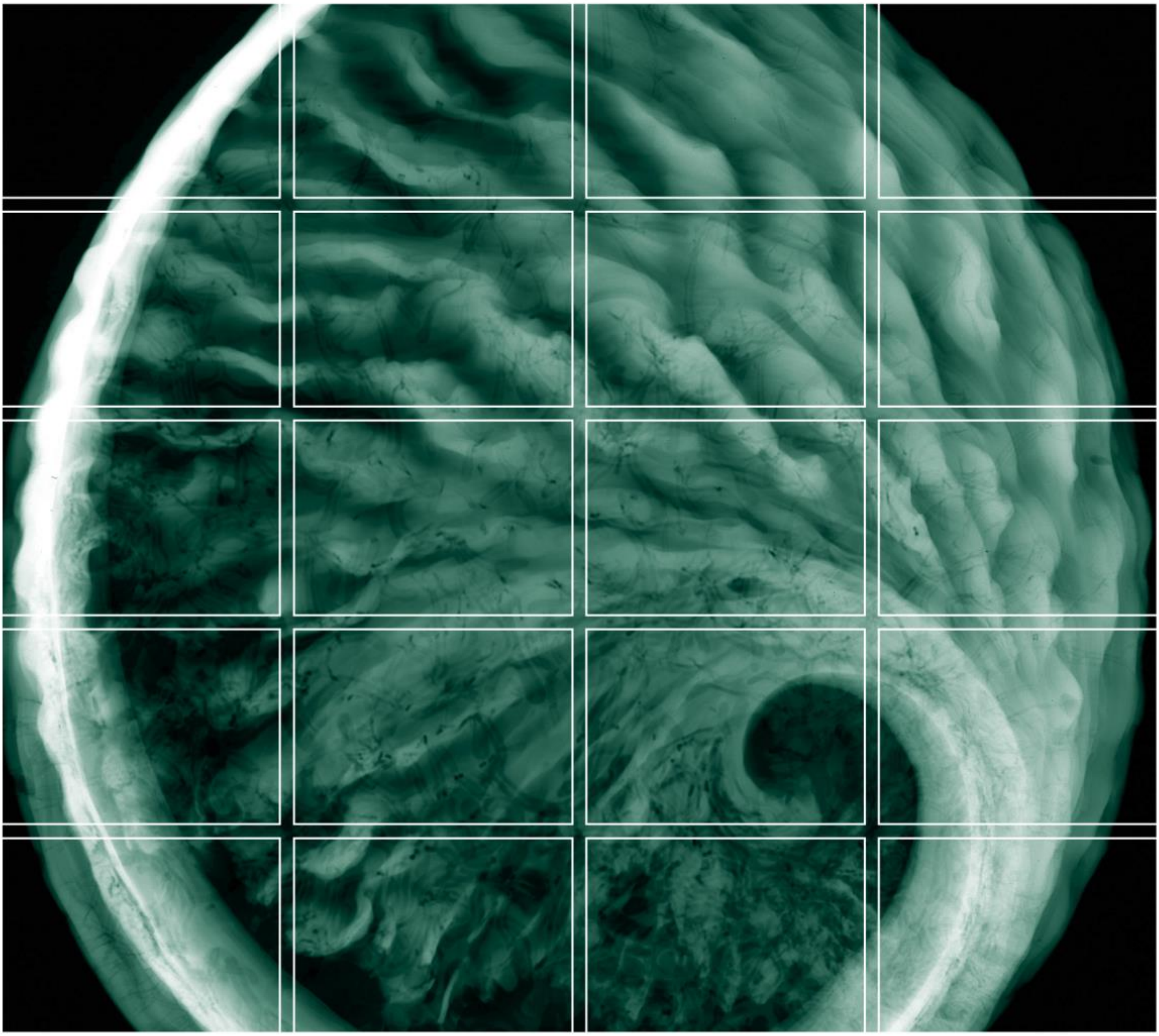

Waste Metal Recovery, Processing and Recycling Facility, 45 and 23- 43 Tattersall Road, Kings Park, Blacktown

Air Quality Assessment

Sell & Parker Pty Ltd

September 2015

0313442 Final

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Waste Metal Recovery, Processing and Recycling Facility, 45 and 23- 43 Tattersall Road, Kings Park, Blacktown

Air Quality Assessment

Approved by:	*Iain Cowan*
Position:	Project Manager
Signed:	*Final Draft*
Date:	*3 September 2015*
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Position:	Partner
Signed:	*Final Draft*
Date:	*3 September 2015*

Environmental Resources Management Australia Pty Ltd Quality System

Sell & Parker Pty Ltd

September 2015

0313442 Final

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FINAL REPORT

Sell and Parker Pty Ltd

Waste Metal Recovery, Processing and Recycling Facility Expansion - 45 and 23-43 Tattersall Road, Kings Park, Blacktown

Air Quality Assessment

September 2015

Reference: 0313442_AirQual_Rp01

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1 INTRODUCTION

Sell and Parker Pty Ltd (Sell and Parker) currently operate a waste metal recovery, processing and recycling facility at 45 Tattersall Road, Kings Park, Blacktown (the "Site"). Environmental Resources Management Australia Pty Ltd (ERM) was commissioned by Sell and Parker to prepare an air quality assessment as part of the Environmental Impact Statement (EIS) to increase the approved capacity of the existing waste metal recovery, processing and recycling facility at 45 Tattersall Road (Lot 5 DP 7086), Kings Park, to 350,000 tpa. The increase in the approved processing capacity of the waste metal recovery and processing business would result in the expansion of the facility to encompass the adjoining lot to the east (Lot 2 DP 550522 or 23-43 Tattersall Road). Both Lot 5 DP 7086 and Lot 2 DP 550522 are collectively referred to as 'the site' within this air quality assessment.

The main site at 45 Tattersall Road is currently used by Sell and Parker as a waste metal resource recovery, processing and recycling facility involving the shearing, fragmenting and shredding of industrial scrap metal, demolition material and car bodies. 23-43 Tattersall Road is currently occupied by 'Dexion', a manufacturing business, which intends to cease operations at this site and relocate offshore.

1.1 SITE ACTIVITIES

The operational process on-site post-upgrade is required to be understood in detail when assessing impacts to air quality. In operations like metals recycling, there are many opportunities for particulates to be emitted including:

- truck delivery/removal of materials;
- truck dumping of materials onto stockpiles;
- material handling (pick up and drop off activities with front-end loaders/mobile material handlers with grapples, conveyor drop points onto stockpiles etc.);
- conveying and conveyor transfer points;
- wet scrubber outlet vents of the hammer mill;
- manual metal cutting; and
- dust from wind erosion off the stockpiles.

A comprehensive understanding of the processes that occur on-site allows the development of a full emissions inventory and the selection of appropriate sources to be included in air dispersion modelling, with the proposed controls and mitigation measures taken into account. The following process description for the proposed handling capacity has informed the emissions inventory and mitigation measures applied. The mass of materials handled is considered to be the upper limit for each piece of equipment discussed.

1.1.1 Process Description

A simplified process diagram showing the proposed metal recycling process is provided in *Figure 2.2* of the main EIS document.

Petrol and oil will be drained from tanks and collected in an above ground storage tanks and removed offsite for processing. Scrap metal that are too large in size to fit on a conveyor will be cut either using a shear or manually using oxy-acetylene torches in the cutting zone. Vehicles with LPG tanks and LPG bottles are not accepted at Site. All loads are inspected and vehicles found with LPG tanks are rejected and sent back to source for disposal through appropriate channels.

Cars and scrap metal are lifted onto a heavy-duty feed conveyor by an electric scrap handler. The operator of the mobile material handler will also check the feed material while loading it onto the conveyor. The materials will pass the control cabin, where an operator will also check incoming materials. The control cabin is an enclosed structure with sound proofing and air conditioning for operator comfort.

The feed conveyor transports raw material into the hammer mill which shreds the metal into fist-sized pieces. Water is fed into the hammermill to cool the process, this produces steam. Along with the steam, particulate matter (<2.5 µm in aerodynamic diameter) primarily consisting of metals from the processed metals and odour are generated. These emissions will be captured via an exhaust capture system and ducted to a cyclone system and a wet scrubber to reduce dust and odorous emissions.

The fragmented raw material is carried upwards by an incline conveyor and will then be dropped into a 'cascade' chute, hitting against its corners and therefore loosening any dirt and dust. Air from the cascade will be extracted by an induced draft fan and passed into the cascade cyclone, which will drop out particulates. Cleaned air will then pass through a wet scrubber to remove fine dust.

The cleaned fragmented material will then pass under drum magnets, which will pick up ferrous metals and drop them onto the picking conveyor, where operators will remove remaining non-ferrous materials. The ferrous metals will continue up a conveyor which offloads the ferrous product into the product stockpile, that is contained in a designated area.

The non-ferrous materials will drop beneath the drum magnets to a conveyor which runs perpendicular to the ferrous product. This conveyor carries non-ferrous metals and wastes such as plastic and glass. The material is conveyed beneath another magnet, which picks up any small remaining quantities of ferrous metals and drops them into a skip for collection. Non-ferrous materials will continue through a pan feeder and trommel which will separate the materials into size streams for sorting.

The streams pass through an eddy-current separator, which collects aluminium, copper and brass into a skip. The streams then join and pass beneath a final eddy-current separator to win any remaining aluminium.

After passing through these stages, the remaining materials are waste products, which will be conveyed to an enclosed building. The new Post Shredder will involve a confidential proprietary arrangement of sizing, screening, eddy currents and induction sorters.

1.1.2 Relevant Emissions

Based on the process description in *Section 1.1.1*, the emissions relevant to the site activities are as follows:

- total suspended particulates (TSP);
- particulate matter with aerodynamic diameter of 10 μm or less (PM_{10});
- particulate matter with aerodynamic diameter of 2.5 μm or less ($PM_{2.5}$);
- dust deposition;
- toxic air pollutants (metal particles from the hammer mill);
- toxic air pollutants (metal fumes from oxy-cutting)
- nitrogen oxide (NO_x); and
- odour.

Throughout this assessment, a conservative approach to emission estimation has been taken. For example:

- no emission estimates are available for dust emissions from scrap metal deposition or piles of scrap metal. Windblown emissions and handling emissions of particulate matter have been derived using NPI emission estimates for high moisture content ores from metalliferous mines, these are likely to result in higher emissions estimates than will occur in reality; and

- emissions of dust and odour from the hammermill treatment system have been limited to manufacturer's guarantees. A manufacturer guarantee often overstates the likely actual emissions and consequently odour and particulate matter concentrations are likely to be lower than predicted in this assessment.

It is therefore considered that the actual impacts of odour and dust to the surrounding land use are likely to be lower than predicted in this assessment due to these conservative assumptions.

2 *ENVIRONMENTAL SETTING*

This section provides a description of the environmental setting of the Site in the context of air quality and provides a description of:

- climate;
- existing ambient air quality; and
- additional sources of emissions.

2.1 *CLIMATE*

The Site is located in a temperate environment, with the local climate generally mild. *Table 2-1* provides an overview of the climatic extremes as recorded by the Bureau of Meteorology between the years 1965 - 2014. Overall, the local area is characterised by:

- annual average rainfall of 760.6 mm;
- average maximum daytime temperature of 29.8°C in January;
- average minimum daytime temperature of 5.9°C in July;
- average maximum humidity of 81% in March; and
- average minimum humidity of 42% in both August and September.

2.1.1 *Typical Wind Conditions*

Figure 2.1 provides wind roses showing the frequency of strength and direction of winds for the past five years (2008-2012 inclusive) at Horsley Park, NSW. The data has been divided to show seasonal and annual trends. The data shows that:

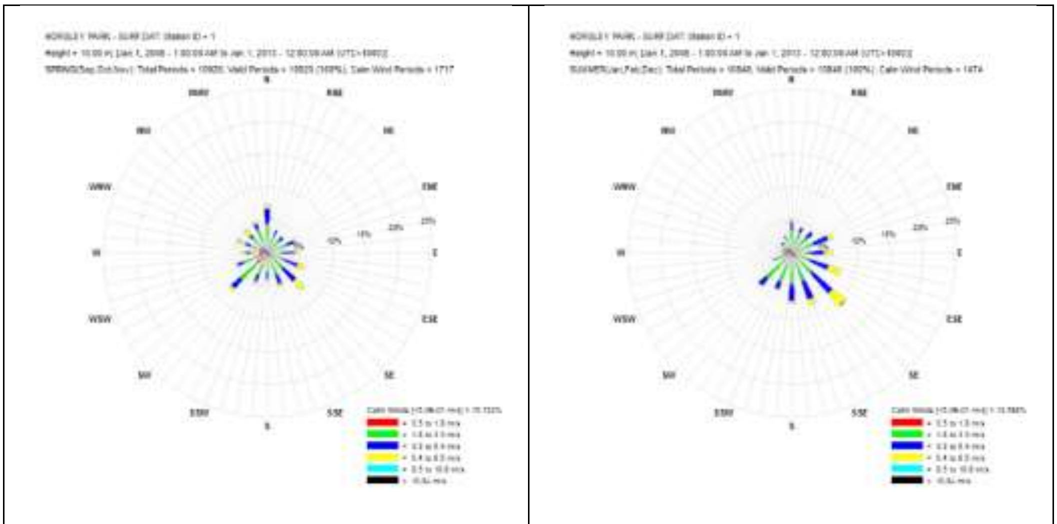
- strong (5.4 – 8.5 m/s) south-easterly winds predominant in the summer and spring months;
- south-westerly winds predominant (15%) in autumn and winter; and
- annually, south-west is the predominant wind direction however the strongest winds originate from the south-east.

Table 2-1 Mean Climatic Conditions for nearest Bureau of Meteorology Observation Station at Horsley Park, NSW

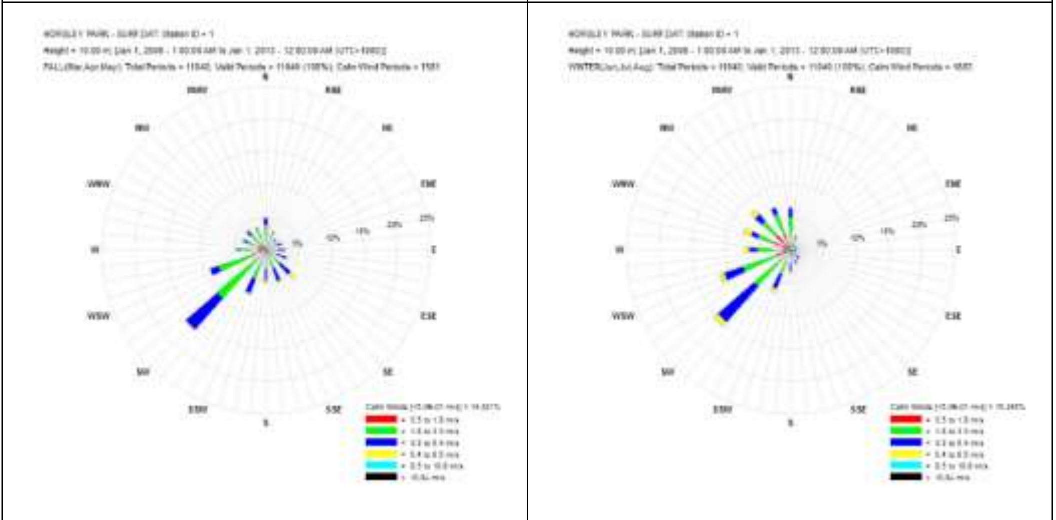
Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Start Year	End Year
Mean maximum temperature (°C)	29.8	28.7	26.7	23.6	20.3	17.6	17.1	19	22.3	24.3	26.2	27.9	23.6	1997	2013
Mean minimum temperature (°C)	17.7	17.8	15.9	12.7	8.9	6.9	5.9	6.5	9.3	11.6	14.4	16.1	12	1997	2013
Mean rainfall (mm)	66.9	119.2	72.3	70.6	50.2	69.8	40.3	32.3	37.3	57.1	84.9	58.8	760.6	1997	2014
Mean number of clear days	12.6	11.7	11.7	8	9.5	8.3	6.6	6.3	7.1	9.2	10.6	10.5	112.1	1968	2001
Mean number of cloudy days	6.6	5	6.7	8.8	9	10	11.3	13.2	11.4	8.3	6.8	7.1	104.2	1968	2001
Mean daily evaporation (mm)	5.5	4.7	3.9	3	2	1.6	1.7	2.5	3.6	4.4	4.9	5.7	3.6	1965	2013
Mean 9am temperature (°C)	22	21.5	19.4	17.5	13.8	11.1	10.3	12	15.6	18.1	19.2	20.9	16.8	1997	2010
Mean 9am relative humidity (%)	73	77	81	76	77	80	78	70	65	61	70	71	73	1997	2010
Mean 9am cloud cover (oktas)	4.8	4.9	4.5	3.7	3.8	3.6	3.2	2.9	3.2	4	4.4	4.5	4	1965	2010
Mean 9am wind speed (km/h)	10.1	9.7	8.9	10.5	10.7	10.3	10.8	11.7	12.2	12.5	11.8	10.7	10.8	1997	2010
Mean 3pm temperature (° C)	28.2	27.1	25.3	22.2	19.2	16.6	16.1	17.8	20.8	22.5	24.2	26.5	22.2	1997	2010
Mean 3pm relative humidity (%)	49	53	54	53	52	55	50	42	42	45	50	48	49	1997	2010
Mean 3pm cloud cover (oktas)	4.8	5	4.8	4.2	4.3	4.2	3.9	3.8	3.9	4.4	4.8	4.6	4.4	1968	2001
Mean 3pm wind speed (km/h)	19.4	17	14.8	14.4	13	12.9	13.9	16.1	18.1	19.8	19.5	19.9	16.6	1997	2010

1. Mean cloudy days, mean clear days, mean daily evaporation, mean 9am cloud cover, and mean 3pm cloud cover have been taken from Prospect Reservoir [067019], 6.2 km away from Horsley Park.

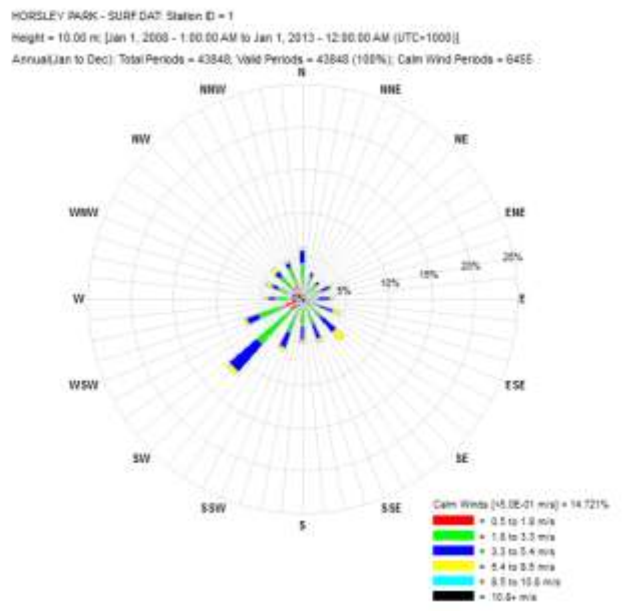
Figure 2.1 ***Seasonal and annual wind roses for the past five years 2008-2012 at Horsley Park, NSW***



Spring (Sep-Dec) Summer (Dec-Feb)



Autumn (Mar-May) Winter (Jun-Aug)



Annual

2.1.2 *Atmospheric Stability*

Atmospheric stability is one of the key parameters that effects dispersion and dilution of emissions away from source. In essence it describes the degree of thermal and mechanical mixing of the atmosphere that occurs due to wind and thermal heating. Higher stability of the atmosphere typically results in poor dispersion conditions and higher ground level concentrations, whilst unstable atmospheres typically have the opposite impact.

Atmospheric stability is described by the Pasquil-Gifford classification where:

- Category A describes a very unstable atmosphere;
- Category B describes an unstable atmosphere;
- Category C describe a moderately unstable atmosphere;
- Category D describes a neutral atmosphere;
- Category E describes a stable atmosphere;
- Category F describes a very stable atmosphere; and
- Category G describes a very, very stable atmosphere.

Usually, categories F and G are combined when describing the frequency of these categories.

Typically, these atmospheric conditions occur under the following conditions:

- Category A – very sunny and very windy conditions;
- Category B – Very sunny but less windy conditions;
- Category C – Moderately sunny and moderately windy conditions;
- Category D – Cloudy conditions; and
- Category E, F and G – Mostly clear or clear night time conditions with decreasing wind speed.

Figure 2.2 shows the predicted frequency of stability categories at the Site. Stability categories have been predicted using the methodology outlined in Section *4.3*.

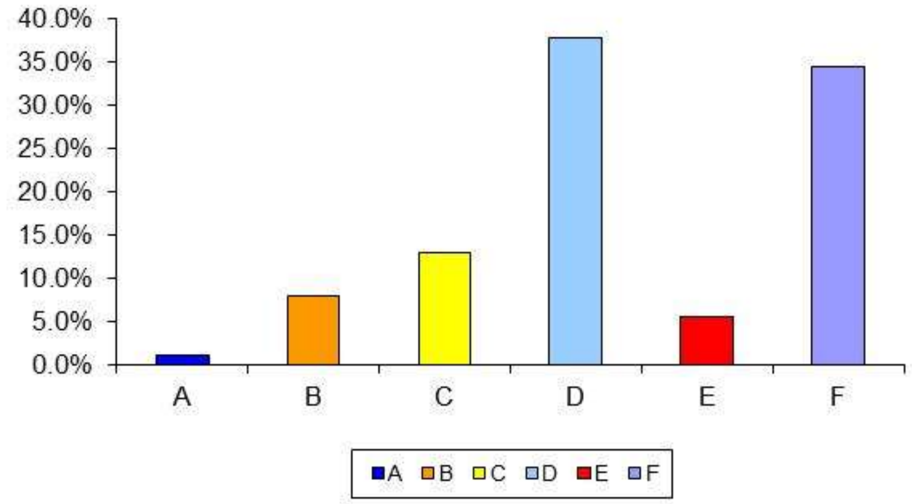


Figure 2.2 ***Frequency of atmospheric stability categories predicted for the Site***

The highest frequency of atmospheric stabilities for the 5 years of predicted meteorological data indicate that category D and F dominate the model domain. This reflects the prevalence of relative neutral daytime conditions followed by clear and calm night time conditions.

2.2 *EXISTING AMBIENT AIR QUALITY*

Existing ambient air quality provides the basis on to which emissions from the project are projected. It is the cumulative concentration, resulting from existing air quality plus project contribution, which forms the prediction that is tested against the adopted assessment criteria.

2.2.1 *PM_{10} Background*

The nearest measurements of ambient air quality are undertaken by the Department of Environment and Heritage (DEH)[1] in William Lawson Park, Myrtle Street, Prospect, 5 km south to south-east of the Site. The maximum 24-hour average and the annual average per year for PM_{10} are presented in *Table 2-2*. It should be noted that 2009 included an extreme dust event which has skewed 24-hour average concentrations to be approximately 1638.5 µg/m^3 higher and annual mean concentrations approximately 6 µg/m^3 higher than other years.

---

[1] Data downloaded from http://www.environment.nsw.gov.au/AQMS/search.htm

Table 2-2 Ambient Background Air Quality PM_{10} Concentrations

Ambient Background Air Quality Concentration (µg/m³)	**2008**	**2009**	**2010**	**2011**	**2012**
Maximum 24-hour average	41.8	1680.3	40.1	41.5	38.7
Annual Average	17.8	25.9	15.4	15.8	17.2

2.2.2 *TSP Background*

Ambient air quality monitoring does not exist for TSP in the local environment, however it is commonly found in the ambient atmosphere. No measurements of existing ambient air quality exist for TSP within the surrounding area. This assessment has taken an average of the 5 years of annual average PM_{10} background concentrations of 18.4 µg/m³ and multiplied by two (2). It is commonly assumed that the particle size distribution ratio between PM_{10} and TSP is 0.5. This provides a typical annual average background concentration for TSP of 36.8 µg/m³.

2.2.3 *Nitrogen Dioxide (NO_2) Background*

The nearest measurements of NO_2 are undertaken at the Prospect monitoring site by the DEH, 5 km south to south-east of the Site. The maximum 1-hour average and annual average per year for NO_2 are presented in *Table 2-3*.

Table 2-3 Ambient Background Air Quality NO_2 Concentrations

Ambient Background Air Quality Concentration (µg/m³)	**2008**	**2009**	**2010**	**2011**	**2012**
Maximum 1-hour average	-	95.9	80.8	73.3	94.0
Annual Average	-	20.7	22.6	18.8	18.8

2.2.4 *Ozone (O_3) Background*

Background levels of ozone (O_3) are needed to calculate the NO_2 conversion from NO_X, based on the O_3 limiting method. Levels of O_3 (O_3 is the oxidant which enables the oxidation of NO_X to NO_2) presents the upper limit of the NO_2 levels in the atmosphere once NO_X is emitted (see *Section 0* for the conversion methodology).

The nearest measurements of O_3 are undertaken at the Prospect monitoring site by the DEH, 5 km south to south-east of the Site. The maximum 1-hour average and annual average per year for O_3 is presented in *Table 2-4* Table 2-3.

Table 2-4 Ambient Background Air Quality O_3 Concentrations

Ambient Background Air Quality Concentration (µg/m^3)	**2008**	**2009**	**2010**	**2011**	**2012**
Maximum 1-hour average	209.7	247.0	203.8	247.0	156.8
Annual Average	27.4	35.3	29.4	29.4	29.4

2.3 *ADDITIONAL SOURCE OF EMISSIONS*

Additional sources of emitted species within the modelled area include emissions from vehicular traffic and possible sources from other industry in the immediate vicinity of the site. These sources are implicitly included through the use of ambient monitoring to supply background air quality concentrations.

2.4 *SENSITIVE RECEPTORS*

Sensitive receptors are locations where the general population is likely to be exposed to the resultant ground level concentrations from the atmospheric emissions. The Approved Methods defines these as:

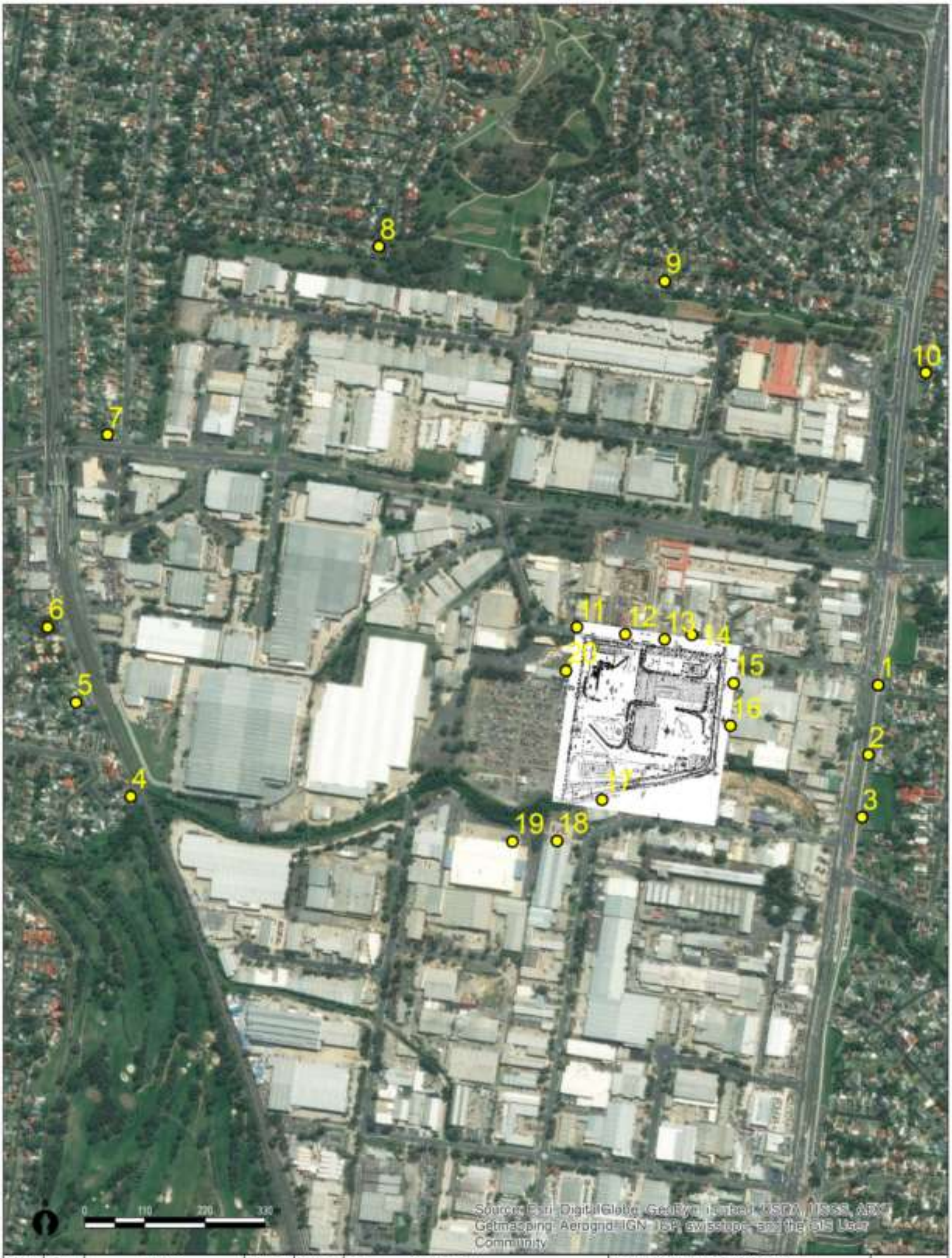
- *"A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area"* (Department of Environment and Conservation, 2005).

Ten (10) sensitive receptors (R1 – R10) in residential areas have been selected on the basis of proximity to Site. These sensitive receptors are intended to be representative of the general residential area. The modelled grid will provide assessment for all other residential addresses not specifically included in the dispersion model. In addition, ten (10) sensitive receptors in the industrial area (R11 – R20) immediately adjacent to the Site and beyond were included in the modelling. It is noted that since the locations of R11 – R20 have been selected to be immediately adjacent to the Site, the modelled results at R11-R20 will also provide the worst-case maximum offsite impacts.

The locations of sensitive receptors included in the model are provided in *Table 2.5* and *Figure 2.3*.

Table 2-5 Locations of Sensitive Receptors

Receptor #	Description	X-coordinate	Y-coordinate
R1	Residence	306993	6263656
R2	Residence	306975	6263528
R3	Residence	306963	6263414
R4	Residence	305627	6263452
R5	Residence	305527	6263624
R6	Residence	305475	6263762
R7	Residence	305584	6264114
R8	Residence	306081	6264458
R9	Residence	306603	6264395
R10	Residence	307080	6264227
R11	Industrial	306442	6263762
R12	Industrial	306531	6263749
R13	Industrial	306602	6263739
R14	Industrial	306653	6263748
R15	Industrial	306728	6263659
R16	Industrial	306723	6263581
R17	Industrial	306489	6263446
R18	Industrial	306406	6263371
R19	Industrial	306325	6263369
R20	Industrial	306423	6263682



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Rev. N.	Date	Revision	Drawn by	Rev. by
0	26/02/14	Initial Issue	A. Radford	I. Cowan
1	16/12/14	Revised to add receptors	I. Cowan	S. Lo

Client: Sell and Parker
Drawing No: Sensitive Receptor Locations.mxd
Date: 16/12/2014 Drawing Size: A4
Drawn By: IC Reviewed By: SYL

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Modelled Sensitive Receptor Locations

Waste Metal Recovery, Processing and Recycling Facility Expansion

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

Figure 2.3 Modelled sensitive receptor locations

3 *LEGISLATIVE CONTEXT*

This section defines the legislative context of the project in relation to air quality impacts, and discusses the adopted assessment criteria.

3.1 *EMISSION CONCENTRATIONS*

The *Protection of the Environment Operations (Clean Air) Regulation 2002* (the 'Regulation') provides the framework for the protection of the air environment in NSW and has been enacted under the *Protection of the Environment Operations Act 1997* (POEO Act) (the Regulation):

- sets emission concentration standards and rate for certain activities;
- sets certain requirements in respect of domestic solid fuel heaters and motor vehicles; and
- establishes a framework for controlling where and what type of substances may be burnt.

Part 5 division 2 of the Regulation provides for standards of concentrations for air impurities for stack or vent emissions from scheduled premises. Section 38 of part 5, division 2 of the Regulation refers to Schedule 3 and 4 in relation to the emission limits allowed under the Regulation.

Schedule 3 provides standards of concentration for scheduled premises where activities and plant are used for a specific purpose. Metal recycling is not listed under Schedule 3.

Schedule 4 of the Regulation provides standards of concentration for general activities and plant at a scheduled premises (i.e. other industries not listed under Schedule 3). In relation to the activities proposed at the Site, only emissions from the hammer mill are ducted to a stack or vent, all other emissions on site will be fugitive. Consequently only emissions from the hammermill, released via stack, will be subject to the Regulation. Schedule 4 provides a specific standard of concentration for total suspended particulates (TSP) for any crushing, grinding, separating or materials handling activity of 20 mg/m^3 (Group 6).

The manufacturer has provided a guarantee that the system will achieve the standard contained in the Regulation (20 mg/m^3 of TSP, expressed at zero degrees, dry and 1 atmosphere) from the hammer mill stack (Annex E). Consequently, it is considered that the requirement of the Regulation for TSP emissions is met.

In relation to all emissions from site and in addition to TSP, Schedule 4 contains a specific standard for NO_2, and an aggregate standard for type 1 and type 2 substances.

As discussed, the Regulation only applies to emissions from a stack or vent. NO_2 emissions will occur as a result of oxy-cutting which results in fugitive emissions of NO_2. Consequently, the emission limit for NO_2 in the Regulation does not apply to emissions from oxy-cutting.

Of the remaining emissions from Site the Regulation also specifies emission concentrations of type 1 and type 2 substances, in aggregate. Type 1 and type 2 substances are:

- Type 1 – antimony, arsenic, cadmium, lead and mercury; and
- Type 2 – beryllium, chromium, cobalt, manganese, nickel, selenium, tin and vanadium

The standard for type 1 and type 2 substances is 1 mg/m^3 (Group 6).

As discussed, the Regulation only applies to emissions from a vent or stack. Consequently, only emissions from the proposed hammer mill stack have been assessed against the requirements of the Regulation. Emissions of type 1 and type 2 emissions from the hammer mill are related to the particulate emissions (see Annex A). The estimated percentages of type 1 and type 2 compounds were obtained from the USEPA Speciate Data Browser (USEPA, 2009) in relation to $PM_{2.5}$ (See Annex A). Using the manufacturer's guarantee of 20 mg/Nm3 TSP along with $PM_{2.5}$ being 15% of emitted TSP it is estimated that the emitted concentrations of Type 1 and Type 2 emissions, in aggregate, will be:

- Type 1 – 0.01 mg/Nm^3; and
- Type 2 – 0.005 mg/Nm^3.

The cumulative concentrations of type 1 and type 2 substances emitted from the stack are therefore anticipated to be below the standard contained in the Regulation and thus acceptable.

3.2 *IMPACT ASSESSMENT CRITERIA*

Part 5: Emission of Air Impurities from Activities and Plant in the Regulation refers to the *Approved Methods for Modelling and Assessment of Air Pollutants in NSW* ('Approved Methods') (Department of Environment and Conservation, 2005). The Approved Methods lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in the state. Industry has an obligation to ensure compliance with the requirements specified in the Regulation.

The NSW EPA prescribes impact assessment criteria, which are outlined in the Approved Methods (Department of Environment and Conservation, 2005). The impact assessment criteria refer to the total pollutant load in the environment and impacts from new sources of these pollutants must be added to existing background levels for assessment of compliance. In accordance with the guidance document, ERM has adopted the assessment criteria shown in *Table 3.1* for particulate matter, nitrogen dioxide (NO_2) and individual toxic air pollutants (metals). It is noted that even though $PM_{2.5}$ are emitted from the Site activities, there are no assessment criteria for $PM_{2.5}$ under the Approved Methods; therefore, no individual impact assessment of $PM_{2.5}$ has been undertaken.

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. *Table 3.1* also shows the maximum acceptable increase in dust deposition over the existing dust levels (2 g/m^2/month) and the maximum total deposited dust level (4 g/m^2/month). Given that there are no ambient dust deposition levels for the local area, this assessment will be compared to the maximum increase in deposited dust level. These criteria for dust deposition levels are set to protect against nuisance impacts.

Odour nuisance impact has been included in the impact assessment. The impact assessment criteria for complex mixtures of odours have been designed to take into account the range of sensitivity to odours within the community and to provide additional protection for individuals with a heightened response to odours. This is achieved by using a statistical approach, dependent upon population size.

The assessment criteria for particulate matter (TSP and PM_{10}), NO_2, dust deposition and lead were applied, in accordance with the requirements of the Approved Methods, as follows:

- at the nearest existing or likely future off-site sensitive receptor;
- the incremental impact (predicted impacts from the site alone) for each pollutant must be reported;
- background concentrations must be included; and
- total impact (incremental impact plus background) must be reported as the 100th percentile and compared with the relevant impact assessment criteria.

The assessment criteria for individual toxic air pollutants were sourced from the Approved Methods and the Ontario Ministry of the Environment for compounds not covered by the Approved Methods or regulations in any other State or Territory in Australia.

The Ontario Ministry of the Environment provides criteria with both half-hour and 24-hour averaging periods. The half-hour standards were applied to the modelling results with one-hour averaging period. The Ontario Ministry of the Environment compounds were assessed at and beyond the boundary of the facility and as the 100th percentile of dispersion model predictions.

The standards for individual toxic air pollutants sourced from the Approved Methods were applied, in accordance with the requirements of the Approved Methods, as follows:

- at and beyond the boundary of the facility;
- the incremental impact (predicted impacts from the site alone) for each pollutant must be reported in concentration units consistent with the criteria (mg/m^3 or ppm), for an averaging period of 1 hour and as the 99.9th percentile of dispersion model predictions for Level 2 (refined dispersion modelling technique using site-specific input data) impact assessments.

The assessment criteria for complex mixtures of odorous air pollutants were applied, in accordance with the requirements of the Approved Methods, as follows:

- at the nearest existing or likely future off-site sensitive receptor;
- the incremental impact (predicted impacts from the site alone) must be reported in units consistent with the impact assessment criteria (odour unit (OU)), as peak concentrations (i.e. approximately 1 second average) in accordance with the requirements of Section 6 of the Approved Methods as the:
- 100th percentile of dispersion model predictions for Level 1 impact assessments; and
- 99th percentile of dispersion model predictions for Level 2 impact assessments.

Table 3-1 Adopted Assessment Criteria

Species	Averaging Period	Criteria	Units
Particulate matter, NO_2 and lead			
TSP	Annual mean[1,4]	90	$\mu g/m^3$
PM_{10}	Annual mean[2,4]	30	$\mu g/m^3$
	24-hour maximum[3,4]	50	$\mu g/m^3$
NO_2	1 hour[3,4]	246	$\mu g/m^3$
	Annual mean[3,4]	62	$\mu g/m^3$
Lead	Annual mean[3,4]	0.5	$\mu g/m^3$
Individual toxic air pollutants			
Iron oxide fumes	1 hour[5]	90	$\mu g/m^3$
Manganese and compounds	1 hour[5]	18	$\mu g/m^3$
Copper dusts and mists	1 hour[5]	18	$\mu g/m^3$
Chromium VI compounds	1 hour[5]	0.09	$\mu g/m^3$
Nickel and nickel compounds	1 hour[5]	0.18	$\mu g/m^3$
Iron (metallic)	24-hour[6]	4	$\mu g/m^3$
	Half-hour[7]	10	$\mu g/m^3$
Titanium	24-hour[6]	120	$\mu g/m^3$
	Half-hour[7]	100	$\mu g/m^3$
Vanadium	24-hour[6]	2	$\mu g/m^3$
	Half-hour[7]	5	$\mu g/m^3$
Zinc	24-hour[6]	120	$\mu g/m^3$
	Half-hour[7]	100	$\mu g/m^3$
Dust deposition			
Maximum increase in deposited dust level	Annual[4]	2	g/m^2/month
Maximum total deposited dust level	Annual[4]	4	g/m^2/month

Odorous air pollutants (complex mixtures)[4,6]

Population of affected community	**Impact assessment criteria for complex mixtures of odorous air pollutants (OU) (nose-response-time average, 99th percentile)**
Urban (≥~2000) and/or schools and hospitals	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single rural residence (≤~2)	7.0

1. National Health and Medical Research Council (National Health and Medical Research Council, 1996)
2. Environment Protection Authority (NSW Environment Protection Authority, 1998)
3. National Environment Protection Council (National Environment Protection Council, 1998)
4. Department of Environment and Conservation (Department of Environment and Conservation, 2005)
5. Environment Protection Authority ((NSW Environment Protection Authority, 2001)
6. Ontario Ministry of the Environment (Ontario Ministry of the Environment, 2012)
7. Ontario Ministry of the Environment (Ontario Ministry of the Environment, 2013)

4 *METHODOLOGY*

In order to determine the predicted ground level concentrations that result from the project, the following approach was adopted:

- dispersion model selection;
- emission estimation;
- meteorological modelling;
- dispersion modelling;
- post processing; and
- assessment.

4.1 *DISPERSION MODEL SELECTION*

Several different dispersion models are routinely used in Australia for the assessment of air quality impacts from industrial releases. These include:

- AERMOD;
- CALPUFF; and
- Ausplume.

Ausplume is the approved dispersion model for use in most simple, near field applications in NSW. The Approved Methods states, however that Ausplume version 6.0 or later as specifically not approved in the following applications:

- complex terrain, non-steady-state conditions;
- buoyant line plumes;
- coastal effects such as fumigation;
- high frequency of stable calm night-time conditions;
- high frequency of calm conditions; and / or
- inversion break-up fumigation conditions (Department of Environment and Conservation, 2005).

Consideration of *Figure 2.1* and *Figure 2.2* show that over the five years of data:

- calm winds (< 0.5 m/sec) occur for approximately 14% of the time; and
- stable night time conditions occur for approximately 35% of all hours.

Consequently, as determined by the Approved Methods, the CALPUFF model has been used for this assessment.

CALPUFF was selected as a multi-layer, multi-species non-steady state puff dispersion model that can simulate the effects of time- and space-varying meteorological conditions on pollutant transport, transformation and removal (Scire, et al., 2000).

CALPUFF is a highly versatile and widely-used model which can be run in three-dimensional or two-dimensional mode with respect to meteorology. The three-dimensional mode allows spatially varying wind fields, for example, to be incorporated: this can be important in coastal regions with seabreeze effects. CALPUFF also allows plumes to be tracked through time as they are transported by regional winds: in coastal regions recirculation of pollutants due to seabreeze and land breeze cycles can also be important.

CALPUFF contains algorithms for near-source effects such as building downwash, partial plume penetration, sub-grid scale interactions as well as effects such as pollutant removal, chemical transformation, vertical wind shear, a Probability Distribution Function for dispersion in the convective boundary layer and coastal interaction effects (e.g. sea-breeze recirculation and fumigation within the Thermal Internal Boundary Layer).

Meteorological data used to drive CALPUFF are processed by the CALMET meteorological pre-processor (Scire, et al., 2000). CALMET includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects and terrain blocking effects. The pre-processor produces fields of wind components, air temperature, relative humidity, mixing height and other micro-meteorological variables to produce the three-dimensional meteorological fields that are used in CALPUFF. CALMET uses measured and/or modelled meteorological inputs in combination with land use and geophysical information for the modelling domain to predict gridded meteorological fields for the region of interest.

CALPUFF is a United States Environmental Protection Agency (USEPA) regulatory model and is widely used in Australia.

4.2 *EMISSION ESTIMATION*

Estimates of emissions provide the basis for atmospheric dispersion modelling. Consideration of the processes on site has concluded that the dominant species to be emitted are:

- TSP;
- PM_{10}; and
- Dust deposition;
- Toxic air pollutants (metal particles);
- Toxic air pollutants (metal fumes);
- Nitrogen dioxide (NO_2); and
- Odour.

The only combustion processes that occur on site are from vehicle engines, with the conveyors, hammermill, shear and shredder powered by mains electricity. As discussed previously, the change in vehicle movement is expected to be less than 5%, and the change in emissions as a result of vehicle use is not considered to be a significant contribution to overall site emissions. The assessment has therefore concentrated on emissions of species described above from the handling and processing that occurs on site.

Table 4-1 shows the sources identified from the understanding of the process together with the source name used within the modelling. *Table 4.2* and *Table 4.3* include a summary of pollutant emission rates included in the dispersion modelling for volume and point sources, respectively. The pollutant emission rates take into account the water suppression as a mitigation action, achieving 70% reduction in emissions (Department of Sustainability, Environment, Water, Population and Communities, 2012). The water suppression is committed to be undertaken by site management for the following emission sources:

- Materials handling (MH01 – MH11); and
- Truck dumping (TRKD01 – TRKD02).

The site has also committed to enclosing all conveyors, including the conveyor transfer points, to further reduce particulate emissions from the Site compared to current operations.

The oxy-cutting source, C1, is considered fugitive emission sources; for sensitivity analysis, C1 have been modelled as volume and point sources to determine the more appropriate modelling configuration to represent these fugitive sources (see *Annex D*).

The sources TP01 – TP08, TRKD01 - TRKD02, C1, WE01-WE06 and WSS01 have variable TSP/PM_{10} emission rates dependent on operational hours, wind speed, rainfall, or temperature, or a combination thereof, and are discussed further in *Annex A*.

Table 4-1 Source Identification and Process Description

Source Name	Process Description
MH01	Non-ferrous material is transferred to the non-ferrous processing building
MH02 MH03	Transfer of raw material directly to the inspected stockpile of scrap metal (bypass pre-shredder)
MH04 MH05	Transfer of raw material from stockpile to pre-shredder
MH06 MH07	Transfer of pre-shredder output to a truck to convey to the inspected stockpile of scrap metal close to the conveyor into the hammer mill
MH08 MH09	Transfer of the inspected stockpile of scrap metal close to the conveyor onto the hammer mill conveyor
MH10 MH11	Ferrous metals are collected from the stockpile by front end loader and loaded into trucks
TP01	Pre-shredder drop point
TP02	The cleaned fragmented material (on a conveyor) passes under a drum magnet, where ferrous metals are dropped onto the picking conveyor
TP03	Ferrous metals transferred from the picking conveyor, where operators remove remaining non-ferrous materials
TP04	Ferrous metals are conveyed onto the product stockpile.
TP05	Non-ferrous materials drop beneath the drum magnet to a conveyor (C4) that runs perpendicular to the ferrous product
TP06	Transfer point at conveyor bend 1
TP07	Transfer point at conveyor bend 2
TP08	Transfer point at conveyor bend 3
TRKD01	Truck dumping at raw material delivery
TRKD02	Truck carries pre-shredder output to the inspected stockpile of scrap metal close to the conveyor into the hammer mill
C1	Metals cutting at scrap cutting area
WE01	Wind erosion (scrap stockpile)
WE02	Wind erosion (scrap stockpile)
WE03	Wind erosion (post pre-shredder stockpile 1 – at pre-shredder)
WE04	Wind erosion (post pre-shredder stockpile 2 – at hammer mill)
WE05	Wind erosion (ferrous product stockpile)
WE06	Wind erosion (ferrous product stockpile)
WSS01	Wet scrubber stack (hammermill)

1. Emission rates for sources TP01 – TP08, CV01 – CV33, TRKD01 – TRKD02, C1 – C2, WE01-WE06 and WSS01 are discussed in detail in *Annex A*.

Table 4-2 Mass Emission Rates by Volume Source

Source Name[1]	Source Type	Throughput (tonnes/day)	Operation[2] (hours/day)	Units	Species	
					TSP	**PM_{10}**
MH01	Volume	50	15	g/sec	0.0014	0.0006
MH02	Volume	750	14	g/sec	0.022	0.0089
MH03	Volume	750	14	g/sec	0.022	0.0089
MH04	Volume	300	14	g/sec	0.0089	0.0036
MH05	Volume	300	14	g/sec	0.0089	0.0036
MH06	Volume	300	14	g/sec	0.0089	0.0036
MH07	Volume	300	14	g/sec	0.0089	0.0036
MH08	Volume	1050	14	g/sec	0.031	0.013
MH09	Volume	1050	14	g/sec	0.031	0.013
MH10	Volume	790	14	g/sec	0.024	0.0094
MH11	Volume	790	14	g/sec	0.024	0.0094
TP01	Volume	300	14	g/sec	See Annex A	
TP02	Volume	790	14	g/sec	See Annex A	
TP03	Volume	790	14	g/sec	See Annex A	
TP04	Volume	790	14	g/sec	See Annex A	
TP05	Volume	40	14	g/sec	See Annex A	
TP06	Volume	240	14	g/sec	See Annex A	
TP07	Volume	240	14	g/sec	See Annex A	
TP08	Volume	240	14	g/sec	See Annex A	
TRKD01 – TRKD02	Volume	1500	15	g/sec	See Annex A	
C1	Volume	-	6	g/sec	See Annex A	
WE01 – WE06	Volume	-	24	g/sec	See Annex A	

1. Sources TP01 – TP08, CV01 – CV33, TRKD01 – TRKD02, C1, WE01-WE06 and WSS01 are discussed in detail in *Annex A*. These sources have variable emission rates dependent on wind speed, rainfall, or a combination thereof.
2. Sources have been modelled as occurring between the hours of 6am-9pm (15 hours/day), 6am-8pm (14 hours/day), or 7am – 5 pm (10 hours/day).
3. C1 was modelled as both volume and point sources for sensitivity testing to assess the more appropriate modelling configuration to represent these fugitive sources. Modelling results will only be taken from the more appropriate modelling configuration. See *Annex D* for further details.

Table 4-3 Mass emission rates by point source (C1 and WSS01) for NO_X, odour and toxic air pollutants

Source Name[1]	Source Type	Operation[2] (hours/day)	Species Odour (OU/s)	NO_X (g/s)	Iron oxide fumes (g/s)	Manganese and compounds (g/s)	Copper dusts and mists (g/s)
C1[3]	Point	6	0.018	0.043	0.0003	0.00003	0.000005
WSS01	Point	10	See Annex A				

1. Source C1 is discussed in detail in *Annex A*.
2. Metals cutting take place from 9am to 3 pm (6 hours/day).
3. C1 was modelled as both volume and point sources for sensitivity testing to assess the more appropriate modelling configuration to represent these fugitive sources. Modelling results will only be taken from the more appropriate modelling configuration. See *Annex D* for further details.

Annex A provides a description of the methodology used to derive the emission estimates for each of the sources listed, together with the input data used in the emission estimation.

The proposed expansion is likely to result in a decrease in emissions of particulate matter from the site whilst increasing in the throughput to 350,000 tonnes/annum. This reduction will be achieved through effective dust control measures and operational efficiencies.

Efficiencies and mitigation measures proposed for the expansion that reduce the level of emissions from the site include:

- The site will be totally sealed. A sealed surface provides a paved road for truck movement on and off site. This eliminates a large source of particulate matter emissions compared to an unpaved road (Department of Sustainability, Environment, Water, Population and Communities, 2012). Unpaved roads emit particulate matter as the force of the wheels on the road surface pulverise the surface material into fine particles. These fine particles are lifted by and dropped from the rolling wheels of vehicles and are removed by traffic through re-entrainment into the atmosphere. The road surface is also exposed to strong air currents in turbulent shear with the surface. The turbulent wake that is left behind the vehicle continues to act on the road surface after the vehicle has passed, resulting in further emissions of particulate matter. Therefore, paving the road surface reduces the emission of particulate matter on site significantly, assuming the silt loading on the surface of the road is maintained at an acceptable level.

- A sealed surface also reduces the emission of particulate matter from the mobile materials handling equipment due to a more consistent driving surface and the ability to select more direct routes across the site.

- The new site design no longer requires trucks to enter the site twice but allows for one main entrance and exit point, reducing the kilometres travelled by trucks. This reduces the emissions of particulate matter from the exhaust and reduces any potential emissions from wheel generated dust. Emissions from vehicle exhaust are not considered significant unless a change in net annual average daily traffic (AADT) or peak traffic flows are greater than ±5% or ±10% (Environmental Protection UK, 2010). The proposed expansion will not result in a change in traffic conditions of more than 5% net across the expanded site (accounting for existing Dexion operations) and hence vehicle emissions have not been considered in this assessment.

- A gas collection system will be installed above the hammer mill exhaust vent. The system will not be attached to the exhaust vent as this presents a health and safety risk in drawing air through the system and adding additional oxygen. Rather the system will consist of an 'extraction hood' which will collect the exhaust gases. The exhaust gases will then be passed through a cyclone and a wet scrubber to reduce particulate content of the exhaust air stream. It is considered that the wet scrubber will also reduce odorous emissions, however the manufacturer is not able to provide a guarantee in respect of this reduction (consequently odour emission concentrations from odour testing have been used to directly estimate emissions). After the gases have passed through the cyclone and the wet scrubber, they will be ducted to a central point on the site and released to atmosphere from a 15.5 m high stack. The intent of using a stack as the final emission point is to increase vertical velocity to improve dispersion of emissions to atmosphere.

- All of the conveyors and conveyor transfer points will be fully enclosed to prevent dust emissions from these sources.

- The site will install a 1400 tonne capacity shear to replace the current 800 tonne capacity shear. This will mean that the thickness of metal that can be cut through use of the shear will increase to 100mm. This means that the level of oxy-cutting can be substantially reduced with the minimum thickness of metal cut being greater than 100 m. This will reduce the number of oxy-cutters from two to one, the hours of oxy-cutting from ten hours per day to six hours and the emission rate of metal oxide fumes. Overall, this will reduce the level of metal oxide fumes being released from oxy-cutting. Shears produce minimal amounts of particulate matter as the process only applies pressure with a blade to cut the metal, meaning that no grinding of metal occurs.

- Oxy-cutting will be undertaken under wet conditions, which will reduce the level of metal fumes and NO_X emissions being produced.

- Additional equipment purchased for the upgrade will conform to the standards of the latest technology.

4.3 *METEOROLOGICAL MODELLING*

In dispersion modelling, meteorology drives dispersion and dilution of emissions and therefore determines the predicted concentrations at ground level. It is important, therefore, that meteorology used in the dispersion modelling provides a reasonable representation of Site meteorology.

In order to provide the dispersion model with appropriate meteorological information, the following approach was taken:

- Meteorological model selection;
- Year selection;
- Meteorological model setup; and
- Meteorological model validation.

4.3.1 Meteorological Model Selection

Meteorological modelling conducted for this assessment included The Air Pollution Model (TAPM) and CALMET (a three dimensional micro-meteorological model). Insufficient site specific meteorological data was available for the site to adequately describe the local wind flows given the complex nature of the terrain in the model domain. TAPM was selected as an industry standard method able to create a 3-dimensional data file of gridded meteorological parameters by predicting airflow important to local scale air pollution from large scale meteorology provided by synoptic analyses. The TAPM outputs can be converted to file compatible with CALMET using CALTAPM and used as an initial estimated wind field in CALMET.

CALMET is the meteorological pre-processor for the chosen dispersion model and considers the initial estimated wind fields together with any observational data from further afield, terrain and land use information to produce a three-dimensional micro-meteorological model for use in dispersion modelling.

4.3.2 Year Selection

The most recent five years with available meteorological data at the time of preparing the assessment (2008-2012) were selected as the meteorological model years in accordance with international standard practice for dispersion modelling.

4.3.3 Meteorological Model Setup

Meteorological modelling was conducted in accordance with the *Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia'* (Barclay & Scire, 2011). The following sub-sections detail the adopted methodology.

TAPM

Meteorological data was prepared for the dispersion modelling using TAPM developed by CSIRO. TAPM v4 solves the fundamental fluid dynamics and scalar transport equations to predict meteorology and (optionally) pollutant concentrations. It consists of coupled prognostic meteorological and air pollution concentration components. The model predicts airflow important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analyses. The Technical Paper by Hurley (2008a) describes technical details of the model equations, parameterisations, and numerical methods. A summary of some verification studies using TAPM is also given in Hurley (2008b).

A meteorological dataset for 2008-2012 was created using meteorological information and terrain data inherent to TAPM. TAPM v4 has a tendency to over-predict the incidence of light winds in some situations. However, this tendency is considered to lend a conservative bias as low wind speeds are conducive to higher ground level concentrations.

TAPM was configured with the following information:

- centre grid point: 306580mE, 6263617mN (UTM Grid Zone 56S);
- grid points NX x NY x NZ = 35 x 35 x 25;
- 4 grid resolutions (nests) were defined: 30,000, 10,000, 3,000, 1,000; and
- 4 spin up days were allocated and meteorology was output after 2 days.

CALTAPM

CALTAPM was developed to provide users of the TAPM model the ability to create an hourly, 3-dimensional data file of gridded meteorological parameters of the type 3D.DAT for direct use in the CALMET diagnostic meteorological model. When used this way the TAPM data can be used in CALMET to determine the initial guess wind field, prior to the weighting of true observations or even to run CALMET in no-observation mode. The TAPM output file was converted to a 3D.DAT file using CALTAPM for input into CALMET as an initial guess wind field.

CALMET

CALMET is a meteorological pre-processor that includes a wind field generator containing objective analysis and parameterised treatments of slope flows, terrain effects and terrain blocking effects. The pre-processor produces fields of wind components, air temperature, relative humidity, mixing height and other micro-meteorological variables to produce the three-dimensional meteorological fields that are used in the CALPUFF dispersion model.

CALMET requires several datasets in order to resolve the surface and upper air meteorology occurring for each hour of the year:

- surface observations
- wind speed
- temperature
- cloud cover amount
- precipitation amount and type
- base cloud height
- upper air observations
- height of observation
- wind speed and direction at each height
- temperature at each height
- barometric pressure at each height
- land use data
- topographical data

Surface observation data in the surrounding area was available from a Bureau of Meteorology (BoM) meteorological station at Horsley Park, NSW. A precipitation file was also generated from observations at Horsley Park. CALTAPM provided a 3D.DAT file containing surface and upper air observations at every grid point in the model domain. CALMET was run with a grid resolution of 0.2 km covering a 24 km by 24 km model domain. The vertical resolution incorporated 12 cell face heights up to 2000 m. The grid origin was located at 294580 mE, 6251617mN (UTM Zone 56S).

Land Use

The land use for the Project area was obtained from European Space Agency (ESA) GlobCover Portal. ESA delivers global composites and land cover maps using as input observations from the 300 m MERIS sensor on board the ENVISAT satellite mission. The land use maps were generated from observations taken during January - December 2009.

The model domain is mainly characterised by the urban land use category given the location in the north-western suburbs of Sydney.

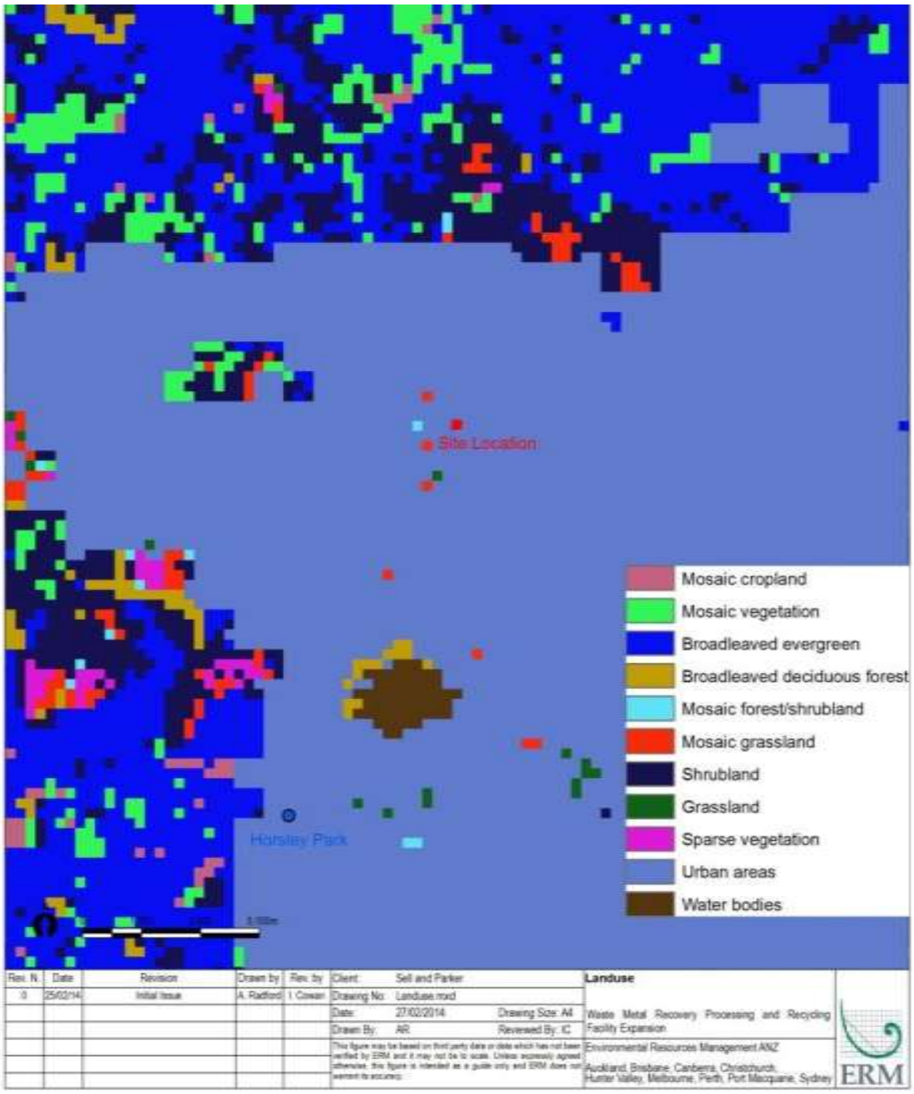


Figure 4.1 ***Landuse used in the meteorological modelling***

Terrain

The terrain for the Project area was obtained from the NASA SRTM Mission at a 90 m spatial resolution. The terrain close to the site is quite uniform with a change in height of less than 40 m within 5 km of the site. The landscape could be described as gentle rolling hills with some larger terrain features to the north-east of the site. Horsley Park in the south-west of the modelling domain is likely to experience significantly different local wind flows than that at the site. Horsley Park is an elevated location is dominated by wind flows from the south-west. Given the undulating hills surrounding the site, wind directions are likely to channel through the valleys to the west-south-west. Both sites will be influenced on a local scale by drainage flows characterised by mountain-valley interactions.

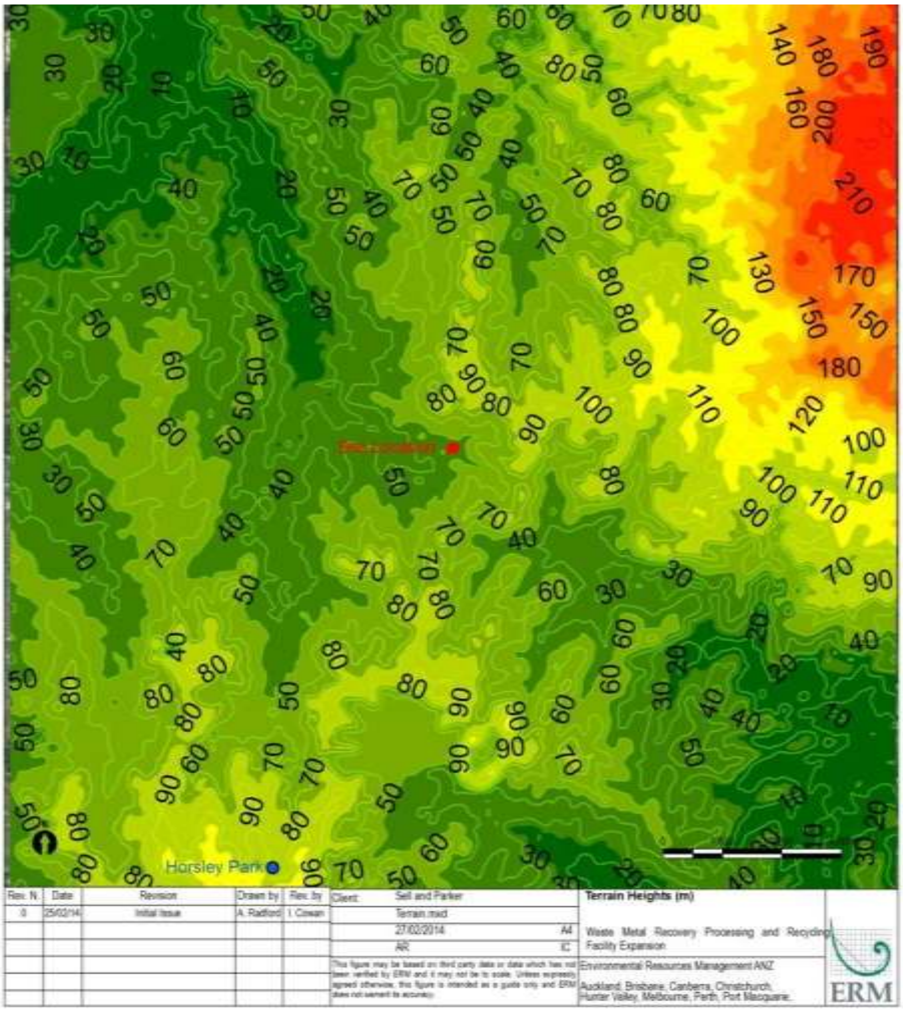
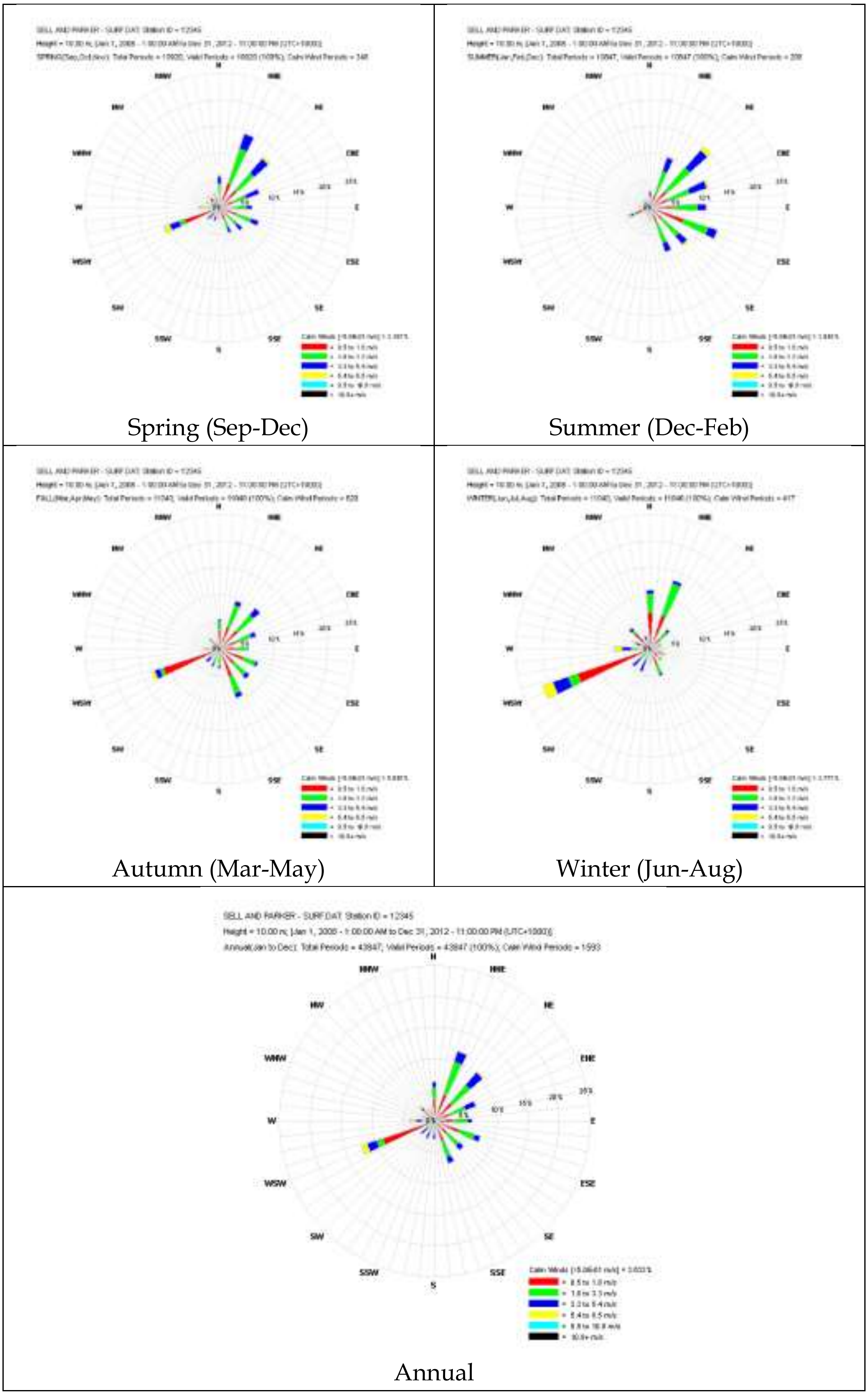


Figure 4.2 Terrain used in the meteorological modelling

4.3.4 Meteorological Model Validation

Figure 4.3 shows the wind roses predicted for the Site by CALMET including the data from TAPM and observation location at Horsley Park as described above.



Spring (Sep-Dec)

Summer (Dec-Feb)

Autumn (Mar-May)

Winter (Jun-Aug)

Annual

Figure 4.3 Predicted wind roses for the site

Comparison of *Figure 4.3* with *Figure 2.1* indicates similarities between the datasets with almost no wind flow from the west or north-west. Comparison of the wind roses predicted for the site (*Figure 4.3*) with the local terrain (*Figure 4.2*) shows that the wind flows for both sites are likely to align with their local shallow valley system. It is considered that the decrease in calm conditions at the Site compared to Horsely Park is reflective of local drainage in a shallow valley system at the Site compared to the position of the BoM monitor at the base of a hill at Horsely Park. The calm conditions demonstrated at Horsely Park are likely to be reflected in the higher frequency of 0.5 m/sec to 1.0 m/sec winds predicted at the Site as a result of cool air drainage.

4.4 *DISPERSION MODELLING*

Dispersion modelling was undertaken using the CALPUFF dispersion model. The emission sources were configured in the dispersion model using the parameters shown in *Table 4-4* together with the rates shown in *Table 4.2* and *Table 4.3*

Table 4-4 Emission parameters used in dispersion model

Source Name[1]	Source Type	Diameter (m)	Release velocity (m/sec)	Release Height (m)	σy (m)	σz (m)
TRKD01	Volume	-	-	2.5	1.16	2.33
TRKD02	Volume	-	-	2.5	1.16	2.33
MH01	Volume	-	-	4	1.02	0.37
MH02	Volume	-	-	3.5	1.02	2.16
MH03	Volume	-	-	4	1.02	0.37
MH04	Volume	-	-	3.5	1.02	2.16
MH05	Volume	-	-	4	1.02	0.37
MH06	Volume	-	-	2	1.02	2.16
MH07	Volume	-	-	4	1.02	0.37
MH08	Volume	-	-	2	1.02	2.16
MH09	Volume	-	-	2	1.02	0.37
MH10	Volume	-	-	3.5	0.84	2.21
MH11	Volume	-	-	4	0.84	0.37
TP01	Volume	-	-	7	0.47	0.23
TP02	Volume	-	-	1.0	0.47	0.09
TP03	Volume	-	-	1.0	0.47	0.09
TP04	Volume	-	-	7.0	0.47	0.23
TP05	Volume	-	-	1.0	0.47	0.09
TP06	Volume	-	-	3	0.70	0.09
TP07	Volume	-	-	3	0.70	0.09
TP08	Volume	-	-	3	0.70	0.09
WE01	Volume	-	-	3.5	2.33	3.26
WE02	Volume	-	-	3.5	2.33	3.26
WE03	Volume	-	-	3.5	1.16	3.26
WE04	Volume	-	-	3.5	2.33	3.26

Source Name[1]	Source Type	Diameter (m)	Release velocity (m/sec)	Release Height (m)	σy (m)	σz (m)
WE05	Volume	-	-	3.5	2.33	3.26
WE06	Volume	-	-	3.5	2.33	3.26
C1[3]	Volume	-	-	0.75	0.23	0.70
WSS01	Point	0.595	25	15.5	-	-
C1[3]	Point	0.05	0.01	1	-	-

1. The release temperature for all sources (aside from C1 as point source and WSS01, see *Annex A*) is ambient air temperature.
2. C1 has been modelled as both volume and point sources for sensitivity testing to assess the more appropriate modelling configuration to represent these fugitive sources. Modelling results will only be taken from the more appropriate modelling configuration.

The locations of the sources, described by the source names in Table 4-4, are indicated in Figure 4.4.

4.4.1 *Time Varying Emission Rates*

Time varying emission rates have been used for some emission sources which do not emit on a constant temporal basis and/or do not emit at a constant rate. The wet scrubber will operate between the hours of 6 am to 8 pm and has been modelled only for these hours. The emission rate from the wet scrubber has also been correlated to the ambient temperature (*Annex A*). The metal cutting operations typically take place up to 10 hours in a day (assumed from 7 am to 5 pm).

The materials handling activities on-site, which have been represented as volume sources, have also been modelled between the hours of 6 am to 8 pm. Truck dumping, associated with the transportation of raw materials on the proposed site, has been modelled between the site operation hours of 6 am to 9 pm. The emission rates associated with proposed truck dumping and wind erosion from stockpiles have utilised equations relating wind speed and rainfall to the estimate the emissions of dust from these activities (*Annex A*).

4.4.2 *Receptor Grid*

A receptor grid of dimension 12 km by 12 km with a south west corner at 300580 mE, 6257617 mN (UTM Grid Zone 56) at a resolution of 200m was used to model predicted concentrations at ground level. The height of each receptor within the grid was extracted from the SRTM data.

Figure 4.4 Location of the point and volume sources modelled

4.4.3 *NO_X-to-NO_2 Conversion*

On emission to atmosphere nitrogen species are emitted in two main forms:

- Nitric oxide (NO); and
- Nitrogen dioxide (NO_2).

Together these oxidation states of nitrogen species are termed oxides of nitrogen or NO_X.

Atmospheric chemistry results in the oxidation of NO to form NO_2, whilst photodisassociation of NO_2 results in the formation of NO and an oxygen radical.

Consequently, not all emitted NO_X forms NO_2, and the formation of NO_2 is limited by the amount of oxidant in the atmosphere. One of the most prevalent oxidants that converts NO to NO_2 is tropospheric ozone (O_3). The formation of NO_2 can therefore be considered to be limited by the amount of ozone available for feed the reaction.

The ozone limiting method (OLM) presented in the Approved Methods, allows for the consideration of oxidation of NO to form NO_2 within the assessment using *Equation 4.1*.

Equation 4.1 ***Calculation of NO_2 through the ozone limiting method***

$$[NO_2]_{total} = \{0.1 \times [NO_X]_{pred}\} + MIN\{(0.9) \times [NO_X]_{pred} \; or \; ({}^{46}/_{48}) \times [O_3]_{bkgd}\} + [NO_2]_{bkgd}$$

Where:

$[NO_2]_{total}$ is the predicted concentration of NO_2 in µg/m³ including background

$[NO_X]_{pred}$ is the dispersion model prediction of the ground level NO_X in µg/m³

MIN is the minimum of the two quantities in the braces

$[O_3]_{bkgd}$ is the background ambient O_3 concentration in µg/m³

(46/48) is the molecular weight of NO_2 divided by the molecular weight of O_3 in µg/m³

$[NO_2\}_{bkgd}$ is the background ambient $_{NO2}$ concentration in µg/m³.

Equation 4.1 has been used in this assessment using background data from the EPA prospect monitoring station.

4.5 *POST-PROCESSING*

Post processing has been undertaken using CALPOST for each of the five years modelled. This process reviews each of the hourly predicted concentrations across the model grid and at the sensitive receptors, averages the concentrations according to the requirements of the assessment criteria and retrieves the maximum predicted concentration at each location for the requisite averaging period specified by the Impact Assessment Criteria (*Table 3.1*).

Metallic emissions from the hammermill occur as $PM_{2.5}$ and are remnants of the metals being shredded. $PM_{2.5}$ are not in the same form as the metallic compounds released from the oxy-cutting which are in the form of metal oxide fumes. Emission factors for metal fumes are provided for iron oxide fume, manganese oxide fume and copper oxide fume.

The adopted assessment criteria (*Table 3.1*) provide separate criteria for iron oxide fume and iron particulate matter as well as copper fume and copper dusts and mists. For these compounds, emissions from the hammer mill and the oxy-cutting have been considered separately. The criteria for manganese is expressed as manganese and compounds. Consequently manganese particulates from the hammer mill and manganese oxide fume have been summed prior to assessment.

5 RESULTS

The assessment of impacts has considered the predicted concentrations of TSP, PM_{10}, deposited dust, toxic air pollutants (metals), NO_2 and odour at the sensitive receptors, with and without background air quality concentrations.

5.1 CONTOUR PLOTS

The concentration or deposition contours for the modelled domain are presented in *Annex B* for the highest predicted concentration in the five modelled years for:

- Annual mean PM_{10} (excluding background);
- 24-hour mean PM_{10} (excluding background);
- Dust deposition (excluding background); and
- 1-hour mean nitrogen dioxide (including background).

Contour plots have not been provided for all modelled compounds as the majority are predicted to be substantially below criteria. Only those with predicted concentrations that are a significant percentage of the adopted assessment criteria have been presented.

Predicted PM10 concentrations have been presented without background as the elevated background in 2009 due to a dust storm results in an inability to show the influence of the site. The results of a level 2 contemporaneous assessment cannot be demonstrated in a contour plot.

Predicted dust deposition concentrations have been presented without background as the current dust deposition rate in the surrounding area is unknown, instead the results have been assessed against the incremental criterion.

Predicted NO_2 concentrations have been presented with background as compliance was demonstrated with a level 1 assessment (maximum modelled plus maximum background) without the need for a contemporaneous assessment (level 2).

5.2 MODELLING RESULTS

The predicted concentrations are to be assessed against the assessment criteria at the nearest existing off-site sensitive receptors (R1 – R20), as listed previously in *Table 2.5*. It is noted that since R11 – R20 are set up to be immediately adjacent to the Site boundary and beyond, the maximum offsite impacts are also included within the results reported for R11 – R20.

The following tables report the incremental impact from the site, the maximum background concentration (if applicable) and the total impact (increment impact plus background) as the 100th percentile concentration (or deposition), aside from toxic air pollutants and odour. Toxic air pollutants and odour are reported as the 99.9th percentile and 99th percentile (mixed odorants), respectively, for a Level 2 assessment, as required by the Approved Methods.

5.2.1 *TSP Annual Mean*

The predicted annual average TSP concentrations at the receptors were produced from the model. The highest concentration at each receptor over a 5 year period is presented in *Table 5-1* for sensitive receptors. Whilst ambient TSP is not measured at Prospect, typically PM_{10} is considered to be half of the ambient TSP value. Taking the annual average PM_{10} value of 18.4 µg/m^3 this indicates an annual average background TSP value of 36.8 µg/m^3.

The results in *Table 2-1* indicate that the total impact at all the assessed sensitive receptors is below the TSP annual assessment criterion of 90 µg/m^3.

Table 5-1 Highest Annual Average TSP Concentrations at Receptors over 5 years

Sensitive Receptor	X	Y	Maximum TSP Concentration (Increment)[1] (µg/m^3)	Background Air Quality[2] (µg/m^3)	Increment plus background (µg/m^3)	Impact Assessment Criterion (µg/m^3)
R1	306993	6263656	0.23	36.8	37.0	90
R2	306975	6263528	0.21	36.8	37.0	
R3	306963	6263414	0.15	36.8	37.0	
R4	305627	6263452	0.09	36.8	36.9	
R5	305527	6263624	0.07	36.8	36.9	
R6	305475	6263762	0.06	36.8	36.9	
R7	305584	6264114	0.05	36.8	36.9	
R8	306081	6264458	0.08	36.8	36.9	
R9	306603	6264395	0.08	36.8	36.9	
R10	307080	6264227	0.06	36.8	36.9	
R11	306442	6263762	0.05	36.8	36.8	
R12	306531	6263749	4.63	36.8	41.4	
R13	306602	6263739	2.71	36.8	39.5	
R14	306653	6263748	1.66	36.8	38.5	
R15	306728	6263659	1.90	36.8	38.7	
R16	306723	6263581	1.38	36.8	38.2	
R17	306489	6263446	1.80	36.8	38.6	
R18	306406	6263371	1.10	36.8	37.9	
R19	306325	6263369	0.84	36.8	37.6	
R20	306423	6263682	8.11	36.8	44.9	

1. Maximum at each of the receptors over 5 years.
2. Typically PM_{10} is considered to be half of the ambient TSP value. Taking the annual average PM_{10} value of 18.4 µg/m^3 this indicates an annual average background TSP value of 36.8 µg/m^3

5.2.2 *Dust Deposition Annual Mean*

With an unknown background, the maximum allowable increase in deposited dust is 2 g/m²/month. *Table 5-2* shows the highest annual average dust deposition at each of the receptors produced from 5 years of data. The predicted deposition levels at all of the sensitive receptors are below the assessment criteria (*Table 5-2*).

Table 5-2 Highest Annual Average Dust Deposition at Receptors over 5 years

Sensitive Receptor	**X**	**Y**	**Annual Average Dust Deposition (Increment)[1] (g/m²/month)**	**Impact Assessment Criterion (g/m²/month)**
R1	306993	6263656	0.04	2 (allowable increase)
R2	306975	6263528	0.03	
R3	306963	6263414	0.02	
R4	305627	6263452	0.01	
R5	305527	6263624	0.01	
R6	305475	6263762	0.01	
R7	305584	6264114	0.01	
R8	306081	6264458	0.01	
R9	306603	6264395	0.01	
R10	307080	6264227	0.01	
R11	306442	6263762	0.01	
R12	306531	6263749	0.75	
R13	306602	6263739	0.51	
R14	306653	6263748	0.29	
R15	306728	6263659	0.22	
R16	306723	6263581	0.18	
R17	306489	6263446	0.22	
R18	306406	6263371	0.12	
R19	306325	6263369	0.10	
R20	306423	6263682	0.91	

1. Maximum at each of the receptors over 5 years.

5.2.3 *PM_{10} Annual Mean*

The highest annual average PM_{10} concentrations at each receptor are presented in *Table 5-3*. The corresponding background concentration for the year in which the maximum concentration was predicted is also presented. The addition of the background concentration and the maximum increment results in concentrations below the annual mean criteria for PM_{10} (*Table 5-3*).

Table 5-3 Maximum Annual Average PM_{10} Concentrations at Receptors over 5 years

Sensitive Receptor	**X**	**Y**	**Annual Average PM_{10} Concentration (Increment)[1] (µg/m^3)**	**Background Air Quality (µg/m^3)**	**Increment plus Background (µg/m^3)**	**Impact Assessment Criterion (µg/m^3)**
R1	306993	6263656	0.12 (2008)	17.8	17.9	30
R2	306975	6263528	0.11 (2010)	15.4	15.5	
R3	306963	6263414	0.08 (2010)	15.4	15.5	
R4	305627	6263452	0.05 (2012)	17.3	17.3	
R5	305527	6263624	0.03 (2012)	17.3	17.3	
R6	305475	6263762	0.03 (2012)	17.3	17.3	
R7	305584	6264114	0.02 (2012)	17.3	17.3	
R8	306081	6264458	0.04 (2011)	15.8	15.8	
R9	306603	6264395	0.04 (2011)	15.8	15.8	
R10	307080	6264227	0.04 (2012)	17.3	17.3	
R11	306442	6263762	0.03 (2008)	17.8	17.8	
R12	306531	6263749	2.05 (2011)	15.8	17.8	
R13	306602	6263739	1.20 (2012)	17.3	18.5	
R14	306653	6263748	0.76 (2008)	17.8	18.6	
R15	306728	6263659	0.91 (2010)	15.4	16.3	
R16	306723	6263581	0.68 (2010)	15.4	16.1	
R17	306489	6263446	0.87 (2010)	15.4	16.3	
R18	306406	6263371	0.56 (2012)	17.3	17.9	
R19	306325	6263369	0.44 (2012)	17.3	17.7	
R20	306423	6263682	2.78 (2011)	15.8	18.6	

1. Maximum at each of the receptors over 5 years. Corresponding worst-case year in parentheses.

5.2.4 *PM_{10} 24-Hour Mean*

As shown in *Table 2-2*, the maximum 24-hour maximum average PM_{10} background concentration for 2009 exceeds the assessment criterion as a result of an extreme dust storm event that happened that year. The highest 24-hour average PM_{10} concentrations at each receptor are presented in *Table 5-3*, together with the maximum 24-hour average background concentration for the relevant year in which the prediction occurred.

While the highest maximum site contribution to 24-hour average PM_{10} concentrations at each of the receptors over the modelled 5 years are below the assessment criteria, the increment plus background exceeds the assessment criteria at receptors 5, 12, 13 and 20 (*Table 5-4*). The exceedances of the standard are the result of maximum measured backgrounds that are either close to or above the assessment criteria.

Table 5-4 Maximum 24-hour Average PM_{10} Concentrations at Receptors over 5 years

Sensitive Receptor	X	Y	Maximum 24-hour Average PM_{10} Concentration (Increment) [1] (µg/m³)	Background Air Quality (µg/m³)	Increment plus Background (µg/m³)[2]	Impact Assessment Criterion (µg/m³)
R1	306993	6263656	2.02 (2010)	40.1	42.1	50
R2	306975	6263528	2.37 (2010)	40.1	42.5	
R3	306963	6263414	1.57 (2010)	40.1	41.7	
R4	305627	6263452	0.51 (2010)	40.1	40.6	
R5	305527	6263624	0.45 (2009)	1680.3	**1680.8**	
R6	305475	6263762	0.32 (2011)	41.5	41.8	
R7	305584	6264114	0.29 (2010)	40.1	40.4	
R8	306081	6264458	0.40 (2011)	41.5	41.9	
R9	306603	6264395	0.68 (2008)	41.8	42.5	
R10	307080	6264227	0.34 (2012)	38.7	39.0	
R11	306442	6263762	0.41 (2010)	40.1	40.5	
R12	306531	6263749	14.11 (2011)	41.5	**55.6**	
R13	306602	6263739	12.31 (2012)	38.7	**51.0**	
R14	306653	6263748	8.32 (2012)	38.7	47.0	
R15	306728	6263659	7.15 (2010)	40.1	47.3	
R16	306723	6263581	6.54 (2010)	40.1	46.6	
R17	306489	6263446	8.15 (2012)	38.7	46.9	
R18	306406	6263371	5.03 (2012)	38.7	43.7	
R19	306325	6263369	3.76 (2012)	38.7	42.5	
R20	306423	6263682	16.22 (2010)	40.1	**56.3**	

1. Maximum at each of the receptors over 5 years. Corresponding worst-case year in parentheses.
2. Exceedances of the impact assessment criterion are highlighted in bold font.

Level 2 Contemporaneous Assessment

The guidance document for the modelling and assessment of air pollutants (Department of Environment and Conservation, 2005) states that, where a Level 1 assessments indicates an exceedance of the impact assessment criteria, it must be demonstrated that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity through a contemporaneous assessment.

The guidance indicates that the maximum predicted concentrations at the receptors, as a result of site activities, must be matched with the corresponding 24-hour average in the background ambient air quality data. This approach also needs to be applied vice versa, in that the maximum concentrations in the ambient air quality data are matched with the corresponding predicted 24-hour average concentration from site activities at the receptors.

Given the potential for additional exceedances, Sell & Parker will install two ambient PM_{10} monitors on the boundary, but within, the site. The monitors will be of a type that is portable in order to move the monitors upwind and downwind of the site as needed. Given the dominant air flows through the year, it is generally recommended that the monitors are located on the south-western and north-eastern boundaries, however as wind directions change through the year these positions will need to be altered.

Where the downwind monitor measures a rolling four hour average greater than the 24-hour standard during working hours and the upwind monitor demonstrates compliance with the standard, Sell & Parker will reduce dust generating activities and where continued exceedance for the next hour occurs cease all dust generating activities until the monitors demonstrate a sufficient baseline level that operations may continue. It is considered appropriate that quarterly reporting of the 24-hour average concentration derived from the monitoring data, for each monitor, along with any stoppages in work would be provided to the EPA on a confidential basis, and included in the annual licence return.

With this commitment in mind, a contemporary analysis of the original dispersion modelling with baseline levels measured at Prospect was undertaken to identify periods where the rolling four hour average was above the 24-hour standard. Data from the Prospect monitoring station is only provided as a 24-hour average and this value was used for each hour of the day that is represented by the 24-hour average. This identified periods within the five modelled years where dust generating activities needed to cease operations. A time varying file for the fugitive dust sources and for the hammer mill point source were produced, reducing emissions to zero for periods where the cumulative (site contribution plus background) four hour rolling mean of the initial run indicated concentrations above 50 $\mu g/m^3$.

Following this remodelling a contemporary analysis, in accordance with the Approved Methods was completed. To facilitate the contemporary analysis, the highest maximum 24-hour average PM_{10} concentrations as a result of site operations were extracted at each of the receptors for 5 years from the model data for receptors that indicated an exceedance in the Level 1 assessment. These maximum concentrations at the receptors were matched with the corresponding 24-hour background concentration and added together to provide the increment plus background, when the concentrations at the receptors are at their highest over 5 years

Table 5-5 shows the maximum predicted site contributions to the surrounding sensitive receptors for the five modelled years for the receptors which indicated a potential for exceedance when adding the maximum modelled concentration to the maximum measured background (*Table 5-4).* These concentrations have been added to the measured background concentrations which occurred on the day of the predicted maximum concentration at each receptor. This analysis indicates that when maximum impacts are likely to occur ambient concentrations are typically sufficiently low to prevent additional exceedances of the standard.

Table 5-6 shows the maximum, non-exceedance background concentrations, together with the date on which they occurred, the predicted site contribution at the sensitive receptors and the cumulative impact of background plus site contribution for receptors. This analysis indicates that when maximum non-exceedance background concentrations occur, site contribution is typically sufficiently low to prevent additional exceedances of the standard.

In these analyses, the results indicate that there would be no additional exceedances of the standard. This is due to the commitment to monitoring and the cessation of dust generating activities when the need arises.

Table 5-5 *Maximum 24-hour average Site contribution to PM_{10} Concentrations at the Receptors plus background*

PM_{10} Maximum Predicted 24-hour average Site contribution (µg/m³)	Date	Background (µg/m³)	Increment plus Background (µg/m³)
	Sensitive Receptor 5		
0.5	3/06/2009	21.3	21.8
0.4	13/08/2011	20.3	20.7
0.4	15/02/2012	12.3	12.7
0.4	16/01/2012	10.7	11.0
0.3	28/03/2011	11.6	11.9
0.3	8/07/2012	18.1	18.4
0.3	17/06/2008	14.1	14.4
0.3	10/03/2009	16.0	16.3
0.3	4/06/2009	21.8	22.1
0.3	7/11/2009	18.0	18.3
	Sensitive Receptor 12		
14.1	30/05/2011	6.3	20.4
13.1	4/06/2010	8.3	21.4
12.8	7/03/2012	8.2	21.0
12.5	22/07/2011	7.0	19.5
12.5	31/03/2010	8.2	20.7
12.2	12/12/2011	12.5	24.7
11.7	2/10/2011	9.7	21.4
11.7	20/08/2011	12.8	24.5
11.1	12/06/2012	8.7	19.8
11.0	21/02/2012	11.5	22.5
	Sensitive Receptor 13		
12.6	22/10/2008	7.9	20.5
12.3	8/03/2012	5.6	17.9
10.7	16/04/2008	14.4	25.1
10.7	23/10/2008	9.6	20.3
10.4	17/04/2008	11.9	22.3
10.0	5/06/2008	10.0	20.0
9.8	25/04/2008	10.5	20.3
9.6	14/04/2008	13.9	23.5
9.6	25/07/2008	11.2	20.8
9.4	21/01/2008	14.2	23.6
	Sensitive Receptor 20		
16.2	23/06/2010	9.0	25.2
16.2	3/06/2012	8.7	24.9
16.1	20/03/2011	7.7	23.8
15.5	5/10/2010	9.9	25.4
14.7	4/10/2010	10.1	24.8
14.6	26/01/2012	12.1	26.7
13.8	21/01/2012	14.9	28.7
13.8	29/06/2011	12.4	26.2
13.6	10/01/2011	11.1	24.7
13.4	9/01/2011	11	24.4

Table 5-6 24-hour average Site contribution to PM10 concentrations at the sensitive receptors at the time of the highest non-exceeding background concentrations

Date	Back-ground[1] (µg/m^3)	PM$_{10}$ Maximum Predicted 24-hour average Site contribution (µg/m^3) Sensitive Receptors				Increment plus Background (µg/m^3) Sensitive Receptors			
		5	**12**	**13**	**20**	**5**	**12**	**13**	**20**
27/11/2009	48.5	0.00	0.01	0.01	0.29	48.5	48.5	48.5	48.8
20/11/2009	48.1	0.00	0.00	0.00	0.00	48.1	48.1	48.1	48.1
25/02/2009	44.7	0.02	0.30	0.39	0.92	44.7	45.0	45.1	45.6
2/10/2009	42.6	0.00	1.25	0.24	1.18	42.6	43.8	42.8	43.8
6/12/2008	41.8	0.00	0.01	0.78	0.00	41.8	41.8	42.6	41.8
16/09/2008	41.5	0.00	0.04	0.08	0.00	41.5	41.5	41.6	41.5
20/09/2011	41.5	0.00	0.10	0.37	0.00	41.5	41.6	41.9	41.5
25/08/2009	40.9	0.00	0.00	0.00	0.00	40.9	40.9	40.9	40.9
1/07/2008	40.1	0.00	0.01	0.00	0.00	40.1	40.1	40.1	40.1
27/03/2010	40.1	0.00	1.78	1.00	0.86	40.1	41.9	41.1	41.0
26/03/2009	39.7	0.04	0.05	0.59	0.02	39.7	39.7	40.3	39.7
15/09/2008	39.2	0.00	0.00	0.00	0.00	39.2	39.2	39.2	39.2
14/10/2009	38.8	0.00	0.07	0.29	0.00	38.8	38.9	39.1	38.8
23/09/2011	38.7	0.00	0.65	1.72	0.71	38.7	39.3	40.4	39.4
26/10/2012	38.7	0.00	1.33	1.80	0.02	38.7	40.0	40.5	38.7

1. Sourced from the Prospect ambient monitoring station

5.2.5 *Hammermill Metal Emissions*

Particulate emissions of less than 2.5 µm in aerodynamic diameter ($PM_{2.5}$) are also emitted from the hammermill in operation. As discussed, there is no assessment criterion for $PM_{2.5}$ within the Approved Methods. The USEPA Speciate program has however measured the constituents of $PM_{2.5}$ from hammermills and the following species are emitted as $PM_{2.5}$, which also have an adopted assessment criterion (*Table 3-1*):

- Chromium;
- Copper;
- Lead;
- Manganese;
- Nickel;
- Iron;
- Titanium;
- Vanadium; and
- Zinc

As discussed in Section *4.5*, iron oxide fume, copper oxide fume and manganese oxide fume are also released from oxy-cutting. Iron oxide fume and copper oxide fume have separate assessment criteria from iron and copper particulate (*Table 3.1*) and have therefore been assessed separately. Manganese particulate matter from the hammer mill and manganese oxide fume have been summed as the criteria is expressed as manganese and compounds.

Table 5-7 shows the predicted 1 hour average and 24 hour average concentrations at the identified sensitive receptors together with the relevant assessment criteria. It can be seen from *Table 5-7* that none of the predicted concentrations exceeds the relevant assessment criteria for these species.

Table 5-8 shows the predicted 1 hour average iron (metallic), titanium, vanadium and zinc concentrations assessed against the Ontario Ministry of the Environment half-hour standards (Ontario Ministry of the Environment, 2013). None of the predicted concentrations exceeds the relevant assessment criteria for these species.

Table 5-7 Predicted concentrations at identified sensitive receptors for metals associated with $PM_{2.5}$ emissions from the Hammermill

Sensitive Receptor	**Chromium as Chromium VI ($\mu g/m^3$) 1 hr mean**	**Copper ($\mu g/m^3$) 1hr Mean**	**Lead ($\mu g/m^3$) Annual Mean**	**Manganese[1] ($\mu g/m^3$) 1 hr mean**	**Nickel ($\mu g/m^3$) 1 hr mean**	**Iron ($\mu g/m^3$) 24 hr mean**	**Titanium ($\mu g/m^3$) 24 hr mean**	**Vanadium ($\mu g/m^3$) 24 hr mean**	**Zinc ($\mu g/m^3$) 24 hr mean**
1	0.0003	0.0009	0.0001	0.001	0.0003	0.009	0.00004	0.000002	0.003
2	0.0004	0.0009	0.0001	0.001	0.0003	0.009	0.00004	0.000002	0.003
3	0.0004	0.0009	0.0001	0.001	0.0003	0.007	0.00003	0.000001	0.002
4	0.0001	0.0003	0.0000	0.001	0.0001	0.003	0.00001	0.000001	0.001
5	0.0001	0.0003	0.0000	0.001	0.0001	0.004	0.00002	0.000001	0.001
6	0.0001	0.0003	0.0000	0.000	0.0001	0.003	0.00001	0.000000	0.001
7	0.0001	0.0002	0.0000	0.000	0.0001	0.002	0.00001	0.000000	0.001
8	0.0001	0.0003	0.0000	0.000	0.0001	0.003	0.00001	0.000001	0.001
9	0.0002	0.0004	0.0000	0.000	0.0001	0.005	0.00002	0.000001	0.002
10	0.0002	0.0004	0.0000	0.000	0.0001	0.003	0.00001	0.000001	0.001
11	0.0001	0.0003	0.0000	0.000	0.0001	0.002	0.00001	0.000000	0.001
12	0.0007	0.0017	0.0003	0.008	0.0005	0.038	0.00016	0.000007	0.014
13	0.0007	0.0017	0.0003	0.005	0.0005	0.035	0.00015	0.000006	0.013
14	0.0007	0.0017	0.0003	0.004	0.0005	0.025	0.00011	0.000004	0.009
15	0.0008	0.0019	0.0003	0.004	0.0006	0.029	0.00012	0.000005	0.010
16	0.0008	0.0020	0.0003	0.005	0.0006	0.029	0.00012	0.000005	0.010
17	0.0006	0.0016	0.0003	0.013	0.0005	0.031	0.00013	0.000005	0.011
18	0.0004	0.0011	0.0002	0.007	0.0003	0.019	0.00008	0.000003	0.007
19	0.0004	0.0009	0.0001	0.005	0.0003	0.014	0.00006	0.000002	0.005
20	0.0006	0.0016	0.0003	0.019	0.0005	0.029	0.00013	0.000005	0.011
Criterion	0.09	3.7	0.5	18	0.18	4	120	2	120

1 – Manganese results are the summation of manganese particulate matter from the hammermill and manganese oxide fume from oxy-cutting

Table 5-8 Predicted concentrations at identified sensitive receptors for iron (metallic), titanium, vanadium and zinc with 1-hour averaging periods

Sensitive Receptor	**Iron ($\mu g/m^3$) 1 hr mean**	**Titanium ($\mu g/m^3$) 1 hr mean**	**Vanadium ($\mu g/m^3$) 1 hr mean**	**Zinc ($\mu g/m^3$) 1 hr mean**
1	0.1	0.0004	0.00002	0.03
2	0.1	0.0006	0.00002	0.05
3	0.1	0.0004	0.00002	0.03
4	0.0	0.0001	0.00001	0.01
5	0.0	0.0001	0.00000	0.01
6	0.0	0.0001	0.00001	0.01
7	0.0	0.0001	0.00000	0.01
8	0.0	0.0001	0.00001	0.01
9	0.0	0.0002	0.00001	0.02
10	0.1	0.0002	0.00001	0.02
11	0.0	0.0002	0.00001	0.01
12	0.3	0.0011	0.00004	0.09
13	0.2	0.0007	0.00003	0.06
14	0.3	0.0013	0.00005	0.11
15	0.3	0.0012	0.00005	0.10
16	0.3	0.0014	0.00006	0.12
17	0.3	0.0014	0.00006	0.12
18	0.1	0.0005	0.00002	0.04
19	0.2	0.0007	0.00003	0.06
20	0.1	0.0006	0.00002	0.05
Half-hour criterion	10	100	5	100

5.2.6 *Odour*

The evaluation of odour impacts requires the estimation of short or peak concentrations on the time scale of less than one second. The peak odour impacts are estimated from the 1-hour odour modelling results by multiplying with the appropriate factor from Table 6.1 of the Approved Methods. The selection of the appropriate factor to estimate peak concentrations in flat terrain is based on the wet scrubber (volume source) of the hammer mill, which is the largest source of odour (see *Sections A1.5* and *A1.6* in *Annex A),* i.e. the value of 2.3 for a volume source. In relation to odour from the hammer mill, this is generated from the vehicles which are passed through the system. The level of odour generated will, therefore, be directly related to the volume of vehicles being processed at any one time.

It is noted that the odour concentrations are emitted from the wet scrubber (WSS01) and the metals cutting operations. From the analysis of the contour plots and the results, it has been assessed that the cutting fugitive source is best represented as point sources in the modelling. The results in *Table 5-9* are reported for WSS01 as a volume source and C1 as point sources (*Annex D*).

In *Table 5-9*, the incremental odour results are reported for the nearest sensitive receptors (99th percentile for mixed odorants for a Level 2 assessment), as required by the Approved Methods. In addition, the maximum incremental offsite odour impact (99th percentile) has also been reported, as requested by the EPA. No odour background concentrations are available for this assessment.

Table 5-9 ***Maximum predicted peak odour concentrations at Receptors and maximum offsite odour concentrations over 5 years***

Sensitive Receptor	X	Y	Year	Maximum peak odour concentration[1] (OU)	Impact assessment criterion (OU)
1	306993	6263656	2008	0.4	2
2	306975	6263528	2008	0.4	
3	306963	6263414	2008	0.3	
4	305627	6263452	2012	0.2	
5	305527	6263624	2012	0.1	
6	305475	6263762	2012	0.1	
7	305584	6264114	2012	0.1	
8	306081	6264458	2011	0.1	
9	306603	6264395	2011	0.2	
10	307080	6264227	2012	0.2	
11	307442	6263762	2008	0.1	
12	306531	6263749	2010	1.7	
13	306602	6263739	2011	1.6	
14	306653	6263748	2012	1.4	
15	306728	6263659	2008	1.5	
16	306723	6263581	2011	1.4	
17	306489	6263446	2010	1.6	
18	306406	6263371	2012	1.1	
19	306325	6263369	2011	0.8	
20	306423	6263682	2008	1.6	
Maximum offsite location				1.7	

1. Maximum at each of the receptors over 5 years.

Based on an impact assessment criterion of 2 OU (for urban population of >2000 people) as presented in *Table 3.1*, it can be seen that odour impacts from the Site at the sensitive receptors are below the assessment criterion for all locations. These results indicate that any odour generated by the site will be infrequent and short lived meaning that nuisance to surrounding land use is unlikely.

5.2.7 NO_2 *Annual Mean*

Nitrogen oxide (NO_X) is emitted by the metals cutting process (see *Section A1.6* of *Annex A*); however, it is NO_2 that pertains to human health impact. NO_X consists of nitrogen oxide (NO) and NO_2, but NO will undergo oxidation in the atmosphere to become NO_2. This has been taken in to account using the ozone limiting method as recommended in the Approved Methods.

This assessment has used a Level 1 assessment, which uses the maximum predicted annual mean concentrations of the five modelled together with the average mean for NO_2 and ozone (O_3) together with the ozone limiting method to predict site contributions to annual mean NO_2 concentrations.

The results of mean NO_2 concentrations for an annual averaging period are reported for the nearest sensitive receptors in *Table 5.9*. It is noted that the results are reported for metals cutting as a point source.

With an annual mean assessment criterion of 62 µg/m^3, it can be seen from the results in *Table 5.9* that the NO_2 impacts at the sensitive receptors on an annual basis are below the assessment criterion.

Table 5-10 Maximum Annual Average NO_2 Concentrations at Receptors over 5 years

Sensitive Receptor	X	Y	Annual Average NO_2 Concentration (Increment) [1] (µg/m^3)	Background Air Quality (µg/m^3)	Increment plus Background (µg/m^3)	Impact Assessment Criterion (µg/m^3)
1	306993	6263656	0.01 (2009)	20.7	20.7	62
2	306975	6263528	0.01 (2009)	20.7	20.7	
3	306963	6263414	0.01 (2009)	20.7	20.7	
4	305627	6263452	0.005 (2012)	18.8	18.8	
5	305527	6263624	0.005 (2012)	18.8	18.8	
6	305475	6263762	0.004 (2012)	18.8	18.8	
7	305584	6264114	0.003 (2012)	18.8	18.8	
8	306081	6264458	0.006 (2011)	18.8	18.8	
9	306603	6264395	0.005 (2012)	18.8	18.8	
10	307080	6264227	0.004 (2012)	18.8	18.8	
11	307442	6263762	0.003 (2009)	20.7	20.7	
12	306531	6263749	0.105 (2012)	18.8	18.9	
13	306602	6263739	0.084 (2012)	18.8	18.9	
14	306653	6263748	0.062 (2012)	18.8	18.9	
15	306728	6263659	0.051 (2009)	20.7	20.8	
16	306723	6263581	0.058 (2009)	20.7	20.8	
17	306489	6263446	0.175 (2008)	20.7	20.9	
18	306406	6263371	0.119 (2012)	18.8	18.9	
19	306325	6263369	0.103 (2012)	18.8	18.9	
20	306423	6263682	0.439 (2011)	18.8	19.2	

1. Maximum at each of the receptors over 5 years. Year when maximum concentration occurred provided in parentheses.

5.2.8 NO_2 *1-Hour Mean*

In evaluating the predicted 1-hour average concentrations, a level 1 assessment has been used in the first instance. A level 1 assessment uses the maximum predicted (100th percentile) concentration together with the maximum background concentration of NO_2 and O_3 with the ozone limiting method to indicate the maximum potential impact to the surrounding sensitive receptors. It is noted that the results are reported for metals cutting as a point source (*Annex D)*.

With an assessment criterion of 246 µg/m³, it can be seen from the results in *Table 5.10* that the NO_2 impacts at the sensitive receptors on an hourly basis are below the assessment criterion at all modelled sensitive receptors.

Table 5-11 Maximum Hourly Average NO_2 Concentrations at Receptors over 5 years

Sensitive Receptor	X	Y	Maximum 1-hour Average NO_2 Concentration (Increment) [1] (µg/m³)	Background Air Quality (µg/m³)	Increment plus Background (µg/m³)	Impact Assessment Criterion (µg/m³)
1	306993	6263656	2.7 (2011)	73.32	76	246
2	306975	6263528	1.9 (2012)	94	95.88	
3	306963	6263414	1.7 (2012)	94	95.67	
4	305627	6263452	1.5 (2008)	95.88	97.39	
5	305527	6263624	1.2 (2009)	95.88	97.10	
6	305475	6263762	1.2 (2012)	94	95.19	
7	305584	6264114	0.8 (2009)	95.88	96.69	
8	306081	6264458	1.0 (2010)	80.84	81.89	
9	306603	6264395	1.7 (2008)	95.88	97.58	
10	307080	6264227	0.6 (2010)	80.84	81.43	
11	307442	6263762	0.6 (2012)	94	94.60	
12	306531	6263749	23.7 (2011)	73.32	97.06	
13	306602	6263739	17.1 (2009)	95.88	113.01	
14	306653	6263748	12.2 (2009)	95.88	108.09	
15	306728	6263659	8.9 (2009)	95.88	104.75	
16	306723	6263581	11.3 (2011)	73.32	84.58	
17	306489	6263446	60.4 (2012)	94	154.43	
18	306406	6263371	16.4 (2008)	95.88	112.23	
19	306325	6263369	14.5 (2012)	94	108.51	
20	306423	6263682	60.3 (2008)	95.88	156.18	

1. Maximum at each of the receptors over 5 years. Year when maximum concentration occurred provided in parentheses.

5.2.9 *Iron Oxide Fumes*

As discussed in Section *4.5*, iron particulate matter from the hammer mill and iron oxide fume from cutting have been considered separately as the assessment criteria are available for these iron compounds in their different forms.

Table 5.13 presents the 99.9th percentile hourly average iron oxide fume concentrations predicted by the modelling at the sensitive receptors and at any offsite location.

Table 5-12 ***99.9th percentile predicted 1-hour mean iron oxide fume concentrations at Receptors and 8-hour maximum offsite iron oxide fume concentrations over 5 years***

Sensitive Receptor	**X**	**Y**	**Maximum 1-hour Average Iron Oxide Fume Concentration (Increment) [1] (μg/m³)**
1	306993	6263656	0.006 (2009)
2	306975	6263528	0.006 (2009)
3	306963	6263414	0.005 (2012)
4	305627	6263452	0.003 (2012)
5	305527	6263624	0.003 (2012)
6	305475	6263762	0.003 (2012)
7	305584	6264114	0.002 (2012)
8	306081	6264458	0.002 (2010)
9	306603	6264395	0.002 (2012)
10	307080	6264227	0.002 (2012)
11	307442	6263762	0.001 (2009)
12	306531	6263749	0.057 (2009)
13	306602	6263739	0.038 (2009)
14	306653	6263748	0.029 (2009)
15	306728	6263659	0.029 (2009)
16	306723	6263581	0.033 (2009)
17	306489	6263446	0.089 (2008)
18	306406	6263371	0.049 (2011)
19	306325	6263369	0.037 (2008)
20	306423	6263682	0.141 (2009)
Impact Assessment Criterion (μg/m3)			90

1. Maximum at each of the receptors over 5 years. Year when maximum concentration occurred provided in parentheses.
2. Approved Methods Assessment Criterion
3. Safe Work Australia Time Weighted Average

Based on the Approved Methods toxic air pollutants criterion of 90 μg/m³, it can be seen that at the maximum offsite location and at the sensitive receptors, the predicted 1 hour concentrations at 99.9th percentile are at or below the Approved Methods assessment criterion at all modelled receptors.

5.2.10 *Manganese and Compounds*

As discussed in Section *4.5*, manganese particulate matter from the hammer mill and manganese oxide fume from cutting has been considered cumulatively as the criteria for manganese is expressed as manganese and compounds. The results for manganese and compounds have therefore been discussed in Section *5.2.5*.

5.2.11 *Copper Oxide Fume 1-Hour Mean*

As discussed in Section *4.5*, copper particulate matter from the hammer mill and copper oxide fume from cutting have been considered separately as the assessment criteria are available for these copper compounds in their different forms.

Table 5-13 presents the 99.9th percentile hourly and the 100th percentile 8-hour average copper dusts and mists concentrations predicted by the modelling at the sensitive receptors and at any offsite location.

Table 5-13 ***99.9th percentile predicted 1-hour mean copper dusts and mists concentrations at Receptors and 10-hour maximum offsite copper dusts and mist concentrations over 5 years***

Sensitive Receptor	**X**	**Y**	**Maximum 1-hour Average Copper Fume Concentration (Increment) (µg/m^3)**
1	306993	6263656	0.00012 (2009)
2	306975	6263528	0.00012 (2009)
3	306963	6263414	0.00010 (2012)
4	305627	6263452	0.00007 (2012)
5	305527	6263624	0.00005 (2012)
6	305475	6263762	0.00006 (2012)
7	305584	6264114	0.00005 (2012)
8	306081	6264458	0.00005 (2010)
9	306603	6264395	0.00004 (2012)
10	307080	6264227	0.00004 (2012)
11	307442	6263762	0.00003 (2009)
12	306531	6263749	0.00112 (2009)
13	306602	6263739	0.00074 (2009)
14	306653	6263748	0.00058 (2009)
15	306728	6263659	0.00056 (2009)
16	306723	6263581	0.00065 (2009)
17	306489	6263446	0.00174 (2008)
18	306406	6263371	0.00096 (2011)
19	306325	6263369	0.00073 (2008)
20	306423	6263682	0.00276 (2009)
Impact Assessment Criterion (µg/m3)			3.7

1. Maximum at each of the receptors over 5 years. Year when maximum concentration occurred provided in parentheses.
2. Approved Methods Assessment Criterion
3. Safe Work Australia Time Weighted Average

Based on the Approved Methods toxic air pollutants criterion of 3.7 µg/m^3, it can be seen that at the maximum offsite location and at the sensitive receptors, the predicted 1 hour concentrations at 99.9th percentile are below the Approved Methods assessment criterion at all modelled receptors.

6 BENCHMARKING SITE MITIGATION/MANAGEMENT FOR AIR QUALITY AGAINST RECOMMEN DED INDUSTRY BEST PRACTICES

The operations of the Site activities under the future 350,000 tpa scenario will be undertaken using recommended industry best practices for the proposed air quality mitigation and management, where such mitigation and management are considered to be relevant to the Site operations. The benchmarking of the major process steps of the Site operations against industry best practices is provided in *Table 6-1*.

The recommended industry best practices is based on a comprehensive guideline

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Table 6-1 ***Benchmarking Site Mitigation/Management for Air Quality against Industry Best Practices***

Process	Industry Best Practices		Site Mitigation
Control of waste input	Implementation of acceptance procedure BAT[1] recommendation: Operators should select only appropriate feed materials for processing, to achieve low emission levels in line with overall BAT objectives.	1) 2)	Site management has established guidelines/framework on the types and quality of incoming waste materials to be accepted. Scrap metals such as those that contain concealed items such as LPG cylinders, or contaminated materials are not to be accepted. All site personnel are trained on identifying the types of incoming waste material that are unacceptable to be recycled on site.
	Waste inputs BAT recommendation: Operators should follow a clear documented and auditable procedure for the assessment of potential incoming feed material.	3)	Site management has established procedures for assessment of incoming feed material, in line with the guidelines on the types and quality of incoming material that can be accepted. The procedures include, but are not limited to: i) screening of delivery paperwork; ii) weighing of incoming materials; iii) visual inspection; iii) spot sampling of materials to confirm their suitability; iv) notification of non-compliance with paperwork descriptions etc.
	Control of incoming materials BAT recommendation: Operators should ensure that materials received at the installation are suitable for shredding.	4)	The operator of the mobile material handler visually checks the feed material while loading it onto the conveyor.

Process	Industry Best Practices	Site Mitigation
		5) The incoming materials passes the control cabin, where an operator visually checks incoming materials. 6) Metal pieces that are too large to be loaded onto conveyors for transferring to the hammermill for shredding are manually pre-shredded at designated locations within the Site.
	<u>Implementation of waste screening</u> BAT recommendation: Operators should establish quarantine areas for materials that are prohibited, awaiting full inspection, or awaiting testing or removal.	7) LPG cylinders are removed from car before they are fed through the facility. The Site does not accept vehicles containing LPG cylinders and returns them to the customer if they are delivered. 8) Petrol tanks are emptied by draining petrol and oil from tanks and collecting them in above ground storage tanks and removed offsite for processing.
	<u>Dedicated reception area</u> BAT recommendation: Operators should clearly designate a material reception area, with staff controlling the inspection, reception and validation of materials at the installation, trained in their role.	9) The Site has a materials reception area, where materials are pre-checked, pre-weighed and pre-shredded (if the size is too big). The work is undertaken by personnel trained in their roles to identify wastes that are not appropriate to be processed.
Management of process generated emissions	<u>Residue management planning</u> BAT recommendation: Operators should ensure that all materials (including waste products, residues and other materials) are stored in such a way as to prevent or reduce emissions from the installation.	10) The Site has an Environment Management Plan which incorporates consideration of residue management to ensure that all materials (including waste products, residues and other materials) are stored in an appropriate matter to prevent emissions to atmosphere.
	<u>Material handling techniques</u> BAT recommendation: Operators should prevent or reduce emissions including dust from material handling and transport. BAT recommendation: Operators should produce and update a documented detailed material handling plan.	11) The Site has an Environment Management Plan which incorporates material handling and dust management to ensure that dust generation is minimised.
	<u>Covering conveyor belts</u> BAT recommendation: Operators should prevent or reduce the generation of dusts or other emission by the movement and handling of materials by conveyor belt. BAT recommendation: Operators should ensure that	12) The conveyors will be enclosed to prevent this being a significant dust source.

Process	Industry Best Practices	Site Mitigation
	conveyors, transfer points and drop points downstream of the hammermill, are covered to prevent the release of dusts and particulates.	
Process efficiency	Process efficiency BAT recommendation: Operators should monitor and manage the installation's processing efficiency.	13) The Site will keep a site record of processing of metals with a view to managing the processing efficiency of the site and to determine whether any further efficiencies can be achieved, thus reducing atmospheric emissions.
	Accident management plan BAT recommendation: Operators should ensure that the installation is prepared to deal with unusual events/ accidents to prevent and control the uncontrolled release of emissions to the environment.	14) The Site operates in accordance with the Work Health and Safety Regulations.
	Site diary BAT recommendation: Operators should keep a detailed site diary or other similar method to record daily events for the installation.	15) The Site has closed circuit television (CCTV) for the monitoring of daily activities.
Utilities and raw material management	Energy consumption BAT recommendation: Operators should keep a detailed site diary or other similar method to record daily events for the installation. BAT recommendation: Operators should meter the consumption of electrical power within the installation to produce detailed power use assessments. BAT recommendation: Operators should produce detailed production/ power reports to inform on the improvements to energy efficiency.	16) Electrical consumption will continue to be monitored on Site.
	Control and abatement of emissions to air BAT recommendation: Operators should prevent or reduce dust and other emissions to air from the installation. BAT recommendation: Operations should undertake regular air emission and stack emission monitoring on their installations.	17) Site will install an emissions collection system for the hammer mill with cyclone and wet scrubber. Residual emissions will be ducted to a stack for more efficient release and dispersion. 18) The site will replace the current 800 tonne shear with a more efficient 1400 tonne shear. This will reduce the requirement for oxy-cutting from up to 20 man hours per day to up to 6 man hours per day. 19) The site will undertake all oxy-cutting under wet conditions, thereby reducing NO_X and metal

Process	Industry Best Practices	Site Mitigation
		fume emissions 20) Truck transfer (loading/unloading) and materials handling process onsite are dust controlled via water sprays/misters using water collected at the onsite dam (used to capture e.g. rainwater, water run-off from roofs) when required. 21) Site surfaces onsite will be sealed to prevent dust re-entrainment from movements from vehicles and other equipment. 22) Site surfaces are regularly swept to reduce dust and debris accumulation, and water (from the onsite dam) is used to dampen down the site surfaces to suppress dust. 23) Through good control of waste input, materials received at the site are large free from materials which may produce emissions. 24) Plans for fire-fighting are in place, equipment is provided, and staff are trained in its use, to prevent/ control flame events which produce emissions. 25) Site will install ambient PM_{10} monitors in accordance with the Approved Methods for the Measurement and Assessment of Air Pollutants in New South Wales to measure the Site contribution to ambient PM_{10} levels. 26) Where the rolling 4 hour average indicates that the site contribution is resulting in ambient concentrations above 50 $\mu g/m^3$ dust generating activities will be reduced or ceased until such time as the ambient concentration is sufficiently below the standard to accommodate the site contribution.

1 – BAT: Best Available Technology

7 *CONCLUSION*

An air quality assessment has been undertaken for an expansion and increase in the approved handling capacity of Sell and Parker's existing waste metal recovery, processing and recycling facility at Blacktown, New South Wales.

The number and type of sources of emission from the site were thoroughly investigated and appropriately assessed for inclusion in the air dispersion modelling. The air dispersion modelling results indicated that:

- TSP:
  - Annual mean concentrations at all sensitive receptors is predicted to be below the assessment criterion contained in the Approved Methods.
- Dust deposition:
  - Annual mean concentrations at all sensitive receptors is predicted to be below the assessment criterion contained in the Approved Methods.
- PM_{10}:
  - Annual mean concentrations at all sensitive receptors is predicted to be below the assessment criterion contained in the Approved Methods.
  - the maximum predicted 24-hour average PM_{10} concentration together with the maximum measured background concentration (level 1 assessment) results in levels that exceed the assessment criteria at four of the modelled sensitive receptors due to the elevated background ambient air quality concentration in this area;
  - Sell & Parker have committed to the installation of ambient dust monitoring to prevent the occurrence of additional exceedances by ceasing dust generating activities when monitoring indicates that exceedance of the 24 hour standard is likely; and
  - using a contemporary analysis (level 2 assessment), taking into account the cessation of dust generating activities when site operations have the potential to result in additional exceedances of the standard, the Level 2 assessment predicted no additional exceedances of the standard.
- Chromium assumed to be chromium VI particulate:
  - 1-hour 99.9th percentile concentrations at all sensitive receptors is predicted to be below the assessment criterion contained in the Approved Methods.
- Copper particulate:

  - 1-hour 99.9th percentile concentrations at all sensitive receptors is predicted to be below the assessment criterion contained in the Approved Methods.

- Lead particulate:

  - Annual mean concentrations at all sensitive receptors is predicted to be below the assessment criterion contained in the Approved Methods.

- Manganese compounds (manganese oxide fume plus manganese particulate)

  - 1-hour 99.9th percentile concentrations at all sensitive receptors is predicted to be below the assessment criterion contained in the Approved Methods.

- Nickel particulate:

  - 1-hour 99.9th percentile concentrations at all sensitive receptors is predicted to be below the assessment criterion contained in the Approved Methods.

- Iron particulate:

  - 1-hour 99.9th percentile concentrations at all sensitive receptors is predicted to be below the adopted assessment criterion.

- Titanium particulate:

  - 1-hour 99.9th percentile concentrations at all sensitive receptors is predicted to be below the adopted assessment criterion.

- Vanadium particulate:

  - 1-hour 99.9th percentile concentrations at all sensitive receptors is predicted to be below the adopted assessment criterion.

- Zinc particulate:

  - 1-hour 99.9th percentile concentrations at all sensitive receptors is predicted to be below the adopted assessment criterion.

- Odour:

  - Peak 99th percentile concentrations at all sensitive receptors will be below the assessment criterion contained in the Approved Methods.

- NO_2:

  - Annual mean concentrations at all sensitive receptors will be below the assessment criterion contained in the Approved Methods.

    - the maximum predicted 1-hour average NO_2 concentration together with the maximum measured background concentration results in predicted concentrations below the assessment criteria contained in the Approved Methods at all modelled sensitive receptors.

- Iron oxide fume:

    - the maximum (99.9th percentile) predicted 1-hour average iron oxide fume concentration is predicted to be below the assessment criteria contained in the Approved Methods at all modelled sensitive receptors.

- Copper and compounds:

    - the maximum (99.9th percentile) predicted 1-hour average iron oxide fume concentration is predicted to be below the assessment criteria contained in the Approved Methods at all modelled sensitive receptors.

Throughout this assessment, a conservative approach to emission estimation has been taken. For example:

- no emission estimates are available for dust emissions from scrap metal deposition or piles of scrap metal. Windblown emissions and handling emissions of particulate matter have been derived using NPI emission estimates for high moisture content ores from metalliferous mines, these are likely to result in higher emissions estimates than will occur in reality; and

- emissions of dust and odour from the hammermill treatment system have been limited to manufacturer's guarantees. A manufacturer guarantee often overstates the likely actual emissions and consequently odour and particulate matter concentrations are likely to be lower than predicted in this assessment.

It is therefore considered that the actual impacts of odour and dust to the surrounding land use are likely to be lower than predicted in this assessment due to these conservative assumptions.

8 *LIMITATIONS*

This report was prepared in accordance with the scope of work outlined and/or referenced within this report and subject to the applicable cost, time and other constraints. ERM performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental profession. No warranties, expressed or implied, are made.

ERM makes no warranty concerning the suitability of the Site for any purpose or the permissibility of any use, development or re-development of the Site. Use of the Site for any purpose may require planning and other approvals and, in some cases, EPA and accredited site auditor approvals. ERM offers no opinion as to the likelihood of obtaining any such approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environment works.

Except as otherwise stated, ERM's assessment is limited to specified environmental conditions associated with the subject Site and does not evaluate operational or other conditions of any part of the Site (including any buildings, equipment or infrastructure).

This assessment is based on Site conditions described in the report, and information provided by Sell and Parker Pty Ltd or other people with knowledge of the Site conditions. Conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved with the project and, while normal checking of the accuracy of data has been conducted, ERM assumes no responsibility or liability for errors in data obtained from such sources, regulatory agencies and/or any other external sources, nor from occurrences outside the scope of this project.

It is unlikely that the results and estimations presented in this report will represent the extremes of conditions within the Site. Conditions including impact concentrations can change in a limited period of time. ERM have used the last five years of meteorology in assessing the potential for impact to surrounding land use. No guarantee is provided that this contains the worst case meteorological conditions that could ever occur, and higher ground level concentrations than predicted in this assessment are possible. Only the chemicals specifically referred to in this report have been considered. ERM makes no statement or representation as to the existence (or otherwise) of any chemicals other than those specifically referred to herein. Except as otherwise specifically stated in this report, ERM makes no warranty or representation as to the presence or otherwise of asbestos and/or asbestos containing materials (“ACM”) on the Site.

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9 REFERENCES

AP-42, 2006. *AP-42 Aggregate Handling and Storage Piles Section 13.2.4.* [Online] Available at: http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0204.pdf [Accessed 27 February 2014].

Barclay, J. & Scire, J., 2011. *Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'.* [Online] Available at: http://www.environment.nsw.gov.au/resources/air/CALPUFFModelGuidance.pdf
[Accessed December 2012].

Department of Environment and Conservation, 2005. *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales,* Sydney: Department of Environment and Conservation.

Department of Environment, Water, Heritage and the Arts, 2008. *NPI Emission Estimation Technique Manual for Combustion Engines V3.0,* Canberra: Commonwealth of Australia.

Department of Sustainability, Environment, Water, Population and Communities, 2012. *NPI Emission Estimation Technique Manual for Mining V3.1,* Canberra: Commonwealth of Australia.

Environment Agency of England and Wales, 2011. *H1 Annex F - Air Emissions.* [Online]
Available at: http://cdn.environment-agency.gov.uk/geho0410bsil-e-e.pdf [Accessed 17 December 2012].

Environment Australia, 1999. *Emission Estimation Technique Manual for Structural and Fabricated Metal Product Manufacture.* [Online] Available at: http://www.npi.gov.au/system/files/resources/f5095a24-5fb6-9014-3942-fbceb1c39047/files/fstfamet.pdf
[Accessed 27 May 2015].

Environmental Protection UK, 2010. *Development Control: Planning for Air Quality (2010 Update),* London: Environmental Protection UK.

Government of Victoria, 2001. *State Environment Protection Policy (Air Quality Management),* Melbourne: Victoria Government Gazette, No. S 240.

Hurley, P., 2008a. *TAPM v4 - Part 1: Technical Description - Research Paper NO. 25,* Aspendale: CSIRO.

Hurley, P., 2008b. *TAPM v4 - Part 2 - Summary of Some Verification Studies - CSIRO Marine and Atmospheric Research paper No. 26,* Aspendale: CSIRO.

International Finance Commission, 2007. *General EHS Guidelines: Environmental - Air Emissions and Ambient Air Quality.* [Online] Available at: http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS_1-1/$FILE/1-1+Air+Emissions+and+Ambient+Air+Quality.pdf
[Accessed 7 Februrary 2012].

National Environment Protection Council, 1998. *Ambient Air - National Environment Protection Measure for Ambient Air Quality,* Canberra: National Environment Protection Council.

National Health and Medical Research Council, 1996. *Ambient Air Quality Goals Recommended by the National Health and Medical Research Council,* Canberra: National Health and Medical Research Council.

NSW Environment Protection Authority, 1998. *action for Air: The NSW Government's 25-year Air Quality Management Plan,* Sydney: NSW Environment Protection Authority.

NSW Environment Protection Authority, 2001. *Draft Policy: Assessment and Management of Odour from Stationary Sources in NSW,* Sydney: s.n.

Ontario Ministry of the Environment, 2012. *Ontario's Ambient Air Quality Criteria.* [Online]
Available at: https://dr6j45jk9xcmk.cloudfront.net/documents/1341/221a-ambient-air-quality-sorted-by-chemical-en.pdf
[Accessed 27 May 2015].

Ontario Ministry of the Environment, 2013. *Ontario Regulation 419/05 Air Pollution - Local Air Quality.* [Online]
Available at: http://www.ontario.ca/laws/regulation/050419#BK75
[Accessed 21 August 2015].

Scire, J. S., Robe, F. R., Fernau, M. E. & Yamartino, R. J., 2000. *A User's Guide for the CALMET Meteorological Model,* Concord: Earth Tech, Inc.

Scire, J. S., Strimaitis, D. G. & Yamartino, R. J., 2000. *A User's Guide for the CALPUFF Disperison Model,* Concord: Earth Tech, Inc.

SKM, 2005. *Improvement of NPI Fugitive Particulate Matter Emission Estimation Techniques,* Perth: Sinclair Knight Merz.

USEPA, 2009. *Speciate Data Browser.* [Online]
Available at: http://cfpub.epa.gov/si/speciate/ehpa_speciate_browse_details.cfm?ptype=P&pnumber=91180
[Accessed 19 November 2014].

Annex A

Emission Estimation

A.1 EMISSIONS ESTIMATION METHODOLOGY

Annex A provides a description of the methodology used to derive the emission estimates for each source type together with the input data used in the emission estimation.

The general equation for emissions estimation is:

Equation A.1 General Equation for Emission Estimation

$$Ei = A \times EFi$$

where:
Ei = Emission of substance i (kg/day)
A = Activity rate (quantity of materials handled through the source) (t/day)
EFi = Emission factor of substance i (kg/t)

A.1.1 Source Screening

The site activities were screened to ascertain any activities that would not produce a sufficient emission to warrant inclusion in the dispersion model. Complex air quality dispersion models, such as CALPUFF, take increasing amounts of time to run as the complexity of the site increases.

One drop point was considered adequate for the drop off of non-ferrous product by the public to the non-ferrous processing area. The building is enclosed and materials inside the shed are sorted and packed for transport off-site to end users.

Transfer of large items to the shear, the shearing process and loading of shear product onto truck for transport off-site were all deemed activities that would generate few emissions of particulate matter. The material taken to the shear was described as large (i.e. railway sleepers etc.) that were simply cut into more manageable sizes.

The post shredder processing building that processes the 'floc' is an enclosed building designed to recover additional materials from the initial recovery process. It was deemed that the building would not provide an additional source of particulate matter once the conveyor had delivered the 'floc' into the enclosed shed.

A.1.2 Materials Handling/Transfer Points

The materials handling sources include materials handling of raw material, shredded material, product or waste material by front end loaders and/or other material handling equipment fitted with grapples.

The National Pollution Inventory (NPI) Manual for Mining (Department of Sustainability, Environment, Water, Population and Communities, 2012) was used to estimate the emissions from the materials handling processes.

The default emission factors for TSP and PM_{10} are 0.005 kg/t and 0.002 kg/t, respectively, for materials handling of high moisture content ores from metalliferous mines. The high moisture content ore emission factors were selected on the basis that the particulate matter fractions from metals recycling will be much larger than that for metalliferous mines.

The resulting emission factor was fed into *Equation A.1* and applied to every hour the source is operational (6am-8pm for all materials handling operations).

Each of the sources involved in materials handling processes (MH01-MH11), will operate with water suppression controls, which will result in a 70% reduction in emissions.

Transfer points (TP01-TP08) will operate without additional controls (i.e. they will not be enclosed).

A.1.3 Truck Dumping

Truck dumping (TRKD01 – TRKD02) only occurs at two areas of the site, where the raw materials are delivered onto the scrap stockpile, and the dumping of the output from the pre-shredder onto the inspected stockpile near the shredder.

The National Pollution Inventory (NPI) Manual for Mining (Department of Sustainability, Environment, Water, Population and Communities, 2012) provides an equation for the loading and unloading of trucks (rear dumping) that takes into account mean wind speed and moisture content of the product. This equation was used to estimate the emissions from the truck dumping processes.

Equation A.2 Emission Estimation for Loading and Unloading Trucks

$$EFTSP = KTSP \times 0.0016 \times \frac{(\frac{U}{2.2})^{1.3}}{(\frac{M}{2})^{1.4}}$$

Where:
EFTSP = emission factor for total suspended particles (kg/t)
$EFPM_{10}$ = emission factor for PM_{10} (kg/t)
KTSP = 0.74 for particles less than 30 micrometres in aerodynamic diameter
KPM_{10} = 0.35 for particles less than 10 micrometres in aerodynamic diameter
U = mean wind speed (m/s)
M = moisture content (% by weight)

The moisture content entered into this equation for the raw material was 5% (high moisture). Hourly wind speed was extracted at the site from the CALMET meteorological model. This allowed for an hourly changing wind speed to be included in the emission estimation. The wind speed (extracted at 10 m) was adjusted to the release height using *Equation A.3*.

Equation A.3 Wind Speed at Release Height

$$\frac{U}{Ur} = (\frac{Z}{Zr})^{a}$$

Where:
U = wind speed (m/s) at height Z
Ur = wind speed at reference height (10 m)
Zr = reference height (10 m)
a = an empirically derived coefficient that varies dependent upon the stability of the atmosphere

The resulting emission factor was fed into *Equation A.1* and applied to every hour the source is operational (6am-9pm for raw material delivery and 6am-8pm for post pre-shredder dumping). The throughput rates for the source TRKD01 (at the raw material delivery) was 1500 tonnes/day and 300 tonnes/day for TRKD02 (truck dumping pre-shredder output at the inspected stockpile).

Truck dumping will operate with water suppression controls, which will result in a 70% reduction in emissions.

A.1.4 Wind Erosion from Stockpiles and Exposed Conveyors

Wind erosion from material stockpiles (WE01 – WE06) was estimated by using an equation from The National Pollution Inventory (NPI) Manual for Mining (Department of Sustainability, Environment, Water, Population and Communities, 2012). No mitigation has been assumed from wind erosion from the stockpiles or the exposed conveyors.

Equation A.4 Wind erosion from stockpiles and exposed conveyors

$$EFTSP = 1.9 \times (\frac{S}{1.5}) \times 365 \times (\frac{365 - p}{235}) \times (\frac{f}{15})$$

Where:
EFTSP = the emission factor of TSP (kg/ha/y)
S = silt content (5.3% by weight)
p = number of days per year when rainfall is greater than 0.25mm
f = percentage of time that wind speed is greater than 5.4 m/s at the mean height of the stockpile

A silt content of 5.3% was used, which corresponded to the silt content of slag from iron and steel production (AP-42, 2006). For each year assessed, the total TSP content was calculated using *Equation A.4.*

This total emission per year was divided between the number of hours where both the wind speed and rainfall conditions were met. This kg/ha/yr emission rate was converted to a g/sec emission rate using the area of the stockpiles and exposed conveyors.

A wind erosion based particulate matter size distribution between PM_{10} and PM_{30} factor of 0.5 was used to calculate the emission rate of PM_{10} for wind erosion (SKM, 2005).

A.1.5 Hammermill Emissions

Air Species

The hammermill (WSS01) will have a gas collection system fitted together with a cyclone and a wet scrubber system. The exhaust gases will be ducted to a stack to be located at the centre of the site. The stack has therefore been modelled as a point source.

The stack has the following parameters:

- Release height = 15.5 m;
- Temperature = 40°C;
- Manufacturer guarantee of TSP the system = 20 mg/Nm^3;
- PM_{10} concentration = 9.4 mg/Nm3 (assuming PM_{10} to be 47% of TSP[2]);
- $PM_{2.5}$ concentration = 3 mg/Nm3 (assuming $PM_{2.5}$ to be 32% of *PM_{10}*[2]);
- Volumetric flow rate = 25,000 m^3/hr (21,807 Nm^3/hr).
- Stack diameter = 0.595 m; and
- Emission velocity = 25 m/sec.

In addition to the dominant air species emissions of particulates, the wet scrubber vent emits other toxic air pollutants (metals) at a much smaller rate associated with $PM_{2.5}$ emissions. $PM_{2.5}$ emissions were considered to be 32% of PM_{10} emissions[2].

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[2] In accordance with the AP-42 speciation for load-in / load-out contained in http://www.npi.gov.au/system/files/resources/d9d46a4c-f76e-fdc4-5d59-fd3f8181c5b8/files/pm10may05.pdf

The typical list of metals emitted from a hammermill (as a mass percentage of $PM_{2.5}$) was obtained from the USEPA Speciate Data Browser (for Auto Body Shredding – Composite) (USEPA, 2009), for the following metals which have a corresponding assessment criteria (*Table 3.1*) under the Approved Methods:

- Chromium (assumed conservatively to Chromium VI) – 0.04% of $PM_{2.5}$;
- Copper – 0.1% of $PM_{2.5}$;
- Iron – 5.76% of $PM_{2.5}$;
- Lead – 0.49% of $PM_{2.5}$;
- Manganese – 0.088% of $PM_{2.5}$;
- Nickel – 0.031% of $PM_{2.5}$;
- Titanium – 0.025% of $PM_{2.5}$;
- Vanadium – 0.001% of $PM_{2.5}$; and
- Zinc – 2.1% of $PM_{2.5}$.

These percentages were applied to the maximum predicted concentrations at each sensitive receptor and across the grid for the relevant averaging periods.

Odour

The odour source strength from the wet scrubber vent of the hammer mill has been assessed during an odour source monitoring exercise, undertaken on 12 June, 2014 by EML Air Pty Ltd (test results are presented in Annex C).

Using a conservative approach, the maximum measured odour concentration (in units of odour unit (OU)/m^3) for the hammer mill of 1600 OU/m^3 has been used in the odour impact assessment. It is considered likely that the wet scrubber within the system will reduce odour concentration in the exhaust gas, however a manufacturer guarantee has not been provided to this effect. Consequently the maximum measured odour concentration of the exhaust gas of 1600 OU/m3 has been used with the volumetric flow rate of exhaust gases to provide a odour emission rate of 11,111 OU/sec.

A.1.6 Metals Cutting

Air Species

Metal cutting (C1) using oxygen-acetylene torches on site takes place at the scrap metal unloading area. Sell and Parker will install a new 1400 tonne capacity shear, meaning that the size of beam to be cut using oxy-cutting following the redevelopment will be greater than 100 mm in thickness. Sell and Parker has also committed to undertaking cutting in wet conditions following redevelopment.

Due to the additional capacity of the shear, operational hours for oxy-cutting will be reduced to six (6) hours per day, 9am to 3pm.

Metal cutting emissions are considered as fugitive emissions, but fugitive sources do not lend themselves easily to modelling, as a direct modelling configuration is not available. For sensitivity testing, metal cutting has been modelled as both point sources and volume sources, to assess which modelling configuration provides a more representative (and reasonable) simulation to represent these fugitive emission sources.

The National Pollutant Inventory (NPI) has been used as a reference source for establishing the types of emissions from metals cutting. The NPI Emission Estimation Technique Manual for Structural & Fabricated Metal Product Manufacture[3] provided metals cutting emission factors. To facilitate emissions estimation as point sources, the following assumptions were made:

- there are no control equipment for cutting emissions;
- the NPI manual is limited only to emission factors for plasma cutting (with air as the plasma gas) for stainless steel of 25 mm (actual cutting will be for 100mm mild steel) as the thickness of the steel increases emission rates are expected to decrease due to the amount of metal which is melted per second being lower),
- Oxygen is used as the plasma gas, and the notes in the NPI manual allow a reduction of 25% for the metal fume emissions where oxygen is the plasma gas. To provide a conservative assessment this reduction factor has not been applied;
- Sell & Parker have committed to wet cutting as a mitigation measure and as such wet cutting emission factors have been assumed;
- as a conservative approach, cutting takes place continuously through 6 hours in a day (starting 9 am, ending 3 pm);
- the introduction of the 1400 tonne shear will reduce the cutting needs to one person, only one source has therefore been modelled;
- metals cutting was observed to be undertaken at a ground/ low level on 12 June, and therefore as a default 1 m has been assumed;

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[3] http://www.npi.gov.au/resource/emission-estimation-technique-manual-structural-fabricated-metal-product-manufacture

- temperature has been assumed at 700 C, which is the approximate ignition temperature of steel[4];
- exit velocity from metals cutting emissions is not well defined in literature, as it depends on the operating conditions, materials and the environment of application, which may change depend on the scrap metal received. As a conservative measure, a nominally low exit velocity of 0.01 m/s for the emissions has been assumed; and
- exit diameter for metals cutting emission is also not well defined in literature. As a conservative measure, a nominally low exit diameter of 0.05 m has been assumed.

Emission rates have been sourced from Table 4 of the NPI manual for Structural and Fabricated Metal Product Manufacture (Environment Australia, 1999). Emission rates for 35 mm stainless steel were used as this is the maximum thickness available in Table 4. These emission rates are considered to be conservative as the metal cut is mild steel, comparison of emission rates for 8mm mild steel compared to 8mm stainless steel shows lower emissions, it is therefore expected that 100 mm mild steel would have substantially lower emissions than 35 mm stainless steel.

The emissions which have corresponding assessment criteria in *Table 3.1* are shown below:

- Nitrogen oxide (NO_X) = 0.043 g/s;
- Iron oxide fumes = 0.0003 g/s;
- Manganese oxide fumes = 0.00003 g/s; and
- Copper oxide fumes = 0.000005 g/s.

For modelling as volume sources, the following parameters were assumed:

- Release height = 0.75 m (half the height of an average adult);
- Sigma-y = 0.23m; and
- Sigma-z = 0.70m.

The emissions rates are the same as those assumed for point sources.

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[4] http://www.twi-global.com/technical-knowledge/job-knowledge/oxyfuel-cutting-process-and-fuel-gases-049/

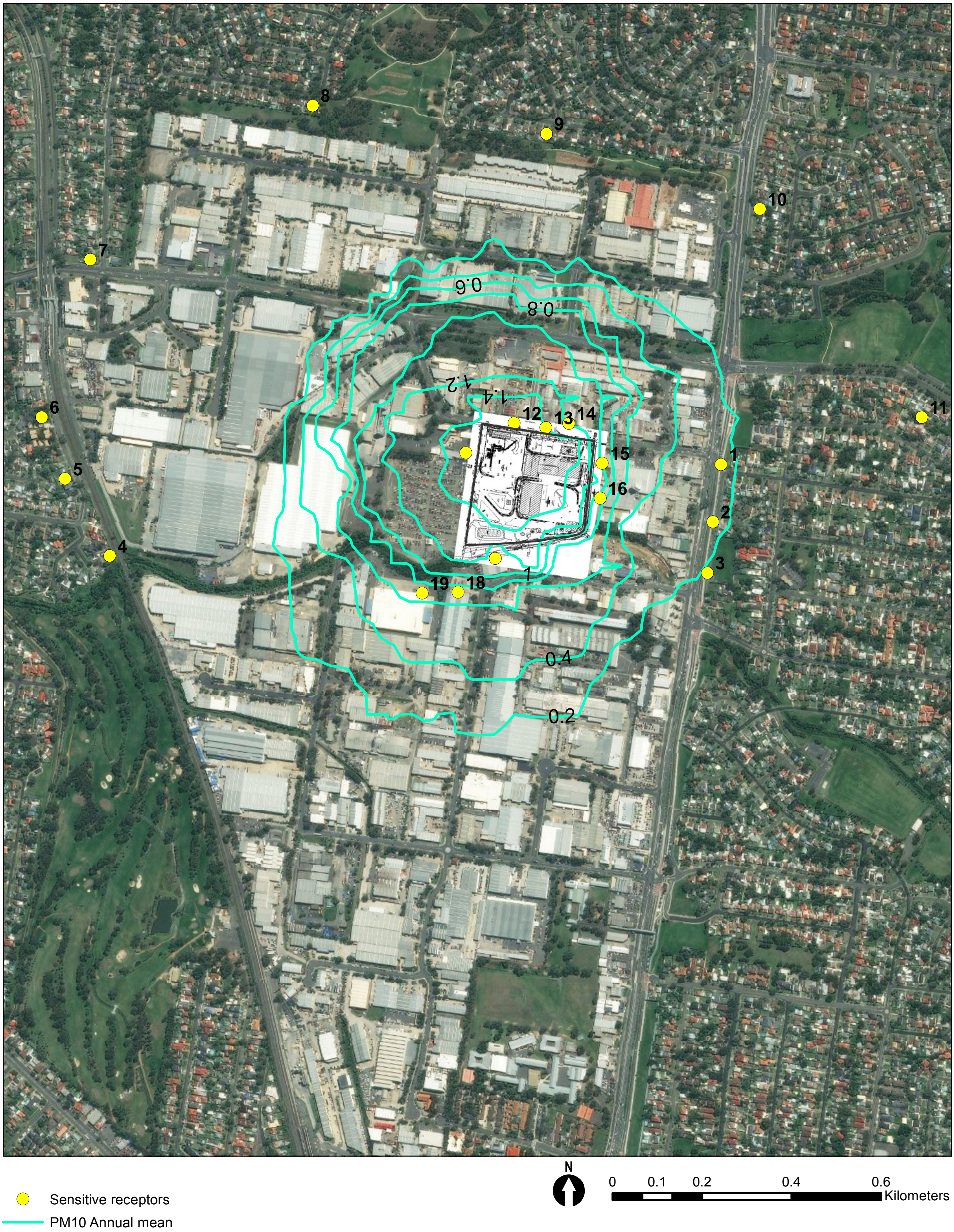
Odour

The odour source strength from metal cutting has been assessed during the odour source monitoring exercise on 12 June, 2014.

Using a conservative approach, the maximum measured odour concentration (in units of odour unit (OU)/m^3) for metal cutting of 940 OU/m^3 has been used in the odour impact assessment. With an exit velocity of 0.01 m/s, this provides an odour source strength of 0.018 OU/s has been used.

Annex B

Figures



Rev. N.	Date	Revision	Drawn by	Rev. by
0	02/09/15	Initial Issue	E.B.	I.C.

Client: Sell and Parker
Drawing No: Figure B1.mxd
Date: 02/09/2015 Drawing Size: A4
Drawn By: E.B. Reviewed By: I.C.

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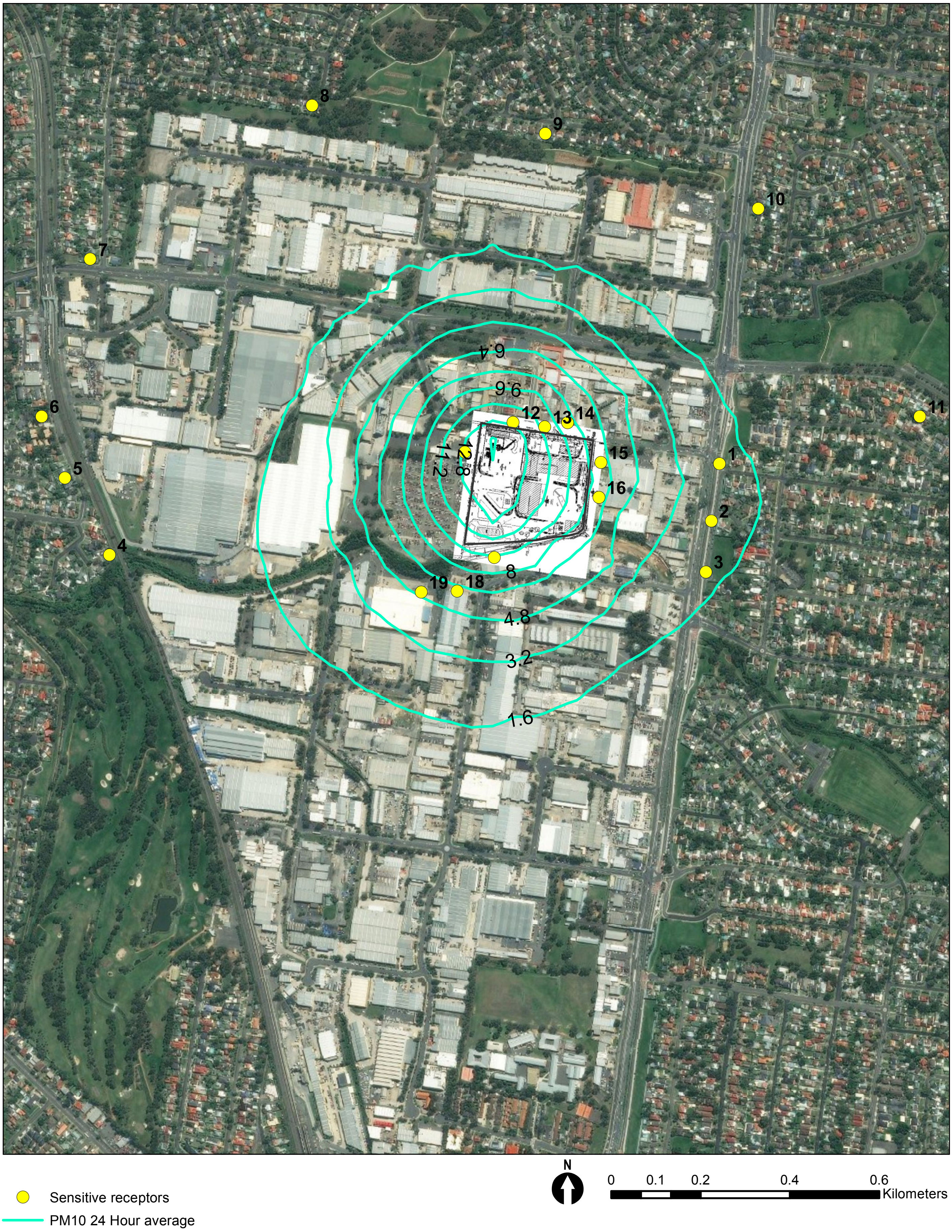
Figure B1. Highest (over five years) site contribution to annual mean PM10 concentrations. Excludes background.

Waste Metal Recovery, Processing and Recycling Facility Expansion

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch,
Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM



Rev. N.	Date	Revision	Drawn by	Rev. by
0	02/09/15	Initial Issue	E.B.	I.C.

Client:	Sell and Parker	
Drawing No:	Figure B2.mxd	
Date:	02/09/2015	Drawing Size: A4
Drawn By:	E.B.	Reviewed By: I.C.

Figure B2. Highest (over five years) site contribution to 24 hour average PM10 concentrations. Excludes background.

Waste Metal Recovery, Processing and Recycling Facility Expansion

Environmental Resources Management ANZ

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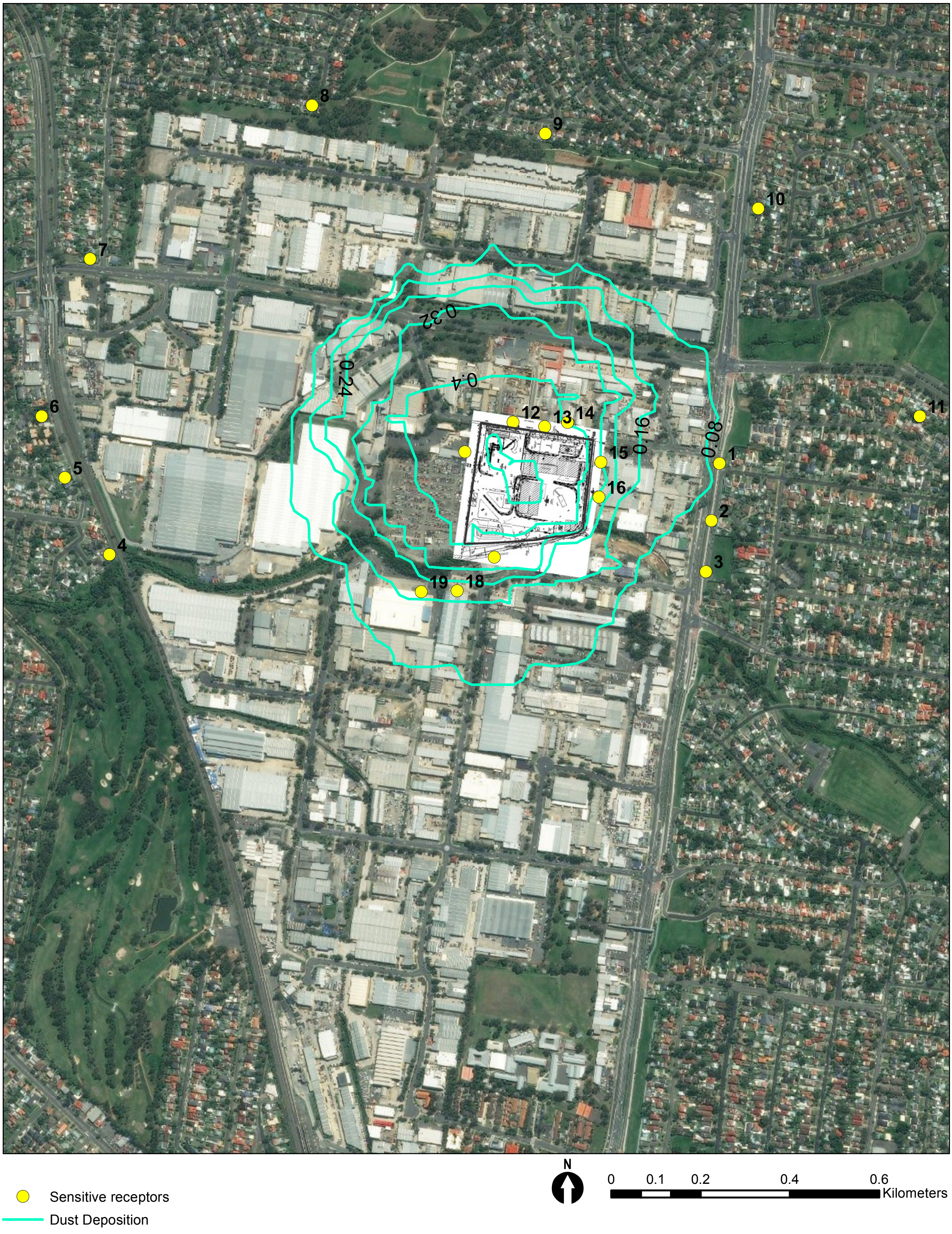
Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM



Rev. N.	Date	Revision	Drawn by	Rev. by
0	02/09/15	Initial Issue	E.B.	I.C.

Client: Sell and Parker

Drawing No: Figure B3.mxd

Date: 02/09/2015 Drawing Size: A4

Drawn By: E.B. Reviewed By: I.C.

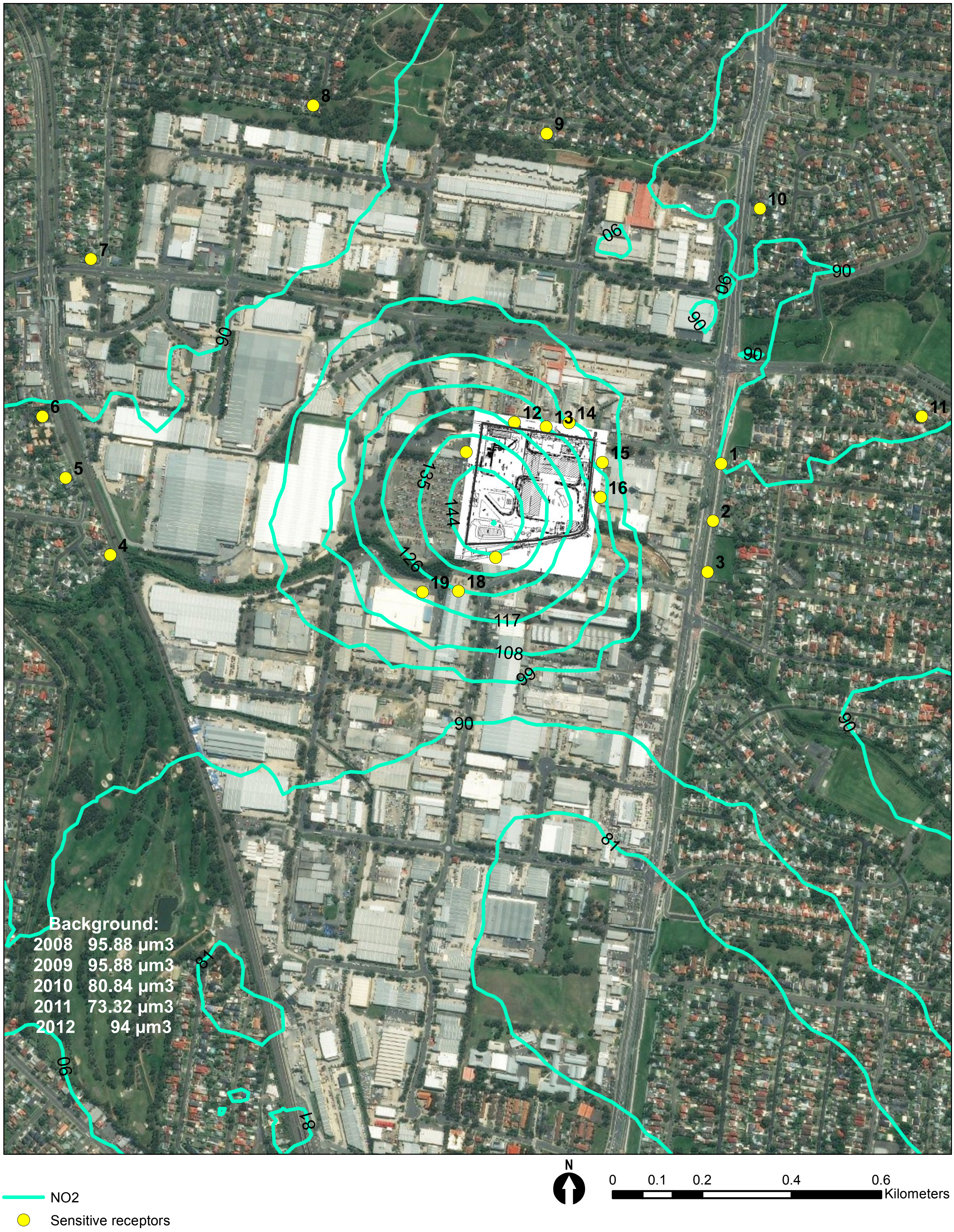
Figure B3. Highest (over five years) Site contribution to annual mean Dust Deposition. Excludes background.

Waste Metal Recovery, Processing and Recycling Facility Expansion

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch,
Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM



Background:
2008 95.88 µm3
2009 95.88 µm3
2010 80.84 µm3
2011 73.32 µm3
2012 94 µm3

Rev. N.	Date	Revision	Drawn by	Rev. by
0	29/05/15	Initial Issue	E.B.	I.C.

Client:	Sell and Parker		
Drawing No:	Figure B4.mxd		
Date:	29/05/2015	Drawing Size:	A4
Drawn By:	E.B.	Reviewed By:	I.C.

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Figure B4. Highest (over five years) site contribution to 1 hour average NO2 concentrations, with cutting source considered as Point source. Includes background.

Waste Metal Recovery, Processing and Recycling Facility Expansion

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

Annex C

Odour Test Data

EML Air Pty Ltd
Report Number N92746

Emission Testing Report
ERM Australia Pty Ltd, Blacktown Plant

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Document Information

Client Name:	ERM Australia Pty Ltd
Report Number:	N92746
Report Title:	Emission Testing Report
Date of Issue:	18 June 2014
Attention:	Dr Iain Cowan
Address:	ERM Australia Pty Ltd Level 3, Tower 3, World Trade Centre, 18-38 Siddeley Street DOCKLANDS VIC 3005

Sampling Information

Sampling Date:	June 2014
Sampling Team:	DH

Report Status

Format	Document Number	Report Date	Prepared By	Reviewed By (1)	Reviewed By (2)
Preliminary Report	-	-	-	-	-
Draft Report	-	-	-	-	-
Final Report	N92746	18 June 2014	JW/AD	MR	MC
Amend Report	-	-	-	-	-

Internal Reference: ad doc:n92746.doc

Amendment Record

Document Number	Initiator	Report Date	Section	Reason
Nil	-	-	-	-

Table of Contents

List of Tables

Appendices

Nil

1 EXECUTIVE SUMMARY

Tests were performed at the request of ERM Australia Pty Ltd to determine emissions to air as detailed below;

Table 1: Testing Summary

Location	Test Date	Test Parameters*
Hammer Mill	12 June 2014	Odour and character
Oxy Cutting Area (up wind)	12 June 2014	Odour and character
Oxy Cutting Area (down wind)	12 June 2014	Odour and character

* Flow rate, velocity, temperature and moisture were determined unless otherwise stated.

2 RESULTS

Table 2: Hammer Mill - Test Results

Date	12/06/2014	**Client**	Sell & Parker - (ERM Australia)		
Report	N92746	**Stack ID**	Hammer Mill		
Licence No.	-	**Location**	Blacktown	**State**	NSW
EML Staff	DH/ZP				
Process Conditions	Please refer to client records.				
Reason for testing:	Client requested testing to determine emissions to air				

Odour		Average	Test 1		Test 2	
Sampling date & Time			12/06/14	1102	12/06/14	1128
Analysis date & Time			13/06/14	1438	13/06/14	1444
Holding time				27 hours		27 hours
Dilution factor & Threshold			1	1000 ou	1	1600 ou
Butanol threshold	29 ppb					
Laboratory temp	20 °C		Concentration		Concentration	
Last calibrated	10/01/14	ou	ou		ou	
No. ITE's used			12		12	
Concentration		1300	1000		1600	
Lower Uncertainty Limit		900	470		750	
Upper Uncertainty Limit		2000	2200		3500	
Hedonic tone			Mildly Unpleasant/Distinct		Mildly Unpleasant/Distinct	
Odour character			Acidic		Acid	

Table 3: Oxy Cutting Area (Up Windl - Test Results

Date	12/06/2014	**Client**	Sell & Parker - (ERM Australia)		
Report	N92746	**Stack ID**	Oxy Cutting Area (Upwind)		
Licence No.	-	**Location**	Blacktown	**State**	NSW
EML Staff	DH/ZP				
Process Conditions	Please refer to client records.				
Reason for testing:	Client requested testing to determine emissions to air				

Odour		Average	Test 1		Test 2	
Sampling date & Time			12/06/14	1248	12/06/14	1322
Analysis date & Time			13/06/14	1451	13/06/14	1500
Holding time				26 hours		26 hours
Dilution factor & Threshold			1	940 ou	1	650 ou
Butanol threshold	29 ppb					
Laboratory temp	20 °C		Concentration		Concentration	
Last calibrated	10/01/14	ou	ou		ou	
No. ITE's used			8		12	
Concentration		790	940		650	
Lower Uncertainty Limit		540	430		300	
Upper Uncertainty Limit		1200	2000		1400	
Hedonic tone			Mildly Unpleasant/Distinct		Mildly Unpleasant	
Odour character			Metal		Metal	

Table 4: Oxy Cutting Area (Down Windl - Test Results

Date	12/06/2014	**Client**	Sell & Parker - (ERM Australia)		
Report	N92746	**Stack ID**	Oxy Cutting Area (Downwind)		
Licence No.	-	**Location**	Blacktown	**State**	NSW
EML Staff	DH/ZP				
Process Conditions	Please refer to client records.				
Reason for testing:	Client requested testing to determine emissions to air				

Odour		Average	Test 1		Test 2	
Sampling date & Time			12/06/14	1248	12/06/14	1322
Analysis date & Time			13/06/14	1421	13/06/14	1431
Holding time				26 hours		25 hours
Dilution factor & Threshold			1	540 ou	1	550 ou
Butanol threshold	29 ppb					
Laboratory temp	20 °C		Concentration		Concentration	
Last calibrated	10/01/14	ou	ou		ou	
No. ITE's used			12		10	
Concentration		550	540		550	
Lower Uncertainty Limit		370	250		250	
Upper Uncertainty Limit		800	1200		1200	
Hedonic tone			Mildly Unpleasant/Distinct		Mildly Unpleasant/Distinct	
Odour character			Smokey, Metal		Smokey,Metal	

3 PLANT OPERATING CONDITIONS

Unless otherwise stated, the plant operating conditions were normal at the time of testing. See ERM Australia Pty Ltd's records for complete process conditions.

4 TEST METHODS

Unless otherwise stated, the following methods meet the requirements of the NSW Office of Environment and Heritage (as specified in the Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales, January 2007). All sampling and analysis was performed by EML Air unless otherwise specified. Specific details of the methods are available upon request.

Table 5: Test Method Table

Parameter	**Test Method**	**Method Detection Limit**	**Uncertainty***	**NATA Accredited**	
				Sampling	**Analysis**
Sample Plane Criteria	NSW TM-1	NA	-	✓	NA
Velocity	NSW TM-2	2ms^{-1}	7%	✓	NA
Temperature	NSW TM-2	0°C	2%	✓	NA
Flow rate	NSW TM-2	Location specific	8%	✓	NA
Moisture content	NSW TM-22	0.4%	8%	✓	✓
Odour	NSW OM-7	16ou	not specified	✓	✓

* Uncertainty values cited in this table are calculated at the 95% confidence level (coverage factor = 2)

5 QUALITY ASSURANCE/ QUALITY CONTROL INFORMATION

EML Air Pty Ltd is accredited by the National Association of Testing Authorities (NATA) for the sampling and analysis of air pollutants from industrial sources (Accreditation number 2732). Unless otherwise stated test methods used are accredited with the National Association of Testing Authorities. For full details, search for EML Air at NATA's website www.nata.asn.au.

EML Air Pty Ltd is accredited by NATA (National Association of Testing Authorities) to Australian Standard 17025 – General Requirements for the Competence of Testing and Calibration Laboratories. Australian Standard 17025 requires that a laboratory have a quality system similar to ISO 9002. More importantly it also requires that a laboratory have adequate equipment to perform the testing, as well as laboratory personnel with the competence to perform the testing. This quality assurance system is administered and maintained by the Quality Assurance Manager.

NATA is a member of APLAC (Asia Pacific Laboratory Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through the mutual recognition arrangements with both of these organisations, NATA accreditation is recognised world –wide.

A formal Quality Control program is in place at EML Air to monitor analyses performed in the laboratory and sampling conducted in the field. The program is designed to check where appropriate; the sampling reproducibility, analytical method, accuracy, precision and the performance of the analyst. The Laboratory Manager is responsible for the administration and maintenance of this program.

6 DEFINITIONS

The following symbols and abbreviations may be used in this test report:

NTP	Normal temperature and pressure. Gas volumes and concentrations are expressed on a dry basis at 0°C, at discharge oxygen concentration and an absolute pressure of 101.325 kPa, unless otherwise specified.
Disturbance	A flow obstruction or instability in the direction of the flow which may impede accurate flow determination. This includes centrifugal fans, axial fans, partially closed or closed dampers, louvres, bends, connections, junctions, direction changes or changes in pipe diameter.
VOC	Any chemical compound based on carbon with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the particular conditions of use. These compounds may contain oxygen, nitrogen and other elements, but specifically excluded are carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
TOC	The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.
OU	The number of odour units per unit of volume. The numerical value of the odour concentration is equal to the number of dilutions to arrive at the odour threshold (50% panel response).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PM_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
BSP	British standard pipe
NT	Not tested or results not required
NA	Not applicable
D_{50}	'Cut size' of a cyclone defined as the particle diameter at which the cyclone achieves a 50% collection efficiency ie. half of the particles are retained by the cyclone and half are not and pass through it to the next stage. The D_{50} method simplifies the capture efficiency distribution by assuming that a given cyclone stage captures all of the particles with a diameter equal to or greater than the D_{50} of that cyclone and less than the D_{50} of the preceding cyclone.
D	Duct diameter or equivalent duct diameter for rectangular ducts
<	Less than
>	Greater than
≥	Greater than or equal to
~	Approximately
CEM	Continuous Emission Monitoring
CEMS	Continuous Emission Monitoring System
DEC	Department of Environment & Conservation (WA)
DECC	Department of Environment & Climate Change (NSW)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra Red
NATA	National Association of Testing Authorities
RATA	Relative Accuracy Test Audit
AS	Australian Standard
USEPA	United States Environmental Protection Agency
Vic EPA	Victorian Environment Protection Authority
ISC	Intersociety committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
APHA	American public health association, Standard Methods for the Examination of Water and Waste Water
CARB	Californian Air Resources Board
TM	Test Method
OM	Other approved method
CTM	Conditional test method
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
NIOSH	National Institute of Occupational Safety and Health
XRD	X-ray Diffractometry

Annex D

Sensitivity Analysis of Metals Cutting as a Volume Source and as a Point Source

D.1 SENSITIVITY ANALYSIS

Due to the non-typical nature of fugitive emissions, ERM has undertaken a sensitivity analysis of modelling metal cutting emissions as both a point source and as a volume source.

One of the main features between modelling metal cutting as a point source and as a volume source is that as a point source, CALPUFF allows a consideration of the cutting temperature in the model; the plume thereby will travel further away from the cutting source, compared to a volume source modelling configuration which does not allow consideration of temperature. As such, a volume source is generally expected to present a more localised peak of ground level concentrations.

For the sensitivity analysis, NO_X (as NO_2) and iron oxide fume emissions, which are both emissions unique to metal cutting, have been used.

D.1.1 Odour

Using odour emissions of metals cutting as an example, a comparison of the peak modelling results (99th percentile) at sensitive receptors is shown in *Table D.1* for point and volume sources.

Table D.1 ***Odour Peak Modelling Results from Metals Cutting as a Point Source and as a Volume Source***

Receptor #	Odour peak modelling results as a point source (µg/m^3)	Odour peak modelling results as a volume source (µg/m^3)	Point source value or volume source value larger?
R1	0.4	0.4	Similar
R2	0.4	0.4	Similar
R3	0.3	0.3	Similar
R4	0.2	0.2	Similar
R5	0.1	0.1	Similar
R6	0.1	0.1	Similar
R7	0.1	0.1	Similar
R8	0.1	0.1	Similar
R9	0.2	0.2	Similar
R10	0.2	0.2	Similar
R11	0.1	0.1	Similar
R12	1.7	1.7	Similar
R13	1.6	1.6	Similar
R14	1.4	1.4	Similar
R15	1.5	1.5	Similar
R16	1.4	1.4	Similar
R17	1.6	1.6	Similar
R18	1.1	1.1	Similar
R19	0.8	0.8	Similar
R20	1.6	1.6	Similar

It can be seen from *Table D1.1* that for peak odour, there is no difference between modelling cutting emissions as a point source or as a volume source. This is because odour emissions from the hammer mill dominate ground level concentrations of odour at sensitive receptors surrounding the Site.

D.1.2 *NO_2*

Using NO_2 emissions of metals cutting as an example, a comparison of the hourly modelling results (100th percentile including background) at sensitive receptors is shown in *Table D.2* for point and volume sources.

Table D.2 ***NO_2 Hourly Modelling Results from Metals Cutting as a Point Source and as a Volume Source***

Receptor #	**NO_2 hourly modelling results as a point source ($\mu g/m^3$)**	**NO_2 hourly modelling results as a volume source ($\mu g/m^3$)**	**Point source value or volume source value larger?**
R1	2.68	2.68	Similar
R2	1.88	1.88	Similar
R3	1.67	1.68	Similar
R4	1.51	1.51	Similar
R5	1.22	1.22	Similar
R6	1.19	1.19	Similar
R7	0.81	0.81	Similar
R8	1.05	1.05	Similar
R9	1.70	1.71	Similar
R10	0.59	0.59	Similar
R11	0.60	0.60	Similar
R12	23.74	23.77	Similar
R13	17.13	17.16	Similar
R14	12.21	12.23	Similar
R15	8.87	8.89	Similar
R16	11.26	11.27	Similar
R17	60.43	60.25	Similar
R18	16.35	16.34	Similar
R19	14.51	14.48	Similar
R20	60.30	60.49	Similar

It can be seen from *Table D.2* that irrespective of distance at 100th percentile, modelling of NO_2 as a result of NO_X emissions as a either a point source or a volume source provides a similar result.

D.1.3 *Iron Oxide Fumes*

Using iron oxide fumes as an example, a comparison of the hourly modelling results (excluding background as none was available; 99.9th percentile) of metals cutting at sensitive receptors is shown in *Table D.3* for point and volume sources.

Table D.3 *Iron Oxide Fumes Hourly Modelling Results of Metals Cutting as a Point Source and as a Volume Source*

Receptor #	Iron oxide fumes hourly modelling results as a point source (μg/m³)	Iron oxide fumes hourly modelling results as a volume source (μg/m³)	Point source value or volume source value larger?
R1	0.006	0.006	Similar
R2	0.006	0.006	Similar
R3	0.005	0.005	Similar
R4	0.003	0.003	Similar
R5	0.003	0.003	Similar
R6	0.003	0.003	Similar
R7	0.002	0.002	Similar
R8	0.002	0.002	Similar
R9	0.002	0.002	Similar
R10	0.002	0.002	Similar
R11	0.001	0.001	Similar
R12	0.057	0.057	Similar
R13	0.038	0.038	Similar
R14	0.030	0.029	Similar
R15	0.029	0.029	Similar
R16	0.033	0.033	Similar
R17	0.089	0.089	Similar
R18	0.049	0.049	Similar
R19	0.037	0.037	Similar
R20	0.140	0.141	Similar

It can be seen from *Table D.3* that irrespective of distance at 99.9th percentile, modelling metal (iron oxide fumes) emissions as a either a point source or a volume source provides a similar result.

Annex E

Manufacturer's Guarantee On Hammer Mill Emission Concentration

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From: Phil Vidler <phil@indux.com.au>
Sent: Wednesday, 26 August 2015 4:39 PM
To: Iain Cowan
Cc: brianroser@indux.com.au
Subject: Sell and Parker.

Dear Iain,

Further to your email to Indux's Brian Roser, regarding the anticipated outlet particulate concentration.
As the proposed scrubber has three stages, venturi, centrifuge and packed tower. The normal running particulate filtration efficiency of the proposed scrubber in good working order at Sell and Parker, Blacktown will be 20mg/m3, or less, at zero degreeC at 1 atmosphere, with the following provisos:-

The particulate, and gaseous emissions quantities and types from the existing hammer mill is unknown.
Information from Sell and Parker indicate that there is sometimes large variations in the potential emissions from the hammer mill.

a) Unknown quantities of oil fumes, when vehicle engines, gear transmissions etc. are processed for recycling. This is minimised by prior crushing but on rare occasions these parts are not crushed completely and may hold various small amounts of oil.
b) On exceptionally rare occasions LPG cylinders are erroronerously processed for recycling and subsequently ignite when shredded.
c) The various metals recycled have unknown contaminates, ie dirt, dust, paint, zinc, plastics, minerals, etc., and unknown quantities of contamination.

In the rare instances of gas ignition, and flaming oil fumes the scrubber will pass some of the resultant emissions as the scrubber may get over powered with ignited gas emissions.

To maintain the scrubber filtration at the highest filtration level, regular refreshing of the scrubber liquor (this is programmable in the scrubber system electronic control), and regular cleaning and maintenance will be required.
The frequency of these maintenance measures are unknown, as the volume of the originating emission generation is unknown and variable.
Odours in will be reduced with the use of additive oxidizer.

Phil Vidler

Environmental Engineer

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