Hydro Aluminium - 2012 Annual Environmental Management Review

Hydro Aluminium - 2012 Annual Environmental Management Review

Prepared for

Hydro Aluminium Kurri Kurri Pty Ltd

Prepared by

AECOM Australia Pty Ltd
17 Warabrook Boulevarde, Warabrook NSW 2304, PO Box 73, Hunter Region MC NSW 2310, Australia
T +61 2 4911 4900 F +61 2 4911 4999 www.aecom.com
ABN 20 093 846 925

2 June 2013

60284956

AECOM in Australia and New Zealand is certified to the latest version of ISO9001 and ISO14001.

© AECOM Australia Pty Ltd (AECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Quality Information

Document Hydro Aluminium - 2012 Annual Environmental Management Review

Ref

Date 2 June 2013

Prepared by Paul Wenta

Reviewed by Graham Taylor

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A		Final	Graham Taylor Technical Director - Environment	

This page has been left blank intentionally.

Table of Contents

1.0 Introduction 1
2.0 Terms of Reference 3
3.0 Progress of SURF Project Construction and Commissioning 5
4.0 Compliance with Consent Conditions 7
4.1 1981 Development Consent 7
4.2 2002 Development Consent 7
5.0 Details of Complaints Received 9
6.0 Comparison of Environmental Impacts and Performance against Predictions 11
7.0 Environmental Monitoring: Trends and Results 13
7.1 Air Quality 13
7.2 Meteorology Monitoring 13
7.3 Noise Monitoring 13
7.4 Vegetation Monitoring 13
7.5 Fauna Surveys 14
7.6 Water Quality 14
8.0 Energy Efficiency 17
9.0 Non Achievement of Environmental Performance Goals 19
9.1 Response to Non Achievements of Environmental Performance Goals 19
9.1.1 Forage fluoride at sites 8 and 9 19
9.1.2 Surface Water fluoride at nominated sites 19
9.1.3 Surface Water pH at nominated sites 20
10.0 Approval and Licence Variations 21
10.1 Approval Variations 21
10.2 Licence Variations 21
11.0 Environmental Management: Targets and Strategies 23
11.1 Achievements over the Reporting Period 23
11.2 Strategies for the Following Reporting Period 23
12.0 Progress on Implementation of Environmental Audit Recommendations 25
13.0 Operational Environmental Management Plan Review 27
14.0 Conclusion 29
15.0 References 31

Appendix A
2012 Independent Environmental Audit Recommendations A

Appendix B
2012 Annual Environment Report B

Appendix C
Summary of Conformance with Predictions made in Approved Documents C

Appendix D
External Noise Monitoring Survey 2012 D

Appendix E
Vegetation Health Survey of Hydro Aluminium Buffer Zone 2012 E

Appendix F
Fluoride Monitoring Level in Lower Hunter Valley Vineyards 2011-12 F

Appendix G
Cattle Monitoring 2012 G

Appendix H
NSW Energy Savings Scheme – 2012 Annual Report H

Appendix I
Emission Monitoring Results 2012 I

List of Tables

Table 1	AEMR Structure	3
Table 2	SURF project: construction and commissioning progress	5
Table 3	Reports to be submitted and where each is addressed in this report	7
Table 4	LUACs and ESCs registered in current and previous reporting periods	17

1.0 Introduction

AECOM Australia Pty Limited (AECOM) has been commissioned by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro) to prepare the Annual Environmental Management Report (AEMR) for its aluminium smelter located at Hart Road, Loxford, close to Kurri Kurri, NSW.

The smelter commenced production in 1969 with a single potline. A second potline was commissioned in 1979, and a third added in 1985. In 2002, Hydro undertook an upgrade program, the Smelter Upgrade and Retrofit (SURF) project, taking production capacity of the smelter to 170,000 tonnes of aluminium per annum. The smelter is surrounded by a 2,100 hectare buffer zone and operates under the following approvals and development consents (DC) and Environment Protection Licence (EPL).:

- NSW Department of Environment and Planning - DC for Proposed Expansion of an Existing Aluminium Smelter at Kurri Kurri, dated 21 August 1981;
- NSW Department of Planning and Infrastructure (DP&I) - DC No. N91/00033, dated 21 August 2002 for the Smelter Upgrade and Retrofit project; and
- NSW Office of Environment and Heritage (OEH) – EPL number 1548.

The publication of an independent AEMR is required under Condition 7.5 of the 2002 DC.

This AEMR reports on the performance of the smelter for the period 1 January 2012 to 31 December 2012. Information used to prepare this report was sourced from discussions with the smelter's Environment Officer, a review of the 2012 monitoring and environmental reports, the 2012 EPL Annual Return and the company's Operation Environmental Management Plan (OEMP). Additionally, the findings, recommendations and actions from an independent environmental audit conducted by DLA Environmental in 2012 have been used as a reference source throughout this report.

Severe financial pressures on the profitability of the smelter resulted in the Hydro Kurri Kurri Board to initially curtail production from Potline 1 along with cessation of all pot relining effective February 2012. In April 2012 a further Board decision was made to curtail all production at the smelter. Production areas across the smelter sequentially ceased operations as follows:

- Manufacturing of anode ceased in June 2012;
- Baking of anodes ceased in July 2012;
- Potline 2 operations ceased in July 2012;
- Potline 3 operations ceased in September 2012; and
- Casting operations ceased in October 2012.

The facility remains in caretaker mode with a small workforce maintain assets.

Environmental source emission monitoring gradually decreased as the smelter production areas were shut down, however all external environmental monitoring programs have been maintained as per EPL requirements.

This page has been left blank intentionally.

2.0 Terms of Reference

Condition 7.5 of the 2002 DC requires that Hydro shall prepare and submit an independent AEMR for the approval of the Director-General of the DP&I. **Table 1**, details the requirements of condition 7.5 and cross-references the section(s) of this report containing the requisite information. This structure also meets the reporting requirements set down under condition 48 of the 1981 DC which requires Hydro to prepare an annual report in respect of the implementation and effectiveness of the planning conditions and those matters which may require further investigation.

Table 1 AEMR Structure

2002 DC condition	Requirement	Cross-reference
7.5(a)	Details of any progress of construction and commissioning of the smelter upgrade and retrofit.	Section 3: Progress details of SURF project construction and commissioning
7.5(b)	Details of compliance with the conditions of this consent and the existing consent.	Section 4: Compliance with consent conditions
7.5(c)	Details of any complaints received for the preceding twelve-month period (exclusive of personal details), and details of how these complaints were addressed and resolved.	Section 5: Details of complaints received
7.5(d)	A comparison of the environmental impacts and performance of the smelter upgrade and retrofit against the environmental impacts and performance predicted in the SEE.	Section 6: Comparisons of environmental impacts and performance against predictions
7.5(e)	Results of all environmental monitoring required under this consent and other approvals, including interpretations and discussion by a suitably qualified person.	Section 7: Environmental monitoring - results and trends
7.5(f)	A list of all occasions in the preceding twelve-month period when environmental performance goals for the smelter upgrade and retrofit have not been achieved, which indicates the reason for failure to meet the goals and the action taken to prevent recurrence of that type of incident.	Section 9: Non-achievement of environmental goals
7.5(g)	Identification of trends in the monitoring data over the life of the smelter upgrades and retrofitting to date.	Section 7: Environmental monitoring - results and trends
7.5(h)	A list of variations obtained to approvals applicable to the smelter upgrade and retrofit and to the site during the preceding twelve-month period.	Section 10: Approval variations
7.5(i)	Environmental management targets and strategies for the following twelve month period, taking into account trends in monitoring results.	Section 11: Environmental management: targets and strategies for 2011
7.5(j)	An update on the progress in implementing the recommendations of any environmental audit report under condition 5.8.	Section 12: Progress on implementation of audit recommendations
7.5(k)	A review of the OEMP required under condition 6.3 to ensure it is up-to-date and any changes to procedures and practices are incorporated.	Section 13: Operational Environment Management Plan review

This page has been left blank intentionally.

3.0 Progress of SURF Project Construction and Commissioning

In 2002, Hydro began a program of plant improvements, known as the Smelter Upgrade and Retrofit (SURF) project, aimed at improving process efficiency and environmental performance of the plant. The SURF project is planned to be carried out in three stages, with Stage 1 and 2 works now complete. The progress of the construction and commissioning of the SURF project is summarised in **Table 2**.

Table 2 SURF project: construction and commissioning progress

Proposed Works	Status
Stage 1 Works	
Structural floor repairs to sections of the Casthouse and Potline 1 concrete floors.	Complete
Installation of a proprietary scrubbing plant on the Greenmix section of the anode plant.	Complete
Stage 2 Works	
Rebuild of Anode Baking Furnace	Complete
Upgrade of potlines 2 and 3 including: - Introduction of point breaker feeders and a new pot control system. - Switchyard modifications; - Improvements to Anode Covering and Cavity Cleaning process; - Cast Iron Rodding of Cathodes; and - Update of Process Control centre.	Complete
Stage 3 Works	
Potline 1 'Hot Change' Modifications including - Introduction of point breaker feeder system; - Upgrade of scrubbing centres and alumina handling system; and - Introduction of cavity cleaning.	Complete
Potline 1 'Cold Change' Modifications including engineering modifications to potline design - yet to be finalised.	No further progress as all production curtailed and facility placed into caretaker mode.
Increase anode size.	No further progress as all production curtailed and facility placed into caretaker mode.

This page has been left blank intentionally.

4.0 Compliance with Consent Conditions

4.1 1981 Development Consent

In 1991 a comprehensive review of the implementation of the 1981 DC conditions was carried out by an independent consultant with a report submitted to the (now) DP&I (Industrial Risk Management, 1991). The report stated that, except for ongoing annual reporting requirements, compliance had been achieved with all other consent conditions. These annual reporting requirements have been addressed by the preparation of this AEMR. **Table 3** identifies the reports which are being submitted to DP&I in conjunction with this report:

Table 3 Reports to be submitted and where each is addressed in this report

Report	Where addressed in this report
2012 Annual Environment Report for the Hydro Aluminium Kurri Kurri Smelter (McNaughton, 2012).	**Appendix B**
2012 External Noise Monitoring Survey (McNaughton, 2012).	**Appendix D**
Vegetation Health Survey of Hydro Aluminium Kurri Kurri Limited Smelter Buffer Zone (AECOM, 2012).	**Appendix E**
Fluoride Monitoring in Lower Hunter Valley Vineyards – Season October 2011 – March 2012 (McNaughton, 2012).	**Appendix F**
Annual Cattle Monitoring Report 2012 (McNaughton, 2012).	**Appendix G**
Emissions Monitoring Results, 2012 (AECOM, 2012)	**Appendix I**

Key sections of these reports are included as Appendices to this AEMR to alleviate cross-referencing of multiple reports.

4.2 2002 Development Consent

Compliance with the conditions of the 2002 DC was independently audited by DLA Environmental in 2012. The audit encompassed compliance with development consents, licences and approvals, assessment of environmental performance against predictions made, effectiveness of environmental management and the appropriateness of the smelters monitoring systems. The audit made only one recommendation which can be found in **Appendix A.** This recommendation related to site closure issues highlighting the need for *"contaminated groundwater … around the Spent Cathode Pile to be treated as an Area of Concern during any remediation process following the decommissioning of the Smelter."*

This page has been left blank intentionally.

5.0 Details of Complaints Received

During 2012, Hydro was not notified of any public complaints regarding the smelter. It should also be noted that Hydro does not have a history of public complaints, recording only four complaints in the last five years, and none of these complaints being confirmed to be associated with Hydro.

This page has been left blank intentionally.

6.0 Comparison of Environmental Impacts and Performance against Predictions

As required in section 7.5(d) of the 2002 DC, the AEMR shall include a comparison of the environmental impacts and performance of the SURF project against the environmental impacts and performance predicted in the Statement of Environmental Effects (SEE) (URS, 2002).

Due to the closure of Potline 1 in January 2012 and the subsequent curtailment of all production at the smelter by end August 2012, a direct comparison of 2012 performance against all predictions is not possible. Where appropriate, an update of site performance during 2012 compared with predictions is provided in **Appendix C** of this report.

Predictions confirmed in previous AEMRs include:

- A 40% reduction in emissions of fluorides and particulate from Potline 1 roof ventilators has been achieved;
- Significant improvement in air emissions from the Greenmix stack with reductions in particulate and polycyclic aromatic hydrocarbon (PAH) emissions;
- A reduction in perfluorinated carbon compounds (PFC) emissions by approximately 90%;
- An increase in plant sulphur dioxide (SO_2) emissions by approximately 10% with an increase in ambient air SO_2 concentrations (7.9% SO_2 emission increase has resulted);
- No significant change in fluoride emissions from Potline 1 and 2 stacks;
- No new waste streams produced;
- An increase in traffic movements; and
- Confirmation of predicted noise levels.

Several SEE Predictions have not yet been fully demonstrated as capital expenditure for activities related to the “cold change” modifications planned in Stage 3 of the SURF project are yet to be approved.

The total emissions of oxides of nitrogen have increased from pre SURF levels by approximately 12%. This does not meet the prediction that there would be no significant increase in ‘other minor emissions from the plant’. This increase is a result of the conversation of the casthouse homogenising furnace from electricity to gas during 2007 which has resulted in a modification to the EPL during 2008 to increase the annual load limit accordingly.

This page has been left blank intentionally.

7.0 Environmental Monitoring: Trends and Results

Hydro conducted an extensive monitoring program throughout 2011 in order to comply with the requirements set out in the EPL and the DC approvals. Monitoring studies assessed impacts to air quality, water quality, flora and fauna, noise and meteorology. This section presents a review of monitoring results and trends. For further details of environmental monitoring refer to individual monitoring reports appended to this AEMR.

7.1 Air Quality

Hydro Aluminium undertakes continuous fluoride monitoring from each of the scrubber stacks and potroom buildings on site. The total emissions vary month to month due to process variability however an average of 0.83 KgTF/tAL (kilograms per tonne of Aluminium produced) for the period January to August 2012 was achieved, below the EPL limit of 1 KgTF/tAL. This level is approximately 7 % higher than the previous year's total but still considerably lower than levels prior to and including 2007. It must be noted that during pot shutdown fluoride emissions increase above "normal" operating levels. Shutdown of pots occurred in Potline1 during January, Potline 2 during May & June and Potline 3 during July & August. Therefore levels can therefore be considered to be within process variability. Fluoride emission results are summarised in the 2012 Annual Environmental Report (AER) (**Appendix B**).

Hydro was unable to complete all annual emission testing during 2012 due to the curtailment of production. The annual Potlines 2 & 3 testing was completed in April 2012, (**Appendix I**) however the annual Anode Bake Furnace and Greenmix stack testing was unable to be completed prior to plant shutdown. EPL parameters measured were below licence limits with Potline Stack emissions for total particulates; Nitrogen Oxides (NOx), Carbon Monoxide (CO) and Sulfur Dioxide (SO_2) similar to the results from previous years.

Ambient monitoring of gaseous and particulate fluoride is carried out on a weekly basis at various sites around the smelter and in the vineyards. At all locations beyond the smelter buffer zone the fluoride levels were found to be well below the Australian and New Zealand Environmental and Conservation Council (ANZECC) guidelines and consistent with previous year's results. This information is documented within the 2012 AER (**Appendix B**). Of significant note is that ambient fluoride levels within the smelter's buffer zone decreased to near background levels as operation curtailment progressed.

7.2 Meteorology Monitoring

In accordance with EPL 1548 meteorological monitoring was carried out in 2012 to collect accurate site specific data to provide context to ambient monitoring results. A summary of the collected information is reported in the 2012 AER (**Appendix B**).

7.3 Noise Monitoring

During 2012 an External Noise Monitoring Survey was carried out during night and day conditions across six sites within a 2 km radius of the plant. The survey can be found in **Appendix D** with key findings summarised below:

- The acoustic environment was dominated by noise generated from dry scrubber and roof fan operations; and
- L_{Aeq} measurements during both day and night periods were below OEH recommended noise levels.
-

7.4 Vegetation Monitoring

The Vegetation Health Survey of Hydro Smelter Buffer Zone (**Appendix E**) and Fluoride monitoring in lower hunter valley vineyards (**Appendix F**) indicated the impacts on vegetation to be similar to previous years. The annual vegetation health inspection was carried out on 17 & 24 April 2012 on the foliage produced during the 2011 – 2012 growing season. Key findings can be summarised as:

- The condition of the vegetation was similar to that of previous years;
- Fluoride damage was below the limits of detection outside the buffer zone with the exception of three areas; one to the west of Bishops Bridge Road south west of the smelter, one north east of the Kurri Kurri TAFE campus and another on the corner of Lumby Lane and Bishops Bridge Road west of the smelter;
- Regeneration of fluoride sensitive species has occurred in recent years in areas close to the smelter perimeter; and
- Whilst the species *Eucalyptus parramattensis* is sensitive to fluoride, there appears to be no threat to its continued viability on the Hydro property, as it continues to flower and produce seed extensively.

Monitoring of fluoride levels in forage grasses and overstorey vegetation was carried out within a 10 km radius of the smelter and reported in the 2012 AER (**Appendix B**). In the forage grasses the 12 month average was found to range from 10 to 52 µg/g within and 6 to 17µg/g outside the smelter buffer zone. Peaks in monthly data for the different sites coincided with the prevailing winds of that season. Exceedences of the ANZECC guidelines were found within the buffer zone and have been discussed further in Section 9.0.

Fluoride monitoring in lower hunter vineyards was carried out in the October 2011 – March 2012 growing season. The body of this report is included in **Appendix F**. The report found that "*grape leaf fluoride levels and ambient air fluoride concentrations measured in the Lower Hunter Valley are not high enough to adversely affect the quality or quantity of fruit produced"* (McNaughton, 2011d).

7.5 Fauna Surveys

The twenty ninth annual cattle survey was conducted in early March 2012. Thsurvey report is included in **Appendix G**, with the report conclusions as follows:

- Fluoride damage based on dental scoring was similar to previous years with all cattle monitored showing little or no exposure to excess environmental fluoride;
- Chemical analysis of skeletal fluoride showed a decrease compared to 2012 levels with all fluoride measurements below the toxic threshold; and
- All cattle examined were in good health and body condition.
-

7.6 Water Quality

Surface and groundwater monitoring in and around the Hydro Site indicates that water quality is generally consistent with previous years. Hydro Aluminium's 2012 AER contains water monitoring and usage data, and is included in **Appendix B**.

The smelter's surface water monitoring program encompasses creek systems of Wentworth Swamp, ephemeral ponds within the buffer zone and catchment dams located between 2 and 7 km from the smelter.

A review of the monitoring data for surface waters indicates:

- The trend from previous years of high fluoride levels at sites close to the smelter, within the buffer zone (1, 2, 9, 14, D and E), continued in 2012. ANZECC guidelines for both irrigation and livestock were exceeded most months at sites 1,2 9 and 14 and occasionally at sites D and E;
- Sites A and B located within the buffer zone met ANZECC guidelines for irrigation and livestock;
- Site 62 which is located within the buffer zone in Wentworth Swamp exceeded the fluoride guideline for livestock on one occasion (October);
- pH levels were within ANZECC guidelines for irrigation (pH 4.5 – 9.0) at all sites apart from site 62 where a value of 4.3 was recorded in April;
- Exceedences at some sites of guidelines for aquatic ecosystems (pH 6.5 – 9.0) were recorded;
- Cyanide concentrations were below laboratory limit of reporting and therefore within ANZECC guidelines;

- Monitoring data for off-site catchment dams shows pH levels within ANZECC water quality guidelines for irrigation (short-term) and livestock uses; and
- Data for off-site catchment dams shows fluoride levels within ANZECC water quality guidelines for irrigation (short-term) and livestock uses.

Hydro's groundwater monitoring program is focussed around the capped Spent Cathode Pile. A review of the 2012 groundwater monitoring data shows fluoride concentrations remained elevated in alkaline conditions, whereas acidic conditions were more likely to be present in areas with deeper-lying groundwater. Hydro's historical monitoring data and studies show that contaminated groundwater is contained within several metres of the surface within a sandy lens. This sandy area is contained within a natural impervious clay barrier and studies have found that it does not present a risk to nearby uncontaminated groundwater.

This page has been left blank intentionally.

8.0 Energy Efficiency

The NSW Greenhouse Gas Abatement Scheme (GGAS) aims to reduce the per-capita greenhouse gas emissions associated with electricity consumption in NSW. Hydro is a registered accredited certificate provider under the GGAS, and as a result is permitted to create a significant number of Large User Abatement Certificates (LUAC) in order to meet its GGAS compliance. It must be noted that the GGAS concluded on 30 June 2012 when the Federal Carbon Pricing Mechanism commenced.

The Energy Savings Scheme (ESS) aims to reduce energy consumption by setting an energy savings target for electricity retailers. Hydro is permitted to create Energy Saving Certificates (ESCs) which represents delivered energy efficiencies.

Appendix C contains the 2012 Annual Report Statement for the NSW ESS.

In respect to the number of LUACs and ESCs registered by Hydro in the reporting period, **Table 4** shows the number produced in the current and previous reporting periods.

Table 4 LUACs and ESCs registered in current and previous reporting periods

Reporting Period	LUACs	ESCs
01/2012 – 06/2012	NIL*	-
01/2012 – 12/2012	-	Xx,xxx
01/2011 – 12/2011	702,004	74,350
01/2010 – 12/2010	716,860	77,638

*** Hydro chose not to create LUACs for this period as sufficient low cost NGACs were available to purchase for compliance purposes**

This page has been left blank intentionally.

9.0 Non Achievement of Environmental Performance Goals

Hydro did not exceed any environmental limits specified in EPL 1548 and the development consent approvals during 2012.

The only identified non-compliance with standards/goals were exceedences of ANZECC guidelines for fluoride in forage grasses as well as exceedences in fluoride and pH levels in surface water and groundwater.

Fluoride levels in forage grasses exceeded ANZECC guidelines at sites 8and 9 situated within the buffer zone to the north-east of the smelter. Exceedences were:

- The running 12 month average (40 µgF/g guideline) exceeded at site 8 for all months;
- Average of two consecutive months not to exceed 60 µgF/g (3 exceedences at site 8 and 2 exceedences at site 9); and
- A monthly sample not to exceed 80 µgF/g more than once in 12 consecutive months (1 exceedence at site 8).

Fluoride levels in surface water samples exceeded ANZECC guidelines:

- Regularly for both irrigation and livestock guidelines at surface water sampling sites immediately surrounding the smelter well within the buffer zone (sites 1, 2, 9, 14, D and E); and
- Occasionally, by minor amounts at site 62 to the north-east of the smelter within the buffer zone located in Wentworth Swamp.

Guidelines for pH in aquatic ecosystems (6.5 – 9.0) were marginally breached at sites in all directions of the smelter, both within and outside of the buffer zone (sites 1, 3, 9, 16, 31, 59, 62 and 88). However sites where exceedences occurred were interspersed with sites where no exceedences occurred.

Groundwater monitoring, focussed around the capped Spent Cathode Pile recorded regular exceedences of ANZECC guidelines for pH and fluoride in a concentrated area to the immediate north-east of the Pile. These results are consistent with previous years and it has been confirmed that this contaminated water us contained within a sandy lens surrounded by a natural impervious clay barrier. A review of the groundwater monitoring network in 1999 by groundwater consultants Woodward-Clyde confirmed that the near surface groundwater is contained and does not present a significant risk of harm (McNaughton 2012a).

It should be noted that groundwater from the smelter site is not used for irrigation or livestock watering purposes, and that monitoring of cattle grazing in the area reported cattle to be in good health and body condition with fluoride exposure below toxic thresholds and constant over the last six years.

9.1 Response to Non Achievements of Environmental Performance Goals

9.1.1 Forage fluoride at sites 8 and 9

Site 8 and 9 are located very close to the actual smelter site boundary and impacted by smelter emissions during periods of dry westerly winds returning to low levels when they cease. They are located well within the Smelter's Buffer Zone which was established to allow the Smelter to manage this issue. As noted in the AER cattle grazing at the site is managed around these fluctuating levels.

9.1.2 Surface Water fluoride at nominated sites

Sites 1, 2, 9, 14, D and E

As noted in the AER these sites are very close to the actual smelter site boundary and consist of very small ephemeral ponds that fill with water during rainfall events and then concentrate fluoride until they evaporate to dryness. With the water not used for any purpose and although results are compared with guideline values, they are not applicable. They are all located well within the Smelter's Buffer Zone which was established to allow the Smelter to manage this issue.

Site 62

During prolonged dry periods Swamp Creek stops flowing resulting in the water in Wentworth Swamp to stagnate and evaporate resulting in increased fluoride levels. It must be noted that Site 62 water quality is also influenced by Sewage Treatment Works discharge into Swamp Creek.

9.1.3 Surface Water pH at nominated sites

During the reporting period there were no emissions from the smelter which can impact on pH levels of the surface water monitoring sites.

Sites 16, 59 and 88
These sites are farm dams for irrigation use and do not represent aquatic ecosystems.

Sites 1, 3, 9, 31, D and E
These are ephemeral ponds which in dry periods evaporate to dryness and do not represent aquatic ecosystems.

Site 62
Historically after prolonged dry periods when significant rainfall occurs creating some short term flows into Wentworth Swamp there is an unexplained short term natural low pH occurrence which occurs well away from the smelter site, as seen at site 62 in February and April 2012 but not at other sites closer to the smelter, with pH quickly returning to more neutral levels.

10.0 Approval and Licence Variations

10.1 Approval Variations

There were no variations to development approvals sought or granted in 2012.

10.2 Licence Variations

During 2012 Hydro applied to the Environmental Protection Authority (EPA) for two variations of the smelter EPL 1548. These variations related to the removal of monitoring and reporting of onsite emissions relating to the curtailment of production from Potline 1 (30 March 2012) and all remaining operations (16 July 2012).

The EPL approved these variations on 11 October 2012 (Notice Number – 1505741) with a Special Condition that permits Hydro not to measure and report emissions whilst Potline 2 and 3 are not operation. However it appears that the EPA inadvertently did not include points 10, 13 and 14 (Carbon Plant and total smelter emission points) in the Licence variation. Hydro is pursuing this licence condition anomaly with the EPA.

This page has been left blank intentionally.

11.0 Environmental Management: Targets and Strategies

11.1 Achievements over the Reporting Period

During 2012 Hydro met all of its environmental management targets Operations were successfully closed down with all production curtailed by November.

11.2 Strategies for the Following Reporting Period

Although Hydro has curtailed all production at the smelter Hydro will continue to maintain all external monitoring programs as per EPL requirements.

This page has been left blank intentionally.

12.0 Progress on Implementation of Environmental Audit Recommendations

Section 7.5(j) of the 2002 DC requires each AEMR to include an update and review of the progress of the most recent independent triennial environmental audit.

The most recent audit within the scope of this AEMR was conducted by DLA Environmental in October 2012. The audit included only one recommendation which related to site closure issues highlighting the need for *"contaminated groundwater … around the Spent Cathode Pile to be treated as an Area of Concern during any remediation process following the decommissioning of the Smelter."* (DLA Environmental 2012).

This page has been left blank intentionally.

13.0 Operational Environmental Management Plan Review

Section 7.5(k) of the 2002 DC requires a review of the OEMP to ensure it is up-to-date and any changes to practices and procedures have been incorporated.

A comprehensive review of the Operation Environmental Management Plan (OEMP) was carried out in 2009 with recommendations relating to the referencing of the Emergency Services Cooperation Agreement implemented and the OEMP restructured in line with the DP&I publication *Guideline for the Preparation of Environmental Management Plans* (DIPNR, 2004).

Separate Environmental Management "sub-plans" were prepared for the Potrooms, Carbon Plant and Casthouse operating departments to further highlight environmental issues at the operations level and drive continual improvement.

No changes to the OEMPs were required within the reporting period.

This page has been left blank intentionally.

14.0 Conclusion

The Hydro Kurri Kurri Smelter operates a complex and comprehensive environmental monitoring program. The results of the program are reported routinely to the appropriate regulatory authorities and the relevant local stakeholders. The fundamentals of this process have been in place for over twenty years, and the result is a satisfactory picture of the smelter's environmental performance in terms of both its emission envelope, and the measured impact of those emissions at our current state of knowledge.

Hydro has repeatedly complied with environmental performance goals as stipulated in approvals and licence conditions, and continued to do so during 2012. Fluoride levels recorded in forage vegetation and waters around the smelter continued to be elevated similarly to previous years, however fluoride impacts are generally confined to the buffer zone area. No significant fluoride effects were recorded in the Lower Hunter Valley vineyards or to cattle within the buffer zone lands, indicating that key receptors to environmental fluoride are unlikely to be affected by smelter fluoride emissions.

Due to the curtailment of Potline 1 production early in the year, it is not possible to comment on the predictions made in the SURF Statement of Environmental Effects with regard to this Potline. However previous AEMRs have reported that the majority of predictions made in the Statement of Environmental Effects for the SURF project have been demonstrated to have occurred, notably the reduction in total particulate and total fluoride emissions from Potline 1, the reduction in PAH and particulate emissions from the Greenmix plant, and reductions in PFC emissions.

Outcomes from the Independent Environment Audit undertaken in 2012, combined with monitoring results show that Hydro's environmental performance has continued to meet expectations. In addition to the improvements associated with the completion of the majority of the SURF project, general environmental performance has continued to improve in recent years.

The continuation of the smelter's environmental monitoring programs whilst production is curtailed will enable the compilation of a "background" set of results which can be used for comparison purposes should production at the smelter recommence.

This page has been left blank intentionally.

15.0 References

AECOM 2012a *Potline Emissions Testing Report 2012*. AECOM, May 2012.

AECOM 2011b. *Vegetation Health Survey of Hydro Aluminium Kurri Kurri Limited Smelter Buffer Zone,* AECOM, July 2012.

ANZECC. 1990. *Ambient Air Quality Goals: Fluoride.* Australian and New Zealand Environment and Conservation Council. Canberra.

DIPNR. 2004. *Guideline for the Preparation of Environmental Management Plans.* Department of Infrastructure, Planning and Natural Resources.

DLA Environmental 2012, *Independent Environmental Audit, Hydro Aluminium Kurri Kurri.* DLA Environmental November 2012.

Hydro Aluminium. 2012. *2012 Environment Protection Licence Annual Return.* Hydro Aluminium Kurri Kurri.

Industrial Risk Management. 1991. *Alcan Australia Limited, Implementation and Effectiveness of the Planning Conditions of Consent to third potline Expansion Project*.

McNaughton. K. 2012a. *2012 Annual Environmental Report.* Hydro Aluminium Kurri Kurri

McNaughton. K. 2012b. *2012 Annual Cattle Monitoring Report.* Hydro Aluminium Kurri Kurri.

McNaughton. K. 2012c. *Fluoride Monitoring in Lower Hunter Valley Vineyards – October 2011 –March 2012*. Hydro Aluminium Kurri Kurri.

McNaughton. K. 2012d. *2012 External Noise Monitoring Survey*. Hydro Aluminium Kurri Kurri.

NSW Department of Planning and Infrastructure *Development Consent No. N91/00033* dated 21 August 2002 for the Smelter Upgrade and Retrofit (SURF) project.

NSW Office of Environment and Heritage *Development Consent for Proposed Expansion of an Existing Aluminium Smelter at Kurri Kurri* dated 21 August 1981 for the smelter's Line 3 expansion.

URS. 2002. *Statement of Environmental Effects VAW Smelter Upgrade and Retrofit Projects.*

This page has been left blank intentionally.

Appendix A

2012 Independent Environmental Audit Recommendations

Appendix A 2012 Independent Environmental Audit Recommendations

8.0 AUDIT FINDINGS WITH RECOMMENDATIONS

This section presents the Audit findings with recommendations for improvement that arise out of this Independent Environmental Audit undertaken at Hydro.

Table 8a below outlines the 2002 Development Consent and EPL condition number with brief Recommendations for Improvement (RFI) based on the Audit findings. Given the planned decommissioning of the smelter the RFI should be addressed as Areas of Concern during any remediation process during or following on from the decommissioning.

Table 8a – Audit Findings and Recommendations for Improvement (RFI)

2002 DC/EPL Condition	Audit Finding	Rec. No.	RFI
4.11	**NON COMPLIANCE** As per site visit, no breakage of hardstand surface areas was noticed. Hardstand areas to the east of 7B/C furnace were designed as load bearing. As per Hydro Aluminium 2011 Annual Environmental Management Report regular exceedances of the ANZECC guidelines aquatic ecosystem pH and for fluoride and pH in irrigation and livestock water quality have been recorded in groundwater results, consistent with previous years. Exceedances are focused around the north east of the capped Spent Cathode Pile.	1	The contaminated groundwater has been confirmed to be within a sandy lens surrounded by a natural impervious clay barrier. Groundwater around the Spent Cathode Pile should be treated as an Area of Concern during any remediation process following the decommissioning of the Smelter.

Appendix B

2012 Annual Environment Report

Appendix B 2012 Annual Environment Report

2012 ANNUAL ENVIRONMENT REPORT

HYDRO ALUMINIUM KURRI KURRI SMELTER

Prepared by:

Kerry McNaughton
Environment Officer

CONTENT

			Page No.
1.	INTRODUCTION		1
2.	CONSENT CONDITIONS		2
3.	EMISSIONS		3
4.	METEOROLOGY		6
5.	AMBIENT AIR MONITORING		10
6.	VEGETATION MONITORING		
	6.1	Fluoride Levels in Vegetation	28
	6.2	Visual Inspection of Vegetation	28
7.	GREENHOUSE MONITORING		32
8.	WATER		
	8.1	Fresh Water Usage	34
	8.2	Surface Water Monitoring	34
	8.3	Ground Water Monitoring	34
9.	WASTE GENERATION AND DISPOSAL		43
10.	HYDRO ALUMINIUM KURRI KURRI CONTACT DETAILS		46

1. INTRODUCTION

This document is a summary of the environmental performance of the Hydro Aluminium Kurri Kurri Pty Ltd smelter, for the calendar year 2012. This coincides with the company's New South Wales Environment Protection Authority annual Environment Protection Licence (EPL) reporting period.

This report has been compiled to meet two objectives. Firstly, to meet the annual report requirement, condition 48, of the smelter's Line 3 expansion Instrument of Approval as obtained from the New South Wales Department of Planning in August 1981, and secondly, to provide a comprehensive technical summary of environmental performance to regulatory and community groups and Hydro personnel.

The fluoride emission performance of the smelter is provided and compared with previous years. Summaries of the interpretation of the atmospheric dispersion of these emissions based on meteorological data collected onsite are also provided.

A condition of the Instrument of Approval was the establishment of a buffer zone around the smelter, the outer boundary of which was determined by the then State Pollution Control Commission (SPCC) based on dispersion modelling. Measured fluoride levels in ambient air are presented and compared with relevant ANZECC (Australian and New Zealand Environment and Conservation Council) guidelines and the buffer zone. Measured fluoride levels in forage grasses and native vegetation, and the zone of first visible impact on fluoride sensitive native vegetation are also presented.

Summaries of greenhouse emissions, fresh water usage, surface and ground water quality and waste management and disposal with regard to the smelter and its operations are also included.

Separate annual comprehensive reports covering:

- grapeleaf and ambient fluoride levels as measured at Lower Hunter Valley vineyards;
- and external noise monitoring.

have been forwarded to the EPA and are not included in this report.

2. CONSENT CONDITIONS

The smelter's Line 3 expansion Instrument of Approval of August 1981 contained 51 conditions, many of which were not of an ongoing nature. In 1991 a comprehensive review of the implementation of consent conditions was carried out by independent consultants Industrial Risk Management, and a detailed report prepared and submitted to the Department of Planning.

The report stated that, except for the ongoing annual reporting requirements detailed below, compliance had been achieved with all other consent conditions. The report also stated that, upon acceptance of the report by the Department of Planning, future annual reporting requirements would be reduced to:

- onsite and offsite environmental monitoring results;
- modelled ambient fluoride and sulphur dioxide concentrations; and,
- waste storage and disposal.

The smelter received additional Development Consent from Planning NSW on 21 August 2002 to carry out

- structural floor repairs;
- installation of a Greenmix Plant scrubber;
- upgrade the Anode Bake Plant;
- retrofit and upgrade Potlines 2 and 3;
- upgrade Potline 1; and
- increase anode size across all three potlines

This consent requires an independent, qualified person to complete an Annual Environment Management Report (AEMR) which "reviews the smelter's performance against the Operation Environmental Management Plan, the conditions of the 2002 consent, and other license and approvals relating to the smelter upgrade and retrofit".

3. EMISSIONS

Table 3.1 shows, for each month of 2012, the total fluoride emissions to atmosphere from the scrubber stacks and Potroom buildings onsite. Table 3.1 and Figure 3.1 show the total smelter emissions as calculated from the individual source emissions as prescribed in the smelter's Environment Protection Licence. The total smelter month to month variation is due to the combined inherent process variability from each source, an important consideration taken into account in setting licence limits.

In 2003 the EPA reviewed the principal environmental performance indicators for the smelter, extending these to annual atmospheric emission of fluoride, coarse and fine particulates, nitrogen oxides and sulphur dioxide, with lead being added in 2010.

2012 annual emissions were as follows:

	Emission	EPA Licence Limit
total fluoride	62,055 kg	165,000 kg
coarse particulate	32,378kg	100,000 kg
fine particulate	76,177 kg	200,000 kg
sulphur dioxide	950,371 kg	3,800,000 kg
nitrogen dioxide	19,683 kg	40,000 kg
lead	2.5 kg	N/A

Table 3.1: Fluoride Emissions from the Hydro Aluminium Kurri Kurri Smelter
(All results are in kilograms total fluoride per tonne of aluminium produced)

	Line 1 Stack	Line 1 Roof	Line 2 Stack	Line 2 Roof	Line 3 Stack	Line 3 Roof	Anode Bake	Total Smelter
2005 Annual Average	0.10	0.98	0.15	0.64	0.06	0.68	0.003	0.86
2006 Annual Average	0.09	1.08	0.15	0.73	0.07	0.69	0.003	0.93
2007 Annual Average	0.09	0.81	0.15	0.70	0.06	0.75	0.004	0.86
2008 Annual Average	0.07	0.69	0.13	0.63	0.05	0.71	0.001	0.76
2009 Annual Average	0.08	0.69	0.15	0.73	0.06	0.67	0.001	0.79
2010 Annual Average	0.09	0.77	0.14	0.61	0.11	0.68	0.001	0.80
2011 Annual Average	0.06	0.72	0.14	0.62	0.07	0.70	0.001	0.77
2012 Annual Average	0.04	0.97	0.10	0.64	0.07	0.80	0.001	0.83
Jan-2012	0.04	0.97	0.09	0.78	0.10	0.97	0.001	0.99
Feb-2012			0.10	0.65	0.10	0.90	0.001	0.88
Mar-2012			0.12	0.61	0.08	0.44	0.001	0.61
Apr-2012			0.14	0.64	0.10	0.58	0.001	0.73
May-2012			0.07	0.45	0.04	0.90	0.001	0.74
Jun-2012			0.08	0.71	0.10	0.92	0.001	0.92
Jul-2012					0.03	0.82		0.84
Aug-2012					0.04	0.88		0.93
Sep-2012								
Oct-2012								
Nov-2012								
Dec-2012								
Monthly EPA limit								1.0

Figure 3.1: Hydro Aluminium Kurri Kurri Aluminium Smelter
Fluoride Emissions (kgF/tAl) for 2012

4. METEOROLOGY

The most important factor which controls the dispersion of any emission is site specific meteorology (i.e. wind speed and direction, presence or absence of inversion layers, calm conditions, rainfall - total and frequency, temperature). With the approval to construct Potline 3, it was a requirement that the smelter install and maintain a meteorological tower to collect accurate site specific data for inclusion in the dispersion model. A summary of this data is presented in Tables 4.1 to 4.3 and Figure 4.1.

Tables 4.1 and 4.2 present the median, daily highest and lowest hourly average temperatures, respectively, for the past 20 years. In summary the 2012 data shows that temperatures were above average for summer days and nights.

Table 4.3 presents the monthly rainfall for the past 20 years. In 2012, significant rainfall fell in June (100mm) however the annual total of 515mm was below the 20 year average of 619mm.

Figure 4.1 presents the quarterly wind roses, which show the usual pattern of strongest winds from the northwest in winter, moderate winds from the south and southwest in spring and autumn and moderate to strong southeast winds in summer.

Table 4.1: Median, Daily Highest, Hourly Average Temperature (degrees Celsius) as recorded at the Hydro Aluminium Kurri Kurri Smelter

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1993	28.2	28.0	23.6	23.2	19.5	17.4	17.5	19.0	18.4	22.3	23.5	26.9
1994	29.4	28.3	22.5	23.3	20.8	17.4	17.1	18.0	22.0	23.1	25.6	26.4
1995	24.5	26.3	26.2	22.5	18.8	17.2	17.1	19.4	18.3	23.1	24.0	23.9
1996	26.1	25.2	25.2	23.6	19.8	18.2	17.4	18.3	21.3	22.7	24.3	26.6
1997	24.3	28.1	26.6	24.6	19.8	17.5	17.0	19.0	20.3	24.7	27.5	29.4
1998	29.5	30.5	29.0	24.3	20.2	17.5	16.5	18.0	20.7	23.8	22.5	26.9
1999	28.3	27.6	27.1	21.9	22.2	17.5	17.8	18.3	22.9	25.3	22.1	24.8
2000	23.9	29.3	27.7	25.9	21.9	18.0	18.9	20.7	25.9	25.8	26.8	31.6
2001	33.4	31.7	27.4	26.3	21.6	21.9	19.8	21.5	24.3	27.0	26.8	31.0
2002	30.9	28.6	28.1	26.7	21.2	18.9	19.3	20.6	23.8	27.5	28.8	29.6
2003	28.5	28.3	26.9	23.1	21.2	20.6	17.9	20.5	23.2	23.4	26.1	30.3
2004	32.5	33.2	27.7	27.2	22.7	20.9	19.0	21.7	23.8	26.7	27.8	30.2
2005	30.3	31.6	27.5	27.4	22.3	20.0	18.8	20.8	22.0	25.9	26.7	32.3
2006	30.8	29.6	27.9	24.4	21.3	17.6	18.3	21.4	22.9	25.3	27.8	30.5
2007	32.5	31.8	29.7	25.7	24.0	17.7	18.2	21.8	23.1	30.2	28.1	28.0
2008	28.8	27.2	27.4	22.2	22.6	20.6	18.2	18.5	23.3	26.8	26.2	30.8
2009	33.9	30.6	29.2	24.2	22.3	19.4	18.6	23.2	24.4	24.4	31.3	29.3
2010	31.6	30.4	29.6	26.9	21.5	19.2	17.9	19.8	23.4	24.0	27.5	29.5
2011	30.4	31.4	29.8	24.4	21.0	18.6	17.9	20.8	23.6	23.7	29.0	25.5
2012	29.2	28.7	27.0	25.6	22.4	18.3	18.5	21.8	25.4	25.3	30.0	29.8
Average	29.4	29.3	27.3	24.7	21.4	18.7	18.1	20.2	22.7	25.1	26.6	28.7

Table 4.2: Median, Daily Lowest, Hourly Average Temperature (degrees Celsius) as recorded at the Hydro Aluminium Kurri Kurri Smelter

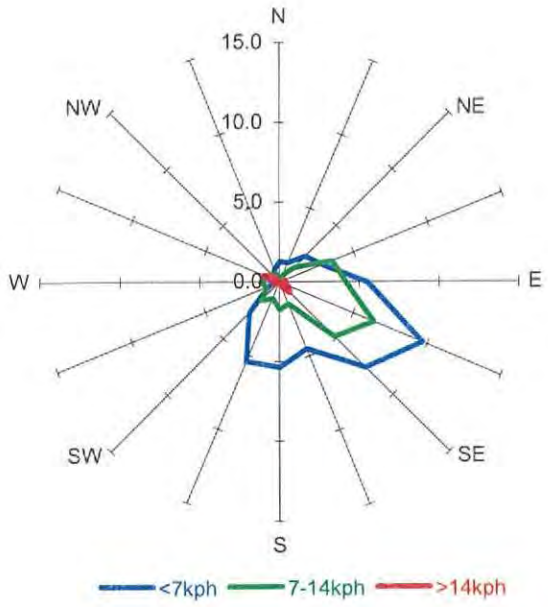
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1993	19.1	17.4	15.8	10.8	9.8	7.9	8.0	7.1	8.6	11.5	13.4	17.2
1994	17.3	17.6	16.0	10.0	10.5	7.5	4.3	4.3	5.0	8.9	16.1	16.5
1995	17.7	17.5	13.9	11.2	11.4	8.4	7.5	8.8	11.6	12.1	16.4	16.2
1996	18.1	17.0	14.6	11.2	11.6	8.8	6.9	8.3	11.5	11.4	13.8	16.1
1997	17.3	20.7	15.7	9.7	12.4	7.5	7.7	6.5	11.5	11.1	17.1	19.4
1998	20.7	19.1	17.5	13.3	14.0	11.0	9.8	10.5	11.5	12.0	15.3	17.5
1999	20.2	19.0	18.5	13.9	10.9	10.0	9.5	7.9	10.8	13.7	12.5	15.7
2000	17.2	16.5	19.2	14.7	11.3	7.1	7.5	8.8	10.7	13.0	16.4	18.3
2001	20.2	21.2	18.4	13.9	11.7	7.1	8.8	8.3	9.7	10.2	15.4	17.8
2002	18.3	20.0	16.9	14.7	11.5	11.3	5.5	8.1	8.5	12.7	16.8	17.8
2003	18.8	21.1	16.0	15.3	13.5	11.0	8.4	7.3	10.5	13.9	13.2	18.6
2004	20.2	19.5	17.3	13.4	9.4	7.0	7.0	8.8	10.5	13.5	16.0	18.1
2005	20.2	19.1	17.0	13.4	11.3	9.3	8.9	4.5	11.3	16.0	17.7	19.3
2006	22.0	20.9	19.0	11.3	9.4	7.5	10.3	8.8	10.4	13.4	15.0	16.9
2007	18.5	19.7	17.8	14.4	11.1	9.2	8.1	10.2	11.1	12.8	16.7	18.1
2008	20.9	18.4	16.5	15.0	8.0	12.7	6.8	5.7	9.6	13.3	17.1	17.8
2009	18.3	20.3	17.2	15.8	12.2	10.0	8.3	4.8	10.8	13.4	17.8	19.8
2010	21.4	20.6	18.0	13.0	10.2	9.2	9.8	9.6	12.3	13.7	16.7	19.2
2011	21.3	20.2	18.8	14.3	9.8	10.7	9.4	7.3	9.4	12.8	17.5	16.7
2012	19.8	18.8	12.0	14.7	7.8	9.2	8.6	6.6	7.9	10.9	16.7	18.0
Average	19.4	19.2	16.8	13.2	10.9	9.1	8.1	7.6	10.2	12.5	15.9	17.8

Table 4.3: Rainfall (mm) as recorded at the Hydro Aluminium Kurri Kurri Smelter

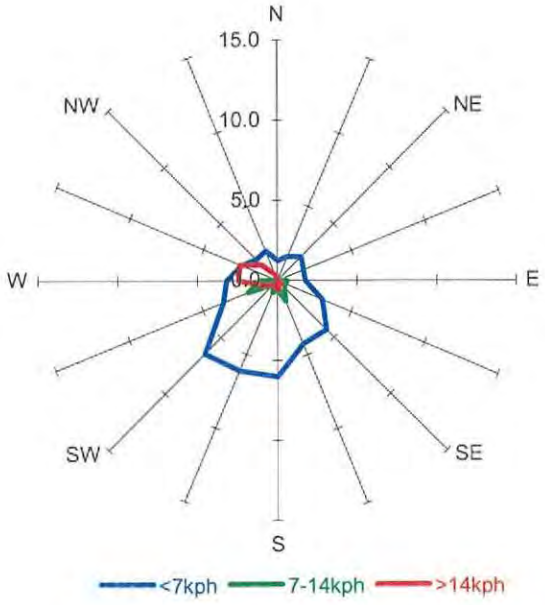
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1993	35	74	60	4	15	52	51	28	32	28	50	28	457
1994	34	81	50	41	19	22	4	9	1	27	68	56	412
1995	118	52	94	4	100	31	0	0	70	28	93	39	629
1996	55	55	18	0	64	39	20	35	58	26	64	58	492
1997	72	86	32	6	42	38	34	14	46	36	10	55	471
1998	75	68	1	32	115	68	81	108	61	54	63	40	766
1999	50	40	24	32	4	38	40	22	28	110	96	48	532
2000	42	22	252	125	38	9	18	25	25	40	83	36	715
2001	54	154	129	91	100	1	41	17	15	23	65	71	761
2002	30	229	114	15	41	15	21	11	13	10	28	74	601
2003	5	68	36	52	65	8	33	32	0	80	69	50	498
2004	64	129	61	14	17	6	16	37	35	104	76	64	623
2005	62	122	93	8	81	60	8	1	35	65	62	7	604
2006	27	70	46	13	8	30	31	23	128	2	24	30	432
2007	12	74	81	34	33	352	11	63	24	14	151	66	915
2008	98	145	34	161	3	86	13	15	122	53	64	59	853
2009	3	197	95	74	81	60	18	1	20	47	35	50	681
2010	108	55	73	26	59	88	41	18	18	26	39	42	593
2011	41	24	48	36	92	141	20	48	74	70	137	96	827
2012	52	50	99	76	7	100	35	10	25	5	28	28	515
Average	52	90	72	42	49	62	27	26	42	42	65	50	619

Figure 4.1:Hydro Aluminium Kurri Kurri Quarterly Wind Data for 2012

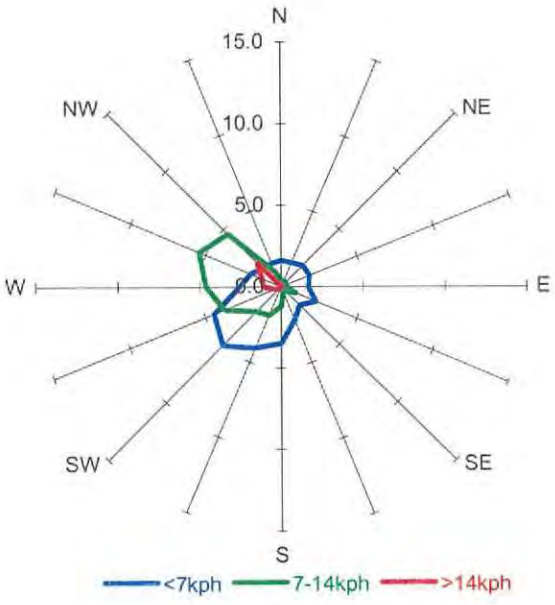
(radial value is percent of time wind from direction of axis)



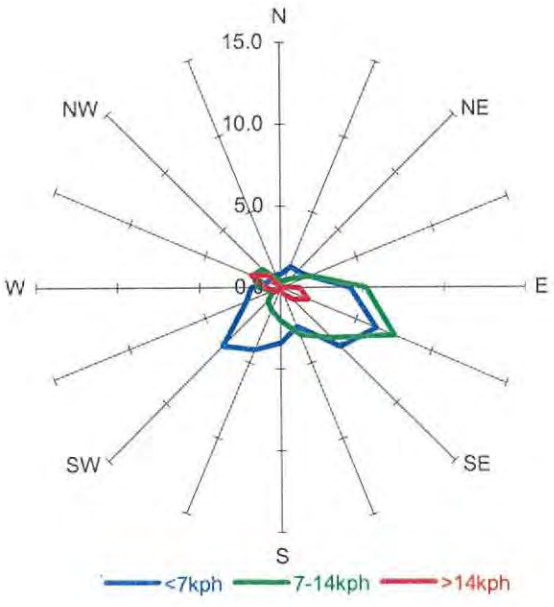
Jan - Mar



Apr - Jun



Jul - Sep



Oct - Dec

5. AMBIENT AIR MONITORING

Goals for fluoride in ambient air are designed to protect against injury to plants and grazing animals. The Australian and New Zealand Environment and Conservation Council (ANZECC) has established guidelines, based on extensive test work, for acceptable levels of fluoride in ambient air. (see Appendix A).

Samples are collected and analysed on a weekly (i.e. seven day average) basis as per Australian Standard Method AS 3580.13.2 - 1991: *Methods for sampling and analysis of ambient air - Determination of fluorides - Gaseous and acid-soluble particulate fluorides - Manual, double filter paper sampling.*

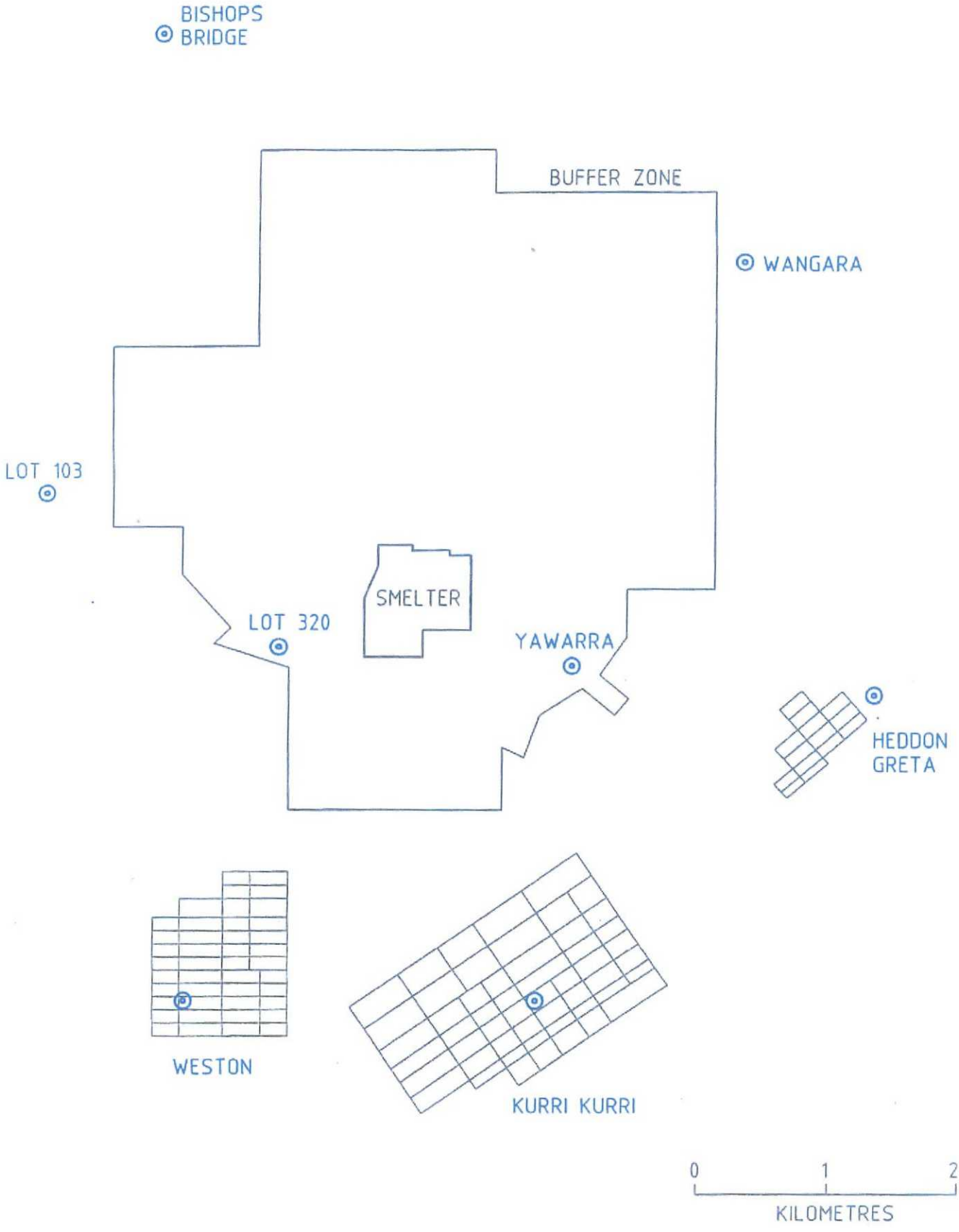
Table 5.1 presents the annual average ambient air fluoride levels at monitoring locations around the smelter and in the vineyards for the 10 year period 2003 to 2012. Monitoring site locations are shown in Figure 5.1 for the sites near the smelter and Figure 5.2 for the vineyards.

Figures 5.3 to 5.16 present the values for the years 2009 to 2012 at each of the locations. The seasonal wind pattern is clearly visible in the 90 day graphs with elevated results to the southeast in winter and the northwest in summer.

In 2012, measured results at all locations beyond the buffer zone were well below ANZECC guidelines. It must be noted that the ANZECC guidelines specifically state that they are not applicable within aluminium smelter buffer zones.

Figure 5.1

Hydro Aluminium Kurri Kurri Pty Ltd
Ambient Air Monitoring Sites



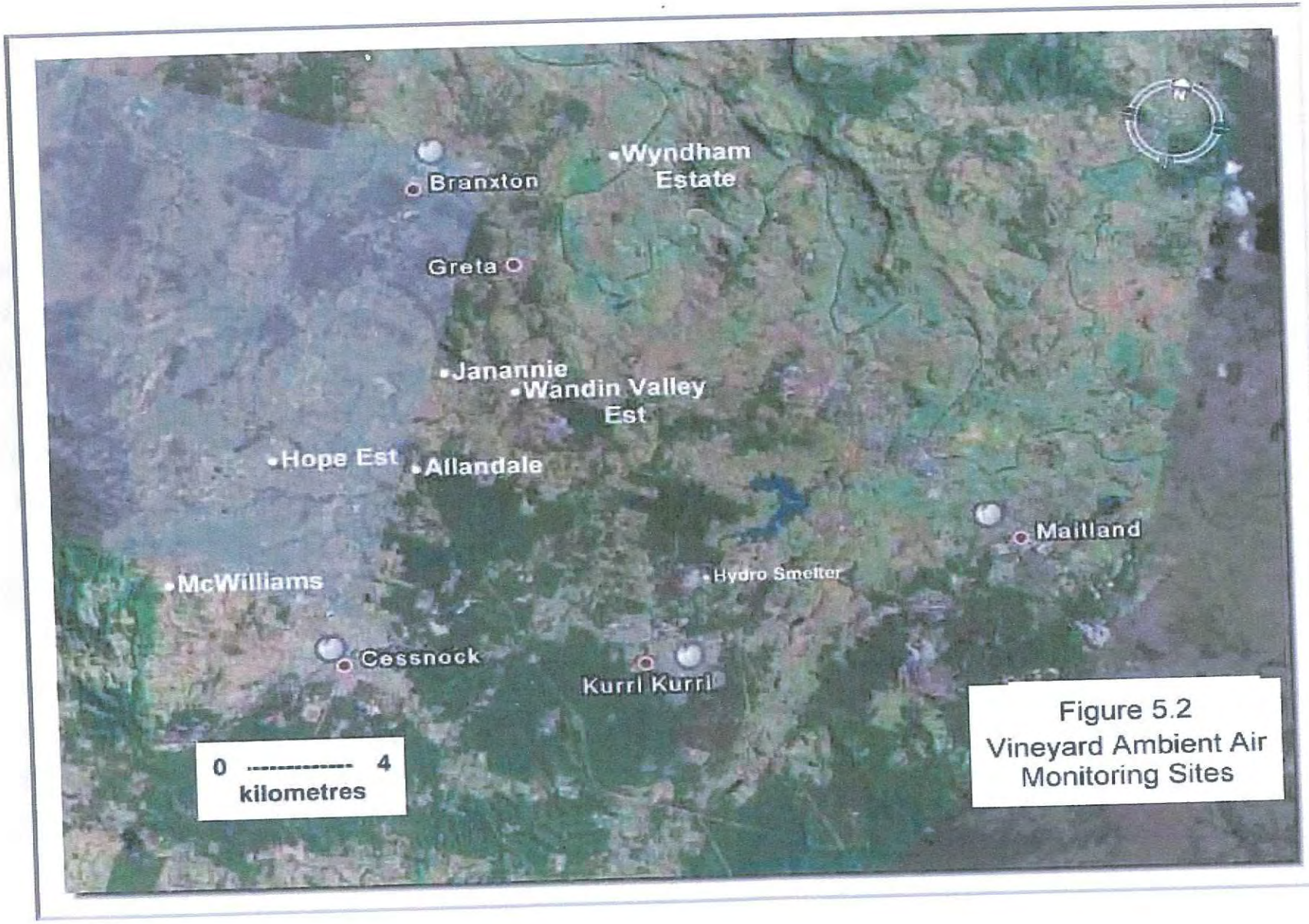


Figure 5.2
Vineyard Ambient Air Monitoring Sites

Table 5.1: Annual Average Ambient Air Fluoride Levels around the Hydro Aluminium Kurri Kurri Smelter

(All results are in micrograms HF per cubic metre)

	2003		2004		2005		2006		2007		2008		2009		2010		2011		2012	
	Gas	Part	Gas	Part	Gas	Part	Gas	Part	Gas	Part	Gas	Part	Gas	Part	Gas	Part	Gas	Part	Gas	Part
Yawarra	0.70	0.21	0.93	0.29	0.75	0.24	0.67	0.24	0.78	0.31	0.76	0.31	0.64	0.26	0.63	0.19	0.43	0.12	0.21	0.11
Mcleods Rd Loxford							0.33	0.21	0.35	0.21	0.37	0.21	0.35	0.22	0.28	0.18	0.22	0.09	0.17	0.14
Heddon Greta	0.24	0.06	0.29	0.08	0.30	0.06	0.28	0.07	0.31	0.08	0.28	0.07	0.27	0.07	0.24	0.05	0.23	0.04	0.16	0.04
Sawyers Gully Lot 103	0.26	0.04	0.29	0.03	0.29	0.04	0.24	0.04	0.20	0.04	0.20	0.03	0.24	0.04	0.18	0.02	0.14	0.02	0.12	0.02
Wangara	0.18	0.04	0.16	0.04	0.14	0.05	0.16	0.07	0.15	0.06	0.14	0.05	0.12	0.05	0.10	0.03	0.07	0.03	0.07	0.03
Bishops Bridge	0.11	0.02	0.12	0.02	0.11	0.02	0.15	0.03	0.13	0.03	0.11	0.01	0.11	0.02	0.10	0.01	0.09	0.01	0.07	0.01
Kurri Kurri	0.14	0.03	0.17	0.03	0.13	0.03	0.14	0.04	0.13	0.05	0.10	0.03	0.10	0.04	0.08	0.03	0.09	0.02	0.07	0.01
Weston	0.09	0.02	0.12	0.02	0.12	0.02	0.10	0.02	0.09	0.02	0.09	0.02	0.08	0.02	0.07	0.01	0.04	0.01	0.06	0.01
Wandin Valley	0.13	0.02	0.15	0.02	0.15	0.02	0.17	0.02	0.17	0.02	0.13	0.02	0.13	0.02	0.12	0.01	0.10	0.01	0.08	0.01
Janannie	0.08	0.01	0.11	0.01	0.10	0.01	0.11	0.01	0.10	0.01	0.09	0.01	0.09	0.01	0.08	0.01	0.06	0.01	0.06	0.01
Allandale	0.07	0.01	0.08	0.01	0.08	0.01	0.09	0.01	0.09	0.01	0.06	0.01	0.07	0.01	0.06	<0.01	0.06	0.01	0.06	0.01
Hope Estate	0.08	0.01	0.09	0.01	0.09	0.01	0.09	0.01	0.10	0.01	0.07	0.01	0.08	0.01	0.07	<0.01	0.07	<0.01	0.06	0.01
McWilliams	0.06	0.01	0.08	0.01	0.08	0.01	0.07	0.01	0.07	0.01	0.06	0.01	0.06	0.01	0.05	0.01	0.05	<0.01	0.04	0.01
Wyndham Estate	0.07	0.01	0.08	0.01	0.07	0.01	0.08	0.01	0.08	0.01	0.06	0.01	0.07	0.01	0.07	0.01	0.07	0.01	0.07	0.01

Figure 5.3 (a): Ambient Gaseous Fluoride (ugHF/m3) at Yawarra
[within buffer zone] (7 day average)

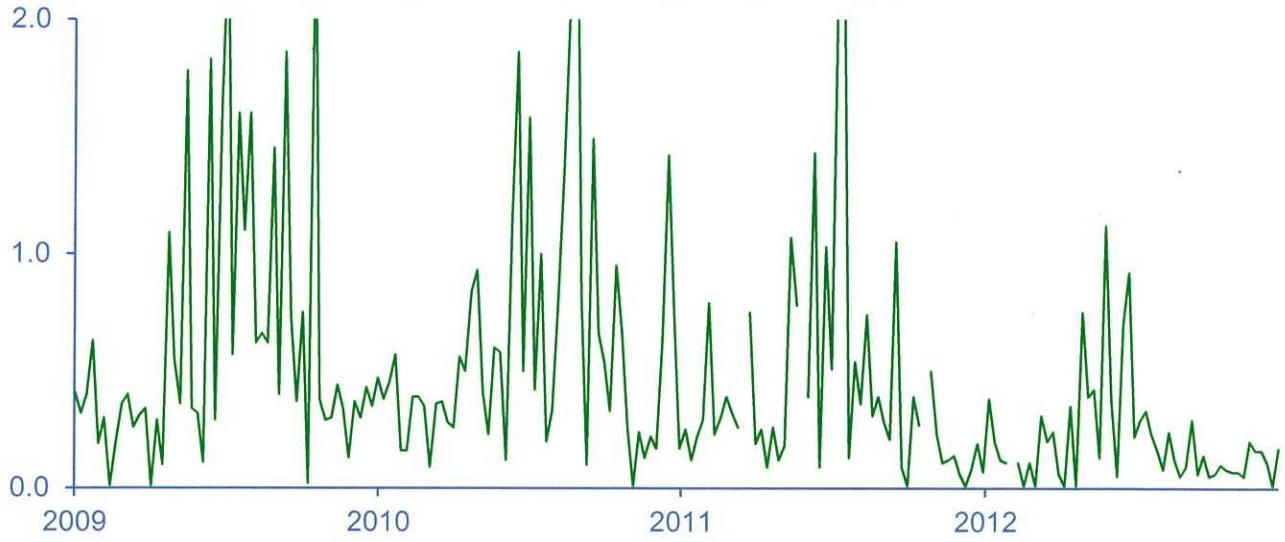


Figure 5.3 (b): Ambient Gaseous Fluoride (ugHF/m3) at Yawarra
[within buffer zone] (30 day average)

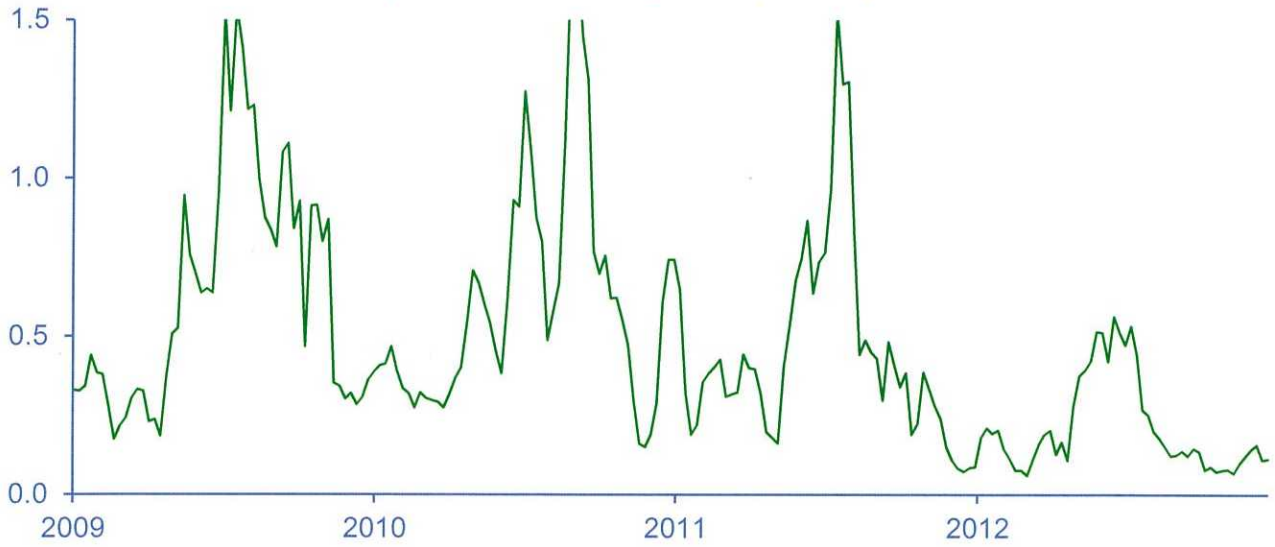


Figure 5.3 (c): Ambient Gaseous Fluoride (ugHF/m3) at Yawarra
[within buffer zone] (90 day average)

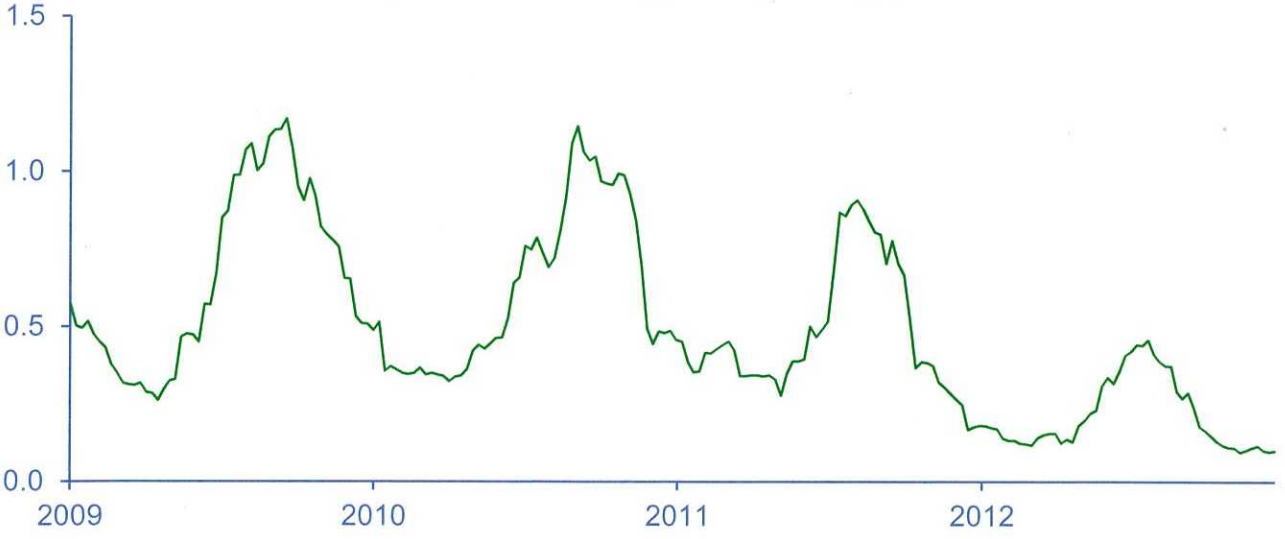
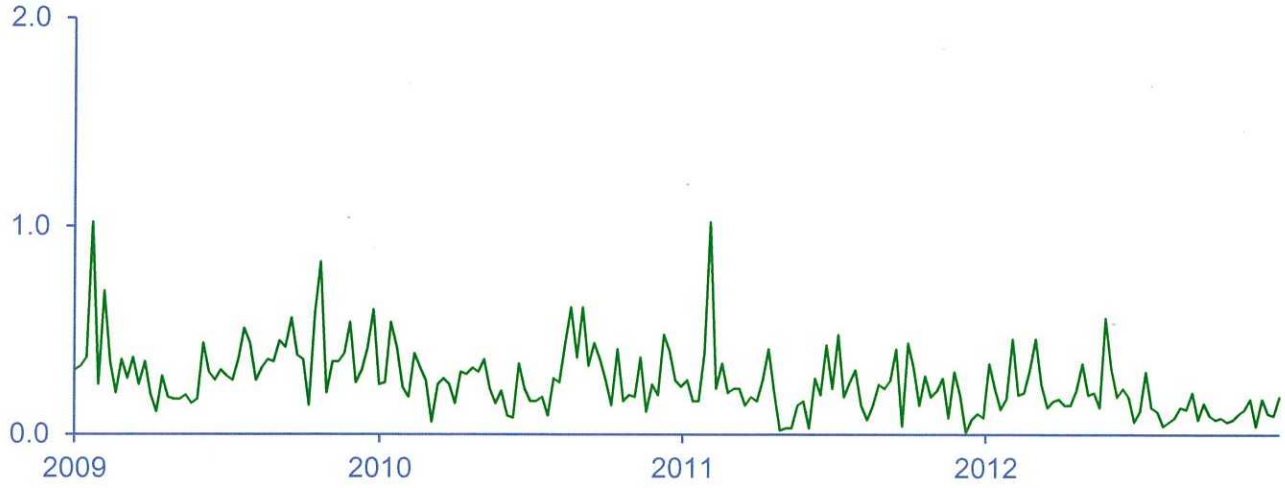
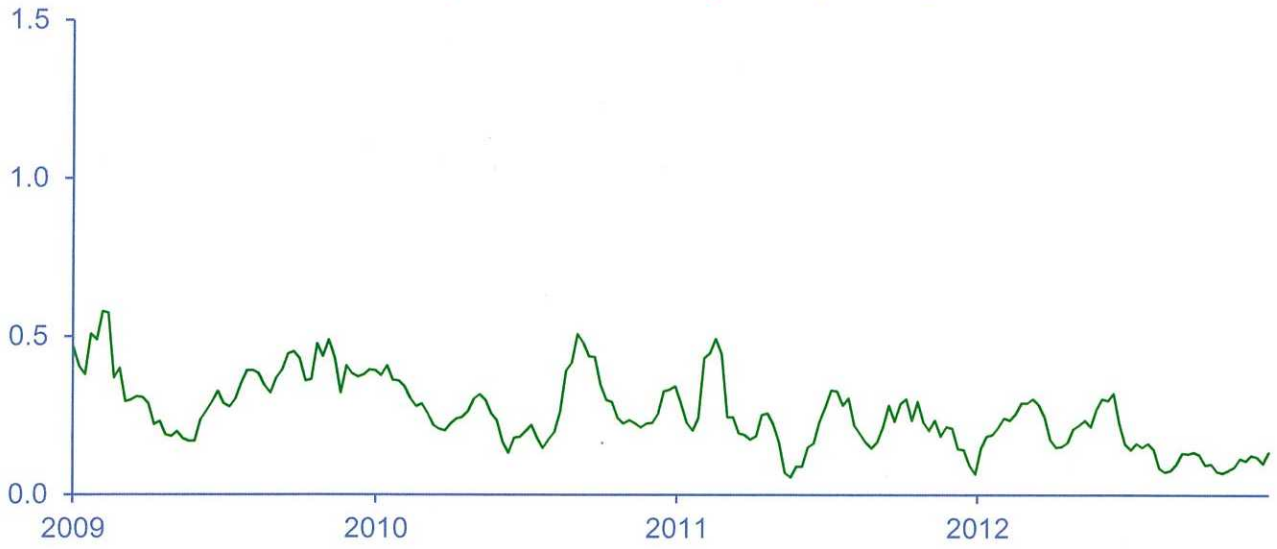


Figure 5.4 (a): Ambient Gaseous Fluoride (ugHF/m3) at Mcleod Rd Loxford [within buffer zone] (7 day average)



(b): Ambient Gaseous Fluoride (ugHF/m3) at Mcleod Rd Loxford [within buffer zone] (30 day average)



(c): Ambient Gaseous Fluoride (ugHF/m3) at Mcleod Rd Loxford [within buffer zone] (90 day average)

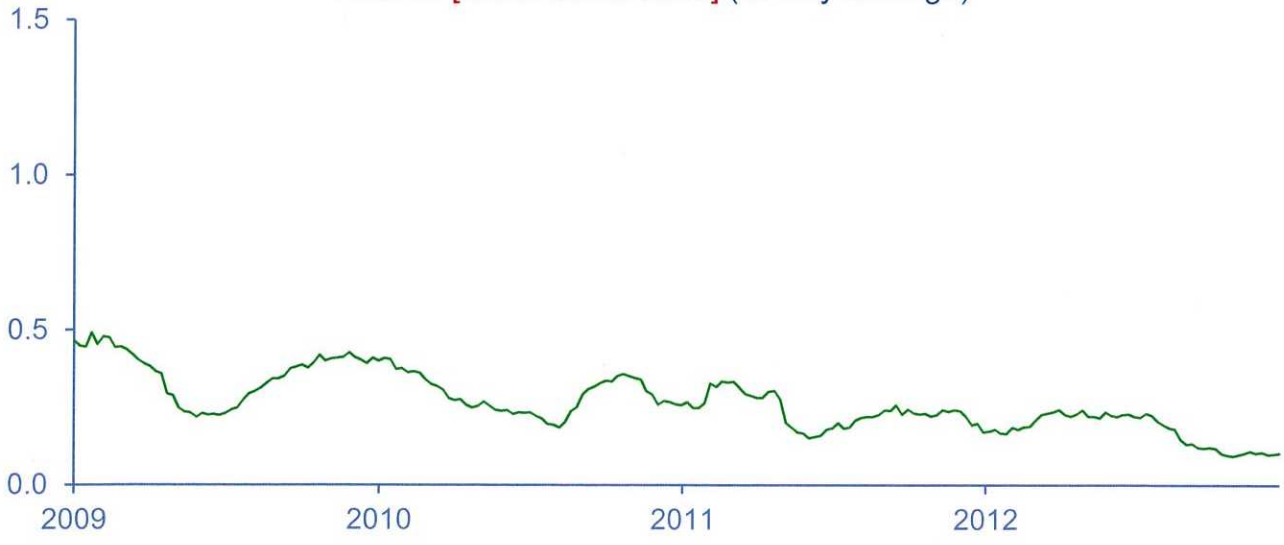


Figure 5.5 (a): Ambient Gaseous Fluoride (ugHF/m3) at Heddon Greta [outside buffer zone] (7 day average)

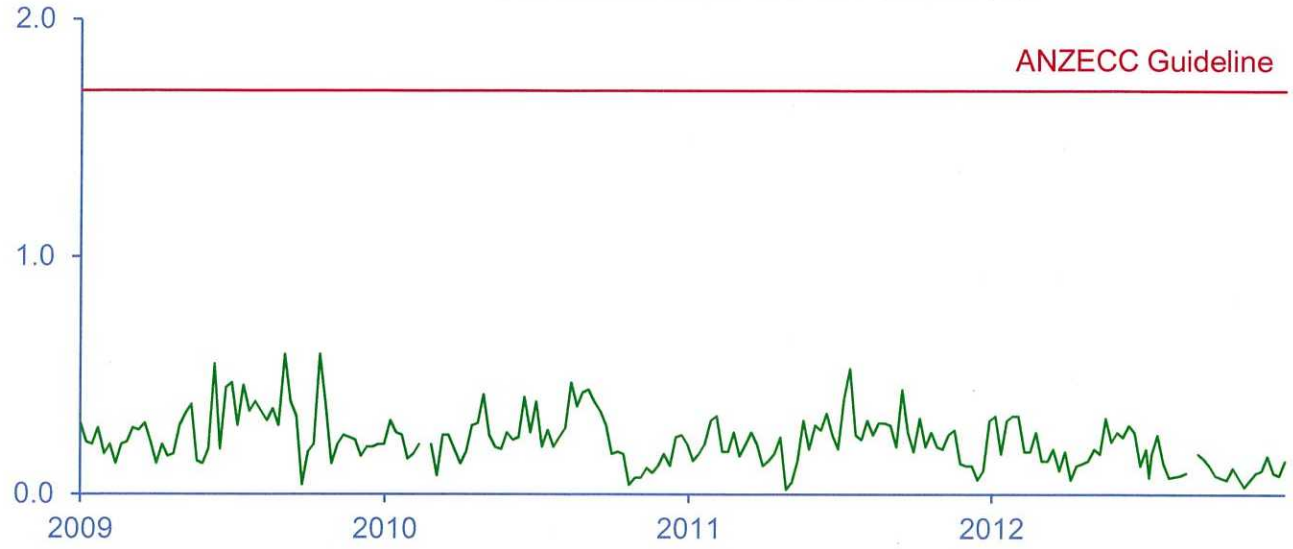


Figure 5.5 (b): Ambient Gaseous Fluoride (ugHF/m3) at Heddon Greta [outside buffer zone] (30 day average)

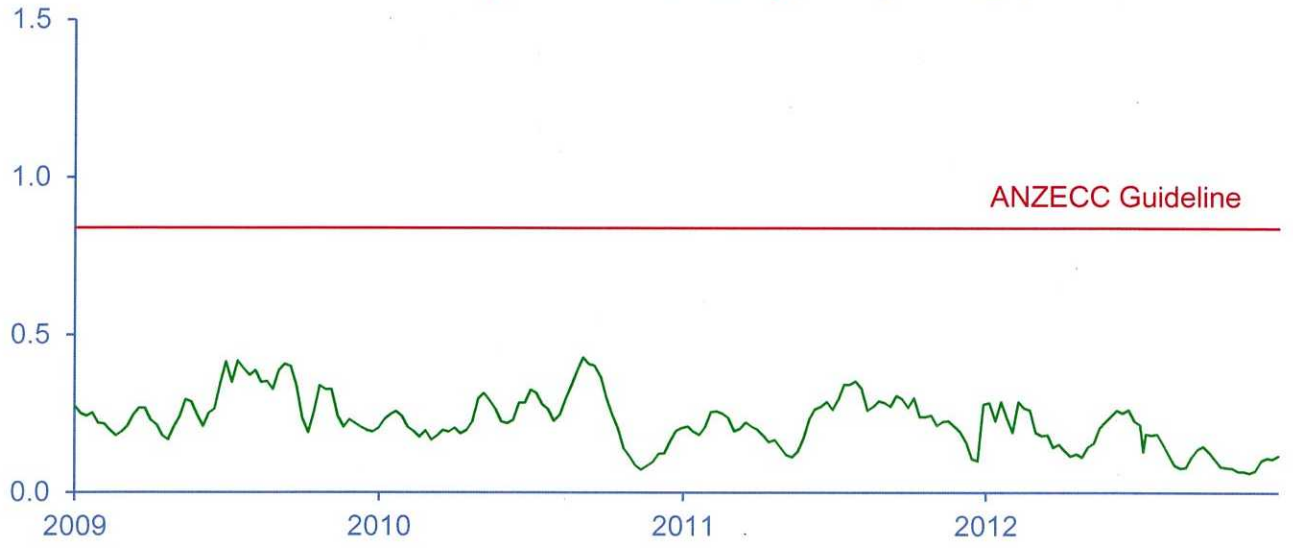


Figure 5.5 (c): Ambient Gaseous Fluoride (ugHF/m3) at Heddon Greta [outside buffer zone] (90 day average)

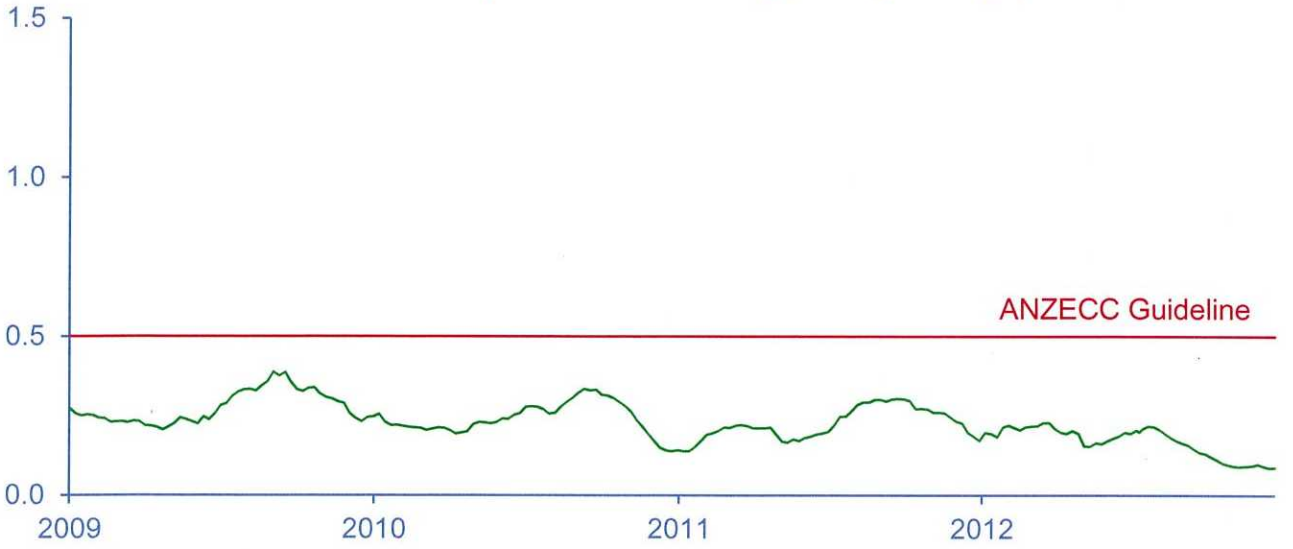


Figure 5.6 (a): Ambient Gaseous Fluoride (ugHF/m3) at Sawyers Gully Lot 103 [outside buffer zone] (7 day average)

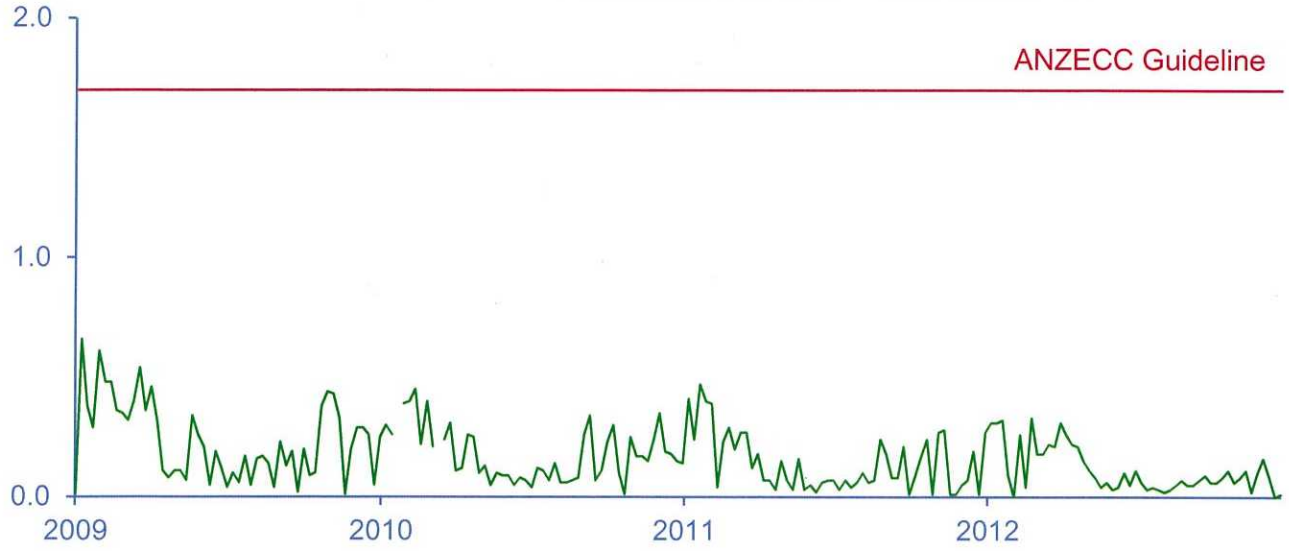


Figure 5.6 (b): Ambient Gaseous Fluoride (ugHF/m3) at Sawyers Gully Lot 103 [outside buffer zone] (30 day average)

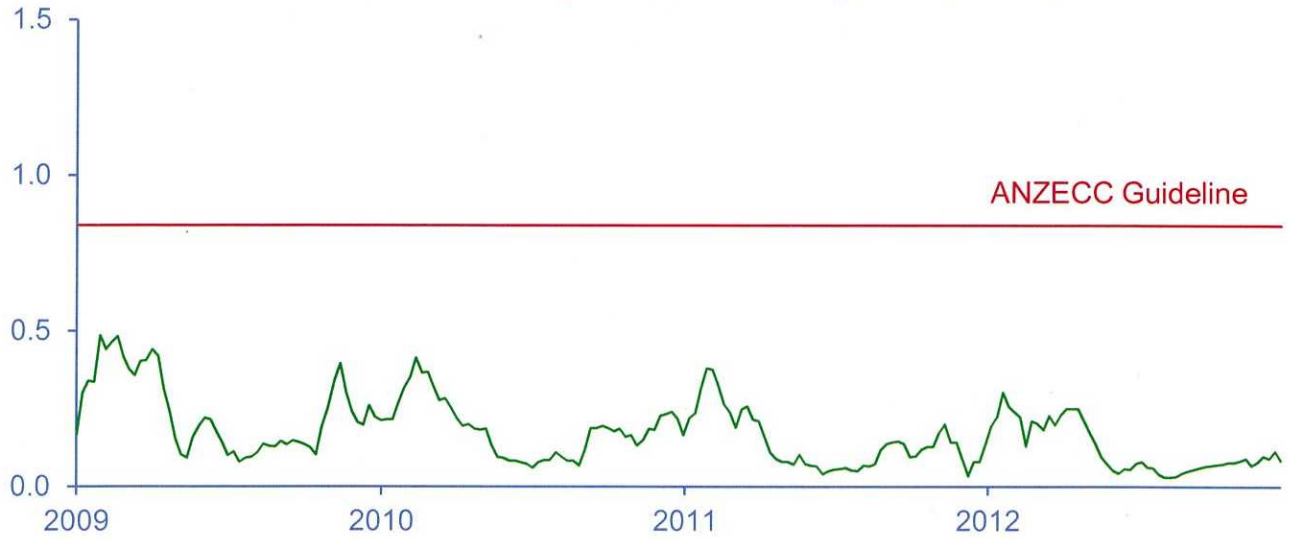


Figure 5.6 (c): Ambient Gaseous Fluoride (ugHF/m3) at Sawyers Gully Lot 103 [outside buffer zone] (90 day average)

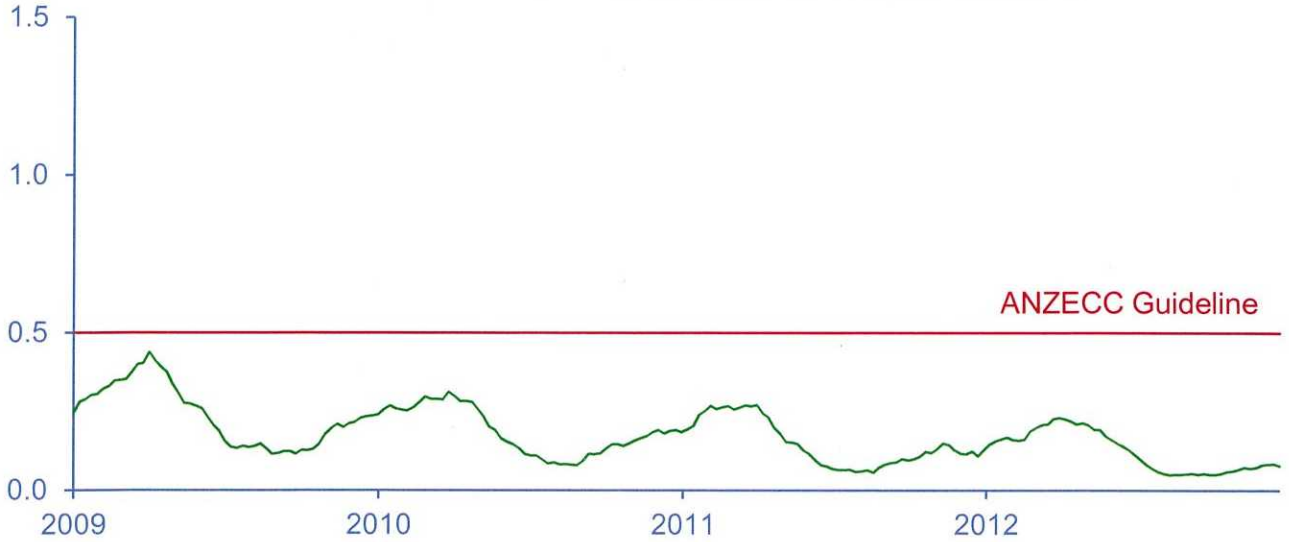


Figure 5.7 (a): Ambient Gaseous Fluoride (ugHF/m3) at Wangara
[outside buffer zone] (7 day average)

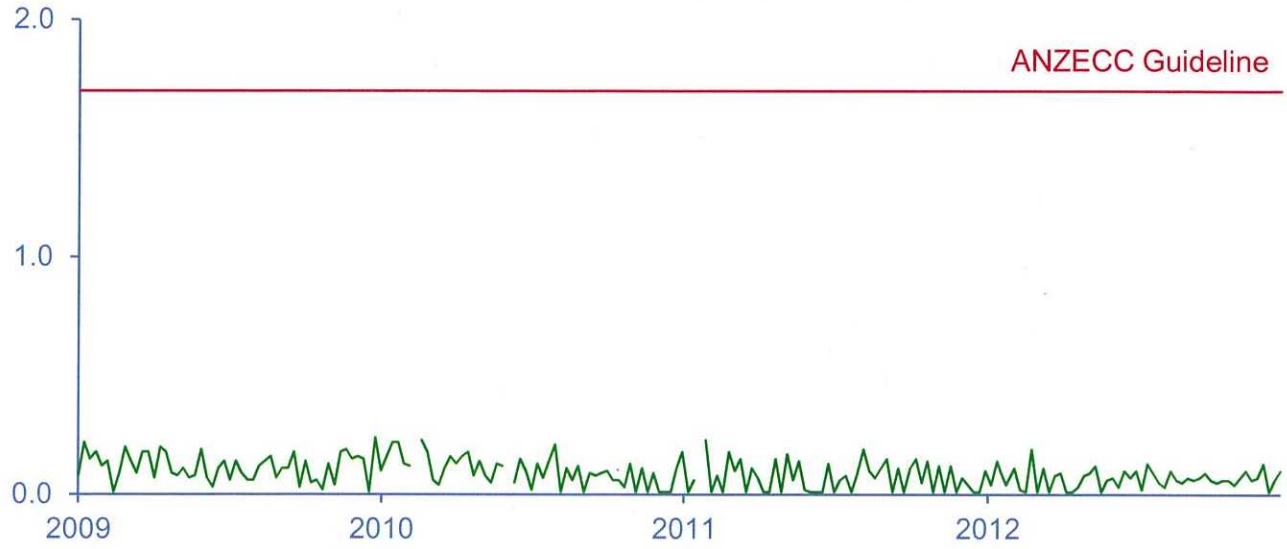


Figure 5.7 (b): Ambient Gaseous Fluoride (ugHF/m3) at Wangara
[outside buffer zone] (30 day average)

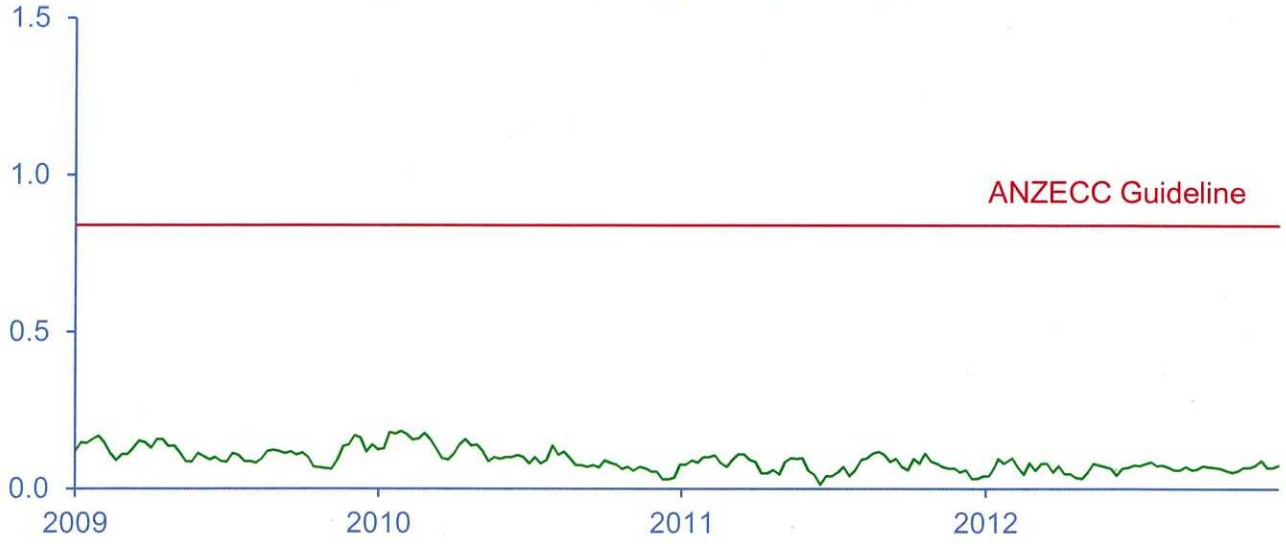


Figure 5.7 (c): Ambient Gaseous Fluoride (ugHF/m3) at Wangara
[outside buffer zone] (90 day average)

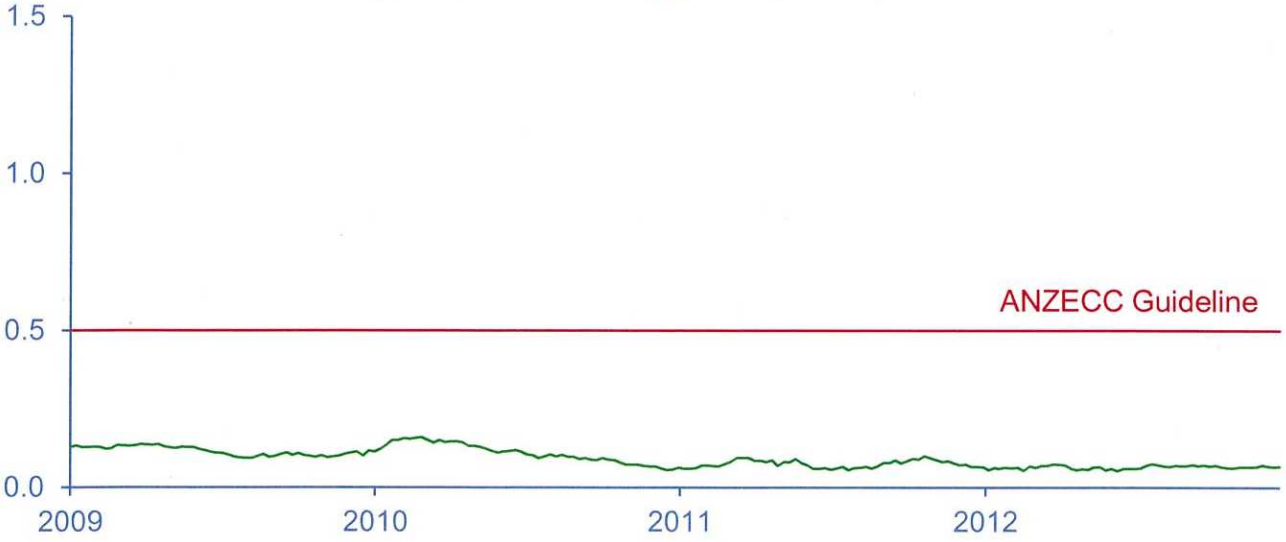


Figure 5.8 (a): Ambient Gaseous Fluoride (ugHF/m3) at Bishops Bridge [outside buffer zone] (7 day average)

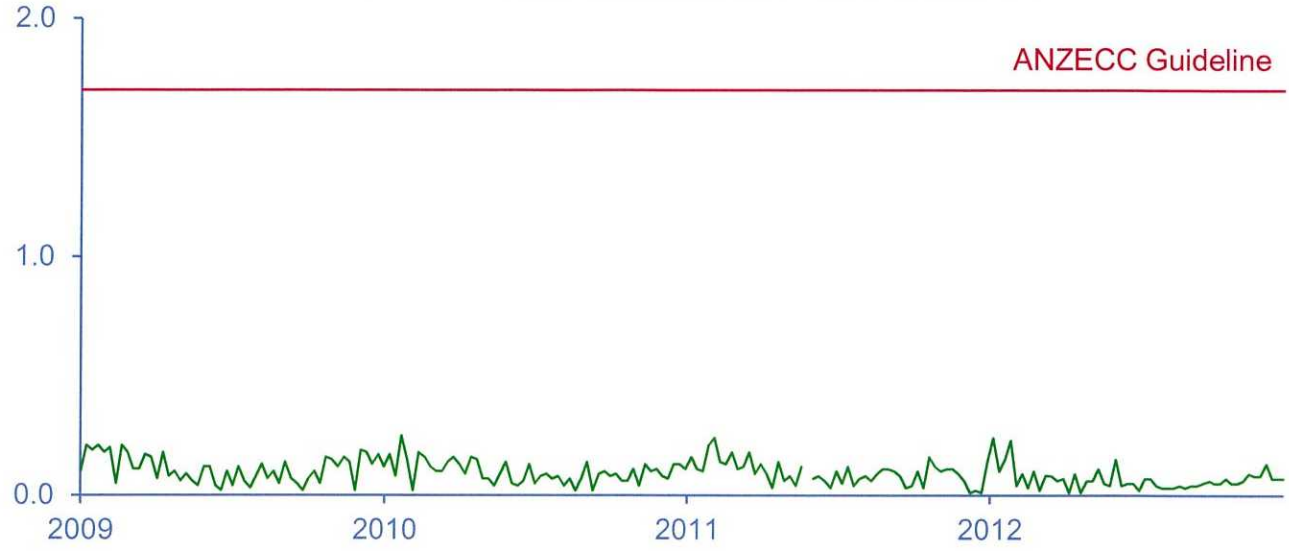


Figure 5.8 (b): Ambient Gaseous Fluoride (ugHF/m3) at Bishops Bridge [outside buffer zone] (30 day average)

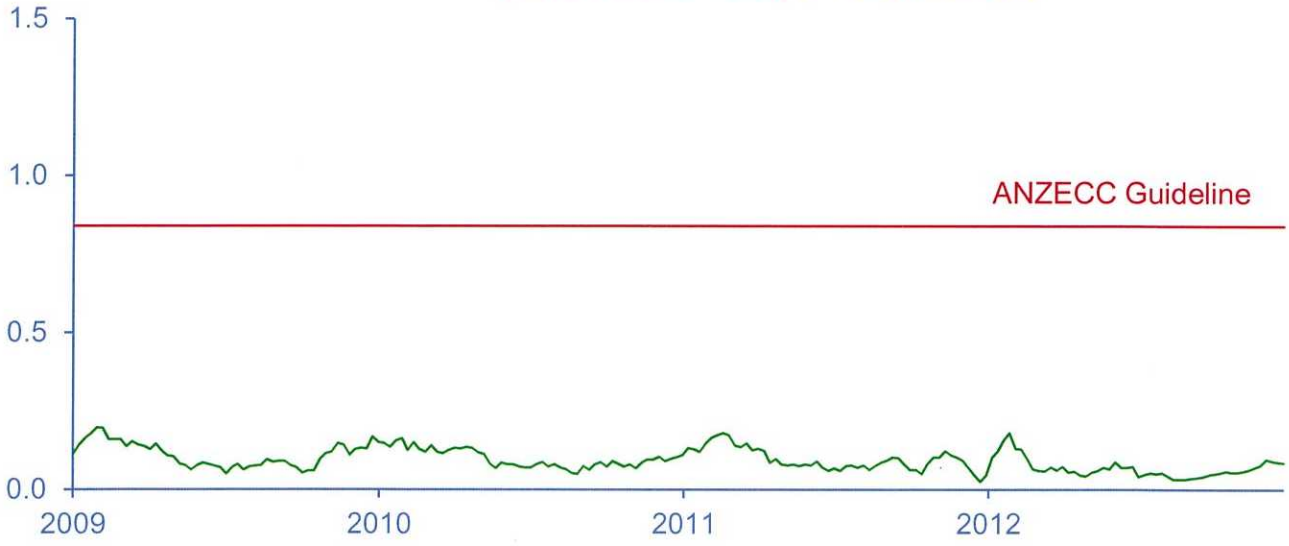


Figure 5.8 (c): Ambient Gaseous Fluoride (ugHF/m3) at Bishops Bridge [outside buffer zone] (90 day average)

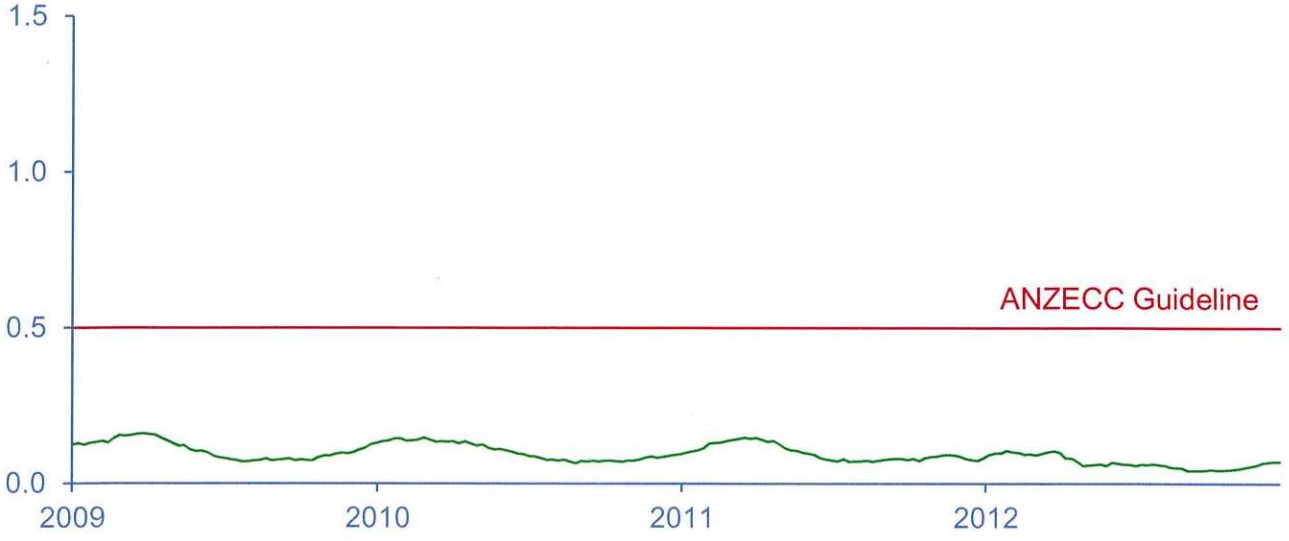


Figure 5.9 (a): Ambient Gaseous Fluoride (ugHF/m3) at Kurri Kurri [outside buffer zone] (7 day average)

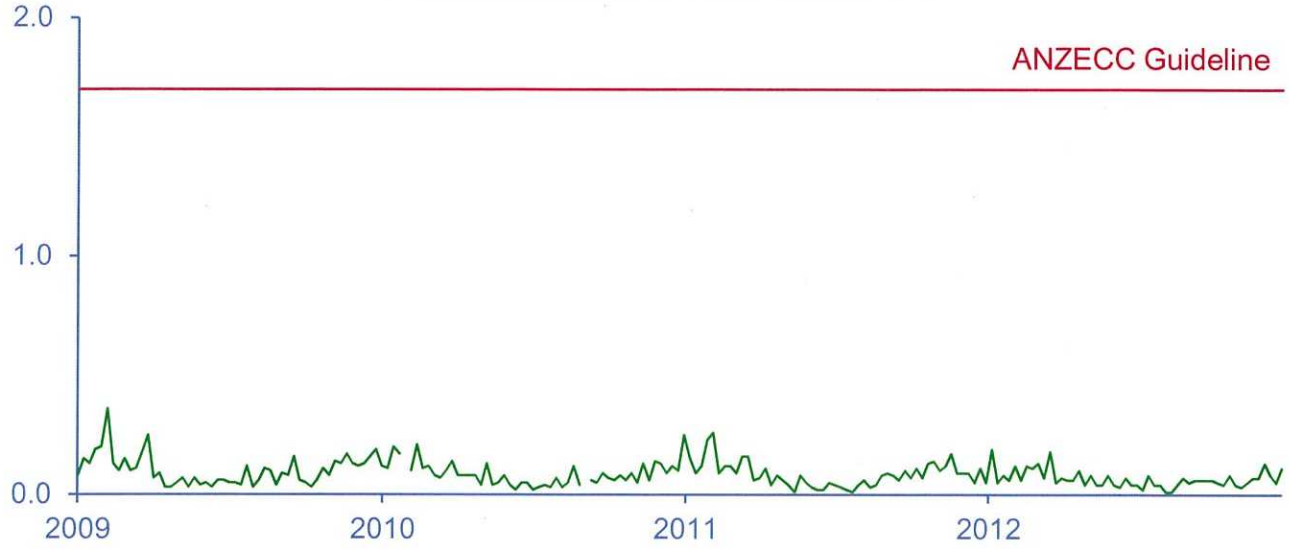


Figure 5.9 (b): Ambient Gaseous Fluoride (ugHF/m3) at Kurri Kurri [outside buffer zone] (30 day average)

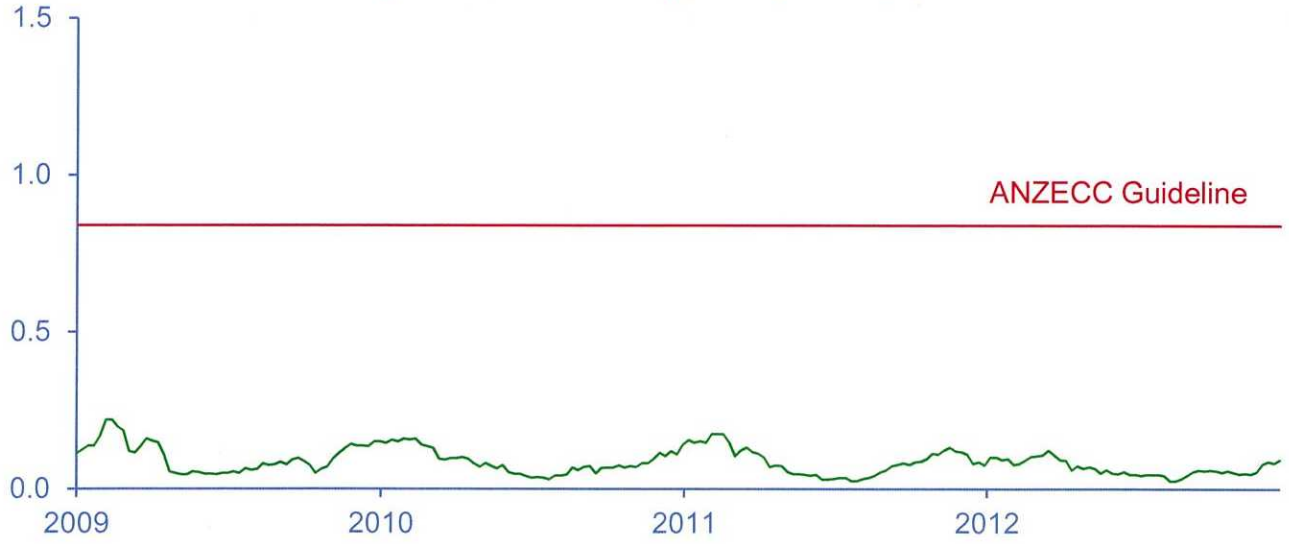


Figure 5.9 (c): Ambient Gaseous Fluoride (ugHF/m3) at Kurri Kurri [outside buffer zone] (90 day average)

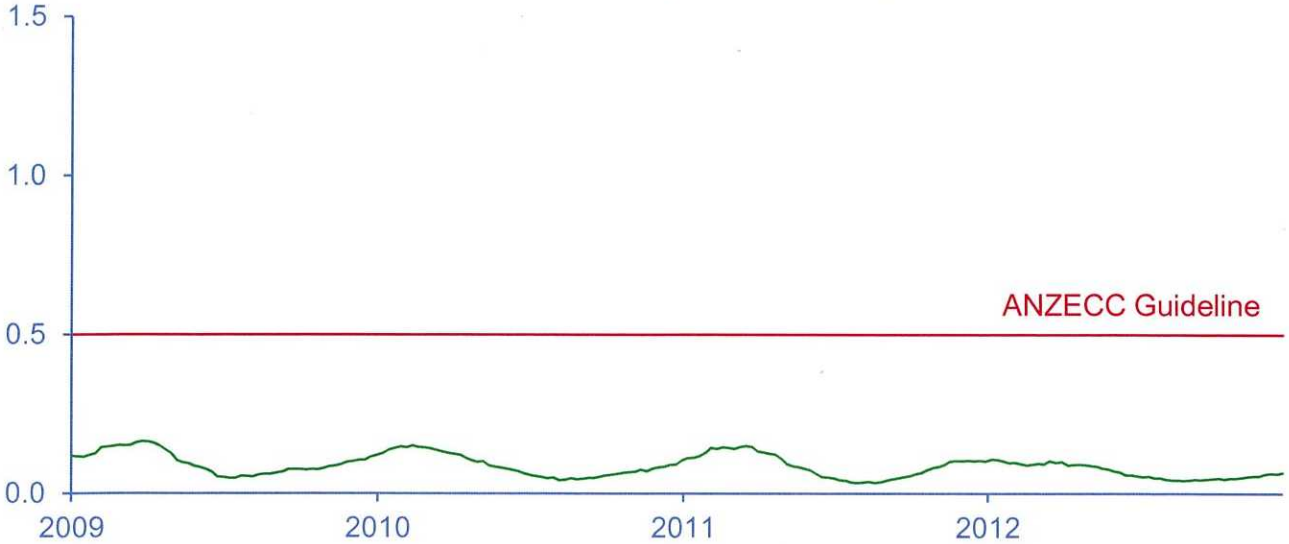


Figure 5.10 (a): Ambient Gaseous Fluoride (ugHF/m3) at Weston
[outside buffer zone] (7 day average)

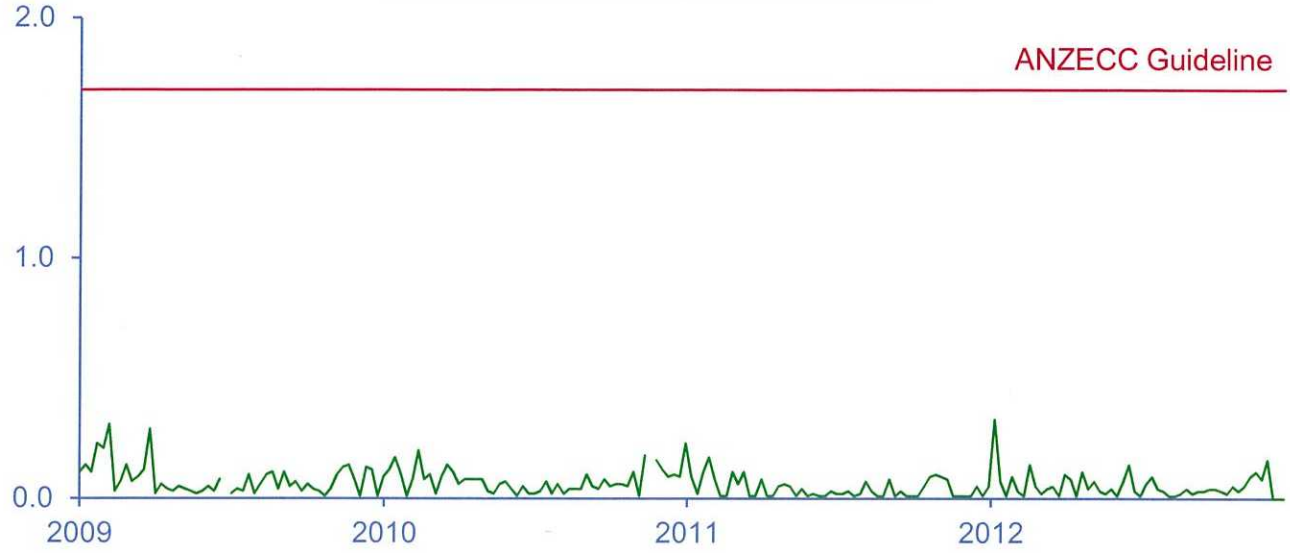


Figure 5.10 (b): Ambient Gaseous Fluoride (ugHF/m3) at Weston
[outside buffer zone] (30 day average)

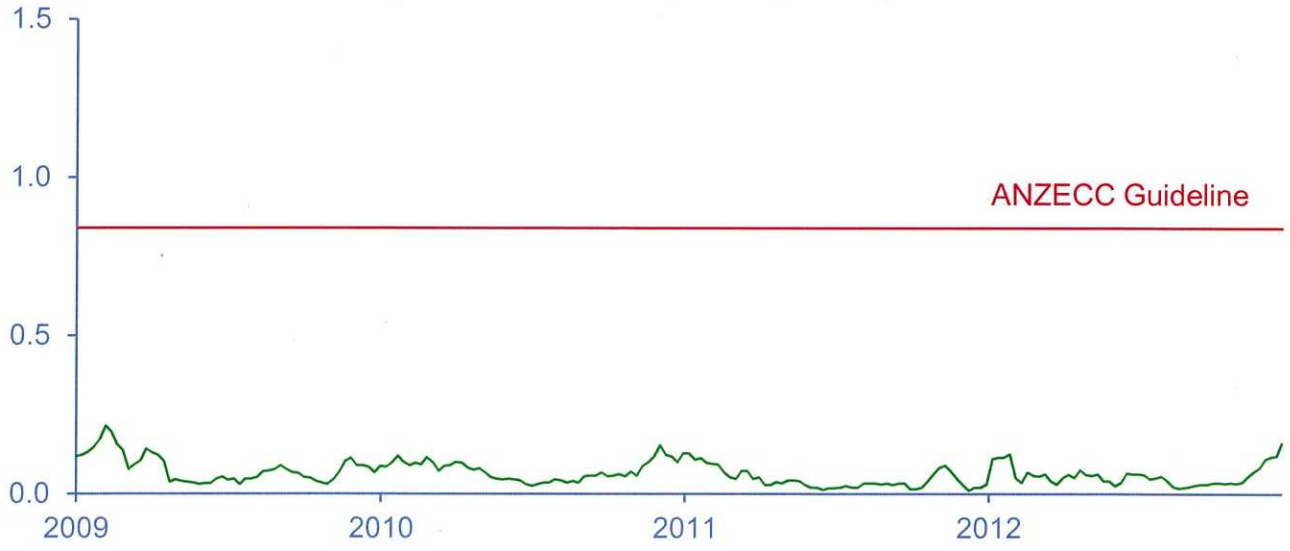


Figure 5.10 (c): Ambient Gaseous Fluoride (ugHF/m3) at Weston
[outside buffer zone] (90 day average)

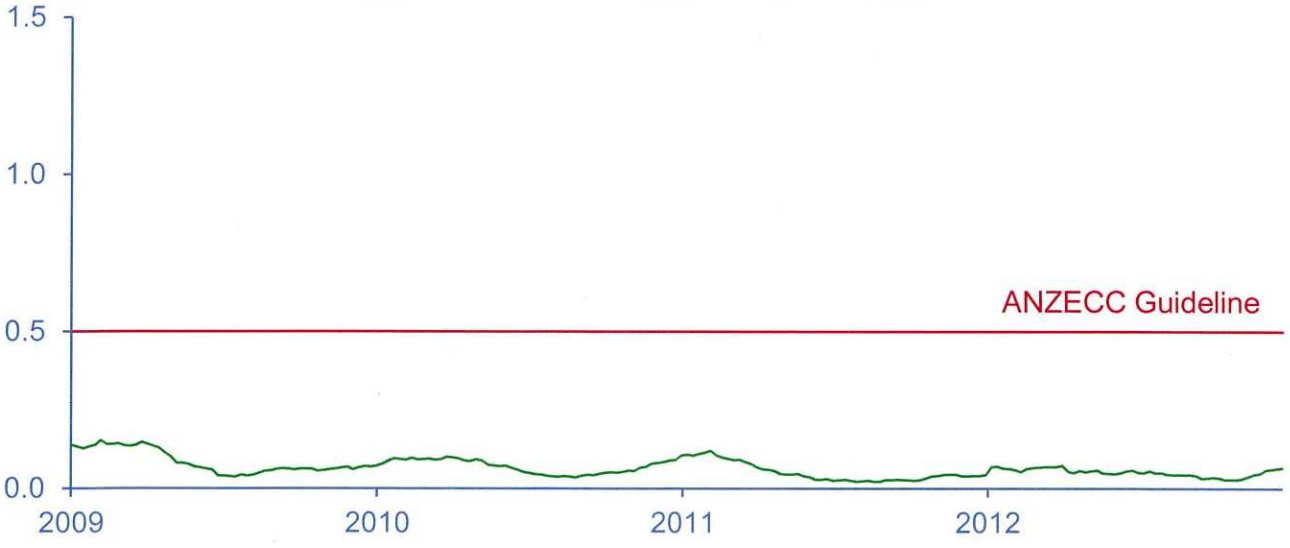


Figure 5.11 (a): Ambient Gaseous Fluoride (ugHF/m3) at Wandin Valley [within vineyards] (7 day average)

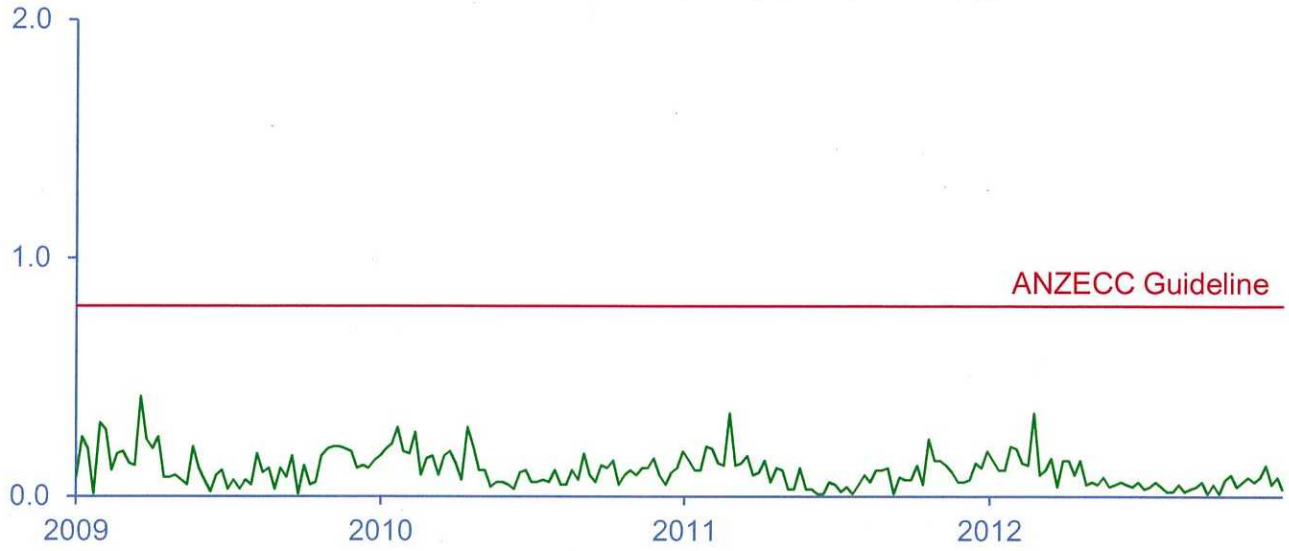


Figure 5.11 (b): Ambient Gaseous Fluoride (ugHF/m3) at Wandin Valley [within vineyards] (30 day average)

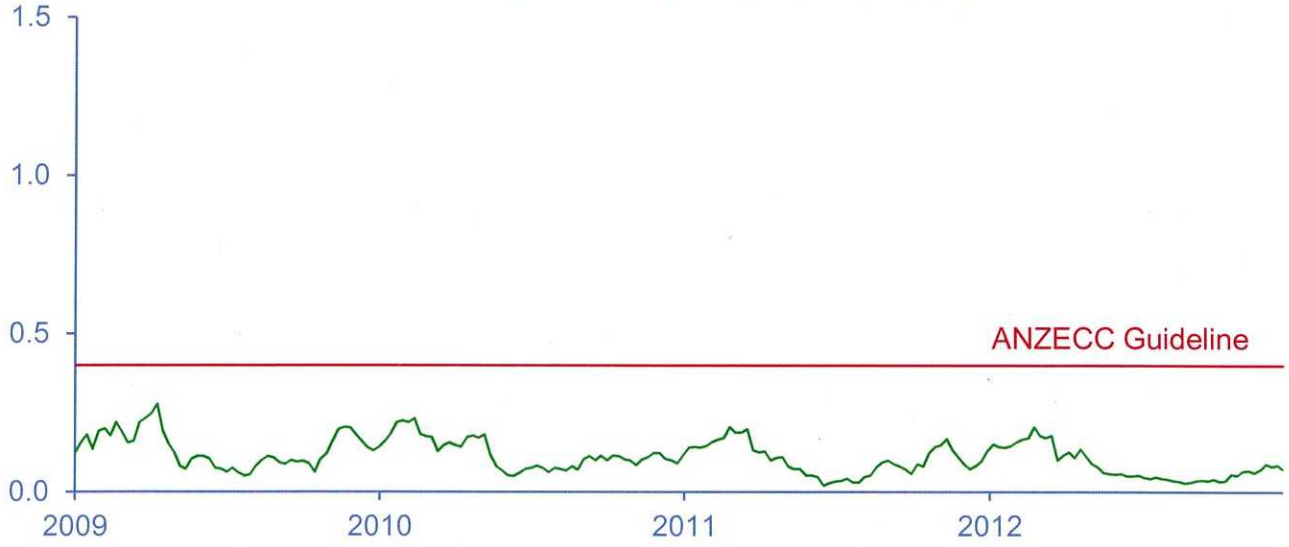


Figure 5.11 (c): Ambient Gaseous Fluoride (ugHF/m3) at Wandin Valley [within vineyards] (90 day average)

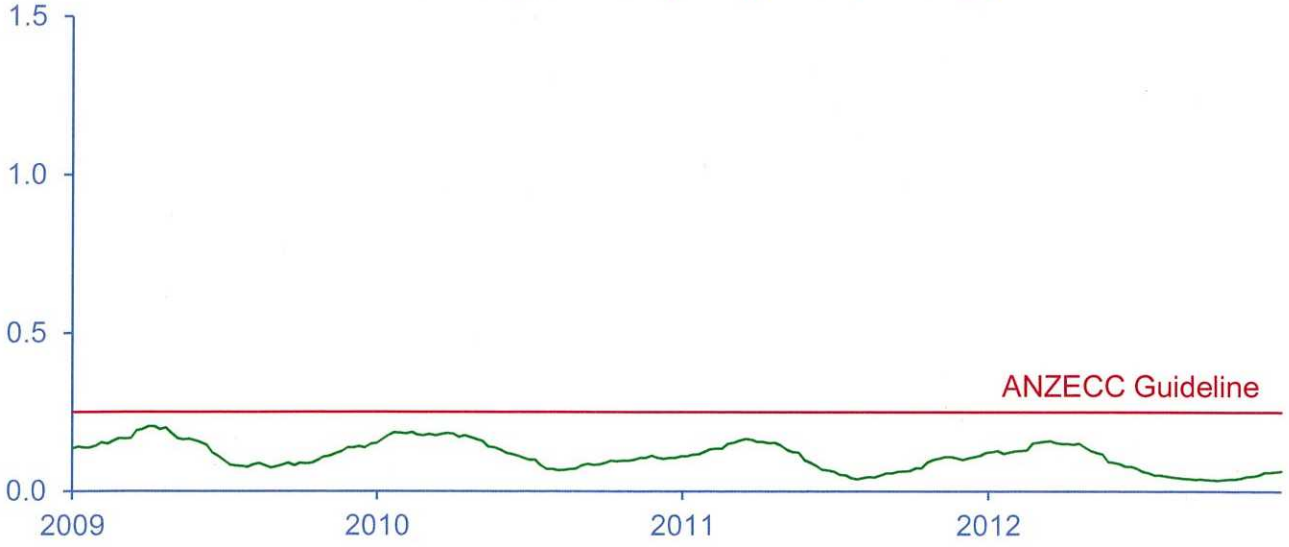


Figure 5.12 (a): Ambient Gaseous Fluoride (ugHF/m3) at Janannie
[within vineyards] (7 day average)

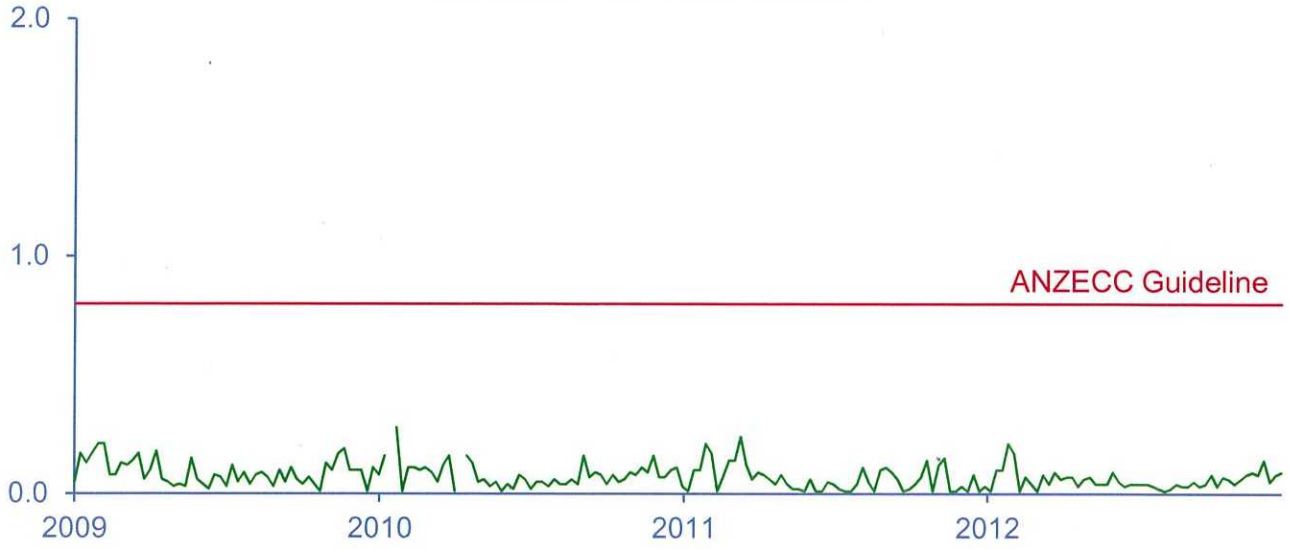


Figure 5.12 (b): Ambient Gaseous Fluoride (ugHF/m3) at Janannie
[within vineyards] (30 day average)

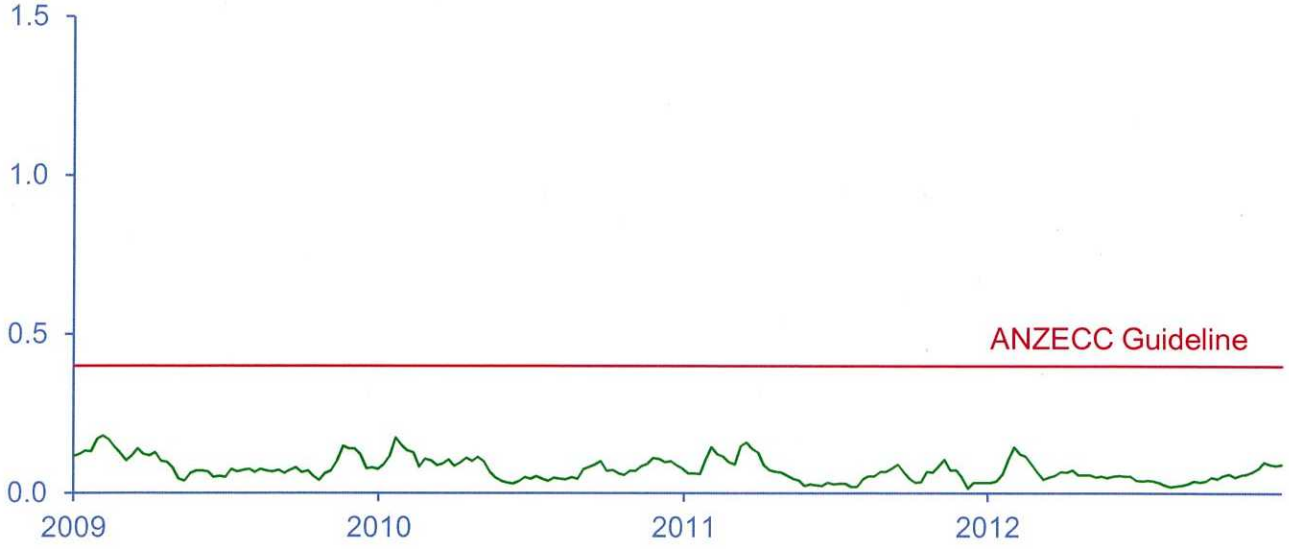


Figure 5.12 (c): Ambient Gaseous Fluoride (ugHF/m3) at Janannie
[within vineyards] (90 day average)

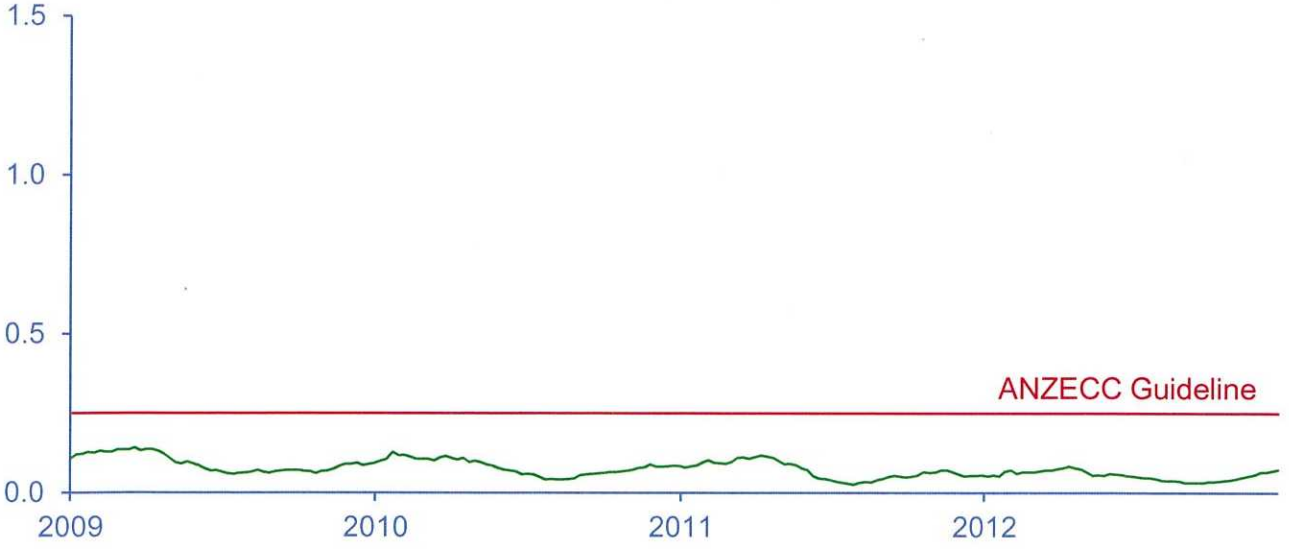


Figure 5.13 (a): Ambient Gaseous Fluoride (ugHF/m3) at Allandale
[within vineyards] (7 day average)

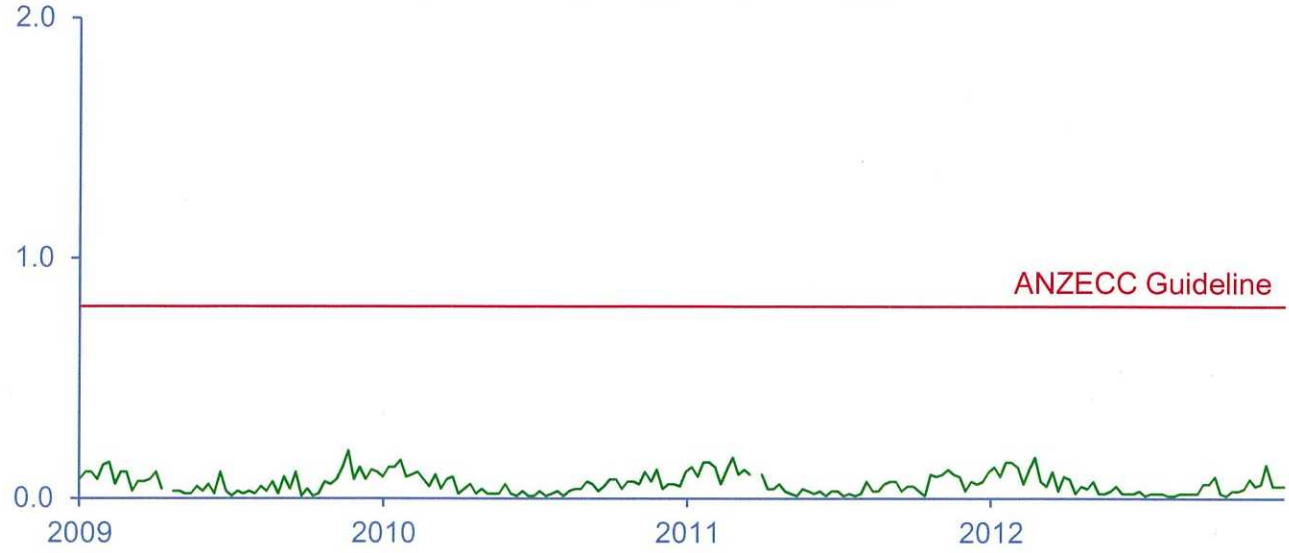


Figure 5.13 (b): Ambient Gaseous Fluoride (ugHF/m3) at Allandale
[within vineyards] (30 day average)

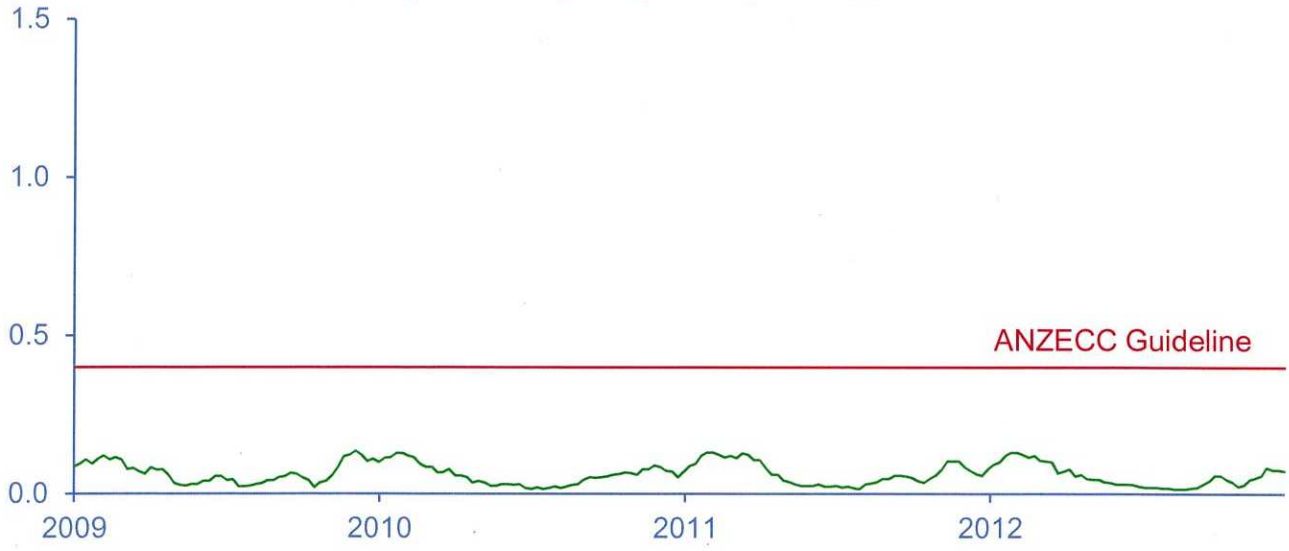


Figure 5.13 (c): Ambient Gaseous Fluoride (ugHF/m3) at Allandale
[within vineyards] (90 day average)

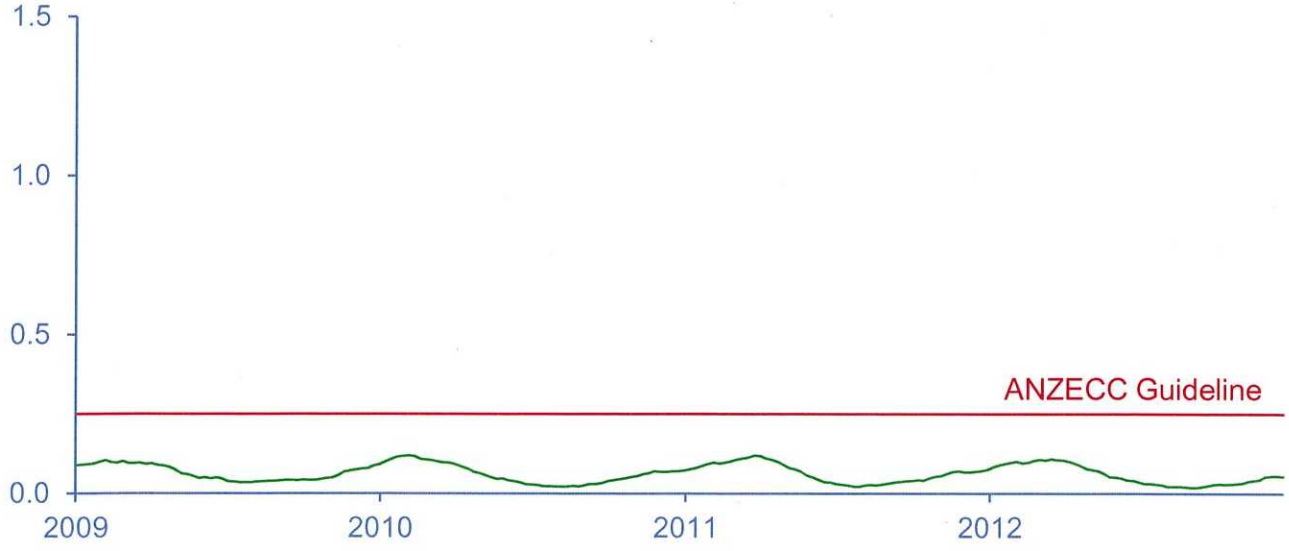


Figure 5.14(a): Ambient Gaseous Fluoride (ugHF/m3) at Rothbury
[within vineyards] (7 day average)

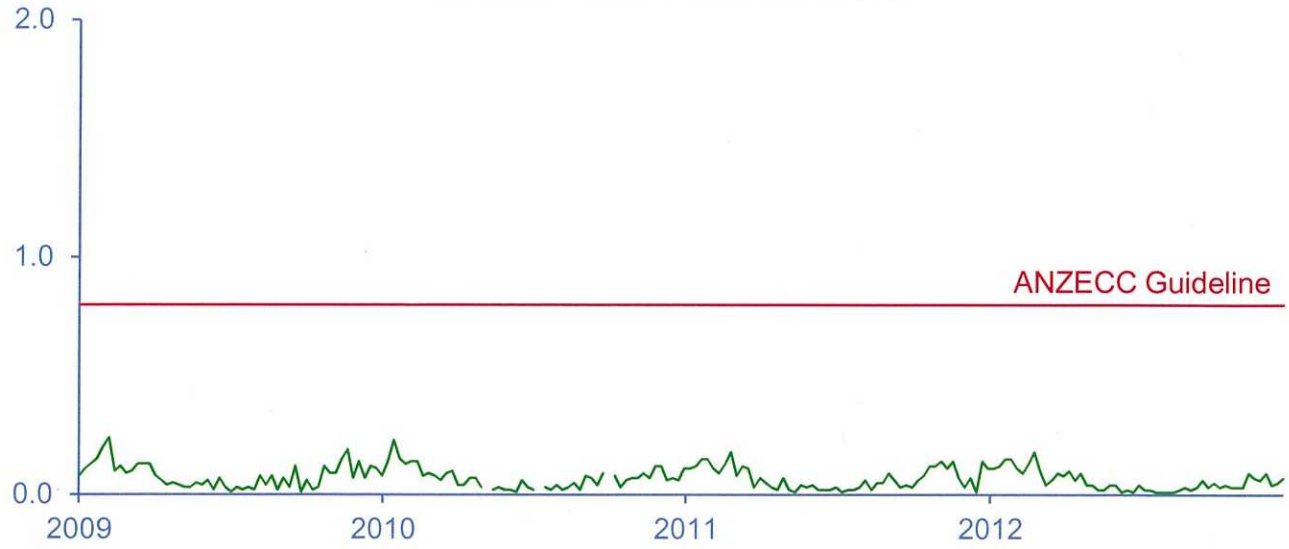


Figure 5.14 (b): Ambient Gaseous Fluoride (ugHF/m3) at Rothbury
[within vineyards] (30 day average)

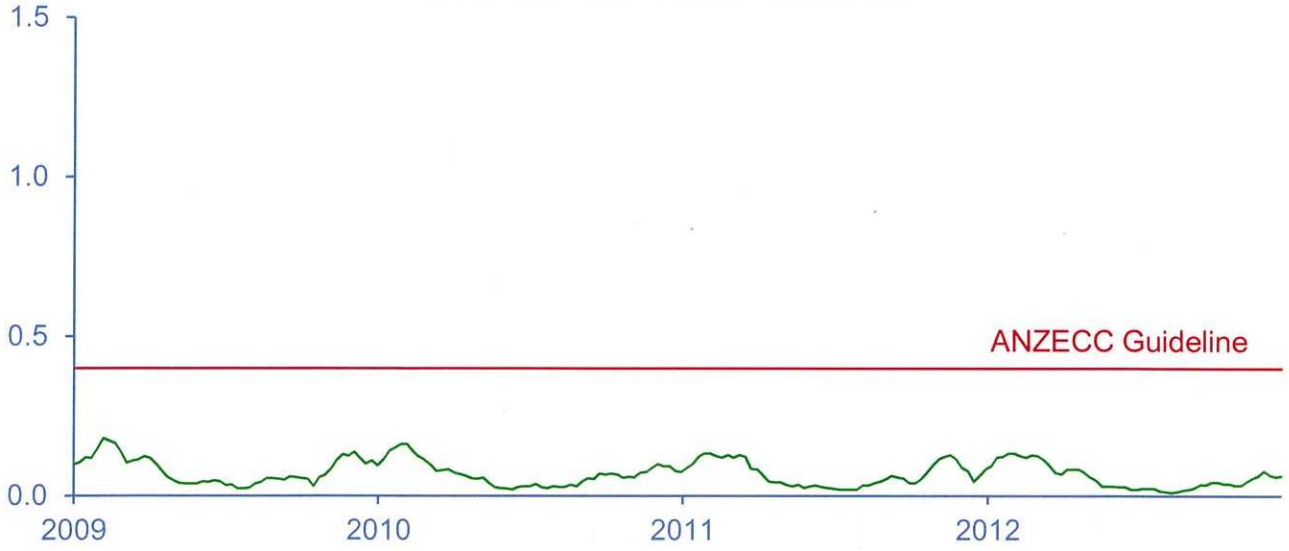


Figure 5.14 (c): Ambient Gaseous Fluoride (ugHF/m3) at Rothbury
[within vineyards] (90 day average)

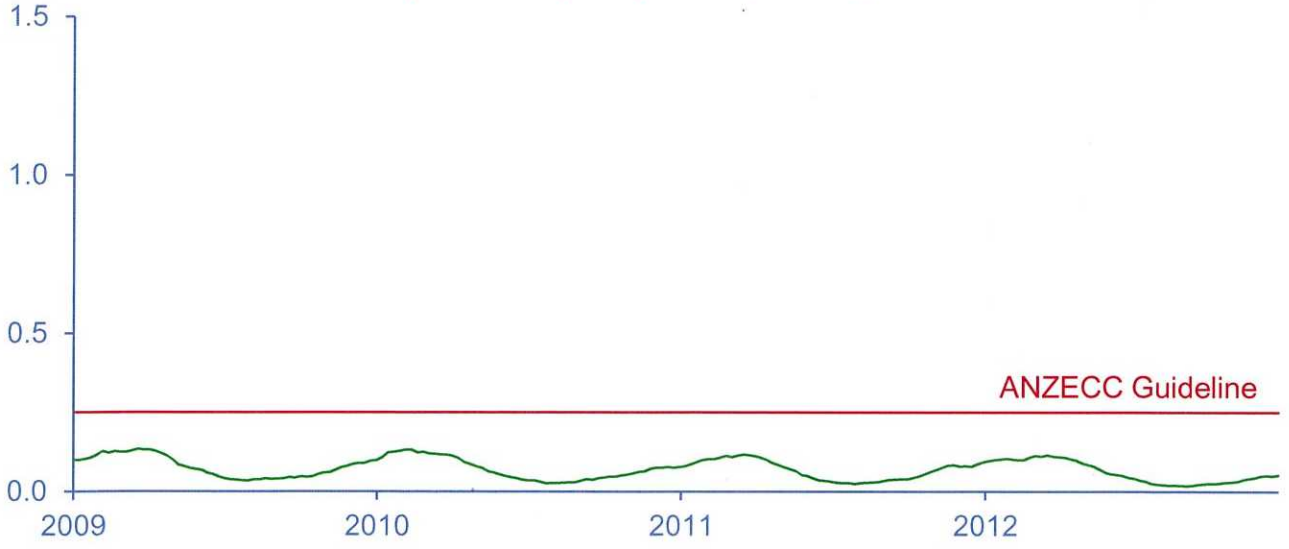


Figure 5.15 (a): Ambient Gaseous Fluoride (ugHF/m3) at McWilliams [within vineyards] (7 day average)

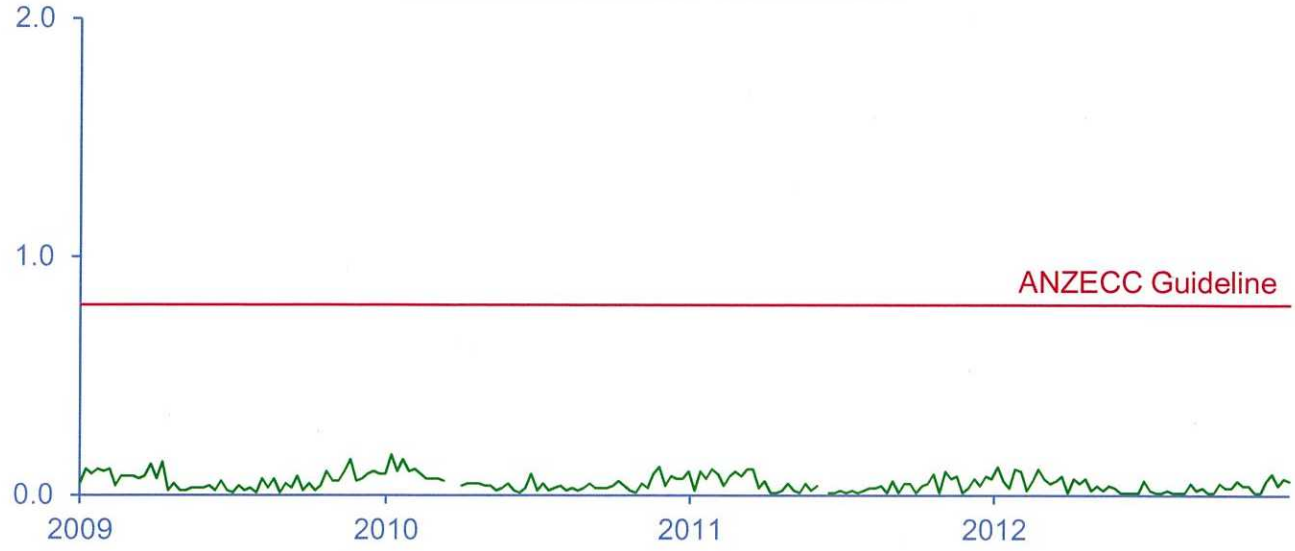


Figure 5.15 (b): Ambient Gaseous Fluoride (ugHF/m3) at McWilliams [within vineyards] (30 day average)

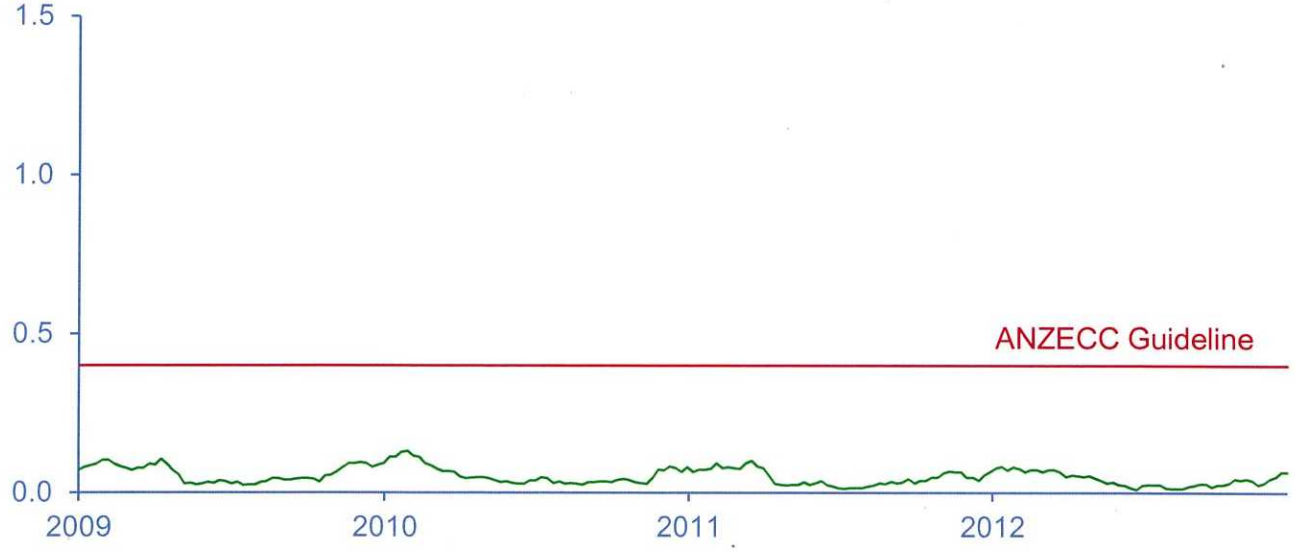


Figure 5.15 (c): Ambient Gaseous Fluoride (ugHF/m3) at McWilliams [within vineyards] (90 day average)

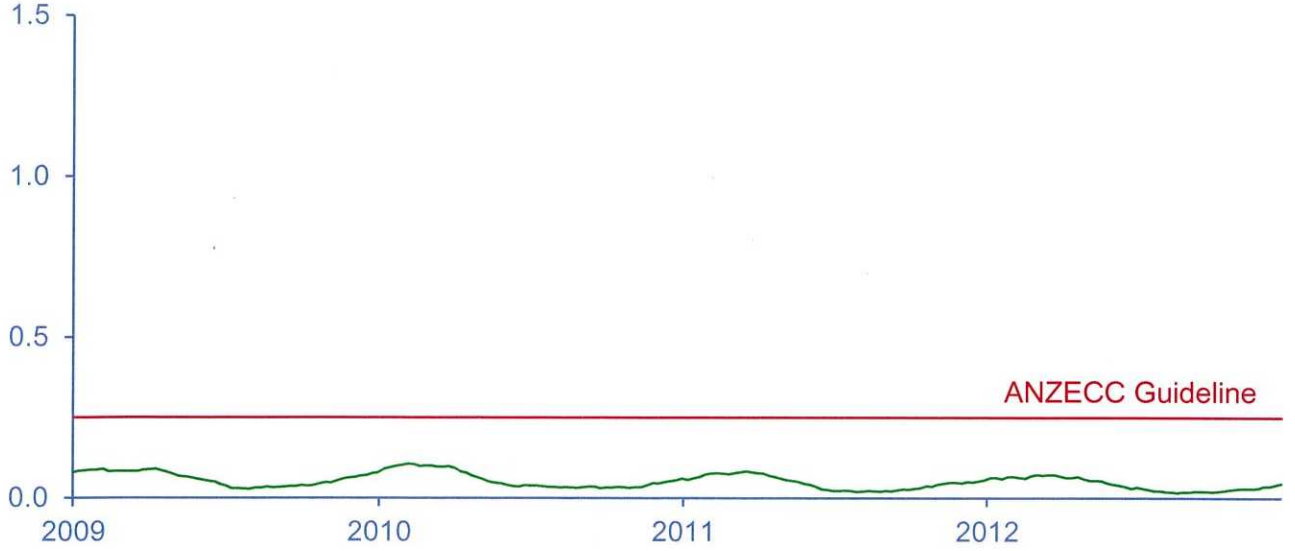


Figure 5.16 (a): Ambient Gaseous Fluoride (ugHF/m3) at Wyndham Estate [within vineyards] (7 day average)

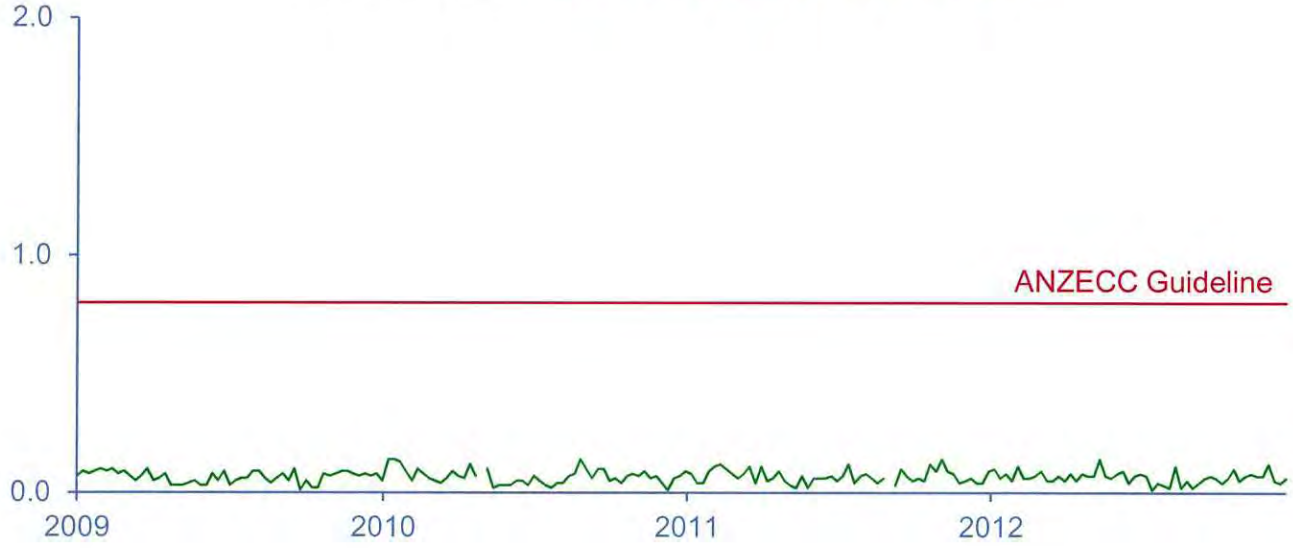


Figure 5.16 (b): Ambient Gaseous Fluoride (ugHF/m3) at Wyndham Estate [within vineyards] (30 day average)

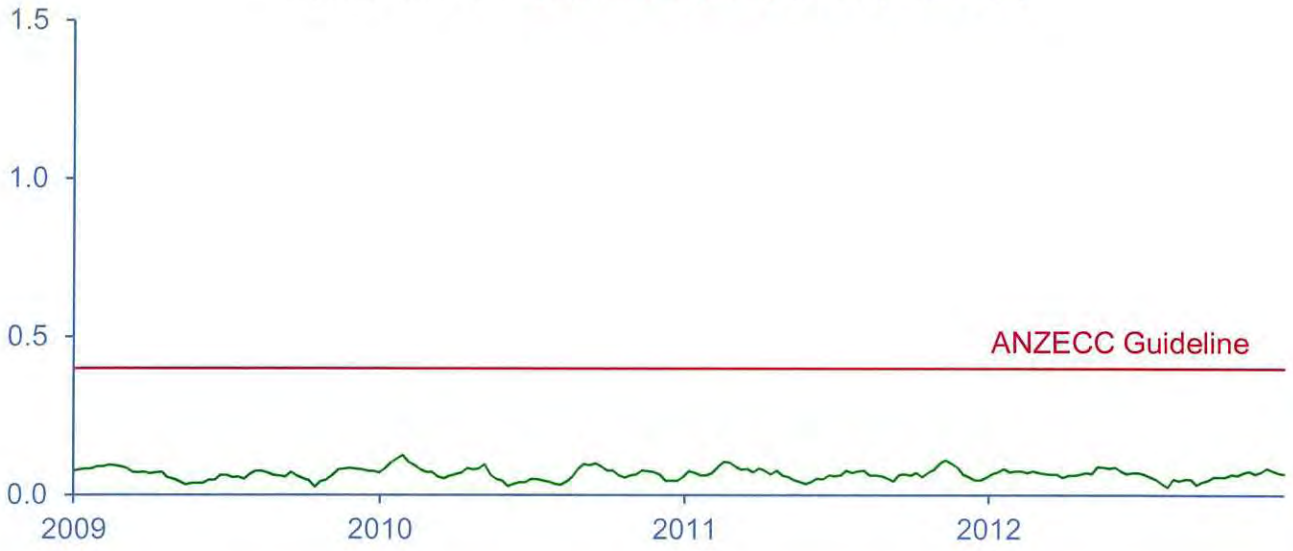
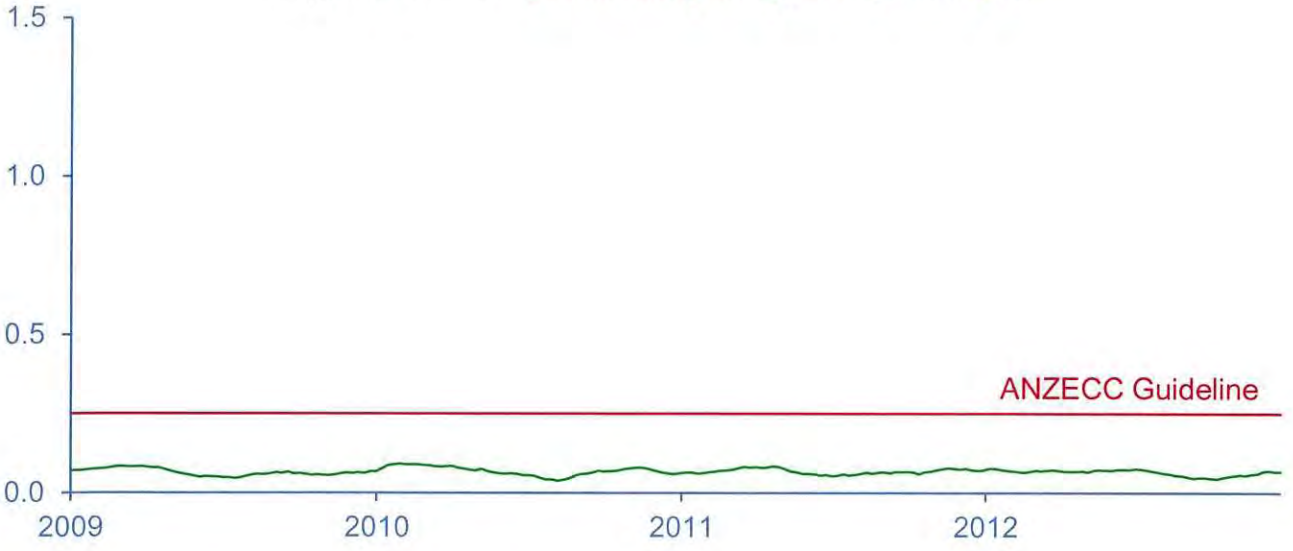


Figure 5.16 (c): Ambient Gaseous Fluoride (ugHF/m3) at Wyndham Estate [within vineyards] (90 day average)



6. VEGETATION MONITORING

6.1 Fluoride Levels in Vegetation

Tables 6.1 and 6.2 present the fluoride levels in forage grasses and overstorey vegetation around the smelter. In general, results follow the wind patterns with higher results to the west during the months of southeasterly winds, and to the southeast during the months of northwesterly winds. Individual forage sites within the buffer zone display occasional ANZECC guideline exceedances, however, farm management practices within the buffer zone ensure that these locations remain ungrazed by cattle until fluoride levels return to below guideline values.

6.2 Visual Inspection of Vegetation

Inspection of natural vegetation for visible impact is a valuable monitoring tool in areas subject to anthropogenic fluoride sources. Sufficiently abundant species that display an early response to hydrogen fluoride are needed to be present for this type of monitoring to be successful. Three native Australian species located within the buffer zone meet these requirements.

Eucalyptus punctata displays chlorosis of the leaf tip and margins when exposed to fluoride. Necrosis occurs in more severely injured leaves, first at the tip and extending down the margins and towards the midrib. Leaves in which more than half the tissue is necrotic are usually shed. *Eucalyptus fibrosa* displays chlorosis between the larger lateral veins and close to the marginal vein of the leaf. *Angophora bakeri* displays a more uniform marginal chlorosis, usually in conjunction with tip necrosis.

Assessment of vegetation within the buffer zone surrounding the smelter takes place at the end (or as close as possible to the end) of the growing season which extends from October to February. The estimated limits to the areas of visible impact on the selected species are then plotted on a map centred on the smelter. The presence of interveinal and marginal chlorosis in the leaf is used to define the outer limit of the affected area for the *Eucalyptus* species. Marginal chlorosis and tip necrosis is used for *Angophora bakeri*.

Figure 6.1 shows the area containing the most affected leaves of all fluoride sensitive species with the area of impact for all inspections predominantly within the buffer zone. Figure 6.1a details inspection locations.

Table 6.1: Total Leachable Fluoride in Forage around the Hydro Aluminium Kurri Kurri Smelter for 2012

(All results are in micrograms fluoride per gram of dried sample)

SITE	SPECIES	Direction	Distance (kms)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	12 month average
5	*T australis*	north	6		5			11		18			12			12
8	*C dactylon*	northeast	1	22	11	69	21	76	124	8	69	87	32	21	21	47
9	*C dactylon*	northeast	2	6	6	12	14	19	48	136	43	42	37	32	13	34
10	*C dactylon*	northeast	4	5	5	12	7	12	10	18	9	15	10	10	10	10
11	*C dactylon*	northeast	6			5		10		8			5			7
12	*P clandestinum*	northeast	10			5		9		8			17			10
14	*C dactylon*	east	1			5		111		63			30			52
15	*C dactylon*	east	2	6	5	15	17	28	34	50	28	33	30	18	60	27
16	*C dactylon*	east	4			5		11		8			5			7
23	*C dactylon*	southeast	6			5				7			11			8
33	*P dilatatum*	southwest	2			5		7		6			5			6
40	*P clandestinum*	west	4			5		9		5			5			6
46	*P dilatatum*	northwest	4			5		12		5			6			7
47	*T australis*	northwest	6			5		5		5			5			5
48	*T australis*	northwest	10			5		10		5			5			6
59	*T australis*	westnorthwest	4	5	5	5	6	7	12	8	9	6	6	11	5	7
61	*C dactylon*	north	3	5	5	7	9	14	25	36	14	21	35	17	17	17
62	*C dactylon*	northeast	3.5	21	5	5	4	11	9	18	13	15	14	18	11	12
63	*C dactylon*	eastnortheast	3.5	5	5	5	5	8	7	9	9	9	7	13	10	8
65	*C dactylon*	northeast	4.8	5	5	5	5	11	11	11	16	9	13	17	8	10
87	*P clandestinum*	northeast	6.5	5	5	5	5	8	5	5	5	5	5	11	6	6
88	*P clandestinum*	southeast	7	5	5	5	5	7	8	5	11	5	7	11	5	7

Outline denotes site within buffer zone

ANZECC Goals for Fluoride in Forage are:

- Running 12 month average not to exceed 40 ug/g
- Average of two consecutive months not to exceed 60 ug/g
- A monthly sample not to exceed 80 ug/g more than once in 12 consecutive months

Table 6.2: Total Leachable Fluoride in Overstory Vegetation around the Hydro Aluminium Kurri Kurri Smelter for 2012

(All results are in micrograms fluoride per gram of dried sample)

SITE	SPECIES	Direction	Distance (kms)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2	*A bakeri*	north	1		54					93			6		
3	*E punctata*	north	2		22					56			52		
4	*C maculata*	north	4		5					5			8		
6	*C maculata*	north	10				5					8			
8	*A bakeri*	northeast	1		5					17			74		
9	*A bakeri*	northeast	2		5					12			38		
10	*A bakeri*	northeast	4		5					8			5		
12	*E moluccana*	northeast	10				5					13			
14	*E tereticornis*	east	1		6					78			25		
15	*E tereticornis*	east	2		5					58			16		
16	*A floribunda*	east	4		5					28			20		
18	*C maculata*	east	10				5					5			
20	*A bakeri*	southeast	1		55					68			236		
21	*E punctata*	southeast	2		5					52			62		
22	*A bakeri*	southeast	4		5					8			11		
24	*C maculata*	southeast	10				5					5			
26	*A bakeri*	south	1		5					23			17		
27	*A bakeri*	south	2		5					7			11		
28	*C maculata*	south	4		5					5			35		
30	*C maculata*	south	10				5					5			
32	*A bakeri*	southwest	1		23					38			35		
33	*C maculata*	southwest	2		5					6			5		
34	*A floribunda*	southwest	4		5					11			16		
36	*E fibrosa*	southwest	10				5					5			
38	*C maculata*	west	1		58					84			27		
39	*A bakeri*	west	2		12					13			12		
40	*C maculata*	west	4		5					5			5		
42	*C maculata*	west	10				5			34		5			
44	*A bakeri*	northwest	1		46					9			46		
45	*C maculata*	northwest	2		5					13			22		
46	*C maculata*	northwest	4		5					26			5		
48	*C maculata*	northwest	10				6					5			

Outline denotes site within buffer zone

Figure 6.1
Most affected leaves of all fluoride sensitive plant species in the vicinity of the Hydro Aluminium Kurri Kurri Smelter (April 2012)

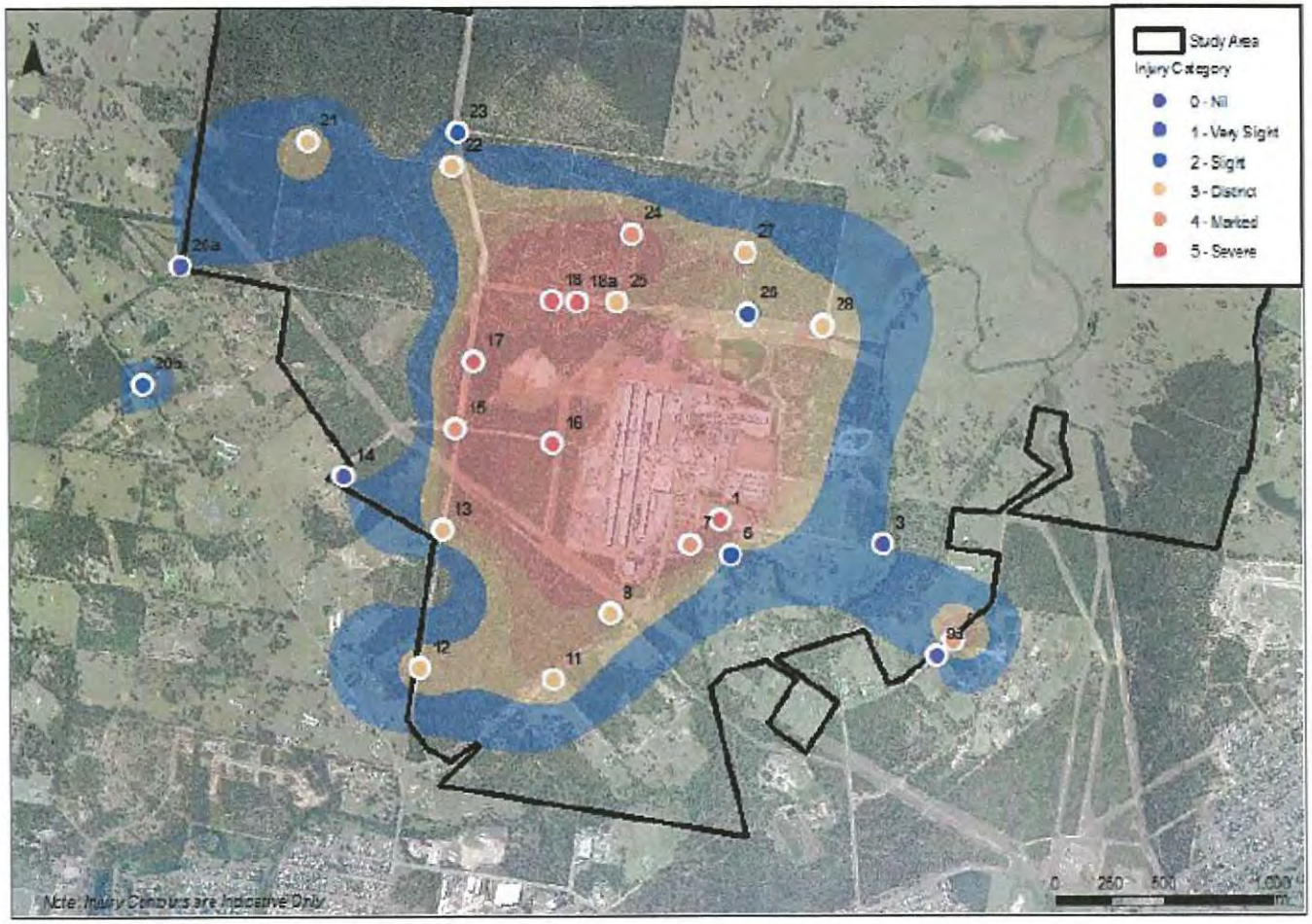
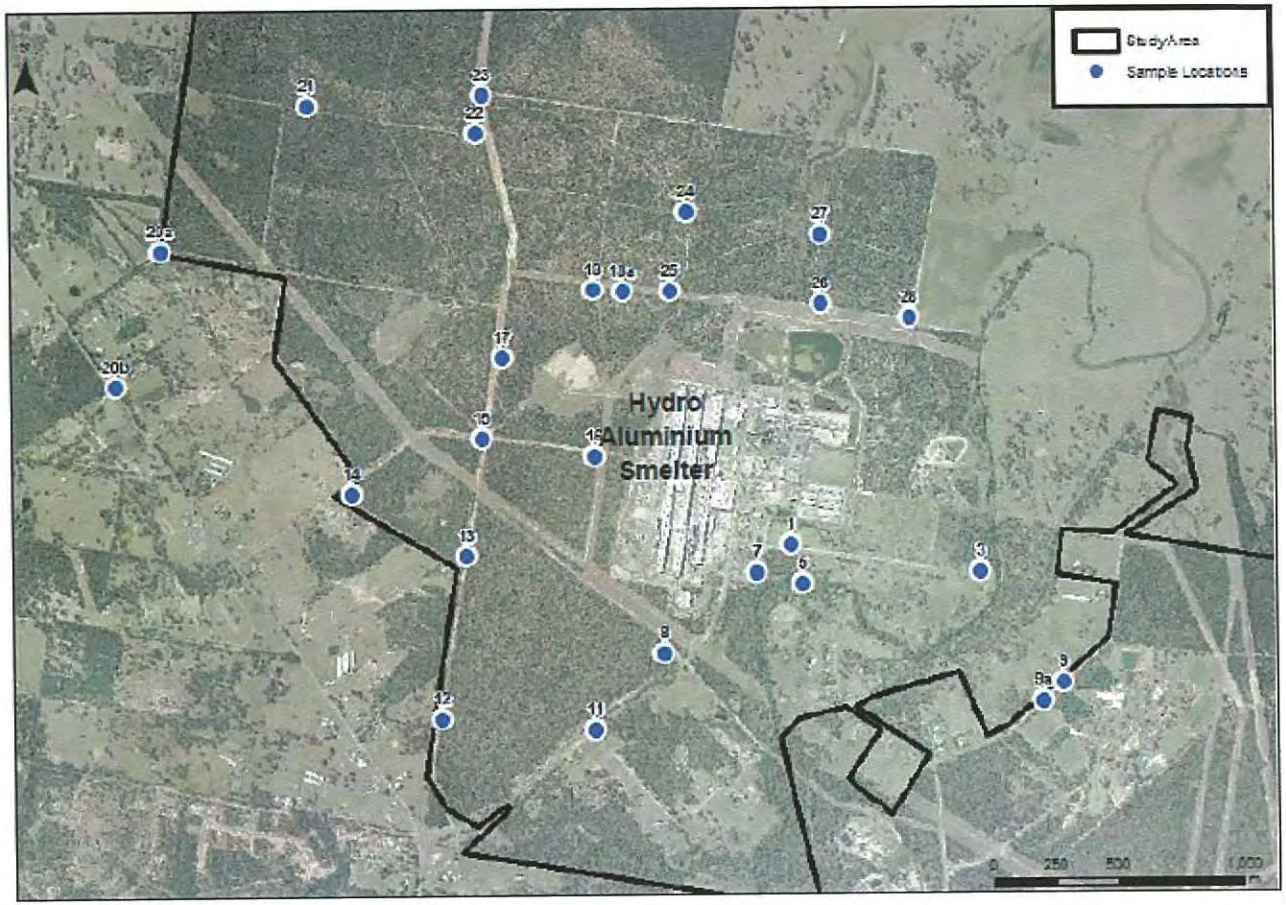


Figure 6.1a

Overview of inspection sites



7. GREENHOUSE

A major raw material in aluminium production is electricity. Therefore the smelter's greenhouse gas inventory accounts for both onsite and offsite sources of greenhouse gases.

Onsite greenhouse emissions are:

- carbon anode consumption in the reaction of the oxygen with the aluminium oxide ore (alumina) to produce carbon dioxide;
- carbon dioxide produced in the combustion of fuels (natural gas, LPG and diesel); and,
- perfluorinated carbon compounds (PFCs), which are inert compounds generated at low levels during "anode effect" (a transient period of high electrical resistance in the pots which begins to electrolyse the molten cryolite) but which have high global warming potential due to their longevity in the atmosphere.

Offsite greenhouse emissions are from the power station generation of electricity consumed.

Figure 7.1 shows the relative onsite direct greenhouse emissions (calculated as tonnes carbon dioxide equivalent per tonne aluminium) for 2002 to 2012 compared with 1990 set as 100.

Figure 7.2 shows the relative electricity consumption per tonne of aluminium for 2002 to 2012 compared with 1990 set as 100. The relative electricity consumption of the smelter is a more accurate indication of greenhouse performance as variations in the greenhouse intensity of the NSW grid include issues outside of the control of the smelter. The smelter receives electricity from a single NSW generator but the NSW greenhouse intensity is impacted by interstate electricity imports.

The impact of the upgrade of potline 1 and the new anode bake furnace are clearly evident since 2006.

Figure 7.1: Hydro Aluminium Kurri Kurri Smelter
Relative Direct Greenhouse Emissions (1990 = 100)

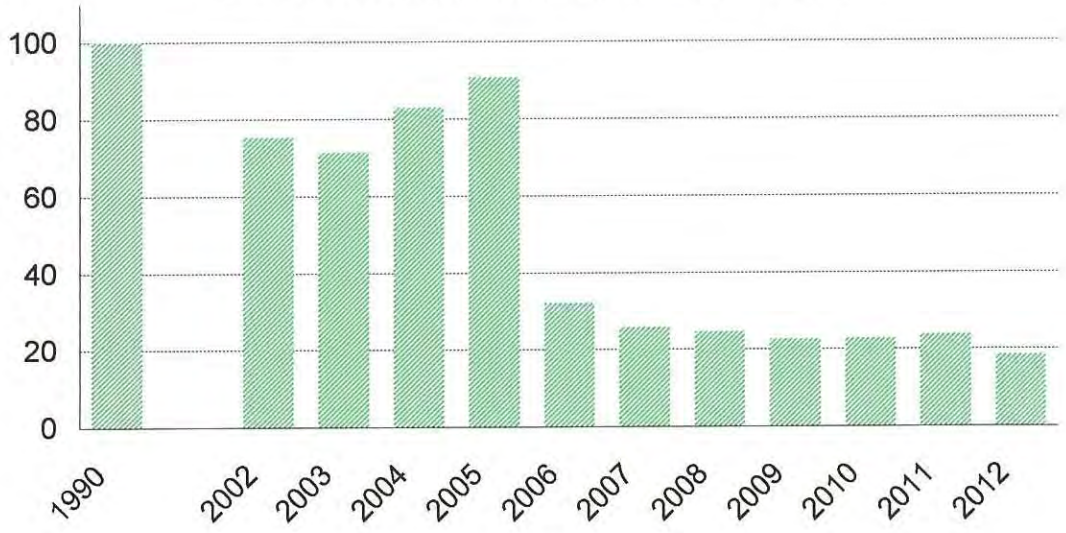
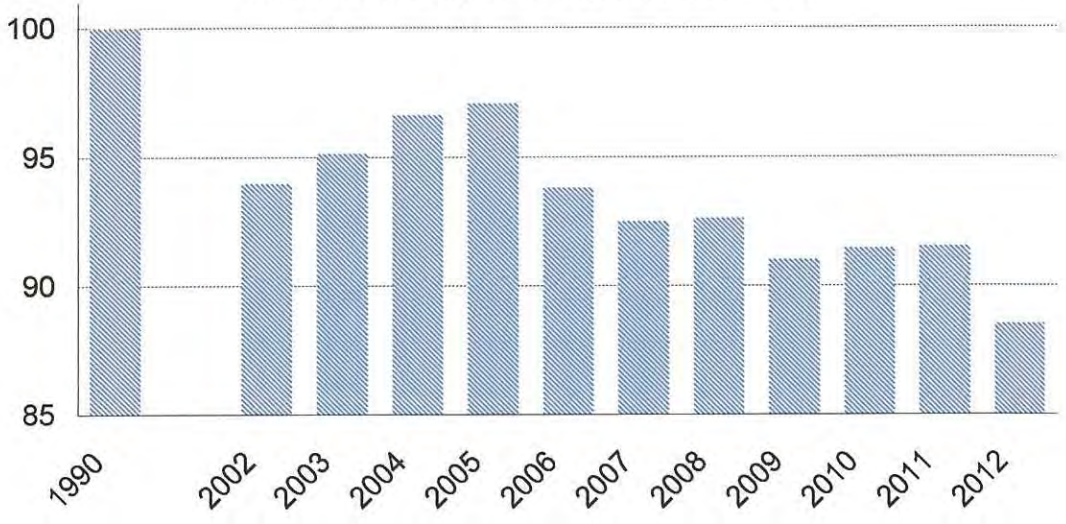


Figure 7.2: Hydro Aluminium Kurri Kurri Smelter
Relative Electricity Consumption (1990 = 100)



8. WATER

8.1 Fresh Water Usage

Figure 8.1 shows the smelter's fresh water usage in kilolitres used per tonne of aluminium, from 1990 to 2012. The main area of onsite water consumption is the cooling of molten metal in the Casting centres. A constant volume of cooling water is bled from the cooling circuits to sewer. The variation in water consumption due to smelting is predominantly due to evaporation losses in the cooling towers.

8.2 Surface Water Monitoring

The Smelter's surface water monitoring programme covers two areas; the first being the creek systems immediately east and west of the smelter site. (Table 8.1); and the second being catchment dams on properties located between 2 and 7 kilometres from the smelter (Table 8.2). Figure 8.2 shows the location of samples sites.

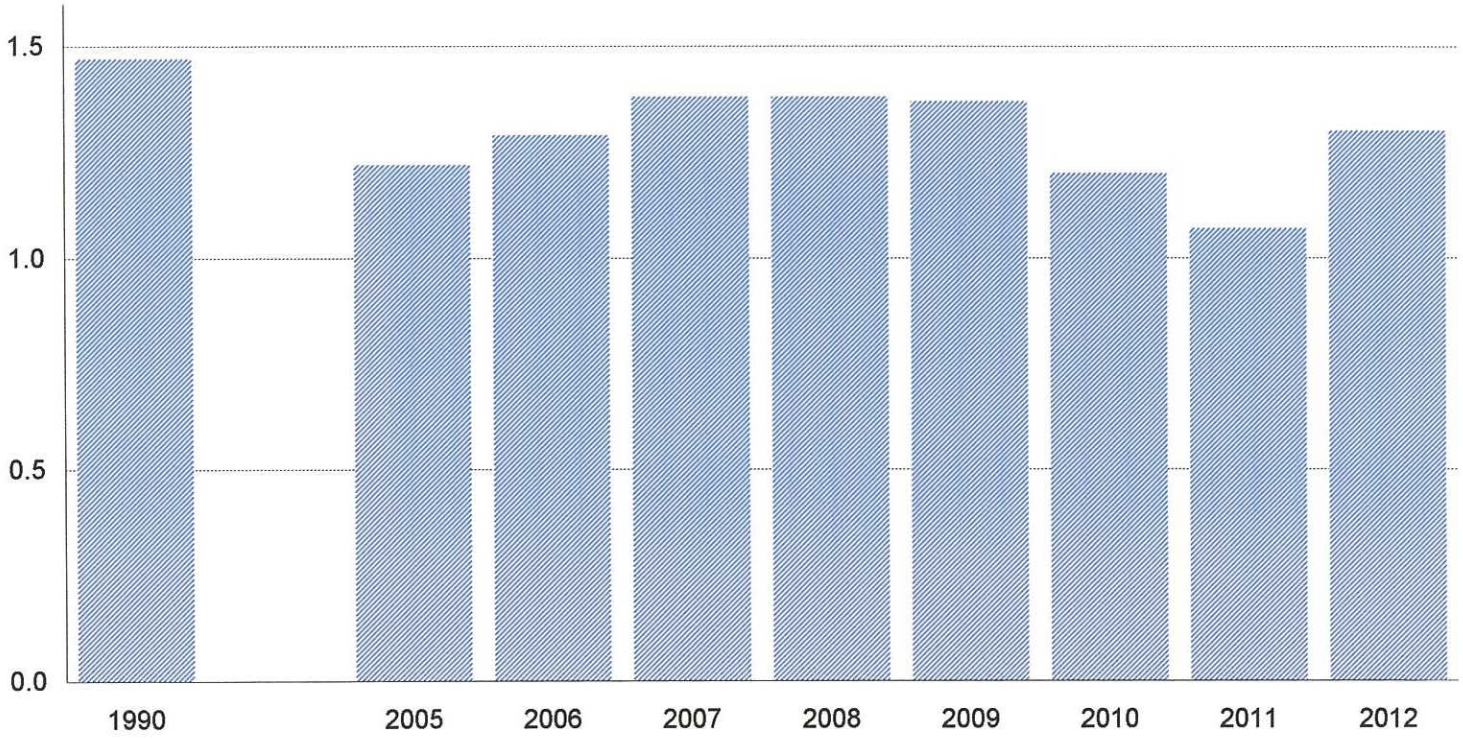
In general, the monitoring data (Table 8.1) indicates that smelter effect on surface water is limited to higher fluoride levels at sampling sites close to the smelter boundaries (i.e. sites 1, 2, 9 and 14), within the buffer zone. For most of the year these sampling locations consist of ephemeral ponds, with fluoride levels increasing between significant rainfall periods.

8.3 Ground Water Monitoring

The Smelter's groundwater monitoring network, established in 1992, is focussed around the capped Spent Cathode Pile. The area immediately northeast of the pile contains near surface contaminated groundwater within a sandy lens surrounded by a natural impervious clay barrier (Table 8.3). Groundwater levels at locations B6 and F8 are at or near ground surface, which indicates that at these sites the water is surface water contained within small sandy pockets and not representative of true groundwater. Deeper groundwater (Table 8.4) is slightly acidic with low fluoride levels.

A review of the groundwater monitoring network in 1999 by groundwater consultants Woodward-Clyde confirmed previous findings that the near surface groundwater is contained and does not present a significant risk of harm. Figure 8.3 shows the location of groundwater sampling sites as well as the extent of the near surface contaminated groundwater.

Figure 8.1: Hydro Aluminium Kurri Kurri Smelter Fresh Water Usage (klitres/tAl)



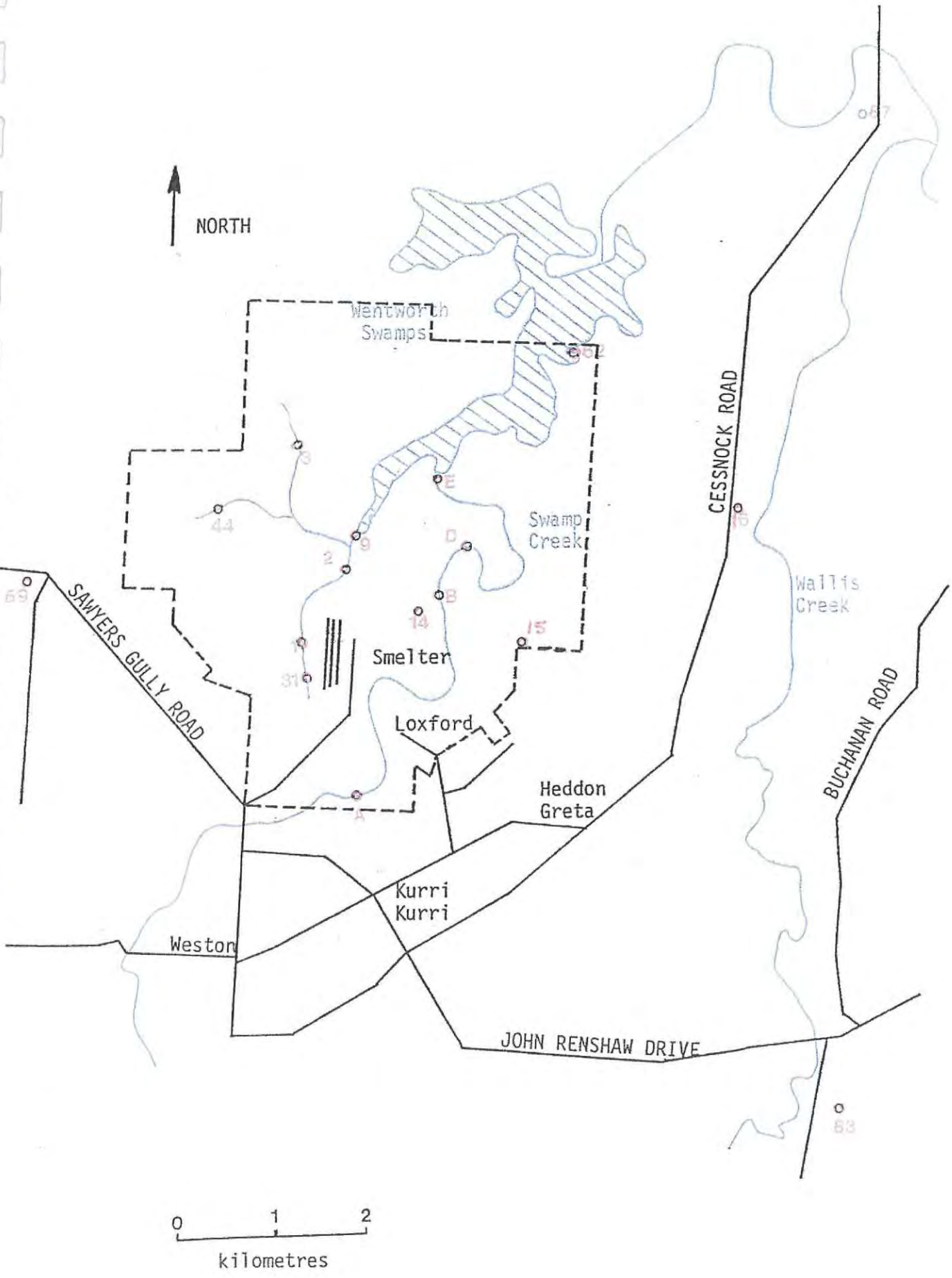


Figure 8.2

Location of offsite surface water sampling sites.

Table 8.1: Surface Water Quality around the Hydro Aluminium Kurri Kurri Smelter for 2012

MONTH		A	14	B	D	E	31	1	2	44	3	9	62
January	pH	7.4		7.1	7.1	7.1						6.7	7.2
	Conductivity (uS/cm)	850		870	860	900						800	860
	Fluoride (mg/L)	0.6		1.6	2.0	3.0						4.0	1.8
February	pH	7.3		7.0	7.0	6.9						6.3	5.6
	Conductivity (uS/cm)	810		790	750	680						630	1300
	Fluoride (mg/L)	0.4		0.8	1.1	0.8						3.2	1.1
March	pH	6.6		7.0	7.0	6.9						6.5	6.7
	Conductivity (uS/cm)	290		780	750	630						550	560
	Fluoride (mg/L)	0.2		0.3	0.9	6.9						2.1	0.7
	Free Cyanide (mg/L)					<0.002							<0.002
April	pH	7.2		7.0	7.0	7.0						6.5	4.3
	Conductivity (uS/cm)	810		960	880	890						1100	1000
	Fluoride (mg/L)	0.6		0.6	1.8	1.3						4.9	0.3
May	pH	7.5	7.2	7.2	7.1	7.0	6.6	6.5	6.6	6.7	5.8	6.6	7.0
	Conductivity (uS/cm)	890	480	990	900	990	1400	990	1300	1600	140	1300	1100
	Fluoride (mg/L)	0.6	18.0	0.6	2.8	2.0	0.4	6.5	6.6	0.4	0.6	4.5	1.3
June	pH	7.2		7.1	7.0	7.0						6.5	6.3
	Conductivity (uS/cm)	890		1000	1000	990						710	790
	Fluoride (mg/L)	0.3		0.3	0.5	0.5						1.9	0.6
	Free Cyanide (mg/L)					<0.002							<0.002

Table 8.1 (cont): Surface Water Quality around the Hydro Aluminium Kurri Kurri Smelter for 2012

MONTH		A	14	B	D	E	31	1	2	44	3	9	62
July	pH	7.4	7.0	7.2	6.7	6.8	6.2	6.4	6.6	6.5	5.9	6.6	6.8
	Conductivity (uS/cm)	970	390	990	840	940	1800	1200	1400	1300	130	1200	1100
	Fluoride (mg/L)	0.5	16	0.6	6.5	4.3	5.9	2.7	2.7	0.4	0.5	3.0	0.9
August	pH	7.5		7.3	7.3	7.2						6.6	6.2
	Conductivity (uS/cm)	1200		1200	1200	1200						1500	2000
	Fluoride (mg/L)	0.8		1.0	0.9	1.3						2.0	0.9
September	pH	7.1		7.1	7.2	7.3						6.5	7.4
	Conductivity (uS/cm)	1300		1300	1300	1400						1800	1800
	Fluoride (mg/L)	0.7		0.8	0.8	1.0						6.5	1.8
	Free Cyanide (mg/L)					<0.002							<0.002
October	pH	7.3	7.2	7.1	7.2	7.2	6.6	6.6	6.6	6.6	dry	6.6	7.4
	Conductivity (uS/cm)	1300	650	1200	1200	1400	3000	2600	2700	3000	dry	2100	2900
	Fluoride (mg/L)	0.5	21.0	0.8	2.1	1.4	0.4	3.6	3.8	0.6	dry	3.7	2.5
November	pH	7.4		7.1	7.2	7.7	dry				dry	6.7	dry
	Conductivity (uS/cm)	990		1100	1100	1400	dry				dry	3100	dry
	Fluoride (mg/L)	0.9		0.9	0.9	1.6	dry				dry	5.7	dry
December	pH	7.5		7.3	7.3	7.5						6.4	8.6
	Conductivity (uS/cm)	1000		1100	1100	1200						4200	2600
	Fluoride (mg/L)	0.7		0.8	0.8	1.3						4.6	1.7
	Free Cyanide (mg/L)					<0.002							<0.002

ANZECC Water Quality Criteria:	pH	Fluoride (mg/L)	Free Cyanide (mg/L)
Irrigation	4.5 - 9.0	1.0	-
Livestock	-	2.0	-
Aquatic Ecosystems	6.5 - 9.0	-	0.0052

Table 8.2: Water Quality in Offsite Dam Waters around the Hydro Aluminium Kurri Kurri Smelter for 2012

SITE		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
15	pH	7.0	6.7	7.2	7.0	7.0	6.9	6.8	7.9	6.7	7.6	8.9	6.4
	Conductivity (uS/cm)	910	490	530	940	1100	780	980	1100	2600	1000	1600	2300
	Fluoride (mg/L)	1.0	0.5	0.3	0.4	0.4	0.2	0.3	0.3	0.8	0.9	1.9	1.1
16	pH					6.3		5.9			6.6		
	Conductivity (uS/cm)					2300		1800			560		
	Fluoride (mg/L)					0.3		0.2			0.2		
59	pH	6.2	6.2	6.2	6.5	6.3	6.2	6.5	6.4	6.7	6.5	7.1	6.8
	Conductivity (uS/cm)	380	550	370	850	560	390	1200	700	770	790	900	950
	Fluoride (mg/L)	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.5	0.2	0.3	0.3
88	pH	7.3	6.7	6.9	6.8	6.9	6.7	6.9	6.2	7.2	7.3	7.3	7.2
	Conductivity (uS/cm)	150	150	150	150	130	130	140	190	140	140	150	160
	Fluoride (mg/L)	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.1	0.3	0.3	0.3	0.3

ANZECC Water Quality Criteria:	pH	Fluoride(mg/L)
Irrigation	4.5 - 9.0	1.0
Livestock	-	2.0

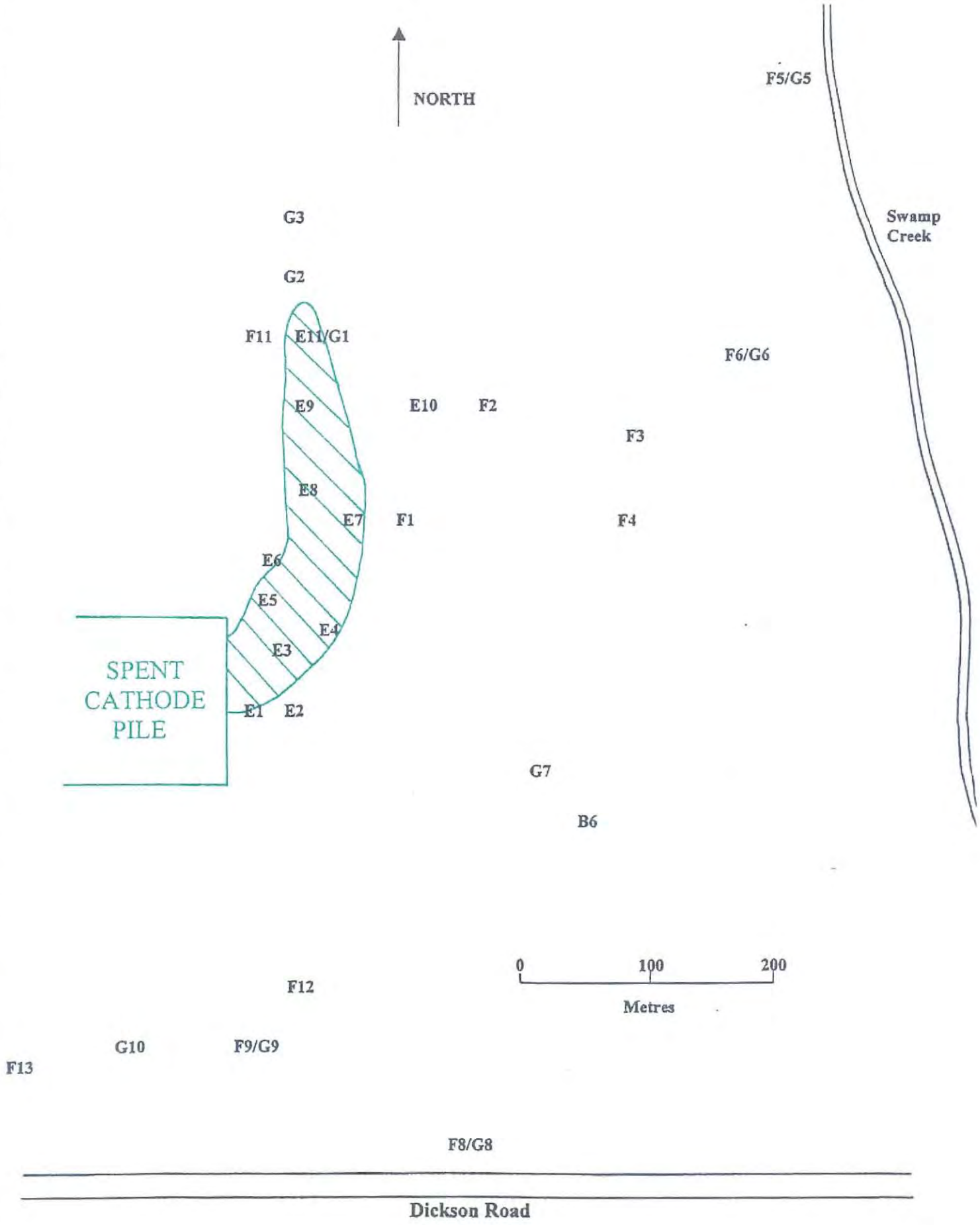


Figure 8.3: Location of Groundwater Monitoring Sites around the Hydro Aluminium Kurri Kurri Smelter

Table 8.3: Near Surface Ground Water Quality from around the Hydro Aluminium Kurri Kurri Smelter for 2012

Borehole ID	Month	Depth to Water Level (metres)	pH	Fluoride (mg/L)	Free Cyanide (mg/L)
E3	MAR	0.7	9.1	297.0	
20 metres east	JUN	0.8	9.2	397.0	
	SEP	1.4	9.2	414.0	
	DEC	1.7	9.1	424.0	
E4	MAR	0.5	9.6	628.0	
50 metres east	JUN	0.5	9.7	651.0	
	SEP	1.0	9.6	660.0	
	DEC	1.7	9.6	676.0	
E5	MAR	0.4	9.5	505.0	
0 metres east	JUN	0.7	9.4	509.0	
	SEP	1.0	9.4	477.0	
	DEC	1.4	9.3	458.0	
E6	MAR	1.2	7.7	0.6	
0 metres east	JUN	1.4	7.8	0.6	
	SEP	1.2	7.8	0.5	
	DEC	1.4	7.2	0.5	
E7	MAR	0.7	7.9	18.7	
80 metres east	JUN	1.0	7.8	27.3	
	SEP	1.1	9.0	79.4	
	DEC	1.4	8.5	31.0	
E8	MAR	0.8	8.8	120.0	
50 metres east	JUN	1.0	8.9	148.0	
	SEP	1.1	8.8	112.0	
	DEC	1.5	9.0	199.0	
E9	MAR	1.2	8.0	29.4	
40 metres east	JUN	1.4	8.1	65.9	
	SEP	1.5	8.5	79.4	
	DEC	2.0	8.3	82.8	
E10	MAR	3.5	8.1	1.8	
130 metres east	JUN	3.6	8.2	2.0	
	SEP	3.6	8.2	1.9	
	DEC	3.4	8.0	1.0	
E11	MAR	1.5	8.2	20.0	
60 metres east	JUN	1.7	8.7	41.1	
	SEP	2.0	9.2	66.9	
	DEC	2.4	9.3	189.0	
F8	MAR	0.2	7.6	24.7	<0.002
220 metres southeast	JUN	0.1	7.0	20.7	<0.002
	SEP	0.6	7.1	36.8	<0.002
	DEC	1.1	7.1	33.9	<0.002
F13	MAR	0.6	6.3	8.6	<0.002
10 metres south	JUN	0.9	6.2	9.1	<0.002
	SEP	1.3	6.2	9.5	<0.002
	DEC	0.9	7.2	5.8	<0.002

Table 8.4: Deep Ground Water Quality near the Hydro Aluminium Kurri Kurri Smelter for 2012

Borehole ID	Month	Depth to Water Level (metres)	pH	Fluoride (mg/L)	Free Cyanide (mg/L)
F2	MAR	3.9	5.3	0.4	<0.002
190 metres east	JUN	3.8	4.9	0.4	<0.002
	SEP	3.7	4.3	0.2	<0.002
	DEC	3.8	5.6	0.2	<0.002
F9	MAR	6.2	6.5	0.4	<0.002
30 metres southeast	JUN	6.1	6.6	0.3	<0.002
	SEP	6.0	6.6	0.2	<0.002
	DEC	6.0	7.2	0.2	<0.002
F12	MAR	3.4	5.6	2.3	<0.002
80 metres east	JUN	3.4	5.7	1.1	<0.002
	SEP	3.4	5.3	0.3	<0.002
	DEC	3.4	5.8	0.1	<0.002
G1	MAR	6.5	6.6	0.5	<0.002
80 metres east	JUN	6.4	6.7	0.5	<0.002
	SEP	6.3	6.9	0.5	<0.002
	DEC	6.3	7.1	0.4	<0.002
G2	MAR	6.9	6.6	0.4	<0.002
90 metres east	JUN	7.0	6.8	0.4	<0.002
	SEP	6.7	6.8	0.4	<0.002
	DEC	6.9	6.4	0.4	<0.002
G5	MAR	1.4	6.4	0.3	<0.002
420 metres east	JUN	1.6	3.2	0.4	<0.002
	SEP	1.7	6.3	0.2	<0.002
	DEC	2.1	5.3	0.1	<0.002
G6	MAR	3.0	4.4	0.4	<0.002
380 metres east	JUN	3.1	5.9	0.2	<0.002
	SEP	3.1	3.2	0.4	<0.002
	DEC	3.4	3.9	0.1	<0.002
G7	MAR	5.5	7.3	1.7	<0.002
320 metres east	JUN	3.1	6.5	1.4	<0.002
	SEP	5.4	6.1	0.3	<0.002
	DEC	5.5	5.0	0.6	<0.002
G8	MAR	4.9	4.5	0.5	<0.002
220 metres southeast	JUN	4.7	4.7	0.4	<0.002
	SEP	4.6	4.2	0.2	<0.002
	DEC	4.7	5.3	0.4	<0.002
G9	MAR	3.9	5.8	0.3	<0.002
30 metres southeast	JUN	3.8	6.0	0.1	<0.002
	SEP	3.8	6.0	0.1	<0.002
	DEC	3.9	7.0	0.1	<0.002
G10	MAR	7.7	3.4	0.1	<0.002
10 metres south	JUN	7.7	3.8	0.1	<0.002
	SEP	7.6	3.5	0.1	<0.002
	DEC	7.6	3.5	0.1	<0.002
ANZECC Water Quality Criteria:					
		Irrigation	4.5 - 9.0	1.0	-
		Livestock	-	2.0	-
		Aquatic Ecosystems	6.5 - 9.0	-	0.0052

9. WASTE GENERATION AND DISPOSAL

The waste management hierarchy of reduce/reuse/recycle is applied across the smelter's operations. Where practicable, opportunities to reduce waste generation at source or return materials back into the various smelter operations are pursued. However some wastes requiring offsite recycle, offsite landfill or onsite storage will be generated. Figure 9.1 shows the tonnages of smelter wastes that fall into these categories for the period 2009 to 2012. Figure 9.2 shows the same data on a per tonne production basis.

Offsite recycle covers dross, scrap steel, carbon dusts and spent pot lining (SPL) which are sent to facilities that can recover the aluminium metal, recycle the steel, recover the energy content of the carbon dust and treated SPL carbon or reuse the SPL refractory.

In 2012 1,360 tonnes of onsite generated SPL was treated through the Regain process and sent to cement kilns for energy recovery or brick manufacturers for refractory reuse with 60 tonnes being added to the onsite purpose built storage sheds.

General rubbish is disposed to the Cessnock Council domestic landfill.

All waste generation remained consistent with previous years.

Figure 9.1: Waste Storage & Disposal Summary for the Hydro Aluminium Kurri Kurri Smelter

(all figures are in ,000 tonnes)

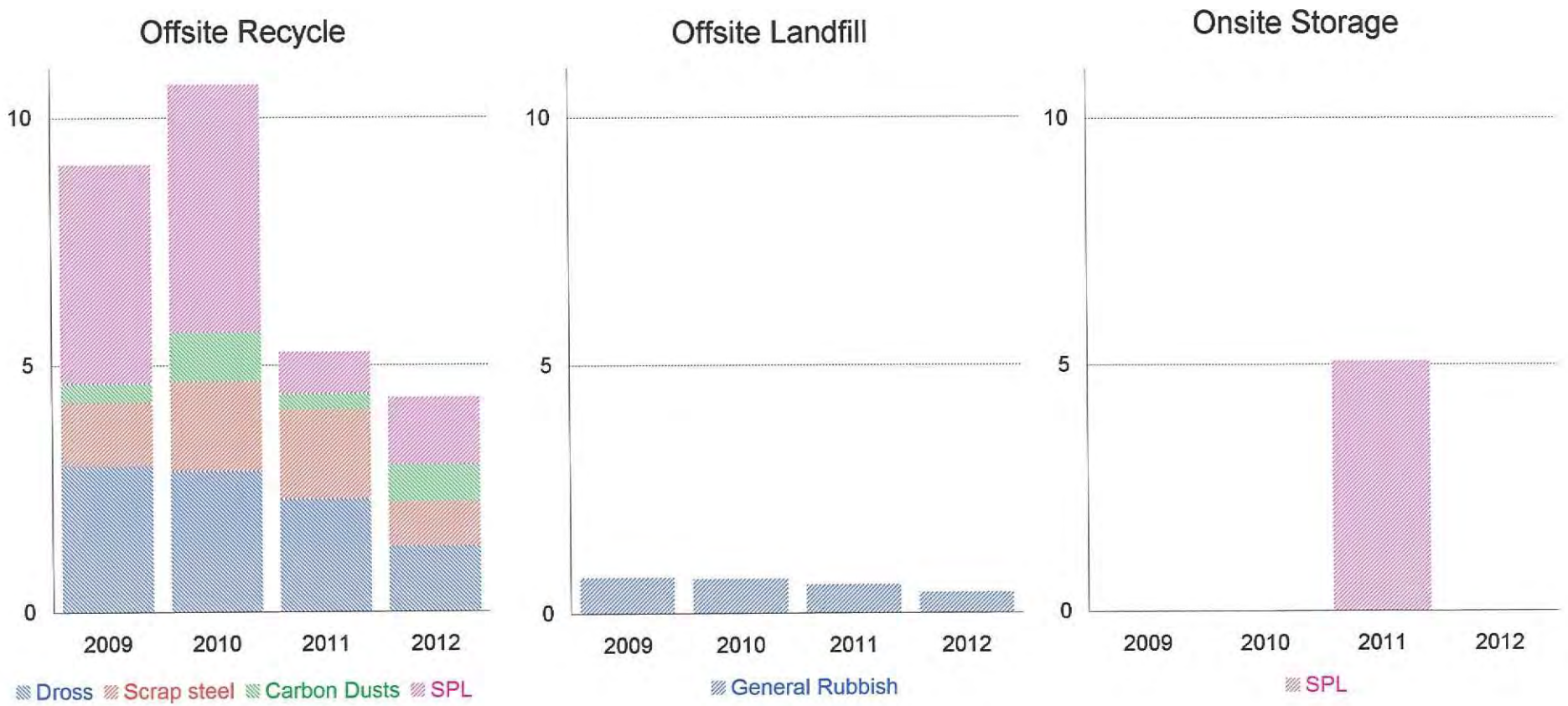
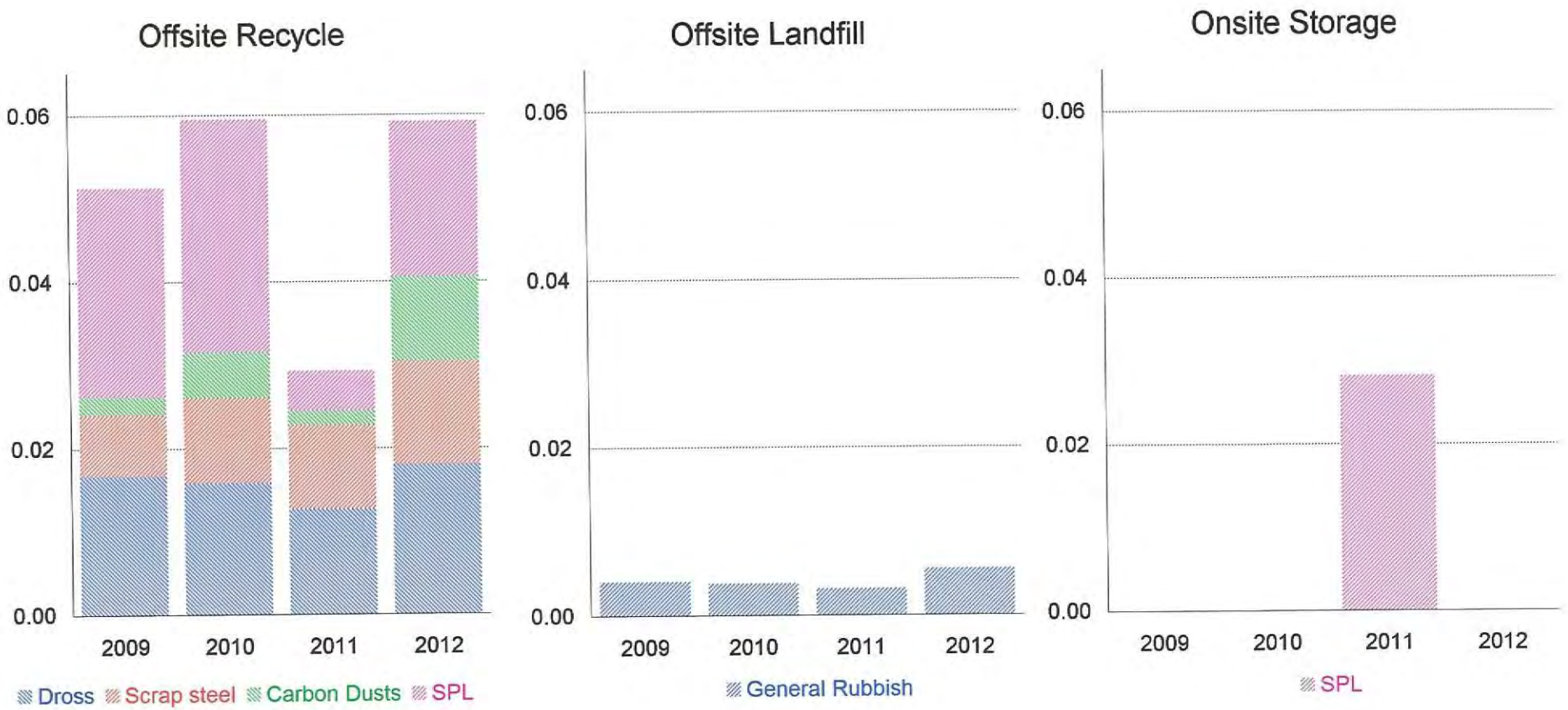


Figure 9.2: Waste Storage & Disposal Summary for the Hydro Aluminium Kurri Kurri Smelter

(all figures are in tonnes per tonne production)



10. HYDRO KURRI KURRI CONTACT DETAILS:

Hydro Aluminium Kurri Kurri is a proud member of the Kurri Kurri community and welcomes inquiries.

Should you wish to contact the company about matters relating to environmental performance the following access points are available to you.

Normal Business hours: Main Office Tel: (02) 4937 1555.

Outside Business hours: Gate Office Tel: (02) 4937 1555.

Smelter personnel will either direct you to a site environmental officer or record your comment and refer it to responsible officers. You may be assured of a prompt response.

Hydro Kurri Kurri postal address is:

Hydro Aluminium Kurri Kurri Pty Ltd
PO Box 1
KURRI KURRI NSW 2327

Appendix C

Summary of Conformance with Predictions made in Approved Documents

Appendix C Summary of Conformance with Predictions made in Approved Documents

Doc. Ref	Page Ref	Issue	Predictions Made	Comments – 2012 AEMR
1.2 b SEE (URS, 2002)				
7.1	7-2	Air Emissions	A reduction in emissions of fluoride and particulates from Potline 1 by 40%. Typical Potline 1 emissions were: - 1.0 g/s or 31,000 kg/yr for Gaseous Fluoride; - 0.9 g/s or 29,000 kg/yr for Particulate Fluoride; - 4.5 g/s or 141,000 kg/yr for PM_{10} Particulates.	Potline 1 production curtailed in January 2012 therefore comparison with this prediction not applicable for 2012.
7.1	7-4	Air Emissions	A reduction of PM_{10} and PAH emissions from the Greenmix stack. Typical emissions were: - 0.8g/s or 12,000kg/yr for PM_{10}; - 0.08 g/s or 1200kg/yr for PAH.	Production in the Greenmix plant curtailed in June 2012 with annual monitoring unable to be carried out.
7.1	7-3	Air Emissions	An increase of SO_2 emissions from the whole plant by Approximately 10%. Typical SO_2 emissions were 108 g/s or 3,417,000 kg/yr.	Smelter SO_2 emissions in 2012 were 950,371 kg, well below the EPL Load Limit. Comparison with historical levels not applicable due to curtailment of production.
7.1	7-7	Air Emissions	A reduction of Perfluorinated Carbon Compounds (PFCs) by approximately 90%. Typical PFC emissions for the total plant were 4.4 g/s or 135,800 kg/yr.	Compliance with predictions confirmed - PFC generation reduced from 2002-05 period to current reporting period. PFC emission reduction directly contributed to a reduction in direct greenhouse gas emissions from 2005 levels, and was the principle component of Hydro's ability to create abatement certificates under the NSW GGAS Scheme.
7.1	7-5, 7-6	Air Emissions	No significant increase in other minor emissions from the plant due to improved process control. These emissions include: oxides of nitrogen (NO_x), carbon monoxide (CO), chlorine (Cl_2), hydrochloric acid (HCl) and volatile organic carbon (VOC). Typical emissions were: - 2.7 g/s or 34,600 kg/yr for NO_x; - 630 g/s or 19,870,000 kg/yr for CO; - 1.6 g/s or 1400 kg/yr for Cl_2; - 4.4 g/s or 4000 kg/yr for HCl; - VOC emissions were not tested.	Total smelter NO_x emissions in 2012 were 19,683 kg, below the 2005 level, due to curtailment of production. For the 2011-2012 National Pollutant Inventory reporting period, other emissions were found to be similar to pre-SURF amounts on a per tonne production basis.

Doc. Ref	Page Ref	Issue	Predictions Made	Comments – 2012 AEMR
7.4.2	7-17	Air Emissions	Potline 1 and 2 dry scrubber outlet (stack) fluoride emissions will not be significantly changed as a result of the modifications.	Compliance with predictions confirmed - total fluoride emissions from Potline 2 stack remains relatively stable. Potline 1 production curtailed in Jan 2012, therefore comparison with this prediction not applicable for 2012. Potline 2 stack average TF emission (1998-2008) is 0.14 kgTF/tAl, whilst the Jan to Jun 2012 average Potline 2 stack TF emissions were 0.10 kgTF/tAl.
7.4.2	7-17	Air Emissions	The modelling predictions have indicated that the reduction in the annual ground level concentrations of gaseous fluoride will range from 0.1 µg/m^3 at locations within a few hundred metres to 0.01µg/m^3 at locations several kilometres from the smelter.	Hydro's ambient fluoride monitoring program indicated that fluoride levels both within the smelter buffer zone, nearby urban areas and lower hunter valley vineyards have not changed significantly from previous years.
7.4.2	7-18	Air Emissions	Results from the AUSPLUME model indicated that the maximum ground level concentrations of sulphur dioxide after the smelter update and retrofit were less than 15% of the NEPM air quality goals for 1 hour, 24 hours and a full year.	Historical data recorded since 1989 indicate that ground level SO_2 concentrations do not change from year to year, and have been significantly below the EPA guideline level of 57 µg/m^3. In compliance with the 2002 Development Consent, Schedule 2, Condition 5.5, Hydro carried out 12 months of continuous ambient sulphur dioxide monitoring from March 2003 and to February 2004. Monitoring results showed levels to be well below one tenth and peaks to be no higher than one quarter of international standards (Hydro Aluminium 2004). Compliance confirmed in the 2006 Independent Environment Audit (HLA Envirosciences 2007).
7.4.2	18-6	Air Emissions	The KIMPS modelling performed by Katestone Scientific gave maximum predicted ground level values less than 50% of the 1 hour NEPM guideline value of 572 µg/m^3. The maximum predicted ground level concentrations of sulphur dioxide also meet the recommended WHO limit of 500 µg/m^3 (10 minutes average). Sensitive receptors such as schools and the hospital were predicted to experience possible maximum ground level concentrations of 150 to 160 µg/m^3, which is less than 30% of the applicable NEPM air quality goal.	As above.

Doc. Ref	Page Ref	Issue	Predictions Made	Comments – 2012 AEMR
9.4	9-1	Energy	The combined effectiveness of the various modifications below to the pots and the planned process changes are predicted to improve the reduction efficiency by approximately 10 per cent. Improving smelting pot insulation and longer pot lining life; Further reductions in anode effects; Improved energy efficiency in the anode baking process; Establishment of energy management teams and energy auditing processes.	AC Electrical Consumption reduced due to curtailment of production. Improved electrical efficiency performance resulted in Hydro creating and registering 97,486 ESCs under the NSW Energy Savings Scheme.
9-3	9-1	Energy	The changes will also result in an increase in smelter metal production of approximately 10%.	Compliance with SEE prediction confirmed in 2007 AEMR.
9.5	9.2	Energy	The combined result of improved reduction efficiency and increased metal production will result in no net change in power consumption in the reduction process (2,500 GWh per annum). 95% used in reduction; 3% dry scrubber fans ensuring that fluoride emissions are contained; 1% Potline roof fans, 1% auxiliaries.	Total electricity consumption during 2012 (1,078 GWh) reduced due to production curtailment.
10.4	10-4	Wastes	Reduction in SPL production through improved pot stability plus the cast iron rodding of the cathodes and the improved lining design planned for Potline 1 should result in improved lining life in all three Potlines.	Not evaluated as Potlining life is a long term parameter. SPL generation constant for the previous three years with no SPL removed from pots due to total cessation of pot relining and aluminium production. Condition 4.23 of the 2002 Development Consent required that Hydro submit a proposal to the DoP by 31 December 2007, detailing how SPL material would be treated to either create an inert waste or create a raw material for other industrial processes. Compliance with this condition was confirmed in the 2009 Independent Environmental Audit (AECOM 2009).
10.4	10-4	Wastes	A reduction in quantities of refractory waste generated through a new furnace design and a new firing system, both of which will assist in extending the life of the baking furnace flues.	Curtailment of production has resulted in this prediction not being able to be evaluated in 2012.
10.4	10-4	Wastes	A new waste stream, bag house material waste, will be produced from the new Greenmix Scrubber and recycled back into the Greenmix plant.	Compliance with SEE predictions confirmed in 2006 AEMR.

Doc. Ref	Page Ref	Issue	Predictions Made	Comments – 2012 AEMR
11.4	11-4	Traffic	Raw material deliveries and metal product shipments will increase by 10%.	Traffic movements directly proportional to the curtailment of production.
15.5	15-4	Dangerous Goods	The only increase will be an approximate 10% increase in the number of liquid pitch (DG Class 9) transport movements, which will result in one or two extra movements per week.	As above.
16.1	16-2, 16-4	Visual Aspects	The existing buffer of tree screening will to be used to reduce the impact of the new Greenmix 40 m scrubber stack on the amenity of the area.	Compliance with SEE predictions confirmed in 2006 AEMR.
19.7	19-6	Monitoring	Ambient sulphur dioxide has the potential to rise with a predicted 10% increase in sulphur dioxide emissions.	Compliance with SEE predictions confirmed in 2006 AEMR.
1.2 c1 Assessment of PAH Emissions to Air from Kurri Kurri Smelter (Zib, 2002)				
c1	4	Air	Air emissions from greenmix plant will be improved as the air emissions from greenmix stack will discontinue as scrubbed emissions will be exhausted from the greenmix scrubber stack.	Compliance with prediction confirmed in 2006 AEMR.
c1	6	Air	Emission reduction and much better dispersion conditions at anode plant stack will reduce ground level concentrations of BaP equivalent - predicted 0.001 µg/m^3.	Curtailment of production has resulted in this prediction not being able to be evaluated in 2012.
c2	4-6 table 18	Noise	Predicted noise levels during operation. Worst case scenario, Predicted total existing operations and upgrade ($L_{aeq,\ 15\ min}$, dBA) Location 1 Government St - 42, Location 2 Railway St - 39, Location 3 Mitchell Ave - 27, Location 4 Burns St - 40.	Compliance with SEE predictions confirmed in 2006 AEMR.

Appendix D

External Noise Monitoring Survey 2012

Appendix D External Noise Monitoring Survey 2012

Hydro Aluminium Kurri Kurri Pty Ltd
ABN 55 093 266 221

HYDRO

2012 EXTERNAL NOISE MONITORING SURVEY

Prepared By:

Kerry McNaughton
Environmental Specialist/
Buffer Zone Supervisor

HYDRO ALUMINIUM KURRI KURRI SMELTER PTY LTD

2012 EXTERNAL NOISE MONITORING SURVEY

Conducted by:

Kerry McNaughton
Environment Officer
Buffer Zone Supervisor

CONTENTS

Page No.

1. INTRODUCTION.....3

2. DISCUSSION OF RESULTS..... 4

3. METHODOLOGY.....5

4. MAP OF SITE LOCATIONS.....6

5. RESULTS.....8

6. REFERENCES.....9

APPENDIX 1: AMENITY CRITERIA

APPENDIX 2: HISTORICAL NOISE MEASUREMENTS

1. INTRODUCTION

During 2012 a number of Environmental Noise Monitoring Surveys was conducted under daytime and night-time conditions at six designated sites near the Kurri Kurri Smelter.

The purpose of the exercise was to obtain valid data relating to the emission of noise from the smelter which satisfies Environment Protection Authority requirements and is representative of levels to which local residents are exposed.

In 2000 all six sites were assigned background L_{Aeq} noise level limits, which were obtained from *"NSW EPA Environmental Noise Management Industrial Noise Policy"* document

The policy recommends a range of L_{Aeq} noise levels (the equivalent continuous noise level) which differ according to the time of the day, the type of receiver and the indicative noise amenity area.

Site specific background L_{Aeq} noise level criteria were selected on the basis of zoning of the noise receiver area and predominant land use of receiver area.

Site locations were as follows:

a) Site 1 - 0.9km W (Lot 320)
b) Site 2 - 1.2km NE (SW corner of "Wangara" irrigation paddock)
c) Site 3 - 1.2km SSE (Intersection of Scales Avenue/Horton Road)
d) Site 4 - 1.4km ESE (End of Bowditch Avenue near railway line)
e) Site 5 - 1.5km WSW (200 metres South of "Lucky Acres")
f) Site 6 - 1.6km SE (Lot 463)

2. DISCUSSION OF RESULTS

During the monitoring survey the acoustic environment was dominated by noise generated from dry scrubber and roof fan operations.

L_{Aeq} measurements at all sites during daytime and night-time monitoring were below recommended noise levels from industrial noise sources for the appropriate indicative noise amenity area and type of receiver.

3. METHODOLOGY

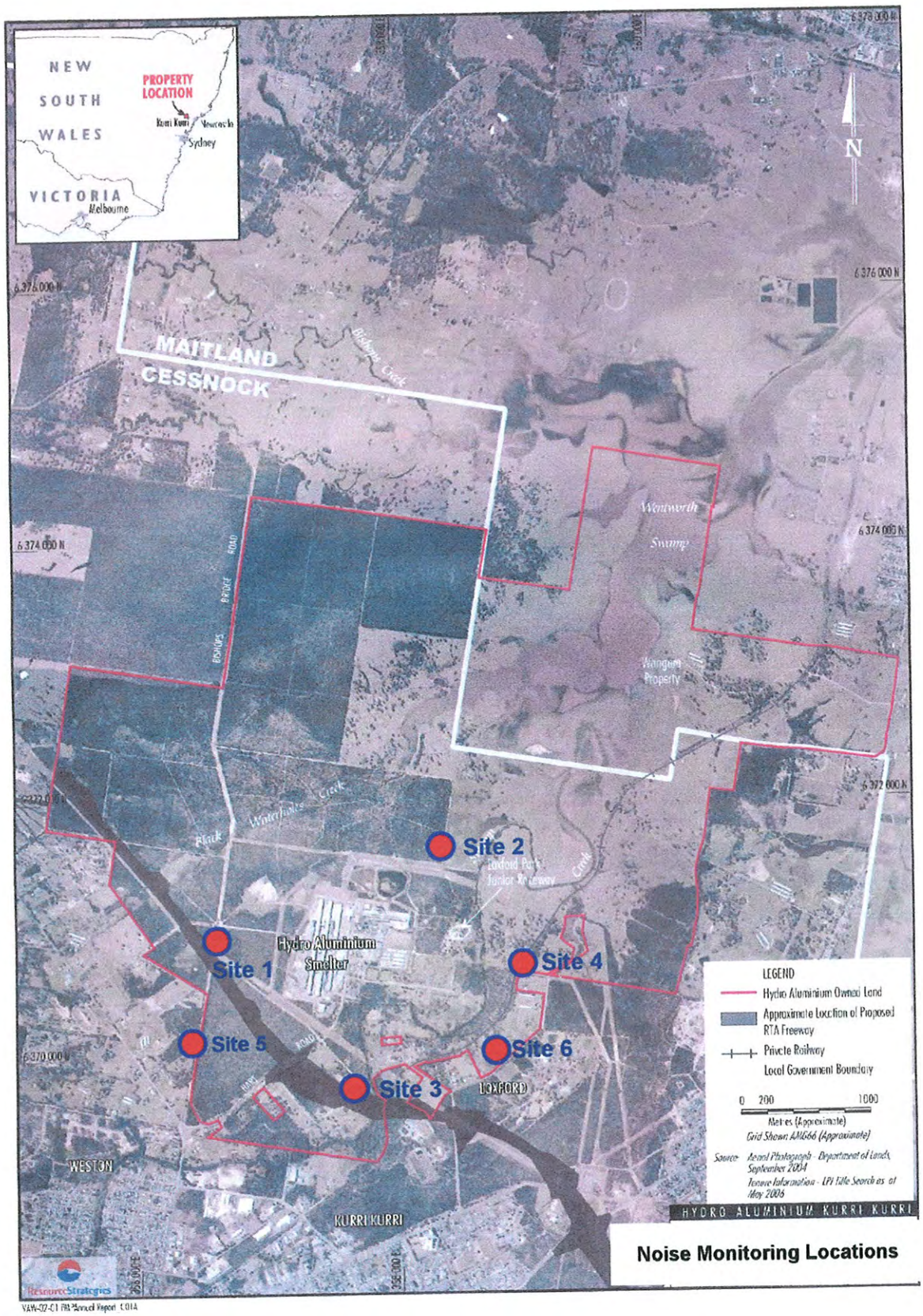
Monitoring equipment was as follows:

Bruel & Kjaer Type 2231 Precision Sound Level Meter.

Under the current policy measurements taken between the period from 7:00 a.m. to 6:00 p.m. Monday to Saturday; or 8:00 a.m. to 6:00 p.m. on Sundays and public holidays were classified as daytime. The period from 6:00 p.m. to 10:00 p.m. was considered to be evening while all remaining periods were classified as night.

The meter was situated in a free field on a Tripod 1 metre above ground level. Measurement time was 15 minutes. After this time the meter was paused and the L_{Aeq} weighted (Fast) values obtained.

The meter was calibrated before and after every 15 minute measurement period. No significant drift ($\pm$ 5%) occurred.


NEW SOUTH WALES
PROPERTY LOCATION
Kurri Kurri
Newcastle
Sydney
VICTORIA
Melbourne
N
6 378 000 N
6 376 000 N
6 374 000 N
6 372 000 N
6 370 000 N
MAITLAND
CESSNOCK
Black Creek
Wentworth Swamp
Wangum Property
BOUNDES REPORT ROAD
Water Gums Creek
Flats
Site 1
Site 2
Site 3
Site 4
Site 5
Site 6
Hydro Aluminium Smelter
LOXFORD
WESTON
KURRI KURRI
LEGEND
Hydro Aluminium Owned Land
Approximate Location of Proposed RTA Freeway
Private Railway
Local Government Boundary
0 200 1000
Metres (Approximate)
Grid Shown AMG66 (Approximate)
Source: Aerial Photograph - Department of Lands, September 2004
Tenure Information - LPI Title Searches at May 2006
HYDRO ALUMINIUM KURRI KURRI
Noise Monitoring Locations
Resource Strategies
VAW-02-01 RTA Noise Report 2.01A

2012 BUFFER ZONE NOISE MONITORING RESULTS

5. RESULTS

A) L_{eq} A-Weighted Measurements

The following tables (1-6) display:

a) Daytime and night-time noise measurements.

B) Meteorological conditions for monitoring periods

Site 1 **Location : 0.9 km W (Lot 320)**

Recommended Leq Noise Levels From Industrial Noise Sources

Time of Day	Acceptable	Recommended Maximum
Day 7.00am - 6.00pm Monday - Saturday 8.00am - 6.00pm Sunday & Public Hol.	65	70
Evening 6.00pm - 10.00pm	55	60
Night The Remaining Period	50	55

Date	Time Monitored (hrs) Wind Direction/Speed (m/s)	Daytime Leq Level	Evening Leq Level	Night-time Leq Level
10/05/2012 20/06/2012 30/06/2012 20/09/2012	11:00 WNW 3.0 18:12 WSW 2.4 0:08 Calm 11:38 N 1.3	59.9 *** 45.2***	45.1	54.4

*** Impacted by Hunter Expressway construction work

Site 2 **Location : 1.2 km NE (SW corner of Wangara irrigation paddock)**

Recommended Leq Noise Levels From Industrial Noise Sources

Time of Day	Acceptable	Recommended Maximum
Day 7.00am - 6.00pm Monday - Saturday 8.00am - 6.00pm Sunday & Public Hol.	65	70
Evening 6.00pm - 10.00pm	55	60
Night The Remaining Period	50	55

Date	Time Monitored (hrs) Wind Direction/Speed (m/s)	Daytime Leq Level	Evening Leq Level	Night-time Leq Level
10/05/2012	8:30 Calm	46.5	39.2	49.6
20/06/2012	18:37 WSW 2.4			
29/06/2012	22:50 Calm			
20/09/2012	8:47 SSE 1.1	42.9		

Site 3 **Location : 1.2 km SSE (Intersection of Scales Avenue/Horton Road)**

Recommended Leq Noise Levels From Industrial Noise Sources

Time of Day	Acceptable	Recommended Maximum
Day 7.00am - 6.00pm Monday - Saturday 8.00am - 6.00pm Sunday & Public Hol.	65	70
Evening 6.00pm - 10.00pm	55	60
Night The Remaining Period	50	55

Date	Time Monitored (hrs) Wind Direction/Speed (m/s)	Daytime Leq Level	Evening Leq Level	Night-time Leq Level
10/05/2012	9:30 SE 0.5	49.4	54.2	49.7
20/06/2012	19:07 SW 1.2			
29/06/2012	23:21 Calm			
20/09/2012	9:45 N 0.4	50.0		

Site 4 **Location: 1.4 km ESE (end of Bowditch Avenue near railway line)**

Recommended Leq Noise Levels From Industrial Noise Sources

Time of Day	Acceptable	Recommended Maximum
Day 7.00am - 6.00pm Monday - Saturday 8.00am - 6.00pm Sunday & Public Hol.	65	70
Evening 6.00pm - 10.00pm	55	60
Night The Remaining Period	50	55

Date	Time Monitored (hrs) Wind Direction/Speed (m/s)	Daytime Leq Level	Evening Leq Level	Night-time Leq Level
10/05/2012	13:05 WNW 2.5	47.5	56.2	43.1
20/06/2012	19:37 SW 1.2			
30/06/2012	1:11 Calm			
20/09/2012	10:38 SSE 0.8	34.6		

Site 5 **Location:** **1.5 km WSW (200 metres South of "Lucky Acres"**
Recommended Leq Noise Levels From Industrial Noise Sources

Time of Day	Acceptable	Recommended Maximum
Day 7.00am - 6.00pm Monday - Saturday 8.00am - 6.00pm Sunday & Public Hol.	65	70
Evening 6.00pm - 10.00pm	55	60
Night The Remaining Period	50	55

Date	Time Monitored (hrs) Wind Direction/Speed (m/s)	Daytime Leq Level	Evening Leq Level	Night-time Leq Level
10/05/2010	**10:10 W 1.8**	49.5	53.5	52.7
20/06/2012	**20:09 WSW 2.0**			
29/06/2012	**23:45 Calm**			
20/09/2012	**11:09 NNE 1.4**	42.5		

Site 6 **Location : 1.6 km SE (Lot 463)**

Recommended Leq Noise Levels From Industrial Noise Sources

Time of Day	Acceptable	Recommended Maximum
Day 7.00am - 6.00pm Monday - Saturday 8.00am - 6.00pm Sunday & Public Hol.	65	70
Evening 6.00pm - 10.00pm	55	60
Night The Remaining Period	50	55

Date	Time Monitored (hrs) Wind Direction/Speed (m/s)	Daytime Leq Level	Evening Leq Level	Night-time Leq Level
10/05/2012	13:35 WNW 2.5	42.6	48.3	44.3
20/06/2001	20:43 WSW 2.0			
30/06/2012	0:44 Calm			
20/09/2012	10:17 SSE 0.8	44.8		

Appendix E

Vegetation Health Survey of Hydro Aluminium Buffer Zone 2012

Appendix E Vegetation Health Survey of Hydro Aluminium Buffer Zone 2012

AECOM

Buffer Zone Study
Hydro Aluminium Kurri Kurri Limited
13 July 2012

Vegetation Health Survey of Hydro Aluminium Kurri Kurri Limited Smelter Buffer Zone

Vegetation Health Survey of Hydro Aluminium Kurri Kurri Limited Smelter Buffer Zone

Prepared for

Hydro Aluminium Kurri Kurri Limited

Prepared by

AECOM Australia Pty Ltd
17 Warabrook Boulevarde, Warabrook NSW 2304, PO Box 73, Hunter Region MC NSW 2310, Australia
T +61 2 4911 4900 F +61 2 4911 4999 www.aecom.com
ABN 20 093 846 925

13 July 2012

AECOM in Australia and New Zealand is certified to the latest version of ISO9001 and ISO14001.

© AECOM Australia Pty Ltd (AECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Quality Information

Document	Vegetation Health Survey of Hydro Aluminium Kurri Kurri Limited Smelter Buffer Zone
Ref	60247852
Date	13 July 2012
Prepared by	Gabriel Wardenburg, Rochelle Lawson and Kate Michelmore
Reviewed by	Peter Horn

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	13/07/2012	Draft	Peter Horn Associate Director Environment	
A	13/07/2012	Final	Peter Horn Associate Director Environment	

Table of Contents

Executive Summary i
1.0 Introduction 1
1.1 Assessment Procedure 1
1.1.1 Classification of Visible Injury Symptoms 1
1.2 Interpretation of Injury Symptoms 3
1.2.1 Field recording 3
1.2.2 Injury category 3
1.2.3 Emissions injury 3
1.2.4 Foliage age 3
1.2.5 Position and orientation of foliage 4
1.2.6 Mimicking symptoms 4
1.3 Criteria for Injury Due to Industrial Emissions 4
1.4 Assessment sites 5
2.0 Vegetation at Selected Sites 8
2.1 Geographical extent of injury 8
2.2 Condition of Vegetation South-East of Smelter 12
2.2.1 Dickson Road / Football Field (Site 1) 12
2.2.2 Swamp Creek (Site 3) 12
2.2.3 Lot 422 (Site 5) 12
2.2.4 Smelter Car Park (Site 7) 12
2.2.5 TAFE vineyard (Sites 9 and 9a) 12
2.3 Condition of Vegetation South and West of the Smelter 12
2.3.1 Hart Road (Sites 8 and 11) 12
2.3.2 Former Crown Land (Sites 12, 13) 12
2.3.3 Lot 320 (Sites 14, 15, 16) 12
2.3.4 Lot 319 (Site 17, 18 & 18a) 12
2.3.5 Far Western Area (sites 20a, 20b) 12
2.4 Condition of Vegetation North of the Smelter 13
2.4.1 North-Western Area (Sites 21 and 22) 13
2.4.2 Lot 316 (Site 23, 24, 25) 13
2.4.3 Lot 317 (Site 26, 27, 28) 13
3.0 Conclusion & Recommendations 14

Appendix A
Field Sheets A

List of Tables

Table 1 Symptom code for visible injury to vegetation, with particular reference to fluoride 1
Table 2 Categories of Visible Injury Attributable to Smelter Emissions for Major Groups of Native Plant Species 2
Table 3 Summary of Sites Examined for the Distribution of Visible Injury to Vegetation 5
Table 4 Field sheet - Visible injury to vegetation in the Hydro Aluminium Smelter Buffer Zone, April 2012 A-1

List of Figures

Figure 1 Overview of Vegetation Inspection Sites 7
Figure 2 Visible Injury to foliage of *Angophora bakeri* and *A. floribunda* in April 2012 9
Figure 3 Visible injury to foliage of *Eucalyptus parramattensis* ssp *parramattensis* in April 2012 10
Figure 4 Most-affected leaves of all fluoride sensitive plant species in the vicinity of the Hydro Aluminium Kurri Kurri Smelter, April 2012. 11

Executive Summary

An inspection of the vegetation in the vicinity of the Hydro Aluminium Kurri Kurri smelter was made on 17 and 24 April 2012. The quantitative assessment of visible injury followed the methodology that had been used in previous assessments at this site.

Vegetation assessments in the Hydro Aluminium Kurri Kurri buffer zone were made on foliage produced during the 2011 -12 growing season. The condition of vegetation in April 2012 was similar to that in recent years despite some variation in the time of year at which the inspections were made. The limits of detection of visible fluoride injury were set at 2% of the length or area of the most-affected foliage on a plant. On this criterion, injury was contained within the smelter buffer zone except for three areas: one to the west of Bishops Bridge Road south-west of the smelter, one north east of the Kurri Kurri TAFE campus and another on the corner of Lumby Land and Bishops Bridge Road west of the smelter. These areas showed 'marked, distinct and slight' injury respectively (<5%, <10% and <25% of leaf length or area visibly exhibiting symptoms of fluoride injury).

There was no evidence that 'distinct' injury in foliage was associated with any obvious reduction in the vigour of plant growth or the production of flowers and fruits. Regeneration of fluoride sensitive species had occurred in recent years close to the smelter perimeter.

The condition of *Eucalyptus parramattensis* trees in Kurri sand swamp woodland vegetation associations around the smelter was generally very satisfactory. While this species is sensitive to fluoride, there appears to be no threat to the continued viability of this species on the Hydro Aluminium property. The continuing development of this species and the repeated occasions of extensive flowering and seed set suggest that it is functioning normally.

Appendix F

Fluoride Monitoring Level in Lower Hunter Valley Vineyards 2011-12

Appendix F Fluoride Monitoring Level in Lower Hunter Valley Vineyard 2011-12

HYDRO ALUMINIUM KURRI KURRI SMELTER

FLUORIDE MONITORING IN LOWER HUNTER VALLEY VINEYARDS SEASON OCTOBER 2011 – March 2012

Prepared by

Kerry McNaughton
Environmental Specialist/
Buffer Zone Supervisor

INDEX

CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

PROCEDURE

MAP OF AREA

- Figure 1

VINEYARD MONITORING RESULTS

AMBIENT AIR MONITORING

MAP OF AIR SAMPLER LOCATIONS

- Hunter Valley Vineyards

GROWING SEASON AIR MONITORING RESULTS

AMBIENT AIR GRAPHS: April 2010- March 2012

REFERENCES

APPENDIX	I	-	Grape Leaf Sampling Method
	II	-	Grape Leaf Analysis Method
	III	-	Ambient Air - Determination of Gaseous and Particulate Fluorides
	IV	-	ANZECC Guidelines
	V	-	Wind Roses - Kurri Kurri
	VI	-	Wind Roses - McWilliams
	VII	-	Visual Assessment (Oct 2011 - Mar 2012)
	VIII	-	Growing Season Meteorological Data – Kurri Kurri
	IX	-	Growing Season Meteorological Data – McWilliams

CONCLUSIONS AND RECOMMENDATIONS

1. Meteorological data from Hydro's McWilliams station supports the previous seasons measurements indicating that during the growing season September '10 - March '12 prevailing air flows from the direction of the smelter are rarely present in the southern Pokolbin region.

2. Ambient air fluoride levels and grape leaf fluoride uptake is affected greatly by seasonal factors, temperature, rainfall, plant vigour etc. (3).

3. Conclusions reached from a number of independent scientific studies (3, 4, 5), also supported by ANZECC guidelines, indicate that grape leaf fluoride levels and ambient air fluoride concentrations measured in the Lower Hunter Valley are not high enough to adversely affect the quality or quantity of fruit produced.

4. Hydro will continue to assist the Hunter Valley Wine Industry Association with interpretation of monitoring data. Hydro personnel will be available to present and discuss monitoring results if further assistance is requested by the Hunter Valley Wine Industry Association.

INTRODUCTION

Hydro's sampling protocol consists of a methodology where the leaves closest to the fruit of approximately 40 vines are collected. The rest of the program includes:

a) A monthly sampling frequency to the end of the growing season.

b) A common cultivar selected for monitoring where possible.

c) Visual assessment including photography.

d) Analysis.

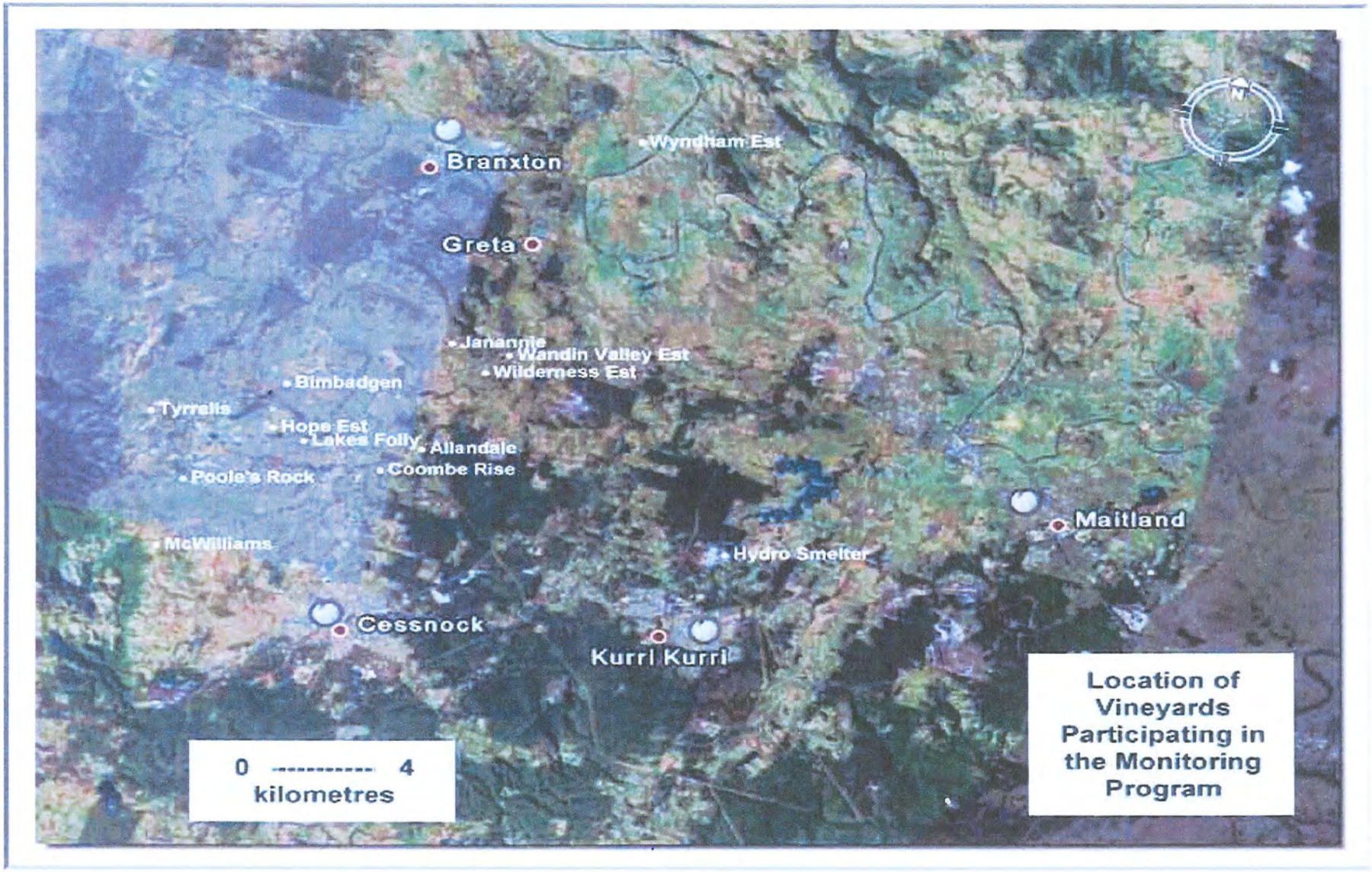
PROCEDURE

Where possible, a common cultivar was sampled. The fourth and fifth leaves closest to the fruit from approximately 40 vines were collected.

The vines sampled were visually assessed for physical damage and one vine tagged for photographing and examination each month of the season. Details, such as chlorosis, necrosis, vigour and fruiting, were noted. While in the field collected samples were stored in an esky, to prevent the samples from sweating. This is a condition which can result in fluoride loss.

After arriving at the laboratory the samples were washed in a dilute detergent solution (Extran 300), rinsed in distilled water and placed in a drying oven at 80°C for at least 24 hours. The leaves were then ground and split into two samples. One split was analysed by Hydro staff using an acid leach – specific ion technique, and the other was available upon request to the Environment Protection Authority (EPA).

Ambient air and fluoride results (µg/g dry weight) were reported monthly to participating vignerons, the Hunter Valley Wine Industry Association and annually to the EPA.


Branxton
Greta
Wyndham Est
Jananmie
Wandin Valley Est
Wilderness Est
Bimbadgen
Tyrrells
Hope Est
Lakes Folly
Allandale
Coombe Rise
Poole's Rock
McWilliams
Maitland
Hydro Smelter
Cessnock
Kurri Kurri
0 ---------- 4
kilometres
Location of Vineyards Participating in the Monitoring Program

Appendix G

Cattle Monitoring 2012

Appendix G Cattle Monitoring 2012

HYDRO ALUMINIUM KURRI KURRI SMELTER

2012 ANNUAL CATTLE MONITORING REPORT

PREPARED BY

KERRY MCNAUGHTON
ENVIRONMENT OFFICER/
BUFFER ZONE SUPERVISOR

Passionate about Pets
Greencross Vets

9 Walker Street
MAITLAND NSW 2320

ABN:80 133 433 833

Phone: (02) 49343044
Fax: (02)49347267

REPORT ON THE TWENTY NINTH ANNUAL SURVEY OF LIVESTOCK IN THE VICINITY OF HYDRO ALUMINIUM PRIMARY METAL SMELTER 2012

DR I.R. GOLLAN, B.V.Sc. (HONS II)

This report presents the findings of the twenty ninth annual survey of livestock in the area of the Hydro Aluminium Primary Metal Smelter in the Lower Hunter Valley of NSW.

The procedure followed in previous years was continued. Cattle were examined for general health and condition, teeth were photographed and given a dental score, tail bone biopsies for fluoride assay were collected surgically, and information on the management and feeding practices of each property was recorded.

The survey was conducted in late February and early March. The Lower Hunter area had experienced a very wet spring and summer, leading to high quality pasture in the survey area. All cattle examined were in advanced body condition and good general health.

HERD D **1st March, 2012**

COW TAG NO:	AGE	TOOTH SCORE	BONE BIOPSY (ppm ash)	REMARKS
906	2.5	1-T-T-T		
9128	2.5	1-T-T-T		
9275	2.5	1-2-T-T	1335	
9146	3	1-1-T-T		
9264	2.5	1-2-T-T	1593	
9047	2.5	1-T-T-T		
9251	2.5	2-T-T-T	1518	
9270	2.5	1-T-T-T		
9256	2.5	2-T-T-T	1373	
9273	2.5	2-T-T-T		
821	3	1-1-2-T		
710	4	1-1-1-2		
41	7	1-1-2-2		
414	7	2-1-1-1		
743	4	1-1-1-1		
42	7	1-1-1-2		
723	4	1-1-2-2		
43	7	1-1-2-2		L1 lost
54	6	1-1-1-1		L1 lost
52	6	1-1-1-1		

MANAGEMENT FACTORS

Management factors remained unchanged from the previous year. This is a self replacing herd of beef cattle, principally Angus and Angus cross-bred cows. The property is situated in the Hydro Aluminium Smelter 'buffer zone', and is closer to the plant than any other property in the survey.

All cattle surveyed were female, and were pregnant or lactating with calves at foot at the time of examination.

Pasture cover on the property was excellent at the time of survey. The pasture consisted of a variety of natural and introduced species, including kikuyu, ryegrass, paspalum and clovers.

This pasture supplied the herd with its entire nutritional needs. No supplementary feeding was provided for these cattle.

All animals examined in the survey were in good health and body condition.

CONTROL HERD TC

29th February, 2012

COW TAG NO:	AGE	TOOTH SCORE	BONE BIOPSY (ppm ash)	REMARKS
962	2.5	1-2-T-T	694	
965	2.5	1-2-T-T	580	
925	3	1-1-1-T		
3621	11	1-1-1-1		
741	4	1-1-1-2		
957	2.5	1-2-T-T		
3590	11	1-1-1-1		
307	9	1-1-1-1		
931	2.5	1-2-T-T		
2097	6	1-1-1-1		
7086	11	1-1-1-1		
813	4	1-1-1-1		
749	4	1-1-2-T		
3916	6	1-1-1-2		
3925	6	1-1-1-1		
712	5	1-1-1-2		
923	3	1-1-1-T		
3915	6	1-1-1-1		
3787	9	1-1-1-1		
7129	9	1-1-1-1		

MANAGEMENT FACTORS

Management of Herd TC has remained constant over many years. It is a dairy herd, consisting of Holstein/Friesian, Australian Illawarra Shorthorn and Jersey cows. The farm is remote from aluminium smelting influences, and consists of a mixture of alluvial river flats and low ridges.

The cows in this herd are milked twice daily, and fed grain based supplements at milking time. Between milkings, these cows graze irrigated improved pasture. This is standard husbandry for milk producing herds in the area.

All cows in the survey were lactating, and the majority of them had been rejoined, and were pregnant.

All animals examined were in good health and body condition.

SUMMARY OF FINDINGS

Average F levels (expressed in ppm F in bone ash) and comparison with 2011 results for each herd are listed below.

HERD	NO. OF SAMPLES	AV. F LEVEL (ppm ash)		% INCREASE/ (DECREASE)
	2012	2011	2012	2011/2012
D	4	1654 (av Age 2.0)	1455 (av Age 2.5)	(12)
TC	2	748 (av. Age 3.5)	637 (av Age 2.5)	(15)

HERD D 100 PAIRS OF TEETH EXAMINED

SCORE AS PERCENTAGE OF ALL TEETH PAIRS EXAMINED

TOOTH SCORE	2011	2012
T	24	35
1	59	45
2	17	20

SCORE AS PERCENTAGE OF PERMANENT TEETH PAIRS EXAMINED

TOOTH SCORE	2011	2012
1	78	69
2	22	31

HERD TC 100 PAIRS OF TEETH EXAMINED

SCORE AS PERCENTAGE OF ALL TEETH PAIRS EXAMINED

TOOTH SCORE	2011	2012
T	6	14
1	86	76
2	8	10

SCORE AS PERCENTAGE OF PERMANENT TEETH PAIRS EXAMINED

TOOTH SCORE	2011	2012
1	92	88
2	8	12

DISCUSSION OF FINDINGS OF HYDRO ALUMINIUM HERDS

The same protocols were followed for the 2012 fluoride survey of cattle as for previous years. Farm D is a beef herd in the vicinity of the Hydro Aluminium Smelter, while farm TC is a dairy herd remote from the Smelter. Cattle in this herd are used as a control group, to give an indication of a background level of fluoride in cattle away from any possible industrial fluoride emitting sources.

Direct comparisons between herds are difficult as each herd has a different system of management and production. Herd D is a large beef herd on a large property deriving its entire nutrition from pasture grown on the property, while Herd TC is a commercial dairy herd which derives its nutrition from irrigated farm pasture and high quality grain based supplements.

Herd D is the only herd in which the cattle receive all their nutrition from pasture grown on the farm. Consequently, fluoride readings in this group of cattle should most accurately reflect the exposure of the property to fluoride contamination.

Teeth are scored in the survey according to the numerical method devised by Professor John Suttie, with a score of 1 being unaffected by fluoride, and a score of 4 being severely affected. The brief descriptions of tooth findings for each score are as follows:

1. Normal unaffected permanent incisor
2. Some mottling or striation apparent
3. More severe mottling and hypoplasia
4. Tooth wearing excessively

The scores are given for permanent incisor teeth. Suttie does not believe that temporary (deciduous) teeth are affected, so each deciduous tooth is recorded as T.

In each survey, the numbers of teeth recorded for each score have been expressed as a percentage of the total number of teeth examined in each herd. These figures have then been compared with those of previous years.

Over the past fourteen years, a second group of figures expressing the number of teeth in each scoring category as a percentage of <u>permanent</u> teeth examined has been included. This gives a better estimate of the real figure for each scoring category, as permanent teeth can be scored but temporary teeth cannot.

Both systems of comparisons have been included again this year.

HERD D

Teeth scores in this herd have continued the benign trend of recent years, with all teeth scoring 1 or 2. These scores confirm that cattle grazing on the property are ingesting only low levels of environmental fluoride.

Bone biopsy results also reflect low fluoride exposure, and this year have further decreased by 12% to 1455 ppm fluoride in bone ash. This reading is well below toxic levels.

CONTROL HERD TC

Teeth scores in the control herd have remained low. All permanent teeth scored 1 or 2, confirming low ingestion of dietary fluoride.

Bone biopsy results have decreased by 15% since last year to 637 ppm fluoride in bone ash. This reading is consistent with levels expected on farms remote from fluoride emitting sources.

CONCLUSION

The trends in 2012 indicate surveyed herds are not being subjected to fluoride damage. Dental scoring, using the Suttie method, revealed 100% of cattle in Herd D and Control Herd TC scored 1 or 2, indicating no or slight exposure to environmental fluoride.

Chemical analysis of bone showed decreases in skeletal fluoride in Herd D and Herd TC.

All fluoride measurements remained below toxic thresholds in the herds examined.

All cattle examined were in good health and body condition.

Appendix H

NSW Energy Savings Scheme – 2012 Annual Report

Appendix H NSW Energy Savings Scheme – 2012 Annual Report

ESS Energy Savings Scheme

IPART New South Wales

ANNUAL REPORT STATEMENT

Annual Report Statement – ESS

This form is to be completed by Accredited Certificate Providers on an annual basis, as per the requirements stipulated in Item 3 of the Schedule to the Accreditation Notice.

Accredited Entity Name:	Hydro Aluminium Kurri Kurri Pty Ltd
Reporting Period:	1 January 2012 to 31 July 2012

A separate Annex (refer page 2) to the Annual Report Statement must be lodged for each Recognised Energy Savings Activity (RESA) which comprises the Accreditation. For example, if you have more than one Schedule to the Accreditation Notice, you will require a separate annexure for each.

Lodgement of Annual Report Statement

Completed forms must be marked 'confidential' and lodged at the following address:

Scheme Administrator
NSW Energy Savings Scheme
Independent Pricing and Regulatory Tribunal
PO Box Q290
QVB Post Office NSW 1230

Or delivered to:
Level 8
1 Market Street
SYDNEY NSW 2000

The Scheme Administrator can be contacted by:

Phone on (02) 9290 8452
Email on ess@ipart.nsw.gov.au

Reporting Requirements for Accredited Certificate Providers (ACPs)

Where stated as a condition of accreditation in the Accreditation Notice, an ACP must provide to the Scheme Administrator an annual written report by no later than the end of the Quarter stipulated in the Accreditation Notice, confirming:

1. that the Accredited RESA is still fully operating in the manner indicated in the ACP's Application for accreditation;
2. that the characteristics and details of the Accredited RESA are not materially different from the characteristics and details identified in the ACP's Application for accreditation; and
3. the number of ESCs created in respect of the Accredited RESA that occurred in the previous calendar year and current calendar year (to date) with supporting calculations.

In addition, the Act, Regulations, Rule, and Accreditation Notice contain further provisions in relation to providing information to the Scheme Administrator, to assist it in monitoring the compliance of an ACP with the Scheme.

To assist ACPs in preparing their annual written report, the Scheme Administrator has developed this Annual Report Statement. ACPs are to submit their annual written report on this form.

Reporting Period for Accredited Certificate Providers

The first Annual Report Statement must cover the period from the Entitlement Date (in Item 2(d) of the Schedule to the Accreditation Notice) to the end of the period identified in Item 3 (b) of the Schedule to the Accreditation Notice (inclusive).

In subsequent years, the Annual Report Statement must then cover the next 12 month period following on from the last reporting period, for all Accredited RESA related information.

Please contact the Scheme Administrator if you are uncertain about the reporting period for your first, or subsequent, Annual Report Statements.

Annexes to be completed

Each accredited RESA that comprises the accreditation must have its own separate Annex completed. For example, if an ACP is accredited in respect of two RESAs, it must complete Annex 1 in respect of its first RESA (refer Schedule 1 of the Accreditation Notice) and Annex 2 in respect of the second RESA (refer Schedule 2 of the Accreditation Notice). The Annual Report Statement makes allowance for up to 6 Annexes (or RESAs).

Please delete any Annexes that are not required for the purposes of your Annual Report Statement.

Declaration

I, Richard Brown, as an authorised representative of **Hydro Aluminium Kurri Kurri Pty Ltd,** submit this Annual Report Statement on behalf of the aforementioned entity or person(s) and do hereby declare that:

- records which demonstrate the accuracy and reliability of the statements made in this form have been retained, and can be provided on request,
- the information contained in this form and accompanying documentation is correct and not misleading by inclusion or omission; and
- I am aware that there are penalties for providing false or misleading information in this Annual Report Statement

Note:

- Section 158 of the *Electricity Supply Act 1995* imposes a maximum penalty of 100 penalty units and/or six (6) months imprisonment for knowingly providing false or misleading information to the Scheme Administrator
- Section 138 of the *Electricity Supply Act 1995* imposes a maximum penalty of 2,000 penalty units for failure to comply with a condition of accreditation and may additionally result in the suspension or cancellation of the Accredited Certificate Provider's accreditation under clause 78P of the *Electricity Supply (General) Regulation 2001*

Please also confirm that:

Yes	☒	**An Annex for each accredited RESA is attached.**
Yes **N/A**	☒ ☐	ESC calculation spreadsheets for the reporting period are attached for each RESA.
Yes	☒	Evidence of the signatory's authority to sign has been attached to the Annual Report Statement.
Yes	☒	Respective estimates of annual ESC creation for each of the next three calendar years have been attached to the Annual Report Statement.

Signed by or on behalf of the Accredited Certificate Provider

Signature:	
Name of signatory:	Richard Brown
Position:	Managing Director
Date:	03 April 2013

Witness

Signature:	
Name of witness:	Eyvind Roneid
Position:	Financial Manager

ANNEX 1

RESA NAME:	Kurri Kurri Smelter Upgrade and Retrofit
RESA Accreditation Number	GHGRooo44C
ESS Rule Calculation Method	metered baseline per unit of output

RESA Identifier(s) – as per Item 1(b) of the Schedule to the Accreditation Notice:	ESCs created for Energy Savings Activity in reporting period (see front page)	ESCs proposed to be created for Energy Savings Activity in reporting period	Total	ESCs created for Energy Savings Activity in subsequent period (to date)	ESCs proposed to be created for Energy Savings Activity in subsequent period	Total
GHGRooo44C/1	97,486	0	97,486	0	0	0

Appendix I

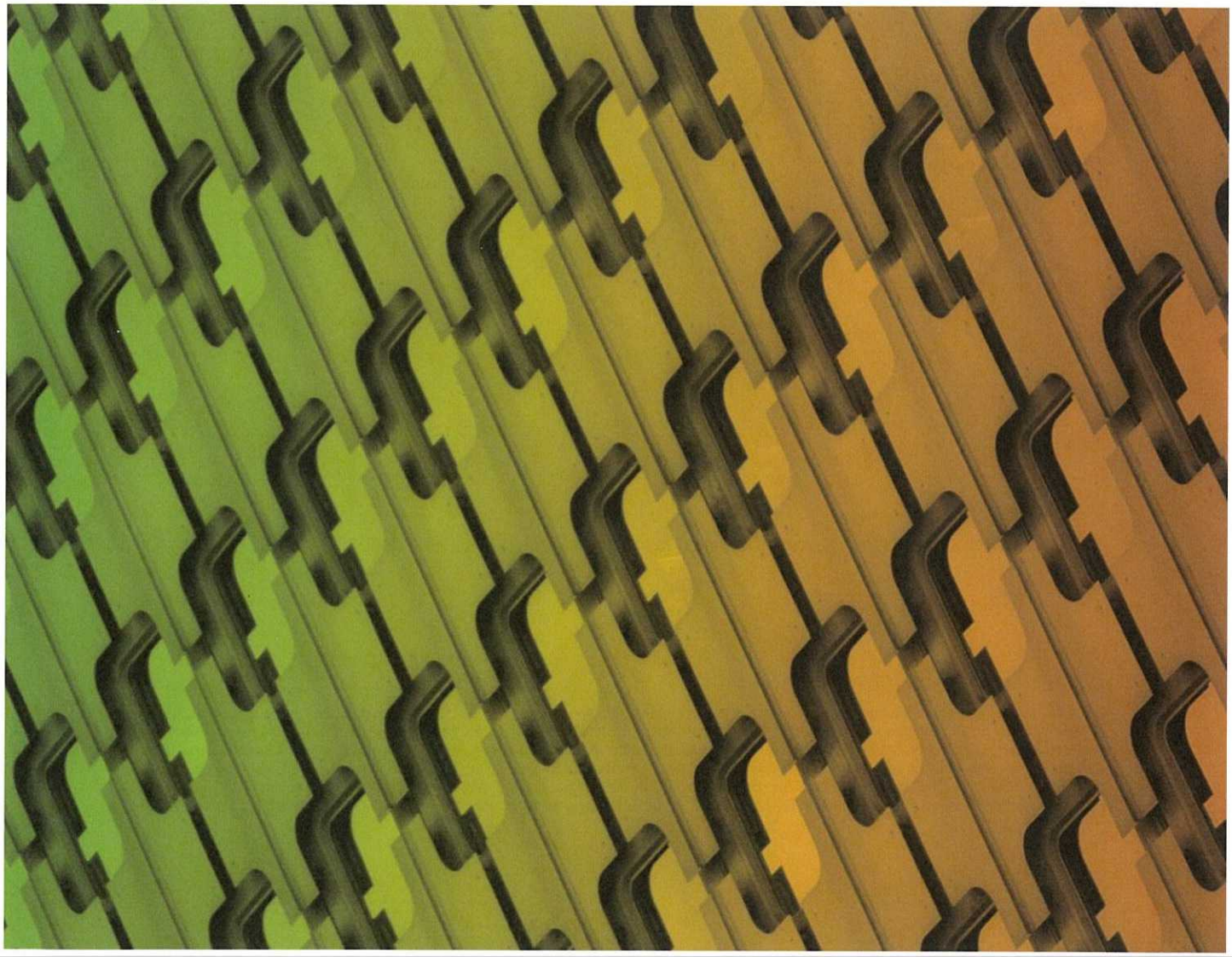
Emission Monitoring Results 2012

Appendix I Emission Monitoring Results 2012

AECOM

Potline Emissions Testing Report 2012

Hydro Aluminium



NATA ACCREDITATION No. 2778 (14391)
Accredited for compliance with ISO/IEC 17025
This document is issued in accordance with NATA's accreditation requirements.
This document may not be reproduced except in full.

Potline Emissions Testing Report 2012

Hydro Aluminium

Prepared for

Hydro Aluminium

Prepared by

AECOM Australia Pty Ltd
17 Warabrook Boulevarde, Warabrook NSW 2304, PO Box 73, Hunter Region MC NSW 2310, Australia
T +61 2 4911 4900 F +61 2 4911 4999 www.aecom.com
ABN 20 093 846 925

30 May 2012

60248375

AECOM in Australia and New Zealand is certified to the latest version of ISO9001 and ISO14001.

© AECOM Australia Pty Ltd (AECOM). All rights reserved.

AECOM has prepared this document for the sole use of the Client and for a specific purpose, each as expressly stated in the document. No other party should rely on this document without the prior written consent of AECOM. AECOM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the Client's description of its requirements and AECOM's experience, having regard to assumptions that AECOM can reasonably be expected to make in accordance with sound professional principles. AECOM may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in its entirety.

Quality Information

Document Potline Emissions Testing Report 2012

Ref 60248375

Date 30 May 2012

Prepared by James Lang

Reviewed by Chad Whitburn NATA Signatory

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
1.0	29-May-21012	Issue to client	Chad Whitburn Principal Professional Scientist	

Table of Contents

1.0 Introduction 1
2.0 Sampling Plane Requirements 2
3.0 Methodology 3
1.0 NATA Accredited Methods 3
4.0 Sampling Location 4
1.1 Sampling Location Summary 4
5.0 Equipment Calibration 5
6.0 Results 6

Appendix A
Field Sheets A

Appendix B
Laboratory Analytical Reports B

Appendix C
Raw and Calculated Gaseous Data C

List of Tables

Table 1 Criteria for Selection of Sampling Planes (AS 4323.1-1995) 2
Table 2 AECOM NATA Endorsed Methods 3
Table 3 Sampling Location Summary- Potline Stacks April 2012 4
Table 4 Emission Testing Summary, April 2012 6
Table 5 Line 2 North Total Particulate Results 3 April 2012. 7
Table 6 Line 2 South Total Particulate Results 2 April 2012. 8
Table 7 Line 3 North Total Particulate Results 3 April 2012 9
Table 8 Line 3 South Total Particulate Results, 3 April 2012. 10

1.0 Introduction

AECOM was appointed by Hydro Aluminium to conduct a series of measurements to determine air emissions from the North and South Potline Stacks at the Loxford Plant, NSW.

Measurements were required for evaluation of the stacks during normal operations. Measurements were performed for compliance with NSW Environment Protection Licence requirements (EPL No. 1548).

Testing was conducted on the 2 and 3 April 2012 to investigate emission concentrations for the following parameters:

- Total Particulate;
- Total Oxides of Nitrogen (NOx);
- Carbon Monoxide (CO); and
- Sulfur Dioxide (SO_2).

Laboratory analysis was conducted by the following laboratory, which holds NATA accreditation for the specified tests:

- Steel River Testing, laboratory NATA accreditation number 18079, performed the following analysis detailed in report numbered 2796-P and 2796-M
  - Total Particulate; and
  - Moisture.

2.0 Sampling Plane Requirements

The criteria for sampling planes are specified in AS 4323.1-1995.

Table 1 Criteria for Selection of Sampling Planes (AS 4323.1-1995)

Type of flow disturbance	Minimum distance upstream from disturbance, diameters (D)	Minimum distance downstream from disturbance, diameters (D)
Bend, connection, junction, direction change	*>2D*	*>6D*
Louvre, butterfly damper (partially closed or closed)	*>3D*	*>6D*
Axial fan	*>3D*	*>8D (see Note)*
Centrifugal fan	*>3D*	*>6D*

NOTE: The plane should be selected as far as practicable from a fan. Flow straighteners may be required to ensure the position chosen meets the check criteria listed in Items (a) to (f) below.

a. *The gas flow is basically in the same direction at all points along each sampling traverse.*

b. *The gas velocity at all sampling points is greater than 3 m/s.*

c. *The gas flow profile at the sampling plane shall be steady, evenly distributed and not have a cyclonic component which exceeds an angle of 15° to the duct axis, when measured near the periphery of a circular sampling plane.*

d. *The temperature difference between adjacent points of the survey along each sampling traverse is less than 10% of the absolute temperature, and the temperature at any point differs by less than 10% from the mean.*

e. *The ratio of the highest to lowest pitot pressure difference shall not exceed 9:1 and the ratio of highest to lowest gas velocities shall not exceed 3:1. For isokinetic testing with the use of impingers, the gas velocity ratio across the sampling plane should not exceed 1.6:1.*

f. *The gas temperature at the sampling plane should preferably be above the dewpoint.*

All sample plane locations do not satisfy the requirements of *AS 4323.1 – 1995* with regard to the distance from upstream and downstream disturbances and the number of sampling ports. Due to the location of all of the sampling planes, only one access port was available and as such sampling was not performed to *AS 4323.1 – 1995*. To compensate for this, additional sampling points were added in accordance with AS4323.1 Section 4.2 and the sampling time at each location was doubled.

3.0 Methodology

1.0 NATA Accredited Methods

The following methods are accredited with the National Association of Testing Authorities (NATA) (accreditation number 2778 (14391)) and are approved for the sampling and analysis of gases. Specific details of the methods are available on request.

All sampling and analysis is conducted according to the methods in **Table 2**.

Table 2 AECOM NATA Endorsed Methods

NSW DECC Approved Methods	USEPA Methods	Method Title
AS4323.1 (NSW OEH TM-1)	USEPA (2000) Method 1	Selection of sampling positions
AS4323.2 (NSW OEH TM-15)	USEPA (2000) Method 5 under approved circumstances	Determination of total particulate matter – isokinetic manual sampling – gravimetric method
NSW OEH TM-2	USEPA (2000) Method 2 or 2C or USEPA (1999) Method 2F or 2G or 2H (as appropriate)	Determination of stack gas velocity and volumetric flow rate (type s pitot tube)
NSW OEH TM-22	USEPA (2000) Method 4	Determination of moisture content in stack gases
NSW OEH TM-23	USEPA (2000) Method 3	Gas analysis for the determination of dry molecular weight
NSW OEH TM-4	USEPA Method 6C	Sulfur Dioxide (SO_2) by analyser.
NSW OEH TM-32	USEPA (1996) Method 10	Carbon Monoxide (CO) by analyser
NSW OEH TM-11	USEPA (2000) 7E	Nitrogen dioxide (NO_2) or nitric oxide (NO) by analyser.

All parameters are reported adjusted to 0°C at 1 atmosphere and dry gas.

4.0 Sampling Location

1.1 Sampling Location Summary

Table 3 provides a summary of the locations sampled by AECOM at the Hydro Aluminium Plant at Loxford during April 2012.

Table 3 Sampling Location Summary- Potline Stacks April 2012

Discharge Description	Line 2 North Stack	Line 2 South Stack	Line 3 North Stack	Line 3 South Stack
Duct Shape	Circular	Circular	Circular	Circular
Construction Material	Steel	Steel	Steel	Steel
Stack Dimensions (mm)	2900	2900	2900	2900
Minimum No. Sampling Points	24	24	24	24
Sampling Ports[1]	1	1	1	1
Min. Points/Traverse	12	12	12	12
Disturbance	Yes	Yes	Yes	Yes
Distance from Upstream Disturbance	2.8D	2.8D	2.8D	2.8D
Type of Disturbance	Junction	Junction	Junction	Junction
Distance from Downstream Disturbance	0.7D	0.7D	0.7D	0.7D
Type of Disturbance	Bend	Bend	Bend	Bend
Ideal Sampling Location	No	No	No	No
Correction Factors Applied	Yes	Yes	Yes	Yes
Total No. Points Sampled	16	16	16	16
Points/Traverse	16	16	16	16
Sampling Performed to Standard[2]	No[2]	No[2]	No[2]	No[2]

[1]Although each stack has 2 sampling ports, only one is accessible to perform the sampling.

[2]AS 4323.1 (1995) Section 4.2, with regards to up and downstream disturbances and the number of sampling ports.

5.0 Equipment Calibration

AECOM has a calibration schedule to ensure the emission testing equipment is maintained in good order and with known calibration. Equipment used in this project was calibrated according to the procedures and frequency identified in the AECOM calibration schedule. Details of the schedule and the calibration calculations are available on request.

6.0 Results

A summary of the Total Particulate and gaseous emission results for the stack emissions testing performed during April 2012 is provided in **Table 4**. **Tables 5 – 8** provide more comprehensive results for the emissions testing performed. Emission concentrations are converted to standard conditions of 0°C, dry gas and 1 atmosphere pressure for comparison with appropriate regulatory limits.

A full summary of oxides of nitrogen, carbon monoxide and sulphur dioxide monitoring results has been provided in **Table 4**. Raw and calculated data relating to these parameters are provided in **Appendix C**. Concentrations are presented at conditions of 0°C, dry gas and 1 atmosphere.

Field notes and calculations are attached as **Appendix A.** Laboratory analysis results may be referred to in **Appendix B**.

Table 4 Emission Testing Summary, April 2012

Parameter	Line 2 North	Line 2 South	Line 3 North	Line 3 South	Regulatory Limit (mg/m^3)
Total Particulate (mg/m^3)	0.69	0.43	0.35	0.25	100
Equivalent Nitrogen Dioxide (NO_2) (mg/m^3)	3	4	1	1	NA
Carbon Monoxide (CO) (mg/m^3)	358	434	415	401	NA
Sulfur Dioxide (SO_2) (mg/m^3)	176	162	170	161	NA

Table 5 Line 2 North Total Particulate Results 3 April 2012.

Sampling Conditions:				
Stack internal diameter at test location	2900	mm		
Stack gas temperature (average)	85.0	°C	358.2	K
Stack pressure (average)	1008	hPa		
Stack gas velocity (average, stack conditions)	21	m/s		
Stack gas flowrate (stack conditions)	140	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	100	m^3/s		
Total Particulate Testing				
Test Period	10:38	-	13:18	
Total Particulate Mass	1.5	mg		
Gas Volume Sampled	2.18	m^3		
Total Particulate Emission*1	0.69	mg/m^3		
Total Particulate Mass Emission Rate*2	71	mg/s		
Regulatory Limit	100	mg/m^3		
Moisture Content (%)	**1.2**			
Gas Density (dry at 1 atmosphere)	**1.29**	**kg/m^3**		
Dry Molecular Weight	**28.8**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 1 atm, dry gas

*2 Mass emission rate determined from pre and post test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Table 6 Line 2 South Total Particulate Results 2 April 2012.

Sampling Conditions:				
Stack internal diameter at test location	2900	mm		
Stack gas temperature (average)	86.5	°C	359.7	K
Stack pressure (average)	1009	hPa		
Stack gas velocity (average, stack conditions)	19	m/s		
Stack gas flowrate (stack conditions)	120	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	92	m^3/s		
Total Particulate Testing				
Test Period	13:00	-	15:42	
Total Particulate Mass	0.8	mg		
Gas Volume Sampled	1.85	m^3		
Total Particulate Emission*1	0.43	mg/m^3		
Total Particulate Mass Emission Rate*2	40	mg/s		
Regulatory Limit	100	mg/m^3		
Moisture Content (%)	**1.7**			
Gas Density (dry at 1 atmosphere)	**1.29**	**kg/m^3**		
Dry Molecular Weight	**28.8**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 1 atm, dry gas

*2 Mass emission rate determined from pre and post test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Table 7 Line 3 North Total Particulate Results 3 April 2012

Sampling Conditions:			
Stack internal diameter at test location	2900	mm	
Stack gas temperature (average)	93.5	°C	366.7 K
Stack pressure (average)	1011	hPa	
Stack gas velocity (average, stack conditions)	21	m/s	
Stack gas flowrate (stack conditions)	140	m^3/s	
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	100	m^3/s	
Total Particulate Testing			
Test Period	12:03	-	14:43
Total Particulate Mass	0.7	mg	
Gas Volume Sampled	2.03	m^3	
Total Particulate Emission*1	0.35	mg/m^3	
Total Particulate Mass Emission Rate*2	36	mg/s	
Regulatory Limit	100	mg/m^3	
Moisture Content (%)	**1.8**		
Gas Density (dry at 1 atmosphere)	**1.29**	**kg/m^3**	
Dry Molecular Weight	**28.8**	**g/g-mole**	

Notes *1 Emission concentration at Standard conditions of 0^0C, 1 atm, dry gas

*2 Mass emission rate determined from pre and post test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test.

Table 8 Line 3 South Total Particulate Results, 3 April 2012.

Sampling Conditions:				
Stack internal diameter at test location	2900	mm		
Stack gas temperature (average)	92.0	°C	365.2	K
Stack pressure (average)	1011	hPa		
Stack gas velocity (average, stack conditions)	19	m/s		
Stack gas flowrate (stack conditions)	130	m^3/s		
Stack gas flowrate (0^0C, dry gas, 1 atm pressure)	94	m^3/s		
Total Particulate Testing				
Test Period	14:06	-	16:46	
Total Particulate Mass	0.5	mg		
Gas Volume Sampled	1.97	m^3		
Total Particulate Emission*1	0.25	mg/m^3		
Total Particulate Mass Emission Rate*2	24	mg/s		
Regulatory Limit	100	mg/m^3		
Moisture Content (%)	**1.6**			
Gas Density (dry at 1 atmosphere)	**1.29**	**kg/m^3**		
Dry Molecular Weight	**28.8**	**g/g-mole**		

Notes *1 Emission concentration at Standard conditions of 0^0C, 1 atm, dry gas

*2 Mass emission rate determined from pre and post test sampling flow measurements and the respective test moisture content. See Q_{std} in field sheets and final calculations "Stack Analysis - Final Calculations" for each test