APPENDIX N2

DUST DEPOSITION LIMIT DETERMINATION

ANGAS PROCESSING FACILITY

MISCELLANEOUS PURPOSES LICENSE APPLICATION 2019/0826

ABN | 67 062 576 238
Unit 7 / 202-208 Glen Osmond Road | Fullarton SA 5063

Terramin Angas Zinc Mine

Terramin Australia Ltd
14 September 2012

Dust Deposition Limit Determination

PEPR Compliance Report

Dust Deposition Limit Determination

PEPR Compliance Report

Prepared for

Terramin Australia Ltd

Prepared by

AECOM Australia Pty Ltd
Level 9, 8 Exhibition Street, Melbourne VIC 3000, Australia
T +61 3 9653 1234 F +61 3 9654 7117 www.aecom.com
ABN 20 093 846 925

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

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Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	03-Sep-2012	Internal first draft	David Rollings Principal Engineer	
B	07-Sep-2012	Issue for Comments	David Rollings Principal Engineer	
C	13-Sep-2012	Final issue following Terramin comments	David Rollings Principal Engineer	

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1.0 Introduction and Background

AECOM Australia Pty Ltd (AECOM) has been commissioned by Terramin Australia Ltd to establish dust deposition gauge limits for the existing monitoring at its Terramin Angas Zinc Mine, located in Strathalbyn, South Australia.

The operating mine currently has limits set as part of its program for environment protection and rehabilitation (PEPR) under the amendments to the Mining Act 2011. These limits however, which are taken from a third-party dispersion modelling predictions in 2006, do not take into account background dust deposition rates and were created prior to site operation. It was therefore considered necessary to update the deposition compliance limits to take account of both of these factors, during both existing operational stage and also post-closure.

The report reviews the current regulatory system relevant to dust deposition, the existing dust deposition monitoring conducted at the site and the meteorological conditions in the area. It then outlines the recommended, more applicable PEPR dust deposition gauge limits to be applied at the site. In addition, recommendations of changes to the existing dust gauge monitoring network have also been discussed to improve representative data capture, where applicable.

2.0 Scope and Study Approach

The establishment of the dust deposition criteria was undertaken using the approach outlined below: -

- A literature review of current national and international dust deposition limits was undertaken to establish if there is a current best practice or preferred dust limit methodology in place;
- The dust deposition monitoring data for the site was analysed and reviewed in terms of dust levels pre-mining and during typical operation, taking into account the average meteorological conditions in the area and the location of the monitoring gauges; and,
- Recommended dust deposition limits were then devised based on the study reviews, with a justification for the limits clearly stated.

3.0 Policy Literature Review

The monitoring of the deposition of dust in Australia is conducted primarily to protect against amenity nuisance impacts. Due to the passive, gravimetric nature of the monitoring, it does not give an indication as to the level of fine particulate matter (less than 10 microns and less than 2.5 microns) present in the air and so cannot be used to assess potential health impacts, which is what national air quality legislation is focussed on.

As such, there is no national legislation/policy stating deposition limits to be adhered to, for example in the National Environmental Protection Measure (NEPM) Ambient Air Quality Standards and Goals.

The monitoring of dust deposition in many cases, using deposition gauges, however is imposed as part of operating site licence conditions and strict Australian standards exist regarding dust monitoring strategies, sampling methodologies and analysis protocol. This method is set out in AS/NZS 3580, 2003[1].

In Australia, the most commonly referred to 'best practice' document for dust deposition for impacts to amenity, generally applied in New South Wales (NSW) and Victoria, set guidelines of a total (insoluble) deposition of 4 g/m^2/month, with a maximum increase of 2 g/m^2/month (insoluble solids) at all sensitive locations. A total dust deposition rate of 4 g/m^2/month is considered to equate to a visible layer of dust on outdoor furniture or on a clean car (the averaging period of a month is classified as a 30-day period).

Criteria for the assessment of dust in ambient air are prescribed in the NSW EPA published guidance document[2] . The assessment criteria are provided in **Table 1**.

Table 1: Deposited Dust Best Practice Criteria in Australia

Pollutant	Averaging Period	Maximum Concentration	Source
		g/m^2/month	
Deposited Dust	Annual	4.0	NERDDC (1998)

In New Zealand, there are also no formal environmental standards for deposited dust, but the Ministry for the Environment (MfE) recommends[3] 'trigger' levels of not more than 4 g/m^2/month, however this is for levels above the existing background dust level.

Commonly referred to international deposition rate guidelines level from both Germany and the UK are also detailed in **Table 2**. The data in this table, together with the deposition trigger level in New Zealand, demonstrates that the Australian application of 4g/m^2/month is a conservative guideline value.

Table 2: Examples of Deposited Dust Best Practice Criteria in Europe

German 'TA Luft' Technical Guidance	British Standard Gauge		Dry 'Frisbee' gauge equivalent	
	Complaints possible - 90th percentile	Complaints likely - 95th percentile	Complaints possible - 90th percentile	Complaints likely - 95th percentile
350 mg/m^2/day *(10.5 g/m^2/month)*	150 mg/m^2/day *(4.5 g/m^2/month)*	190 mg/m^2/day *(5.7 g/m^2/month)*	200 mg/m^2/day *(6.0 g/m^2/month)*	260 mg/m^2/day *(7.8 g/m^2/month)*

[1] AS/NZS 3580, 2003. *Australia/New Zealand Standard: Methods for sampling and analysis of ambient air: Method 10.1: Determination of particulate matter – deposited matter – gravimetric method*, 2003
[2] DEC, 2005. *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*. Department of Environment and Conservation, New South Wales, 2005.
[3] MfE, 2001. *Good practice guide for assessing and managing the environmental effects of dust emissions*. Ministry for the Environment, 2001.

4.0 Existing Meteorological Conditions

The Bureau of Meteorology (BoM) records long-term meteorological data at a number of automatic weather stations across the country. The BoM station closest to the Terramin Angas Zinc Mine site is located at Strathalbyn, however this site is not fully operational, with much of its data last recorded in 2001. The BoM Strathalbyn Racecourse site therefore (latitude 35.28°S, longitude 138.89°E), which lies approximately 3.5 km south west of the mine site, is considered to be the closest fully operational meteorological station. Data recorded at the Racecourse site (BoM site 023747) between 1996 and 2012 are summarised in **Table 3.**

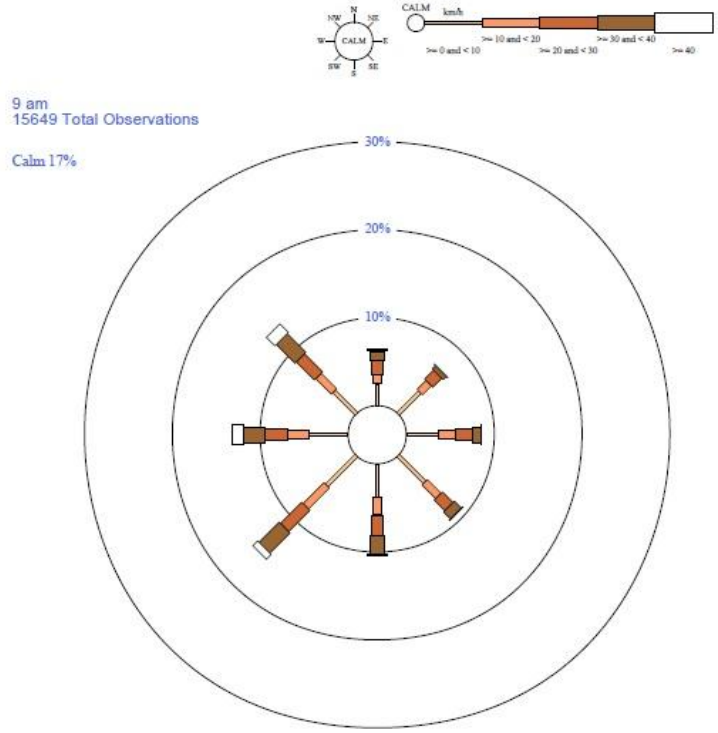
The recorded data, detailed in **Table 3** below, indicates that rainfall within the Strathalbyn and surrounding areas occur predominantly between May to September, with the highest average occurring during August. Summers are warm and dry; winters are mild. The average monthly maximum and minimum temperatures during summer months (December-February) are 27.9^{o}C and 14.6^{o}C, respectively and during winter months (June-August); 15.0^{o}C and 6.4^{o}C. On average, the wettest month is August with an average rainfall of 52.5 mm.

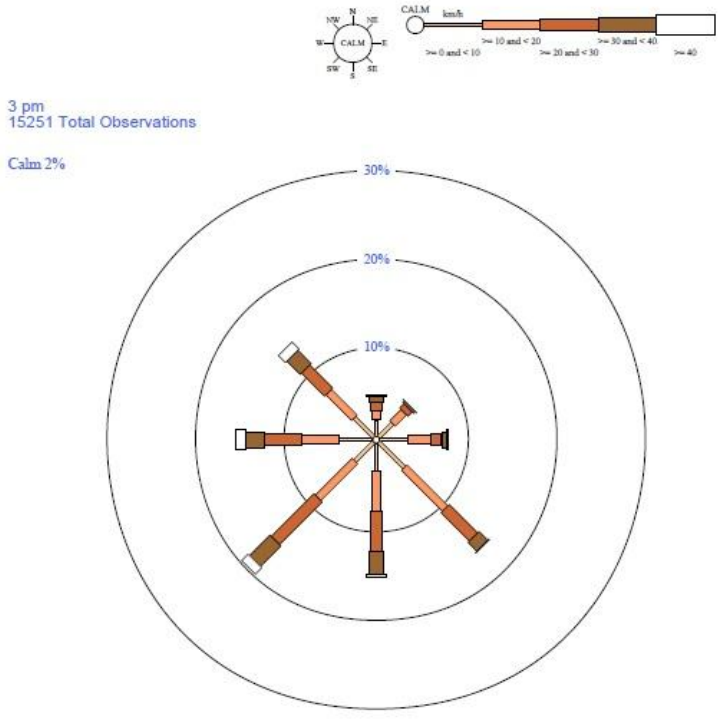
Table 3: BoM Climatic Averages – Strathalbyn Racecourse (1996 – 2012)

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Average temperature (°C)													
Maximum	27.9	27.5	25.0	22.4	18.5	15.8	15.0	16.3	18.6	21.1	24.5	25.9	21.5
Minimum	14.6	14.5	12.5	10.3	9.0	7.4	6.4	6.5	7.7	8.7	11.3	12.8	10.1
Rainfall													
Average rainfall (mm)	15.0	21.6	21.1	26.4	42.5	51.2	47.5	52.5	49.2	37.2	27.2	22.0	415.0
Decile 5 (median) rainfall (mm)	13.1	11.5	13.9	24.0	45.6	46.4	45.4	51.7	46.3	35.3	27.3	21.4	420.4
Mean number of days of rain ≥ 1 mm	2.2	2.5	3.9	4.6	7.1	8.9	9.1	10.6	8.3	6.0	4.7	3.8	71.7
Average 9 am conditions													
Temperature (°C)	20.4	19.7	17.7	16.5	13.8	11.3	10.5	11.8	14.1	16.1	17.6	19.1	15.7
Relative humidity (%)	58	62	65	65	73	78	78	73	67	59	58	56	66
Wind speed (km/h)	16.6	14.7	12.9	13.2	12.8	13.5	14.5	16.3	19.0	19.4	16.7	17.7	15.6
Average 3 pm conditions													
Temperature (°C)	25.8	25.5	23.5	20.7	17.3	14.6	13.8	14.9	16.9	19.2	22.5	23.8	19.9
Relative humidity (%)	41	43	44	47	57	63	64	58	57	48	42	41	50
Wind speed (km/h)	23.9	23.7	21.9	20.0	18.4	18.8	19.9	21.8	22.1	23.1	23.8	24.1	21.8
red = highest value blue = lowest value													

The long term average wind roses for the BoM site at the Strathalbyn Racecourse station are provided in **Figure 1**. The wind roses show the frequency of occurrence of winds by direction and strength. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Overall, the wind roses indicate that whilst there is a slight diurnal pattern in the wind directions illustrated by the small frequency of inland winds (from the north east and east) in the morning shifting to stronger sea breezes (from the south west) in the afternoon, the predominant wind direction throughout the day is from the south west.

Figure 1: 9am and 3pm Long term Wind Roses – Strathalbyn Racecourse (1996 – 2012)





5.0 Monitoring Data Analysis

5.1 Overview

The mine site currently operates 12 dust deposition gauges at both on and off-site locations and each gauge location has an individually set PEPR dust deposition limit which the mine has been assessing its performance against. The existing PEPR limits were however set based on predicted modelling concentrations, carried out by a third party, prior to mining activities at the site in 2006[4]. These limits also take into account estimated emissions during operation only and do not factor in background dust levels.

As a result, each month the mine appears to exceed their 'compliance limits' and therefore updated, more applicable compliance limits were required to be determined.

5.2 Dust monitoring results

5.2.1 Dust monitoring prior to site operation

Details of the dust monitoring study that was conducted prior to mine opening and operation were provided by Terramin Australia Ltd, to give an indication as to the baseline conditions at the site.

The pre-mining dust monitoring was conducted for a period of four months from January - May 2006 at ten sites. Overall, across all monitoring sites distributed in the vicinity of the proposed mine, the monthly mean deposition values were around 3 g/m^2/month (insoluble solids).

Taking three of the sites in isolation, which would be considered as 'background sites' due to their locations away from any obvious dust-causing activities at the time, the four month average deposition level (insoluble solids) would be around 1.6 g/m^2/month[5]. Only the summary report however was available for analysis and therefore it has not been possible to further review this data conducted during this initial monitoring study.

5.2.2 Dust monitoring during site operation

Dust deposition monitoring data conducted at the site between September 2007 – July 2012 were collated and provided for analysis for each gauge location.

It was noted that the monthly dust levels at the mine were being incorrectly reported for total solids, rather than total insoluble solids, as per AS 3580.10.1-1991. The results discussion is therefore based on the analysis of the insoluble solids data and preparing a compliance limit based on this data analysis.

It too was noted that many of the dust gauges, simply due to their siting, would not be considered representative of the impact from the mine, as they would likely be heavily influenced by external, non-mining related factors. This was also observed through analysis of the percentage of organic matter (assumed to be non-mining related) within each of the monthly gauge readings. Many of the monitoring locations also routinely record greater deposition levels than monitoring gauges located in closer proximity (so more representative) to the mine.

Full details of the monitoring data for each site are provided in **Appendix A**, with discussion provided below. The existing dust deposition gauge locations, together with the currently used PEPR compliance limits (taken from the 2006 modelling study) are also illustrated in **Figure 2**.

[4] Terramin Australia Ltd, 2006. Dust Modelling Impact Study, Angas Zine Mine: Strathalbyn, Tonkin Consulting, February 2006.
[5] Terramin Australia Ltd, 2006. Dust Baseline Study, Strathalbyn Mine, Tonkin Consulting, June 2006.

Figure 2: Air quality monitoring sites and existing PEPR compliance limits (g/m^2/month)

(Image provided by Terramin Australia Ltd – editing by AECOM)

Following the literature review detailed in **Section 3.0,** after analysing the total insoluble data (detailed in **Appendix A**) and applying the Australian best practice guideline deposition value of 4 g/m^2/month to all gauge results, with the exception of locations 11 and 12, over the past 18 months only a handful of exceedences have occurred at a small number of gauges.

In order to further understand the potential effects of the mine on the surrounding environment, the analysis is focussed on the percentage of mineral content (soil dust) within each monthly gauge reading. Due to the nature of the site operations, one would expect to see the samples from monitoring gauges directly affected by the mine operations to comprise predominantly minerals / ash (i.e. coal dust) and to have low organic content (i.e. matter resulting from flora or fauna). Whilst simply analysing the percentage mineral content in isolation does not identify the source of the dust each month (other sources may be unsealed roads, agricultural activities, dust storms etc.), such analysis does provide a useful indication as to whether the dust levels have the potential to be a result of site activities. For example, if a deposition gauge collected 6 g/m^2/month of dust during one particular month (which exceeds the recommended PEPR criterion of 4 g/m^2/month), and laboratory analysis showed that the dust

comprised more than 50% organic material, the gauge would likely have collected dust from sources other than the mining activities.

A gauge by gauge summary analysis is provided below, with the complete data set detailed in **Appendix A - Table 4**. Exceedences are highlighted in **red bold underline.** To help give a further level of detail, the percentage ash content for each monthly record is provided in **Table 5**. Records which contain less than or equal to 50% ash content are also highlighted in **red bold underline**, as the high organic content in these samples suggests that the results reflect external, non-mining related activities. This is provided as a way to help identify the potential sources for the readings.

- Monitoring Gauge 1 – Due to the gauge's siting away from the mine, the gauge not being located immediately down-wind of the mine and there being no major dust causing activities identified in the vicinity, this location is considered to be a background location. No deposition levels recorded in excess of the guideline value since December 2008.
- Monitoring Gauge 2 – Only two exceedences have occurred at this off-site down-wind location in the past two years, down-wind location, however the gauge is situated in an olive grove area which sees lots of dusty non-mining related activity, together with there being a waste collection unit located nearby. The deposition levels at this gauge are also regularly higher than those recorded at the on-site monitoring gauge directly upwind (site 5), in a key activity area. One of these two exceedences also contained <50% ash (mineral content), which suggests that the exceedence was due to non-mining related, organic material, resulting from its location.
- Monitoring Gauge 3 – Due to gauge's location up-wind of the mine boundary, adjacent to residential properties and away from identified dust causing activities, this location is also considered to be a background location. One exceedence of 10.5 g/m^2/month in the past 18 months was recorded in January 2011, however analysis of the ash content (17%) suggests this was not related to mining activities.
- Monitoring Gauge 4 – Located within the mine boundary at the main site entrance. The last exceedence was recorded in June 2010 (4.8 g/m^2/month) and again, analysis of the ash content (21%) suggests this was not related to mining activities.
- Monitoring Gauge 5 – Located within the mine boundary up-wind of the primary jaw crusher and ore stockpile. The last exceedence was also recorded in June 2010 (4.2 g/m^2/month) and analysis of the ash content (12%) suggests this was not related to mining activities.
- Monitoring Gauge 6 – One exceedence of 6 g/m^2/month was recorded in the last 18 months in June 2012 at the on-site western location, adjacent to existing properties. The mineral content was 82% which does suggest that this may have been mining-related nuisance. However, there does appear to be evidence of vehicle movements in the area, with the storage of pallecon-type containers on an un-paved area around the dust gauge.
- Monitoring Gauge 7 – Located on the eastern mine boundary adjacent to the concentrate sheds and tailings dam. One exceedence in the last two and half years occurred in February 2012 with a deposition level of 4.7 g/m^2/month. The mineral content was 83% which does suggest that this may have been mining-related.
- Monitoring Gauge 8 – Located within the site in a material storage area, however no exceedences have occurred over the past two years.
- Monitoring Gauge 9 – Over the past two years, one exceedence of 5.4 g/m^2/month occurred in February 2012 at the southern site boundary location. The analysed mineral content was 72% however which does suggest that this may have been mining-related nuisance.
- Monitoring Gauge 10 – Due to the gauge's remote location (furthest away from the mine boundary), coupled with it not being located down-wind of potentially dusty agricultural or commercial/industrial areas, this site is also considered to be a representative background location. It is located on an un-paved driveway, which is not ideal, however there was only one exceedence over the past 18 months recorded in March 2011, with 4.8 g/m^2/month and the ash content was 52%, which suggests that a large proportion of this deposition was organic material.
- Monitoring Gauge 11 – Over the past 18 months, the average ash (mineral content) has been 52%, which suggests that, in addition to the site being located outside and up-wind to the west of the mine

boundary, the exceeding deposition levels at this property location are in part largely considered to be due to non-mining related activities, as they contain high levels of organic material. In June 2012, a deposition level of 13.2 g/m^2/month was recorded, with high ash content. Gauge 6 (detailed above), located in-line with Gauge 11 but within the site, also exceeded this same month, however the deposition level on site was less than half that experienced at Gauge 11. In addition, no other exceedences at Gauge 6 (within the mine boundary) were experienced, which one would expect to occur should the deposition levels have been as a result of mine-related activities.

- Monitoring Gauge 12 – The gauge is located in an agricultural field and routinely experiences levels well above 4 g/m^2/month. The ash content is also predominantly over 50%, which indicates that the dust is not organic and may be related to mining activities. However, due to its location north west of the mine and upon examination of the site, it is considered highly unlikely that the regular exceedences at this location would be due to site mining activities; rather due to harvesting (hay bale) activities on the land, together with general field access. Should mining related, dust causing activities be carried out around the effluent pond to the north, one would expect that dust deposition would naturally occur at the Gauge 1 location, immediately downwind. However, deposition levels at this gauge location have been below 4 g/m^2/month since December 2008.

It should also be noted that the background monitoring gauges (1, 3 and 10) over the complete five year duration of the monitoring period at the mine show an average deposition level of 1.6 g/m^2/month. This average deposition level is coincidently the same as the approximate background deposition level recorded during pre-mining activities, detailed previously.

6.0 Study Recommendations

6.1 Dust deposition gauge limits during mine operation

Following the policy literature review of relevant and appropriate dust deposition guideline values both nationally and internationally, together with analysis of the dust deposition monitoring data conducted over the past five years, it is recommended that the Australian best practice deposition level of 4 g/m^2/month be applied at all gauge locations, for the purposes of the PEPR compliance reporting. The use of a single deposition level, rather than site specific levels (as previously utilised), is considered appropriate as it also allows all gauge locations to be compared against each other equally, as the 4 g/m^2/month level is to determine the potential nuisance impacts for amenity purposes. The Australian best practice level is also considered to be conservative, when compared to deposition levels in New Zealand and countries in Europe.

The complete monitoring data from the mine demonstrates that for the majority of locations (in areas that clearly represent direct impacts from the mine and related activities), deposition levels meet this national criteria. Overall therefore, it can be concluded that impacts from the mine are not expected to result in adverse amenity impacts.

6.2 Dust deposition gauge limits following mine closure

Following mine closure, it is recommended that the deposition level of 4 g/m^2/month remain in place for all deposition gauges, for a period of 12 months post-closure.

Whilst it is acknowledged that existing monitoring and also monitoring conducted prior to mine operation, shows that baseline dust deposition levels are around 1.6 g/m^2/month, this level will naturally fluctuate on the monthly basis through no fault of Terramin Australia Ltd. As a result, it is considered that the best practice agreed value of 4 g/m^2/month is the most appropriate value to not only further protect amenity in the area, but also protect Terramin Australia Ltd from potentially unfounded criticism.

6.3 Location of dust deposition gauges

The analysis of the dust deposition monitoring locations and the data has highlighted that a number of the monitoring gauges would be more effective at monitoring the effects of amenity impacts from the mine, if they were to be sited in other locations. This is because they are currently being influenced by external non-mining related activities.

The Australian Standard (referenced earlier) provides clear details on how and where dust gauges should be located, to ensure that monitoring activities are undertaken in consistent and correct ways and when monitoring a specific entity, it provides guidelines so as to avoid the influences of external factors in the results.

The primary consideration in terms of locating dust gauges is to understand the surrounding land uses and take this into account when placing monitoring equipment. They should not be located in ‘dusty’ locations (except where that dust appears to be as a result of mining activities) i.e. dust gauges should not be located on or near where earth moving or sowing or harvesting is occurring, near landfills, near construction sites (or other mine sites) or near un-paved roads. All of these locations will then end up being difficult to determine whether the recorded dust levels are due to mining activities or are in-fact due to external activities.

In primarily agricultural areas, such as where the Terramin Angas Zinc Mine is located, this can prove problematic due to the natural levels of dust in the air. The most effective way therefore to deal with this, is to locate the deposition gauges in perpendicular transects (of two gauges) at key intervals around the mine site boundary (or main activity areas), in all directions. This will require locating one gauge at each of the closest sensitive receptors, to measure potential amenity impacts, but then (most importantly) locate an additional gauge on the boundary of the dusty activities, in-line with the corresponding gauge at the sensitive receptor (to record the direct levels of dust going off-site). This therefore means that for all wind directions from the centre of the site, it can be determined whether or not the impacts off-site are likely to be attributed to the mine, by simply comparing the deposition levels at the pair of gauges; one at the site boundary and one at the corresponding sensitive receptor.

This placement strategy is already being conducted to a limited degree at the mine, with monitoring gauges 5 and 2 being good examples. This method should be extended however around the site to understand further the off-site impacts and again protect Terramin Australia Ltd from potentially unfounded criticism, both during the current operational phase but also post-mine closure.

7.0 Conclusions

AECOM has been commissioned by Terramin Australia Ltd to establish dust deposition gauge limits for the existing monitoring at its Terramin Angas Zinc Mine, located in Strathalbyn, South Australia.

The report reviews the current regulatory system relevant to dust deposition, the existing dust deposition monitoring conducted at the site and the meteorological conditions in the area.

It is recommended that the Australian best practice dust deposition guideline value of 4 g/m^2/month (originally implement by NSW) should be applied to all dust deposition gauges at the site, in order to protect amenity impacts equally. It is also recommended that these limits should be applied at the site during both the operation and post-closure stages. Post-closure monitoring should be conducted for a period of 12 months in order to confirm that the off-site impacts from the mine, following the end of operations, are negligible.

In addition, it is recommended that changes to the existing dust gauge monitoring network should be undertaken to better understand the direct impact the mine is having on the surrounding environment. This could be done by establishing a series of monitoring transects in all directions from the key mine activities areas, in order to protect Terramin Australia Ltd from unfounded criticism.

Appendix A

Dust Deposition Analytical Results

Appendix A Dust Deposition Analytical Results

Table 4: Dust Deposition Gauge Data – Total Insoluble Matter (g/m^2/month) – All data

	Gauge Number											
Date	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Australian Best Practice Dust Deposition Level - 4 g/m^2/month											
Sep 2007	2.4	2.8	2.0	**4.4**	1.5	**7.0**	-	**8.7**	3.4	1.6	2.4	1.6
Oct 2007	1.4	1.0	0.8	2.4	2.2	2.3	-	3.1	**4.8**	1.5	2.0	2.2
Nov 2007	**4.4**	**4.6**	**4.0**	**5.6**	**7.8**	3.6	-	**4.3**	**5.8**	1.7	2.1	**9.8**
Dec 2007	0.6	1.4	1.6	0.6	**6.2**	2.0	-	2.2	**6.5**	0.5	0.8	**4.2**
Jan 2008	1.6	2.6	**4.4**	3.3	3.2	1.6	-	2.6	3.5	1.3	0.8	2.3
Feb 2008	2.0	3.2	1.6	2.7	3.1	1.7	-	3.9	3.6	0.2	**5.9**	0.9
Mar 2008	1.3	2.2	2.2	2.5	**18.6**	3.8	-	**4.0**	3.2	**4.1**	3.1	**5.4**
Apr 2008	2.7	2.9	3.4	1.4	**7.1**	**8.6**	-	3.7	**6.3**	1.8	1.8	**4.9**
May 2008	1.1	2.1	0.7	1.7	2.7	1.6	0.8	1.2	0.7	0.3	1.0	<0.1
Jun 2008	0.6	1.9	0.6	1.7	1.4	1.5	1.2	1.8	<0.1	1.4	**4.6**	**6.2**
Jul 2008	1.1	1.0	0.2	0.9	1.5	1.0	2.5	**7.1**	2.8	<0.1	**4.2**	1.9
Aug 2008	1.8	1.2	0.7	0.9	0.9	0.9	2.3	2.4	1.0	0.2	0.7	3.0
Sep 2008	1.8	2.7	0.3	2.0	1.0	1.9	1.6	1.2	0.4	0.9	1.9	2.1
Oct 2008	0.7	0.5	-	0.9	0.8	0.5	1.3	0.7	0.2	0.3	3.4	1.3
Nov 2008	**11.0**	2.3	0.5	1.1	2.0	2.5	2.7	3.3	3.0	2.2	1.6	**20.6**
Dec 2008	**4.8**	**6.0**	**4.1**	3.8	3.4	2.6	**4.1**	3.3	1.4	**10.5**	**15.2**	1.6
Jan 2009	1.4	2.8	0.6	1.2	1.7	**4.3**	3.1	2.7	2.3	2.0	**7.7**	2.3
Feb 2009	2.5	3.6	1.0	1.1	0.7	2.0	1.8	2.2	2.8	2.0	2.9	**4.2**

Note - Exceedences of the recommended deposition criteria are highlighted in **red bold underline**

	Gauge Number											
Date	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Australian Best Practice Dust Deposition Level - 4 g/m^2/month											
Mar 2009	2.9	3.5	2.8	3.6	**4.5**	3.4	**5.1**	3.7	3.3	2.1	**6.6**	**5.0**
Apr 2009	0.9	1.3	0.5	1.4	2.6	3.7	2.2	1.0	1.2	1.0	1.6	**15.0**
May 2009	<0.1	0.2	0.2	0.9	1.7	1.1	1.4	1.6	0.3	<0.1	0.1	**6.2**
Jun 2009	0.8	0.8	0.8	<0.1	<0.1	0.6	0.4	0.6	0.7	1.2	2.2	**6.7**
Jul 2009	0.2	0.1	0.1	0.2	0.3	3.0	2.6	1.9	0.4	<0.1	1.1	2.1
Aug 2009	<0.1	0.4	0.2	0.7	1.2	0.6	1.6	2.6	1.0	0.2	2.6	3.2
Sep 2009	0.2	0.2	0.2	0.8	1.4	**31.7**	**15.2**	**8.5**	2.0	1.8	1.0	1.4
Oct 2009	0.9	1.4	0.6	2.0	1.7	**17.4**	1.8	1.1	2.1	-	1.1	0.6
Nov 2009	0.8	0.7	0.9	0.9	0.9	0.7	1.0	2.0	0.7	0.2	0.6	2.1
Dec 2009	1.6	**5.6**	1.3	1.9	3.1	2.0	**6.6**	**5.9**	2.0	0.8	1.7	**4.8**
Jan 2010	1.8	3.8	0.5	1.5	2.2	3.1	**4.0**	2.5	2.2	2.1	1.8	3.8
Feb 2010	0.5	0.8	0.4	0.5	1.5	2.0	1.6	1.2	0.3	1.1	0.1	0.4
Mar 2010	0.8	2.2	0.4	1.2	2.3	1.1	2.5	2.5	0.2	0.3	1.3	2.0
Apr 2010	1.2	3.1	0.1	1.8	2.4	1.0	2.6	2.3	1.2	0.1	1.5	1.4
May 2010	0.3	0.8	0.3	1.5	0.6	0.7	1.6	1.2	0.8	0.9	3.5	1.8
Jun 2010	3.4	**4.2**	3.6	**4.8**	**4.2**	**4.4**	1.8	**4.9**	**7.2**	3.5	3.7	**20.3**
Jul 2010	1.4	0.7	0.8	1.7	2.0	1.9	3.2	2.6	1.5	2.0	0.8	**11.5**
Aug 2010	-	1.4	1.4	0.6	1.2	0.9	2.0	2.4	2.8	0.3	1.1	**12.4**
Sep 2010	0.9	1.4	2.2	1.0	1.6	0.6	3.8	2.5	1.2	1.4	1.2	**8.5**
Oct 2010	0.4	0.8	**9.8**	0.4	1.2	**6.3**	1.5	0.8	1.4	3.0	0.8	1.0
Nov 2010	0.7	1.2	1.2	1.2	2.0	2.2	3.9	1.7	0.6	**6.1**	1.6	2.9

Note - Exceedences of the recommended deposition criteria are highlighted in **red bold underline**

	Gauge Number											
Date	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
	Australian Best Practice Dust Deposition Level - 4 g/m^2/month											
Dec 2010	0.9	2.4	0.4	0.8	1.3	**4.4**	2.2	1.1	0.9	0.6	1.0	1.7
Jan 2011	2.6	1.4	**10.5**	1.2	1.1	1.9	1.2	0.9	1.0	0.9	3.8	1.4
Feb 2011	**4.0**	2.2	0.5	0.8	1.3	0.7	1.0	1.2	2.7	0.8	1.6	2.0
Mar 2011	2.9	2.5	1.2	1.0	2.2	1.3	3.2	2.0	3.2	**4.8**	**10.5**	**8.5**
Apr 2011	1.5	2.2	2.0	0.7	1.7	3.8	3.2	1.7	1.2	3.8	2.1	**6.4**
May 2011	1.1	1.2	1.0	0.4	0.7	0.8	0.6	0.4	0.5	1.5	1.6	3.1
Jun 2011	2.6	0.9	1.0	0.4	0.5	2.2	1.5	0.2	0.5	0.4	**6.6**	**9.5**
Jul 2011	2.0	1.0	0.8	1.8	2.8	3.2	3.7	1.2	2.1	0.6	**4.2**	**17.6**
Aug 2011	1.6	1.4	0.7	1.3	0.7	2.9	1.2	0.5	0.5	0.5	3.4	**6.4**
Sep 2011	0.8	0.5	1.9	0.3	0.6	1.8	0.5	0.4	0.7	1.0	0.4	2.6
Oct 2011	1.4	0.9	1.7	1.7	1.9	2.0	1.8	1.0	1.3	0.4	**4.1**	**4.7**
Nov 2011	1.5	3.8	**4.0**	1.6	0.6	1.8	0.9	0.5	2.5	0.5	1.6	2.1
Dec 2011	1.1	0.8	0.7	1.7	1.2	1.8	0.8	0.6	0.7	0.6	1.1	2.0
Jan 2012	0.8	1.6	2.4	1.3	2.6	3.0	2.2	1.6	1.3	1.5	**5.8**	**7.2**
Feb 2012	0.6	**12.9**	1.6	3.1	2.5	1.6	**4.7**	2.6	**5.4**	0.7	1.8	**6.7**
Mar 2012	1.1	2.2	0.9	1.5	1.8	0.6	1.3	0.8	0.7	0.5	1.8	**7.4**
Apr 2012	1.3	**22.4**	2.2	1.9	2.3	2.2	3.3	2.4	1.6	1.5	**5.1**	**11.9**
May 2012	1.0	2.0	0.6	1.0	1.2	2.1	2.0	1.1	0.9	0.8	**5.5**	**28.8**
Jun 2012	0.7	1.3	0.8	0.8	0.5	**6.0**	1.6	0.9	1.2	0.6	**13.2**	**24.8**
Jul 2012	1.0	3.3	1.6	1.6	1.2	2.4	1.7	1.5	3.9	1.7	2.3	**54.8**
TOTAL AVERAGE	**1.7**	**2.5**	**1.6**	**1.6**	**2.3**	**3.1**	**2.5**	**2.3**	**2**	**1.5**	**3.0**	**6.8**

Note - Exceedences of the recommended deposition criteria are highlighted in **red bold underline**

Table 5: Dust Deposition Gauge Data – Total Insoluble Matter – Percentage Ash (Mineral) Content

	Gauge Number											
Date	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Sep 2007	**41.7%**	**50.0%**	70.0%	**45.5%**	66.7%	72.9%	-	60.9%	**23.5%**	56.3%	58.3%	62.5%
Oct 2007	**42.9%**	**50.0%**	**25.0%**	58.3%	63.6%	52.2%	-	61.3%	70.8%	**40.0%**	**20.0%**	**31.8%**
Nov 2007	70.5%	67.4%	70.0%	67.9%	74.4%	83.3%	-	n/a	n/a	n/a	76.2%	51.0%
Dec 2007	66.7%	92.9%	**43.8%**	**16.7%**	85.5%	70.0%	-	77.3%	**40.0%**	**40.0%**	62.5%	**26.2%**
Jan 2008	56.3%	69.2%	61.4%	78.8%	84.4%	68.8%	-	73.1%	54.3%	**38.5%**	75.0%	**43.5%**
Feb 2008	**50.0%**	71.9%	87.5%	96.3%	93.5%	88.2%	-	94.9%	55.6%	n/a	**37.3%**	100.0%
Mar 2008	76.9%	100.0%	72.7%	100.0%	86.6%	**50.0%**	-	n/a	**50.0%**	**22.0%**	54.8%	**37.0%**
Apr 2008	81.5%	100.0%	97.1%	100.0%	78.9%	81.4%	-	64.9%	79.4%	**50.0%**	83.3%	83.7%
May 2008	72.7%	**42.9%**	100.0%	94.1%	88.9%	81.3%	75.0%	66.7%	100.0%	66.7%	100.0%	n/a
Jun 2008	83.3%	78.9%	**50.0%**	82.4%	85.7%	86.7%	91.7%	88.9%	n/a	64.3%	**41.3%**	80.6%
Jul 2008	90.9%	60.0%	100.0%	88.9%	80.0%	100.0%	96.0%	90.1%	96.4%	n/a	**40.5%**	78.9%
Aug 2008	66.7%	66.7%	71.4%	77.8%	77.8%	88.9%	100.0%	100.0%	80.0%	**50.0%**	71.4%	80.0%
Sep 2008	55.6%	55.6%	**33.3%**	85.0%	100.0%	78.9%	**50.0%**	100.0%	100.0%	77.8%	**47.4%**	61.9%
Oct 2008	85.7%	**40.0%**	-	100.0%	**50.0%**	100.0%	92.3%	85.7%	**50.0%**	66.7%	**35.3%**	**30.8%**
Nov 2008	72.7%	56.5%	80.0%	**45.5%**	60.0%	56.0%	**44.4%**	60.6%	**50.0%**	54.5%	**37.5%**	**21.4%**
Dec 2008	52.1%	**40.0%**	**26.8%**	55.3%	**50.0%**	**38.5%**	65.9%	**45.5%**	71.4%	**36.2%**	**27.0%**	56.3%
Jan 2009	85.7%	67.9%	100.0%	91.7%	100.0%	62.8%	61.3%	**33.3%**	**34.8%**	**10.0%**	**41.6%**	78.3%
Feb 2009	**44.0%**	**38.9%**	100.0%	100.0%	100.0%	75.0%	61.1%	**45.5%**	**50.0%**	**30.0%**	**41.4%**	52.4%
Mar 2009	**41.4%**	**42.9%**	**46.4%**	**47.2%**	53.3%	**38.2%**	58.8%	**45.9%**	**42.4%**	**38.1%**	**22.7%**	**50.0%**
Apr 2009	100.0%	100.0%	100.0%	85.7%	88.5%	24.3%	86.4%	**50.0%**	100.0%	80.0%	68.8%	**28.0%**

Note – Records which contain less than or equal to 50% ash content are highlighted in **red bold underline, to illustrate the months where the gauges may have been largely influenced by external, non-mining related activities, due to high organic matter content**

	Gauge Number											
Date	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
May 2009	n/a	n/a	100.0%	77.8%	88.2%	90.9%	64.3%	81.3%	66.7%	n/a	100.0%	64.5%
Jun 2009	100.0%	100.0%	87.5%	n/a	n/a	50.0%	75.0%	66.7%	85.7%	100.0%	63.6%	50.7%
Jul 2009	**50.0%**	n/a	100.0%	100.0%	100.0%	**10.0%**	96.2%	**36.8%**	100.0%	n/a	**45.5%**	95.2%
Aug 2009	n/a	**50.0%**	**50.0%**	85.7%	91.7%	100.0%	62.5%	61.5%	100.0%	100.0%	**46.2%**	84.4%
Sep 2009	**50.0%**	100.0%	100.0%	87.5%	85.7%	71.3%	78.3%	81.2%	80.0%	100.0%	70.0%	85.7%
Oct 2009	77.8%	**50.0%**	**33.3%**	55.0%	82.4%	56.9%	83.3%	63.6%	**33.3%**	n/a	63.6%	100.0%
Nov 2009	62.5%	71.4%	55.6%	66.7%	88.9%	71.4%	70.0%	**50.0%**	**42.9%**	100.0%	66.7%	**28.6%**
Dec 2009	81.3%	51.8%	76.9%	63.2%	83.9%	70.0%	80.3%	74.6%	70.0%	62.5%	58.8%	**41.7%**
Jan 2010	88.9%	63.2%	100.0%	86.7%	86.4%	64.5%	85.0%	80.0%	**40.9%**	71.4%	77.8%	68.4%
Feb 2010	**20.0%**	87.5%	100.0%	100.0%	80.0%	n/a	87.5%	83.3%	100.0%	90.9%	n/a	75.0%
Mar 2010	75.0%	77.3%	**50.0%**	83.3%	87.0%	81.8%	72.0%	72.0%	100.0%	100.0%	69.2%	**50.0%**
Apr 2010	75.0%	77.4%	n/a	83.3%	100.0%	100.0%	88.5%	91.3%	100.0%	n/a	80.0%	100.0%
May 2010	100.0%	75.0%	66.7%	80.0%	100.0%	85.7%	93.8%	91.7%	87.5%	88.9%	**42.9%**	77.8%
Jun 2010	**14.7%**	**19.0%**	**11.1%**	**20.8%**	**11.9%**	**27.3%**	55.6%	**28.6%**	**16.7%**	**8.6%**	**16.2%**	79.8%
Jul 2010	85.7%	100.0%	87.5%	82.4%	95.0%	84.2%	84.4%	80.8%	86.7%	**50.0%**	**50.0%**	81.7%
Aug 2010	n/a	64.3%	78.6%	66.7%	83.3%	77.8%	90.0%	79.2%	**42.9%**	66.7%	72.7%	91.1%
Sep 2010	66.7%	**50.0%**	63.6%	60.0%	87.5%	100.0%	92.1%	88.0%	75.0%	78.6%	58.3%	89.4%
Oct 2010	75.0%	75.0%	**36.7%**	100.0%	75.0%	73.0%	66.7%	62.5%	78.6%	**50.0%**	62.5%	70.0%
Nov 2010	57.1%	**50.0%**	66.7%	**50.0%**	70.0%	54.5%	79.5%	64.7%	**50.0%**	62.3%	**43.8%**	75.9%
Dec 2010	55.6%	54.2%	100.0%	62.5%	69.2%	70.5%	81.8%	72.7%	66.7%	66.7%	**50.0%**	64.7%
Jan 2011	**50.0%**	57.1%	**17.1%**	58.3%	100.0%	63.2%	91.7%	88.9%	60.0%	66.7%	55.3%	**42.9%**

Note – Records which contain less than or equal to 50% ash content are highlighted in **red bold underline, to illustrate the months where the gauges may have been largely influenced by external, non-mining related activities, due to high organic matter content**

	Gauge Number											
Date	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Feb 2011	55.0%	63.6%	80.0%	62.5%	84.6%	85.7%	90.0%	66.7%	**40.7%**	**50.0%**	62.5%	70.0%
Mar 2011	72.4%	72.0%	**50.0%**	70.0%	81.8%	84.6%	81.3%	75.0%	84.4%	52.1%	51.4%	70.6%
Apr 2011	53.3%	**50.0%**	55.0%	**42.9%**	70.6%	**34.2%**	**50.0%**	**41.2%**	**50.0%**	60.5%	**42.9%**	82.8%
May 2011	72.7%	66.7%	**40.0%**	75.0%	85.7%	62.5%	83.3%	75.0%	60.0%	60.0%	**50.0%**	74.2%
Jun 2011	88.5%	88.9%	80.0%	100.0%	100.0%	59.1%	93.3%	100.0%	80.0%	100.0%	**36.4%**	84.2%
Jul 2011	**40.0%**	60.0%	**50.0%**	55.6%	78.6%	71.9%	83.8%	75.0%	57.1%	66.7%	**45.2%**	88.6%
Aug 2011	75.0%	78.6%	**42.9%**	**46.2%**	85.7%	72.4%	83.3%	80.0%	100.0%	60.0%	61.8%	**46.9%**
Sep 2011	75.0%	80.0%	**36.8%**	100.0%	66.7%	66.7%	100.0%	75.0%	57.1%	**40.0%**	75.0%	84.6%
Oct 2011	**50.0%**	77.8%	**41.2%**	**35.3%**	68.4%	60.0%	83.3%	60.0%	84.6%	**50.0%**	**41.5%**	n/a
Nov 2011	60.0%	73.7%	52.5%	62.5%	83.3%	72.2%	88.9%	100.0%	56.0%	80.0%	**50.0%**	76.2%
Dec 2011	81.8%	75.0%	71.4%	70.6%	100.0%	88.9%	100.0%	66.7%	100.0%	**50.0%**	63.6%	70.0%
Jan 2012	75.0%	**37.5%**	54.2%	76.9%	88.5%	83.3%	90.9%	81.3%	92.3%	60.0%	**12.1%**	56.9%
Feb 2012	66.7%	76.0%	**43.8%**	74.2%	84.0%	62.5%	83.0%	76.9%	72.2%	85.7%	**44.4%**	71.6%
Mar 2012	81.8%	77.3%	77.8%	80.0%	88.9%	83.3%	100.0%	100.0%	100.0%	60.0%	55.6%	63.5%
Apr 2012	76.9%	**42.0%**	95.5%	84.2%	91.3%	90.9%	100.0%	87.5%	87.5%	80.0%	84.3%	79.8%
May 2012	70.0%	65.0%	83.3%	80.0%	83.3%	81.0%	85.0%	72.7%	77.8%	**50.0%**	**29.1%**	89.6%
Jun 2012	71.4%	61.5%	62.5%	62.5%	100.0%	81.7%	75.0%	77.8%	66.7%	**50.0%**	78.0%	69.8%
Jul 2012	**40.0%**	51.5%	**50.0%**	62.5%	66.7%	75.0%	70.6%	60.0%	87.2%	58.8%	56.5%	85.9%

Note – Records which contain less than or equal to 50% ash content are highlighted in **red bold underline, to illustrate the months where the gauges may have been largely influenced by external, non-mining related activities, due to high organic matter content**