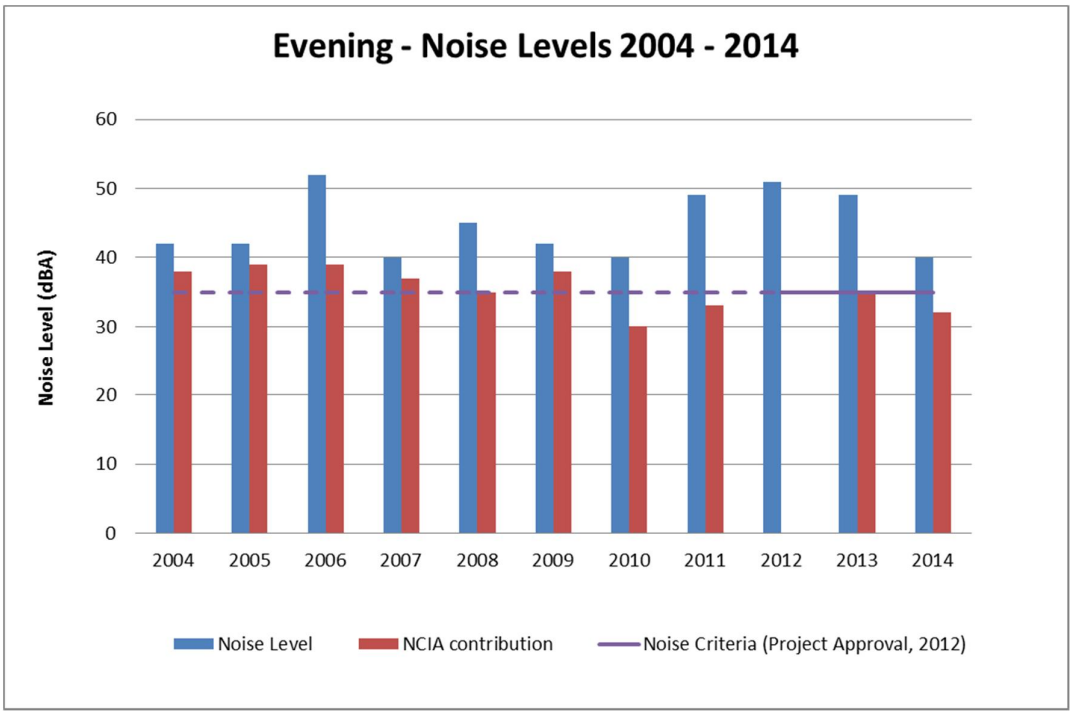

Figure 25 Evening Noise Levels 2004 - 2013

Note: 2012 – NCIA contribution audible but not measurable.

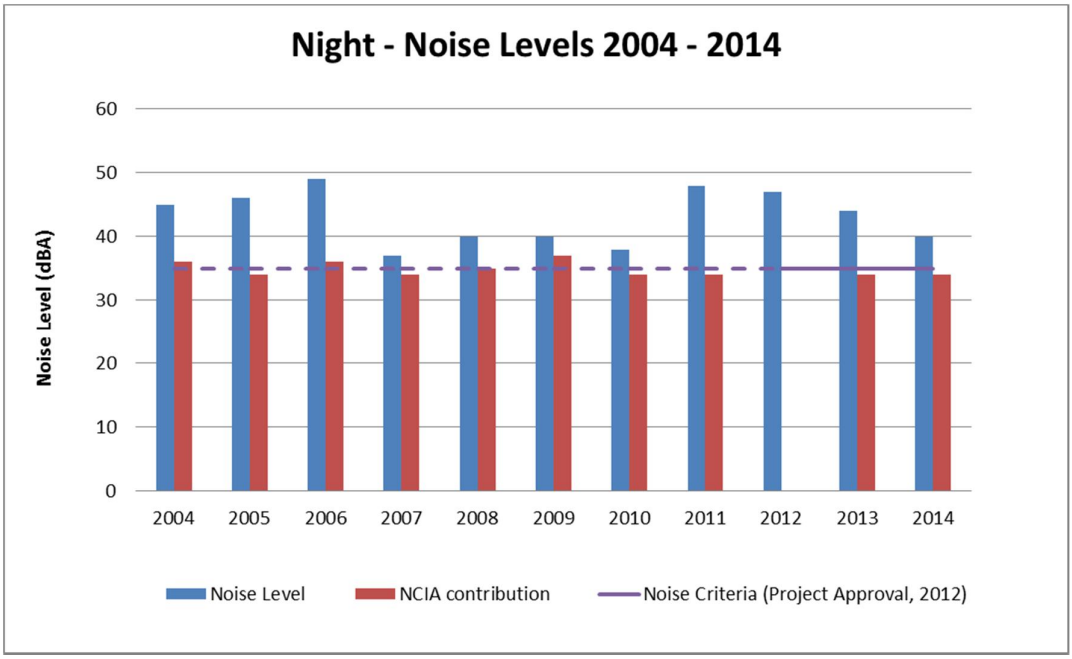

Figure 26 Night Noise Levels 2004 - 2014

Note: 2012 – NCIA contribution audible but not measurable.

6.0 Non-Compliances

Two non-compliances with the conditions of the EPL and Project Approval were recorded during the 2014 AEMR reporting period. Details relating to the non-compliances and the actions taken to remediate the issue and/or prevent a recurrence are summarised in Table 14.

It is noted that fluoride emissions levels are not provided in the EPL and Project Approval, and although the 24-hour fluoride levels have twice exceeded the DECC (2005) guideline criterion during the reporting period, these are not classified and reported as non-compliances in Table 14.

Table 14 Details of Non-compliance with Project Approval or EPL during the 2013 Reporting Period

Condition No. / Reference	Details of Non-compliance	Action Taken
Project Approval Condition 15	There was one exceedance of the 24 hour PM_{10} criteria (50 µg/m^3), with a reading of 63.7 µg/m^3 recorded at the NW monitoring station on 22 May 2014.	Meteorological conditions obtained from the onsite meteorological station for this day indicate that the NCIA facility was unlikely to be a major contributor to the exceedances (as summarised in Section 5.1). NCIA will continue to monitor 24 hour PM10 concentrations and local meteorological conditions.
EPL Condition L2.1	The assessable pollutant load for sulphur oxides discharged to air marginally exceeded the pollutant load limit specified in this condition[2].	Pollutant fee calculated in accordance with the worksheets included in the Annual Return. This issue is being investigated and close monitoring of sulphur oxides emissions will be undertaken during the next reporting period.

[2] It is noted that this non-compliance was mistakenly omitted in Section C ('Statement of Compliance') of the 2013-2014 Annual Return. However the actual loads of sulphur oxides discharged were used for the purpose of Section D of the Annual Return ('Load-Based Fee Calculation Worksheet') and the correct and appropriate pollutant load and fee was reported and paid by NCIA to the EPA.

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7.0 Continuous Improvement Measures

Condition 60(j) of the Project Approval requires the AEMR to identify continuous improvement measures, outlining new developments in air quality and noise control, and detailing practices that have been implemented on the site during the previous year, to reduce air quality and noise impacts.

Emission concentrations of pollutants were generally in accordance with EPL and Project Approval limits, with the exception of one exceedance of the 24 hour PM_{10} criterion and of the sulphur oxide assessable pollutant load which marginally exceeded the maximum load limit specified in the EPL. In addition, on two occasions during the reporting period the 24-hour fluoride concentration levels were above the DECC (2005) guideline criterion.

Noise monitoring results for the 2014 reporting period indicated that noise emissions from NCIA were in compliance with the EPL and Project Approval noise criteria for all time periods, including the sleep disturbance criteria. Noise monitoring confirmed that background noise levels during the day in the Rutherford industrial area remain high, and the NCIA contribution was audible but was not measurable.

General environmental management actions undertaken by NCIA are outlined in Table 15.

Table 15 Timetable for Environmental Improvement Actions

Area of Concern	Identified Action	Completion Date
Baghouse equipment life time	Enclose Kiln baghouse.	Complete
Air quality	NCIA continues to research and test extensively to improve its raw materials and emissions. Particular attention is given to fluoride and sulphur when investigating new materials.	Ongoing
	Consider and implement more routine emissions testing.	
General stack maintenance	Install new components and perform repairs when necessary.	Ongoing
Plant maintenance	General housekeeping and investment in best practice.	Ongoing
Lighting review	Changed all factory lighting in 2014 for lower energy LED lights.	Monitoring electricity efficiency improvements
Vegetation planting	Native vegetation planting and maintenance as per the proposed landscape vegetation planting plan in the 2010 EA.	Ongoing for care and maintenance

In addition to the above measures, NCIA engaged with the NSW OEH in early 2015 to identify potential opportunities in relation to energy efficiency and research. A summary of identified opportunities and associated potential savings are provided in Table 16. Identified opportunities and measures will be implemented where consistent with business objectives.

Table 16 Efficiency Reviews - Summary of Opportunities

Description of Opportunity	Potential Electricity Savings (MWh per annum)	Potential Gas Savings (GJ per annum)	Potential GHG Savings (tonnes CO_2 per annum)
Notched V belts	151	-	160
Avoid leaving glazing line equipment running	155	-	164
Turn off second air wipe after press and install blower wipes	44	-	47
Install timer and switch to turn off	24	-	25

Description of Opportunity	Potential Electricity Savings (MWh per annum)	Potential Gas Savings (GJ per annum)	Potential GHG Savings (tonnes CO_2 per annum)
warehouse induction lights at night			
Install cooling chamber for tile cooling prior to inkjet	43	-	46
VSD on Comb air fan	234	-	248
Stop running scrap line v belt conveyor after kiln 1 (programming)	4	-	4
Install switches to allow switching off of T8 fluorescent lights	54	-	57
Purchasing policy for High Efficiency (E3) Motors	113	-	120
High efficiency burners (half replaced)	0	9,933	651
Poppi heat recovery option	-474	50,473	2,804
Stop bucket elevator when not required, resolve mechanical issues first	11	-	12
OEM Kiln heat recovery	76	26,488	1,816
Alternative combustion air preheat	0	8,500	557
Solar PV	139		147
TOTAL	**498**	**68,906**	**5,041**

8.0 References

AECOM (2015) *NCIA Annual Vegetation Condition Assessment (2014)*, prepared for NCIA by AECOM Australia Pty Ltd, Newcastle, January 2014.

Australian Standard (2003) *AS/NZS 3580.9.6:2003 Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM(sub)10(/sub) high volume sampler with size-selective inlet - Gravimetric method*. Retrieved from Australian Standards Online.

Australian Standard (2007) *AS/NZS 3580.1.1:2007 Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment*. Retrieved from Australian Standards Online.

Australian Standard (2013) *AS/NZS 3580.13.2:2013 Methods for sampling and analysis of ambient air - Determination of gaseous and acid-soluble particulate fluorides - Manual, double filter paper sampling*. Retrieved from Australian Standards Online.

DECC (2005) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*.

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Appendix A

Fluoride Impact on Vegetation – Visible Injury Expression (December 2014)

Appendix A Fluoride Impact on Vegetation – Visible Injury Expression (December 2014)

Table B 1 Condition Assessment of Selected Monitoring Sites Located within the NCIA Premises

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 1 – Access road north of office															
Acacia filicifolia	**0**	**0**	1	0	0	0	0	0	0	0	0	0	✓	0	Along northern fence opposite RSPCA
Acacia longifolia	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	Clay shed entry
Corymbia citriodora	**4**	**4**	0	3	4	3	2	0	1	0	0	0	0	0	Clay shed entry
	3	**3**	1	3	2	3	0	0	1	2					
Eucalyptus moluccana	**2**	**2**	0	2	2	0	0	0	2	0	0	0	✓	✓	North end of shed, opposite weigh bridge
	2	**2**	1	0	2	1	0	0	0	2					
Eucalyptus robusta 1	**1**	**1**	0	0	0	0	0	0	0	0	0	0	0	0	Clay shed entry, next to NCIA road sign.
	3	**3**	1	3	2	1	0	0	1	1					
Eucalyptus robusta 2	**3**	**3**	0	3	2	0	0	0	1	1	0	0	0	✓	~150m north of office
	4	**4**	1	4	2	1	0	0	1	1					
Site 2 – Office car park															
Fraxinus pennsylvanica	**2**	**2**	Mixed	2	0	0	0	0	0	0	0	0	0	0	
Corymbia maculata	**-**	**-**	0	-	-	-	-	-	-	-	0	0	0	0	No new growth

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
	4	**4**	1	4	3	3	0	0	0	2					Mistletoe infested
Eucalyptus robusta	**1**	**1**	0	0	1	0	0	0	1	0	0	0	0	✓	
	4	**4**	1	4	2	1	0	0	1	0					
Site 3 – Access road south of office															
Acacia parramattensis	**0**	**0**	1	0	0	0	0	0	0	0	0	0	✓	0	
Hakea salicifolia	**0**	**0**	1	0	0	0	0	0	0	0	0	-	0	✓	
Site 4 – South-west corner of site															
Acacia longifolia	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	
Bursaria spinosa	**0**	**0**	1	0	0	0	0	0	0	0	2	-	0	0	
Typha sp.	**2**	**2**	1	0	0	2	0	0	0	0	-	-	0	✓	
Eucalyptus amplifolia	**1**	**1**	0	0	0	1	0	0	1	1	0	0	0	0	
	1	**3**	1	0	1	1	0	0	1	2					
Site 5 – South-east corner of site															
Acacia longifolia	**0**	**1**	1	0	0	0	0	0	1	0	0	0	0	✓	
Bursaria spinosa	**0**	**0**	1	0	0	0	0	0	0	0	0	-	✓	0	Just coming into flower
Eucalyptus moluccana	**0**	**1**	0	0	0	0	0	0	1	1	0	0	0	0	Coppice surveyed
	2	**2**	1	2	1	0	0	0	1	1					

- Indicates no visual assessment was undertaken.

Table B 2 Condition Assessment of Selected Monitoring Sites Located in Rutherford and Farley Residential Areas

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 6 – 3 Palisade Street															
Bursaria spinosa	**2**	**2**	1	3	0	0	0	0	0	0	2	-	0	0	
Olea europea	**2**	**2**	1	0	2	0	0	0	0	0	0	0	0	0	New to this survey
Corymbia maculata 1	**-**	**-**	0	-	-	-	-	-	-	-	0	0	0	0	Front of the allotment (road side). No new growth
	4	**4**	1	0	4	0	0	0	0	2					
Corymbia maculata 2	**-**	**-**	0	-	-	-	-	-	-	-	0	0	✓	0	Back of the allotment No new growth
	2	**2**	1	0	2	1	0	0	0	1					
Site 7 – 3 Gillette Close															
Bursaria spinosa	**0**	**0**	1	0	0	0	0	0	0	0	0	-	0	0	
Corymbia maculata	**-**	**-**	0	-	-	-	-	-	-	-	1	1	0	0	Mistletoe infestation of lower branches. No new growth
	3	**3**	1	2	3	3	0	0	0	0					
Eucalyptus acmenoides	**0**	**0**	0	0	0	0	0	0	0	0	0	0	✓	0	
	3	**3**	1	3	0	2	0	0	1	1					
Site 8 – Regiment Road east of Dumont Court															
Acacia baileyana	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	Just coming into flower
Bursaria spinosa	**2**	**2**	1	3	0	0	0	0	0	0	2	-	0	0	New to this survey
Corymbia maculata	**-**	**-**	0	-	-	-	-	-	-	-	1	0	0	0	No new growth

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
	2	**2**	1	2	2	1	0	0	0	1					
Eucalyptus resinifera	**0**	**1**	0	0	0	0	0	0	0	1	0	0	0	✓	
	2	**2**	1	1	1	2	0	0	1	1					
Site 9 – Regiment Road south-east of Squadron Crescent															
Bursaria spinosa	**2**	**2**	1	2	0	0	0	0	0	0	2	-	0	0	Coming into flower
Corymbia maculata	**-**	**-**	0	-	-	-	-	-	-	-	1	0	0	0	No new growth. Low level mistletoe infestation
	1	**1**	1	0	0	1	0	0	1	0					
Eucalyptus resinifera	**1**	**1**	0	0	0	1	0	0	0	0	0	0	✓	✓	
	1	**1**	1	0	0	1	0	0	1	0					
Site 10 – Wollombi Road between sewage works and creek															
Casuarina glauca	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	
Fraxinus excelsior	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	
Grevillea robusta	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	✓	
Pinus radiata	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	
Populus nigra var. *italica*	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	
Site 11 – Hill top on Wollombi Road west of Owl Pen Lane, Farley															
Bursaria spinosa	**0**	**0**	1	0	0	0	0	0	0	0	2	-	0	0	
Hakea gibbosa	**0**	**0**	1	0	0	0	0	0	0	0	0	-	0	✓	

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Corymbia maculata	**-**	**-**	0	-	-	-	-	-	-	-	0	0	0	0	No new growth
	0	**1**	1	0	0	0	0	0	1	1					
Eucalyptus paniculata	**1**	**2**	0	0	0	0	0	1	2	1	0	0	0	✓	
	0	**1**	1	0	0	0	0	0	2	0					
Site 12 – Western end of Quarry Road, Farley															
Corymbia maculata	**2**	**2**	0	0	2	0	0	0	1	1	0	0	0	0	Summer bark shedding
	3	**3**	1	0	3	0	0	0	0	1					
Eucalyptus paniculata	**0**	**1**	0	0	0	0	0	0	1	0	0	0	0	✓	
	0	**1**	1	0	0	0	0	0	1	0					
Pinus radiata	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	✓	

- *Indicates no visual assessment was undertaken.*

Table B 3 Summary Condition Assessment of Selected Monitoring Sites Located in Rutherford Industrial Area

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 13 – NCIA entrance, Racecourse Road															
Corymbia maculata	**2**	**2**	0	2	2	2	0	0	1	1	2	2	0	0	Heavy mistletoe infestation
	3	**3**	1	3	2	3	0	0	0	1					
Eucalyptus amplifolia	**1**	**2**	0	0	0	1	0	0	1	2	2	2	✓	0	Heavy mistletoe infestation Buds very new
	1	**2**	1	0	0	1	0	0	1	2					
Site 14 – 100-104 Kyle Street															
Angophora floribunda	**2**	**2**	0	1	2	2	0	0	0	0	0	4	✓	0	Mistletoe infestation. Tree recovering well from lopping
	1	**1**	1	1	1	0	0	0	1	0					
Eucalyptus amplifolia	**0**	**3**	0	0	0	0	0	0	3	0	0	0	0	0	Mistletoe infestation
	0	**2**	1	0	0	0	0	0	2	2					
Site 15 – 11 Gardiner Road															
Corymbia maculata	**5**	**5**	0	0	5	4	0	0	0	4	0	0	0	0	
	3	**3**	1	2	3	3	0	0	0	3					
Eucalyptus fibrosa	**0**	**1**	0	0	0	0	0	0	1	1	0	0	✓	0	
	2	**2**	1	0	0	2	0	0	1	1					

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 16 – 56 Gardiner Road															
Corymbia maculata	-	-	0	-	-	-	-	-	-	-	0	0	0	0	Mistletoe infestation
	4	**4**	1	4	3	4	0	0	0	0					
Site 17 – Gardiner Road, southern end															
Bursaria spinosa	**2**	**2**	1	0	0	0	0	0	0	0	2	-	0	0	
Olea europea	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	New to this survey
Corymbia maculata 1	-	-	0	-	-	-	-	-	-	-	0	0	0	0	On road verge
	1	**1**	1	1	1	1	1	0	1	1					
Corymbia maculata 2	**0**	**2**	0	0	0	0	0	0	2	0	0	0	0	0	Deeper in bush, ‘sheltered’ by surrounding vegetation.
	1	**1**	1	0	1	1	0	0	0	1					
Eucalyptus fibrosa	**0**	**2**	0	0	0	0	0	0	2	0	0	0	0	0	
	0	**1**	1	0	0	0	0	0	1	1					
Eucalyptus punctata	**0**	**0**	0	0	0	0	0	0	0	0	2	0	0	✓	
	1	**2**	1	0	0	1	0	0	1	2					
Site 18 – Maitland Saleyards, Kyle Street															
Corymbia maculata	**0**	**1**	0	0	0	0	0	0	1	1	0	0	0	0	
	1	**1**	1	0	0	1	1	0	1	1					

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Eucalyptus amplifolia	**0**	**1**	0	0	0	0	0	0	1	0	1	1	0	0	
	1	**2**	1	1	0	1	0	0	0	2					
Eucalyptus moluccana	**2**	**2**	0	0	1	0	0	0	0	1	0	0	0	0	
	0	**1**	1	0	0	0	0	0	0	1					
Eucalyptus resinifera	**0**	**1**	0	0	0	0	0	0	1	1	0	0	0	✓	
	0	**1**	1	0	0	0	0	0	1	1					

- *Indicates no visual assessment was undertaken.*

Table B 4 Summary Condition Assessment of Selected Tree Species at Anambah Homestead (reference site)

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Site 19 – 200 Anambah Road, reference site															
Angophora costata	**0**	**0**	mixed	0	0	0	0	0	0	0	2	2	0	0	Binocular assessment
Araucaria cunninghamii	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	0	
Brachychiton acerifolius	**-**	**-**	-	-	-	-	-	-	-	-	-	-	-	-	Species was flowering and had shed all leaves
Casuarina torulosa	**0**	**0**	1	0	0	0	0	0	0	0	0	0	0	✓	
Corymbia citriodora	**1**	**1**	1	0	0	1	0	0	1	1	0	0	0	✓	
Corymbia maculata	**3**	**3**	1	0	3	0	0	0	0	0	0	0	0	0	
Eucalyptus acmenoides	**3**	**3**	1	0	0	0	0	0	3	0	0	0	✓	✓	
Eucalyptus dives	**0**	**1**	mixed	0	0	0	0	0	1	1	0	0	0	✓	
Eucalyptus grandis	**1**	**2**	1	0	0	1	0	0	1	2	0	0	0	✓	
Eucalyptus robusta	**0**	**2**	mixed	0	0	0	0	0	2	1	0	0	0	0	
Eucalyptus tereticornis	**1**	**2**	1	0	0	1	0	0	1	2	0	0	0	✓	
Ficus macrophylla	**2**	**2**	1	0	2	0	0	0	0	0	0	0	0	✓	
Grevillea robusta	**0**	**0**	1	0	0	0	0	0	0	0	2	0	0	0	Dieback of lower branches
Lophostemum confertus	**2**	**2**	mixed	0	2	0	0	0	2	0	0	0	0	✓	Natural leaf cupping
Macadamia integrifolia	**2**	**2**	1	0	2	0	0	0	0	0	0	0	0	✓	Natural leaf cupping

Site/Species	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits	Comments
Olea europea	**1**	**1**	1	0	1	0	0	0	0	0	0	0	0	✓	Natural leaf cupping
Vitis vinifera – upper block	**0**	**0**	mixed	0	0	0	0	0	0	0	0	-	0	✓	
Vitis vinifera – lower block	**0**	**0**	mixed	0	0	0	0	0	0	0	0	-	0	✓	

- *Indicates no visual assessment was undertaken.*

Table B 5 Annual Comparison of Visible Injury Expression in one-year-old Foliage from Selected Tree Species in the Rutherford Area

Site	Year of survey	Emissions injury	Total injury	Foliar age years	Chlorosis index	Cupping index	Necrosis tip index	Necrosis marginal index	Anthocyanin index	Leaf chewing index	Sap sucking index	Branch dieback	Crown density	Reproduction – buds or flowers	Reproduction – fruits
NCIA Premises – *Eucalyptus moluccana*															
5	2007	2	2	0	2	0	0	0	0	2	0	0	0	✓	✓
	2008	3	4	1	0	0	0	0	3	4	2	0	0	0	0
	2009	3	4	1	0	0	0	0	3	4	2	0	0	0	0
	2010	2	3	1	0	0	2	0	3	3	0	0	0	0	0
	2011	2	3	1	0	0	0	0	2	3	2	1	1	0	0
	2012	1	2	1	0	0	0	0	0	2	2	1	1	0	0
	2013	3	3	1	3	2	0	0	0	1	1	0	0	0	✓
	2014	**2**	**2**	**1**	**2**	**1**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**
Rutherford residential area (Gillette Close) – *Corymbia maculata*															
7	2003	0	2	1	0	0	0	0	0	2	0	0	0	0	0
	2004	0	1	1	0	0	0	0	0	1	0	0	0	0	0
	2005	0	3	1	0	0	0	0	0	3	2	0	0	0	0
	2006	2	3	1	0	0	0	0	2	3	0	0	0	0	0
	2007	2	2	1	0	0	2	0	2	2	0	0	0	0	✓
	2008	3	3	0	3	0	0	0	0	2	3	0	0	0	0
	2009	3	3	1	3	0	2	1	3	3	3	0	2	0	0
	2010	3	3	1	3	0	2	1	3	3	3	0	2	0	0
	2011	2	3	1	2	2	1	1	0	3	2	1	0	✓	0
	2012	2	2	1	1	1	2	2	0	1	0	2	1	0	0
	2013	3	3	1	2	3	2	0	0	0	0	0	0	✓	0
	2014	**3**	**3**	**1**	**2**	**3**	**3**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**
Rutherford industrial area (Gardiner Road) – *Corymbia maculata* 1															
17	2003	0	2	1	0	0	0	0	0	2	2	0	0	0	0
	2004	1	2	1	1	0	1	0	0	2	1	0	0	0	✓
	2005	0	3	1	0	0	0	0	0	3	2	0	0	0	0
	2006	3	3	1	0	0	2	0	3	3	0	0	0	0	✓
	2007	2	3	1	2	0	2	0	3	3	0	0	0	0	0
	2008	4	4	1	4	0	3	2	3	3	3	0	2	0	✓
	2009	3	3	1	3	2	3	0	2	3	2	0	0	0	0
	2010	3	3	1	3	2	3	0	0	3	1	0	0	0	✓
	2011	1	1	1	1	1	1	1	0	1	1	0	0	0	0
	2012	0	1	1	0	0	0	0	0	1	1	1	0	✓	✓
	2013	4	4	1	4	4	2	3	0	0	0	0	0	0	0
	2014	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**0**

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Appendix B

Meteorological Monitoring - Wind Roses

Appendix B Meteorological Monitoring - Wind Roses

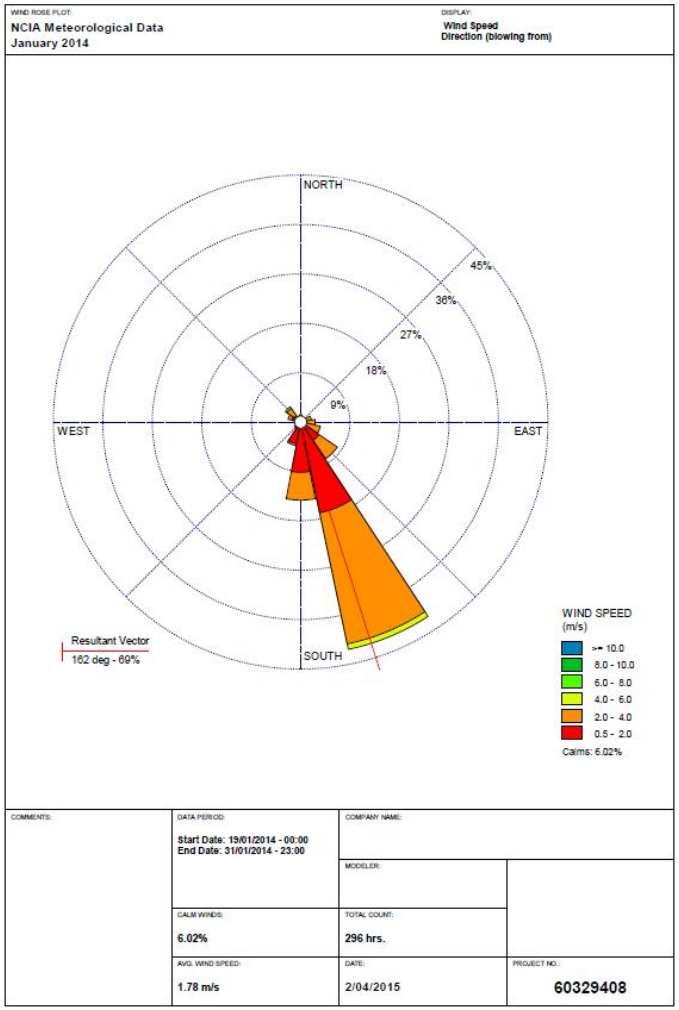

Figure B 1 Wind Speed and Direction (January 2014)

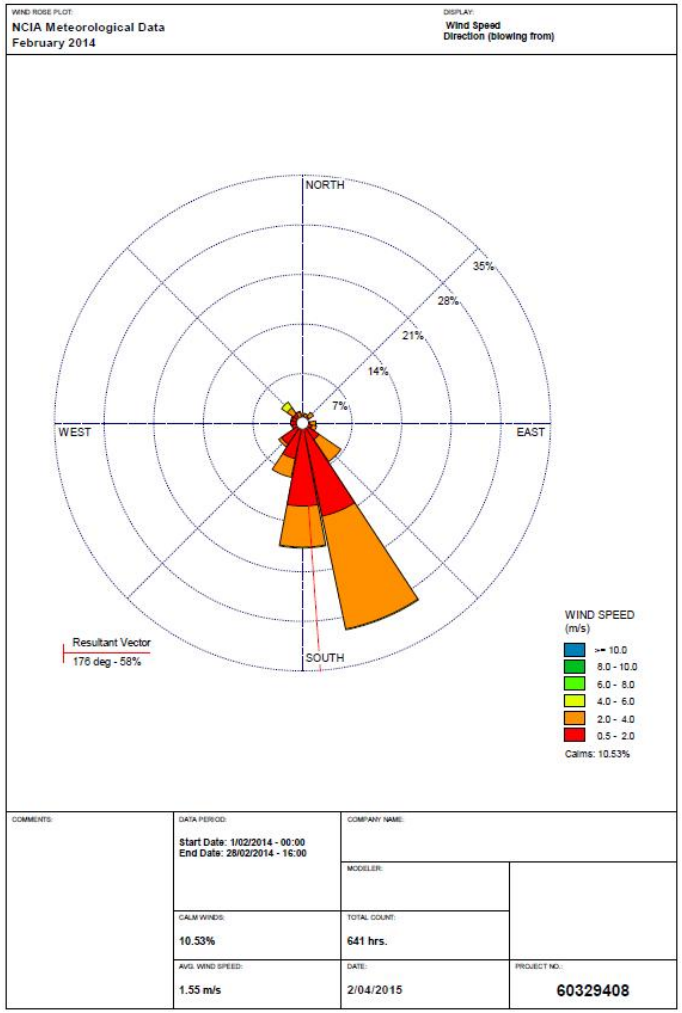

Figure B 2 Wind Speed and Direction (February 2014)

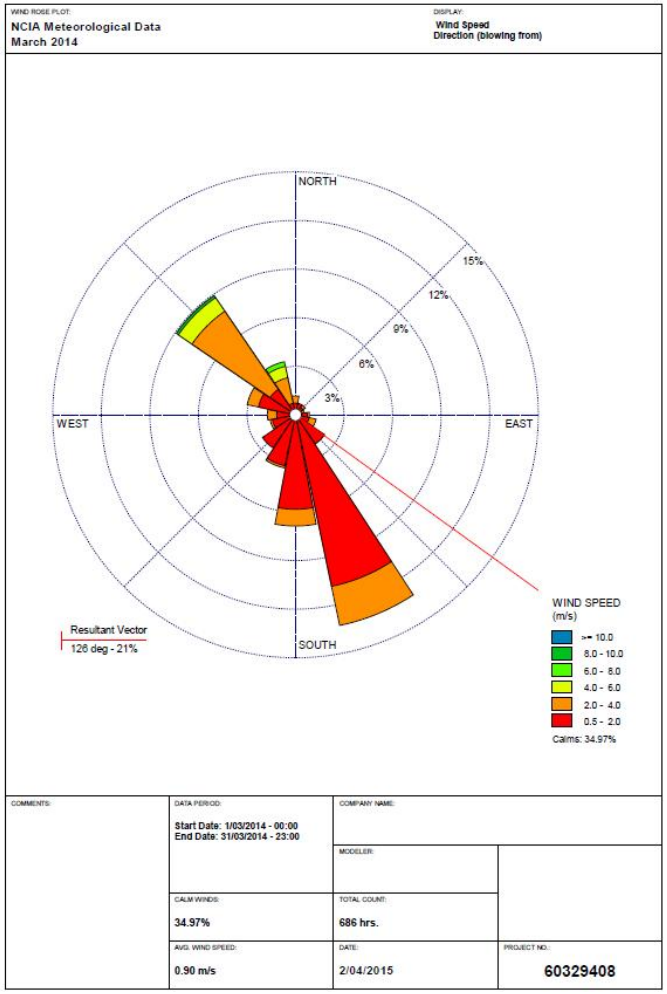

Figure B 3 Wind Speed and Direction (March 2014)

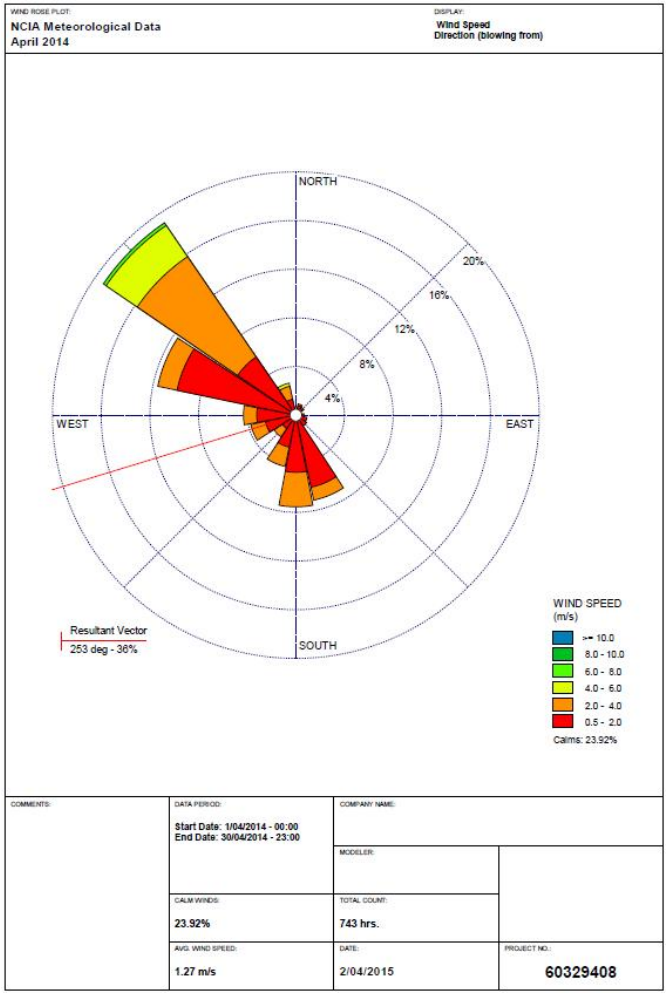

Figure B 4 Wind Speed and Direction (April 2014)

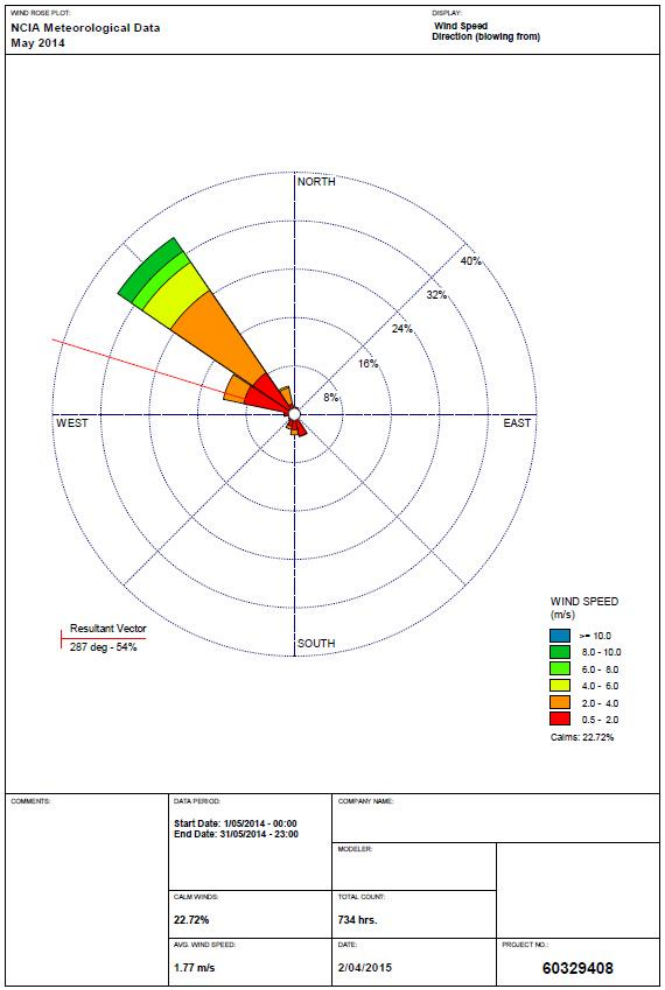

Figure B 5 Wind Speed and Direction (May 2014)

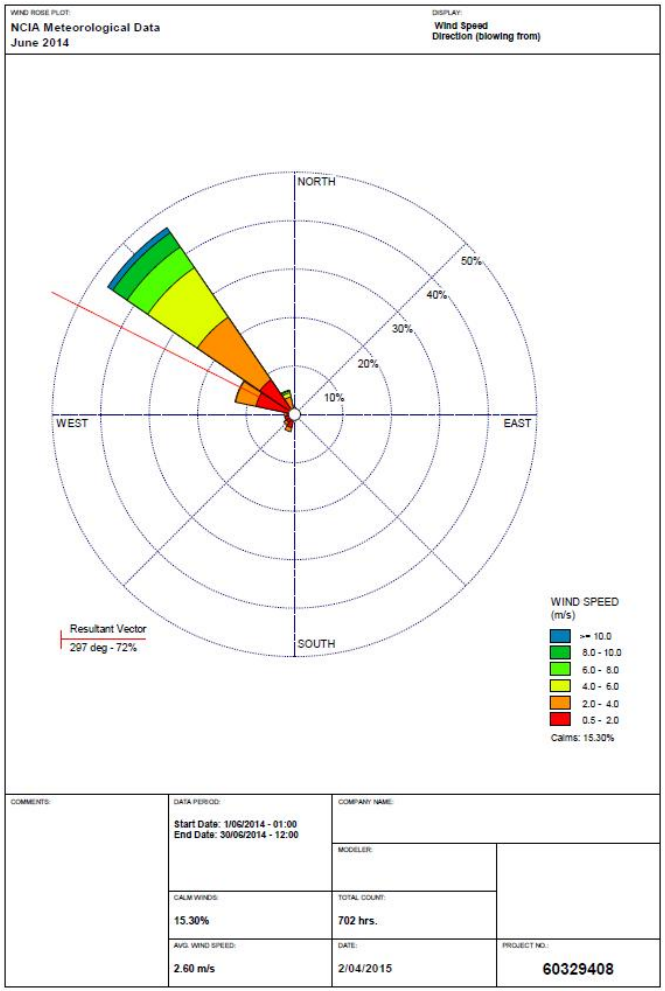

Figure B 6 Wind Speed and Direction (June 2014)

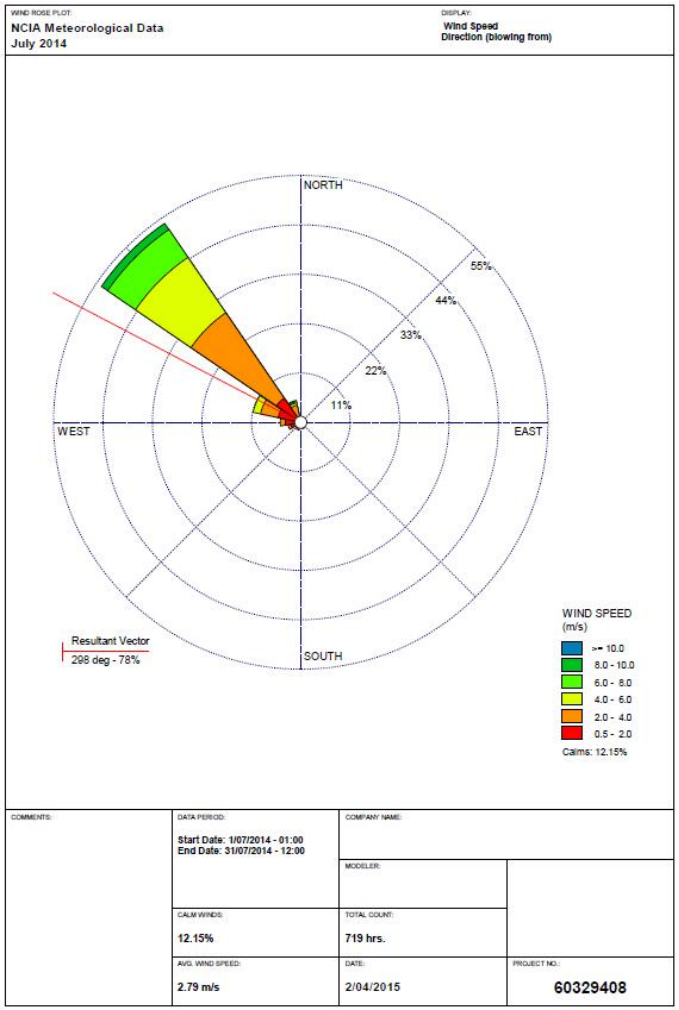

Figure B 7 Wind Speed and Direction (July 2014)

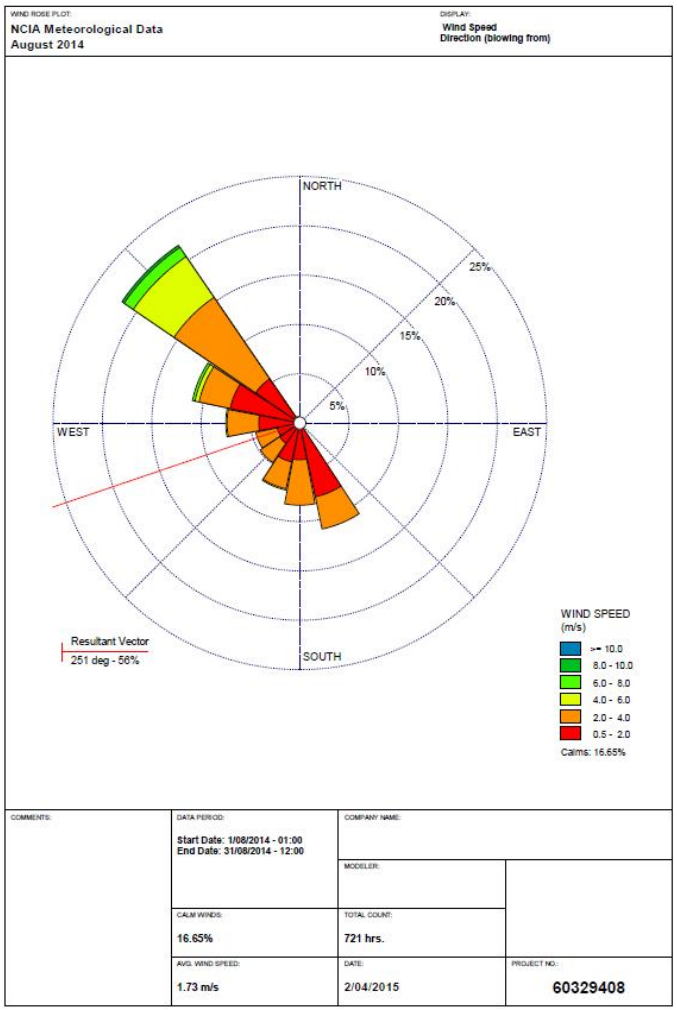

Figure B 8 Wind Speed and Direction (August 2014)

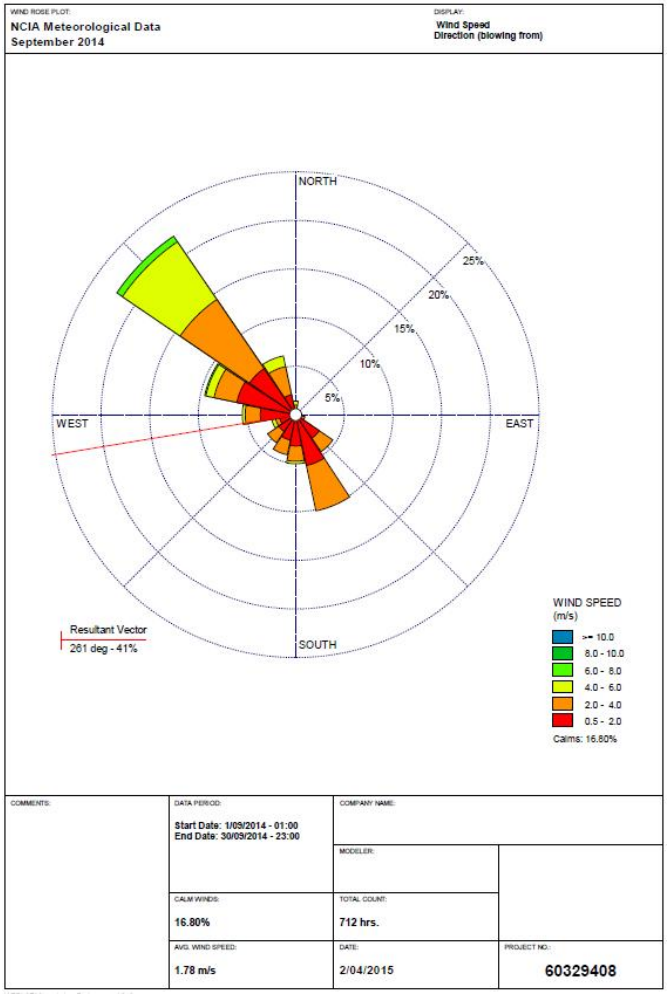

Figure B 9 Wind Speed and Direction (September 2014)

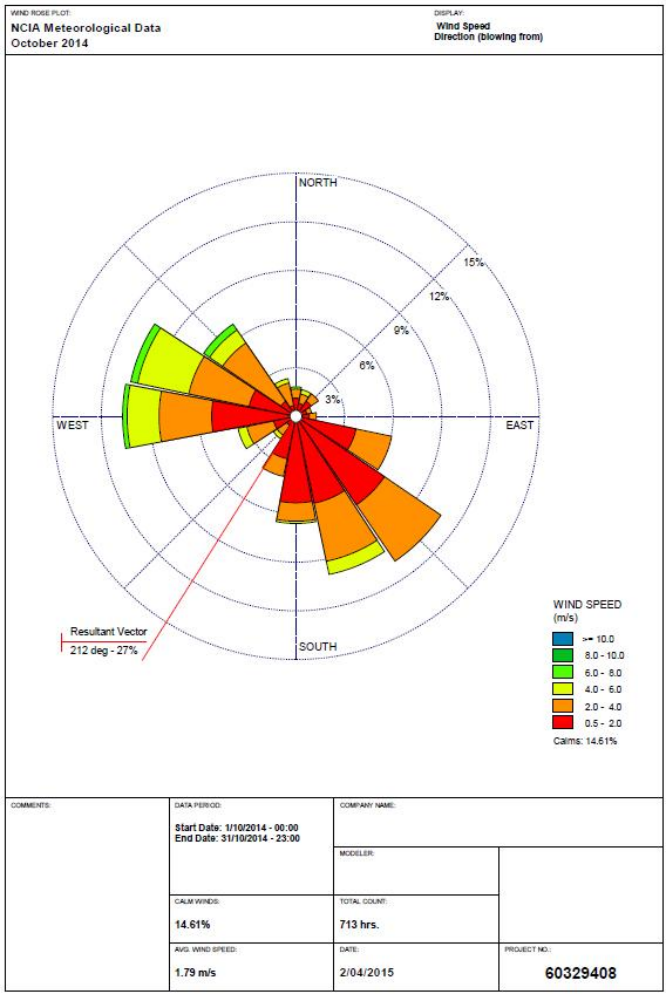

Figure B 10 Wind Speed and Direction (October 2014)

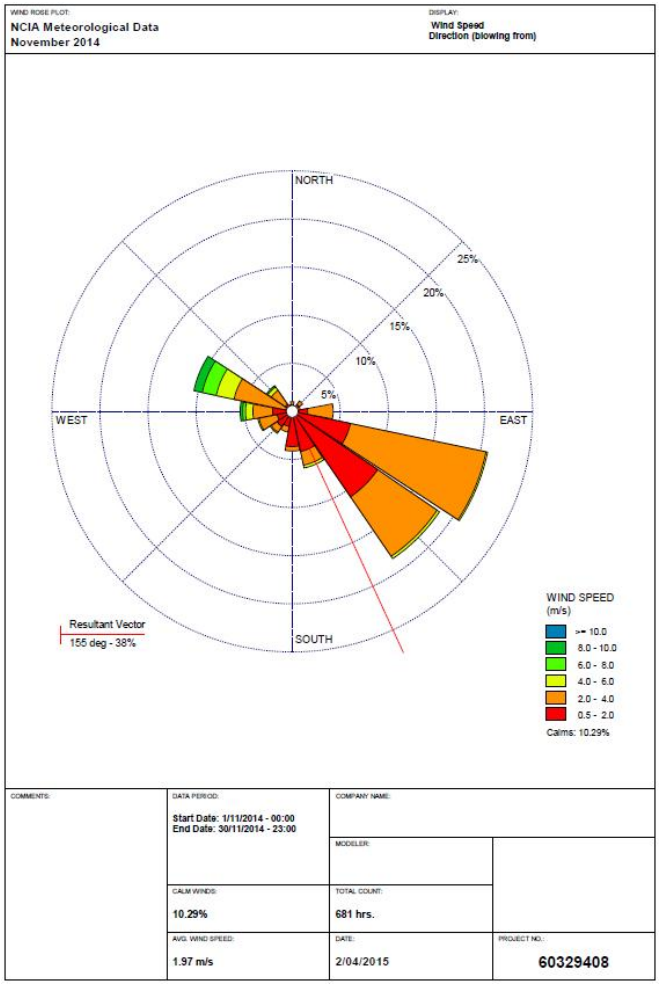

Figure B 11 Wind Speed and Direction (November 2014)

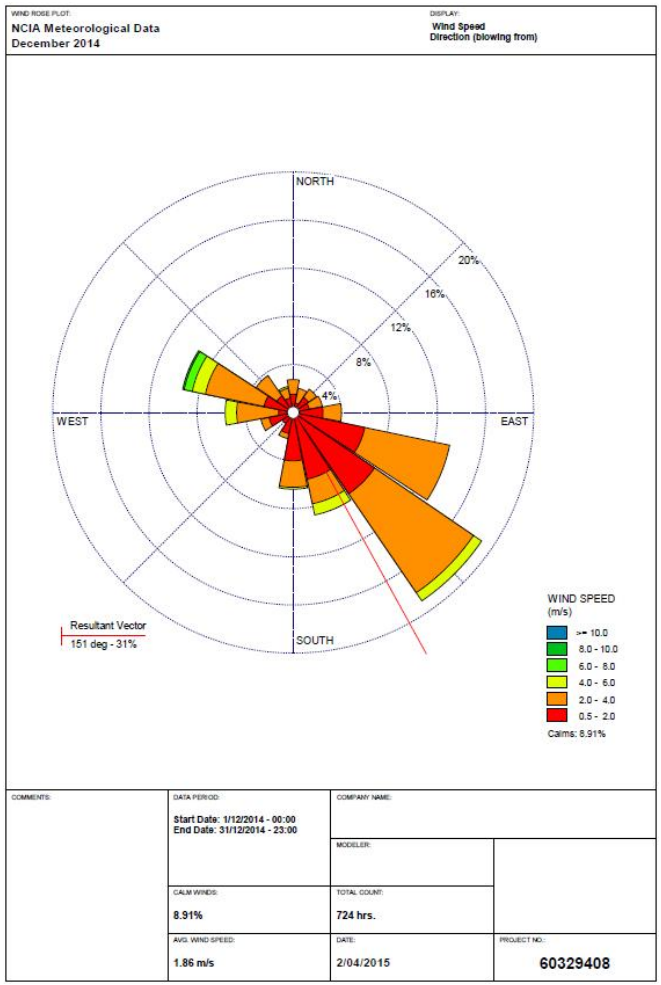

Figure B 12 Wind Speed and Direction (December 2014)

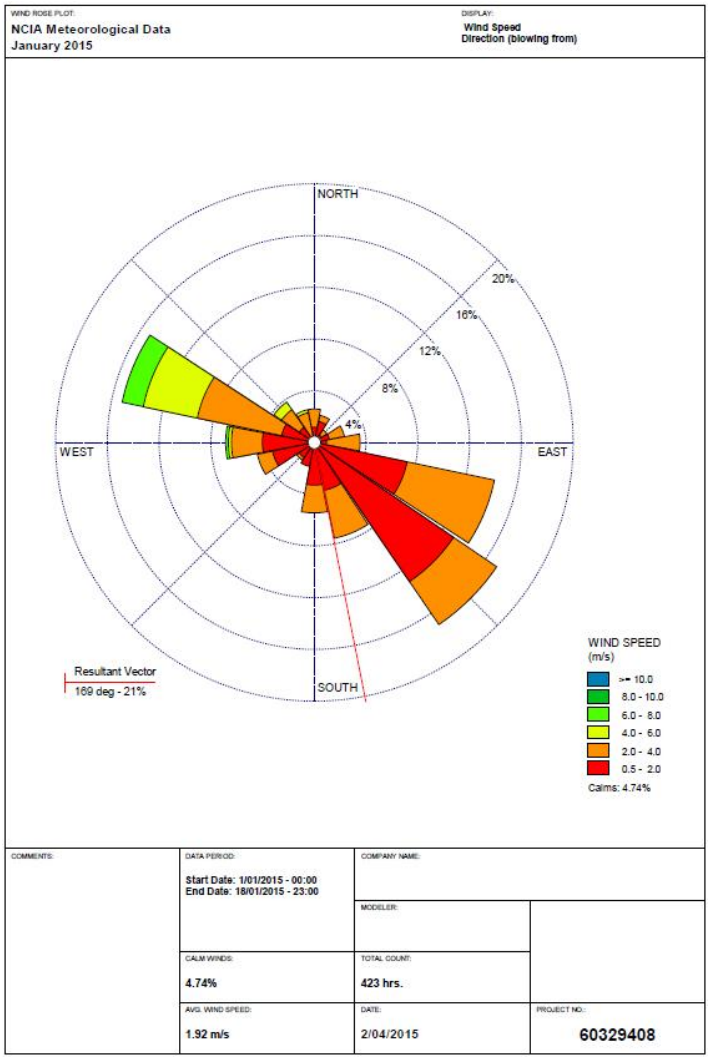

Figure B 13 Wind Speed and Direction (January 2015)