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Ms Pamela Morales
Principle Planner, Industry and Assessments
Department of Planning & Environment
12 Darcy Street
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18 October 2022

BLUESCOPE STEEL (AIS) PTY LTD – PULVERISED COAL INJECTION (PCI) FACILITY MODIFICATION APPLICATION (DA 154-05-00)

Dear Ms Morales,

The Pulverised Coal Injection (PCI) Facility is operated under Environment Protection Licence 6092 and development consent DA 154-05-00 MOD 3.

Pulverised coal is injected into the blast furnace to improve production capability, process efficiency, and reduce the total amount of coke used in the ironmaking process. BlueScope has been investigating a potential carbon source derived from sustainable biomass, namely biochar, to replace a portion of the coal used for blast furnace injection.

The following modification application has been prepared in accordance with section 4.55 (1A) of the Environmental Planning and Assessment Act 1997 to assess the potential impacts arising from the use of biochar at the PCI Facility. The modification application seeks to enable BlueScope to trial, and if successful, implement the use of biochar in the pulverized coal injection system.

Should you have any questions in relation to the attached report, please contact Anita Rojas on (02) 4275 7522.

Yours sincerely,

DocuSigned by:
Brett Tarrant
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Brett Tarrant
Manager Cokemaking & Ironmaking
BlueScope Steel (AIS) Pty Ltd

PCI Facility Modification Application

Environment Assessment
DA 154-05-00

18 October 2022

BlueScope Steel (AIS) Pty Ltd

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1. Introduction

1.1. Project overview

BlueScope Steel (AIS) Pty Ltd (BlueScope) is a leading manufacturer of flat steel products in Australia. Port Kembla Steelworks (PKSW) is an integrated steelworks which currently produces steel using Blast Furnace – Basic Oxygen Furnace (BF-BOF) technology. Iron is produced at the blast furnace via a thermochemical reaction of iron ore, coke, and flux materials before it is converted to steel in the basic oxygen furnace.

Pulverised coal is injected into the blast furnace to improve production capability, process efficiency and reduce the total amount of coke used in the ironmaking process. The Pulverised Coal Injection (PCI) Facility at PKSW has been in operation since 2002 and currently processes approximately 1,250 tonnes of coal per day. The PCI Facility is operated under Environment Protection Licence 6092 and subject to development consent DA 154-05-00 issued by the Department of Urban Affairs and Planning (10 August 2000).

The development consent has since been modified 3 times with modifications summarised in Table1-1.

Table 1-1: Modification details for DA 154-05-00

Modification Approval Reference	Date	Modification Details
DA 154-05-00 MOD 1	4 July 2002	Removal of the proposed installation of a radial stacker for stockpiling PCI feed coal, construction of three yard conveyors and associated receival bins for blending, and construction of a conveyor to transport and discharge PCI feed coal into the existing receival hopper.
DA 154-05-00 MOD 2	2 September 2008	Removal of pulverised coal injection limits of 200kg of pulverised coal per tonne of hot metal for each blast furnace.
DA 154-05-00 MOD 3	2 May 2017	Amendment of the conditions overseeing the sourcing of new coals for use at the PCI Facility, and modification to the environmental reporting requirements from annually to triennially.

The use of PCI at the blast furnace is beneficial to ironmaking at the blast furnace however, it is a non-renewable source of fuel. In line with BlueScope's CO_2 emission reduction goals, BlueScope has been investigating a potential carbon source derived from sustainable biomass, namely biochar to replace a portion of the coal used for blast furnace injection. As such, BlueScope proposes to trial, and if successful implement, the use of biochar in the pulverized coal injection system.

1.2. Reasons for modification

DA 154-05-00 was approved based on the supporting Statement of Environmental Effects (SEE). As the SEE only assessed the potential environmental impacts of the use of coal at the PCI Facility, coal is the only material currently eligible for processing. To allow the processing of biochar at the Facility, a modification to the existing Development Approval is required.

This modification report has been prepared for the Department of Planning and Environment (DPE) by BlueScope under section 4.55(1A) of the Environmental Planning and Assessment Act 1997 (EP&A Act) in accordance with *State significant development guidelines – preparing a modification report: Appendix E to the state significant development guidelines July 2021* to enable BlueScope to proceed with trials and if successful, the ongoing processing of biochar at the PCI Facility.

1.3. Proponent details

The proponent, BlueScope Steel (AIS) Pty Ltd (ABN 19 000 019 625) is a wholly owned subsidiary of BlueScope Steel Limited (BSL) (ABN 16 000 011 058). BlueScope is the owner and operator PKSW, including the PCI Facility.

1.4. Site setting

The PKSW is located in the Wollongong Local Government Area, within an industrial site of approximately 750 ha. It is situated approximately 80 kilometres south of Sydney and is surrounded by the suburbs of Port Kembla, Warrawong and Lake Heights to the south, Cringila and Unanderra to the west, and Figtree, Mount St Thomas, Coniston and Wollongong to the north.

The PKSW site comprises of the No.1 Works, No.2 Works, and Steelhaven. The No.2 Works is further subdivided into the Recycling Area, Rolling Mills, and the Cokemaking, Ironmaking and Steelmaking areas. The PCI Facility is located within the boundary of the PKSW (Lot 1 DP 606434), in the northern section of the Cokemaking area.

The Facility is located approximately 1,400 m from the nearest residential receivers. The activities proposed in this modification will be contained within the existing site.

Figure 1 - Project site locality

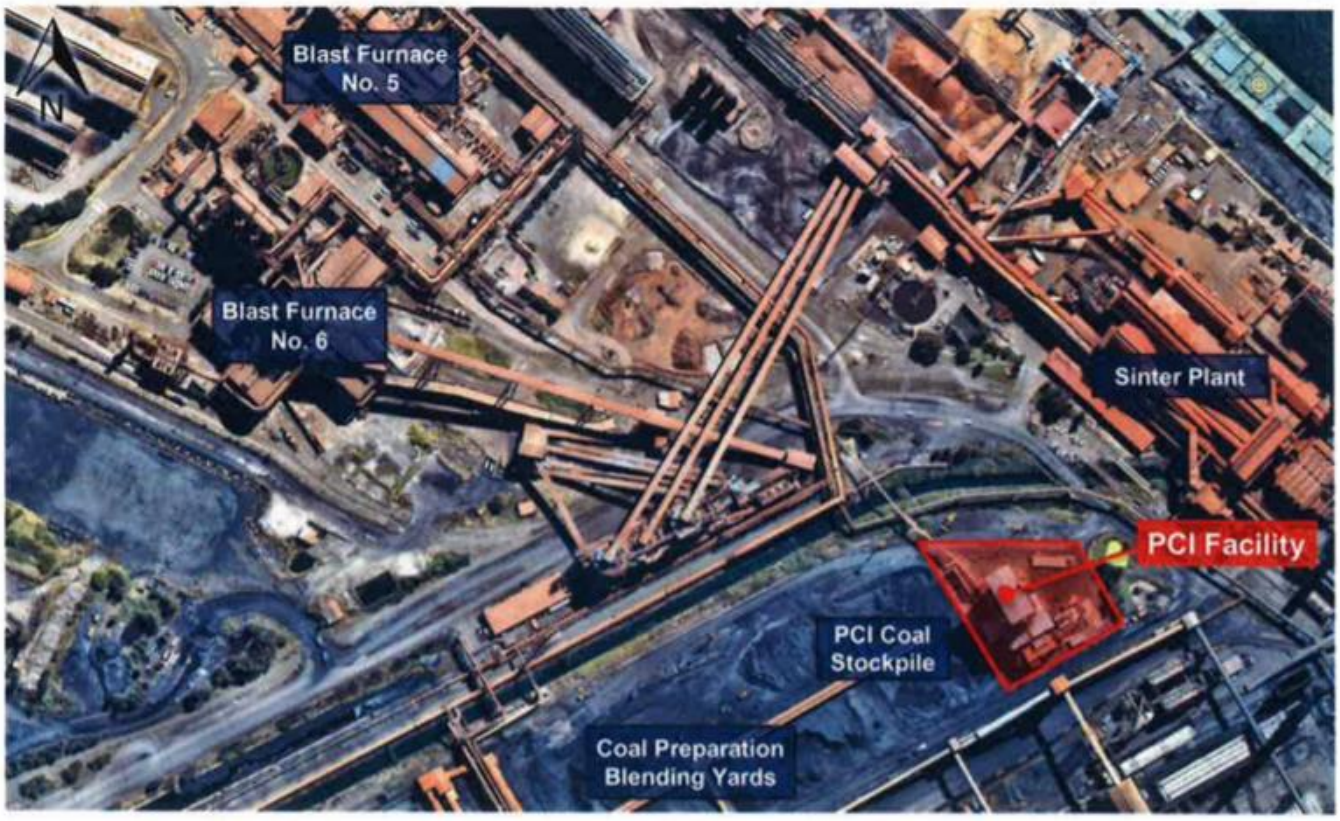


Figure 2 - Plant area location

1.5. PCI Facility process overview

Coal is fed through hoppers onto a fully enclosed vertical lift feed coal conveyor to a storage bin. The coal from the storage bin is then fed to the Grinding and Drying plant via variable speed enclosed drag chain conveyors, where it is pulverised to a fine powdered product. The aim is to grind the coal such that 75 - 80% of the material has a particle size less than 90 microns.

Hot gas is also fed into the Grinding Mill to dry the pulverised coal. The Hot Gas Generator is a burner arrangement, which uses a mixture of Blast Furnace Gas and air to generate Hot Gas with a temperature of approximately 300ºC. The hot gas containing pulverised coal is passed through a Fine Bag filter (similar to a baghouse) to remove the pulverised coal and transported to the Fine Coal Bin via a drag chain conveyer. The filtered hot gas is passed through a condenser to remove excess dust and humidity. It is then recycled through the Hot Gas generator to increase the temperature to 300ºC for re-use in the Grinding.

From the Fine Coal Bin, pulverised coal is fed into an injection hopper which feeds the pulverised coal into a pipeline and is pneumatically conveyed for injection into the blast furnace.

A process diagram is provided as Figure 3.

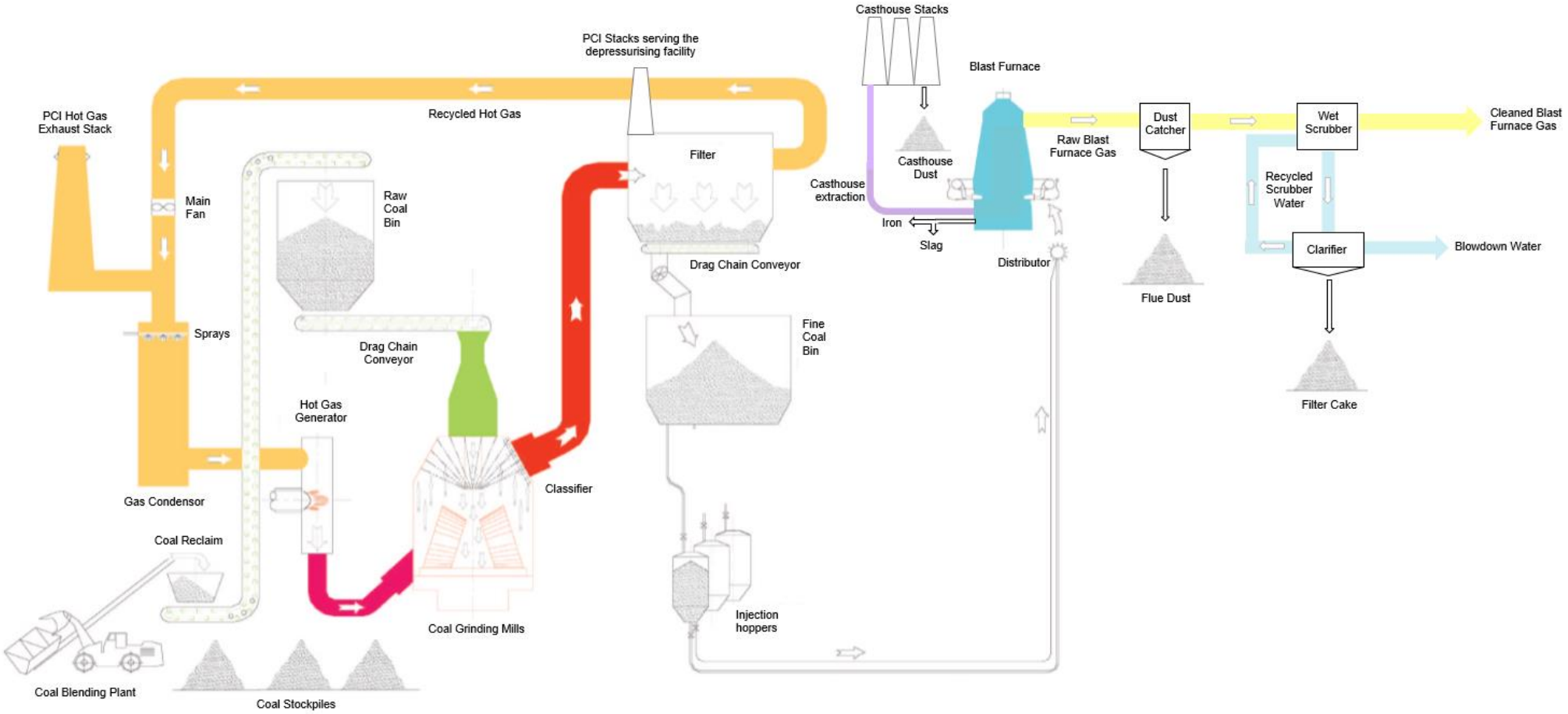


Figure 3 - PCI Facility process and output streams

2. Strategic context

In 2018, BlueScope committed to a 1% year on year reduction in greenhouse gas (GHG) intensity emissions from steelmaking operations between 2018 and 2030. On 1 September 2021, BlueScope announced a 2050 net zero GHG emission target in the BlueScope Climate Action Report. These business goals align with the NSW Climate Change Policy Framework which also strives to achieve net zero emissions by 2050. In line with these goals, BlueScope have been exploring opportunities to utilise biomass derived materials (biochar and bio-coal) in the steel manufacturing process to reduce net CO_2 emissions. Here the biomass could come from a number of sources, including forestry or reclaimed material from land fill streams.

Further, BlueScope aspires to a circular economy, maximising the recovery of outputs and avoiding disposal. Where practical, by-products of the steelmaking process are used as substitutes for virgin raw materials to promote a circular economy and reduce consumption of natural resources and landfilling of waste products. Examples include the use of gypsum in agriculture and blast furnace slag in cement manufacture. The proposed modification helps to achieve this aspiration by recovering waste streams from other industries (biochar) for use as a replacement of non-renewable resources in the steelmaking process.

The use of biochar has been identified as a potential opportunity to fulfill BlueScope's carbon reduction and circular economy goals.

3. Description of modification

3.1. Proposed modification

The proposed modification involves the trial and future use of up to 30% of biochar in the PCI coal feed, thereby replacing a portion of the coal currently used in the ironmaking process. The pulverisation and injection processes remaining consistent with existing operations. No modification to the existing infrastructure is required to accommodate addition of biochar, therefore there are no construction or commissioning requirements for the proposed modification.

This assessment seeks the addition of a new conditions to DA 154-05-00 to allow the trial and future processing of biochar at the PCI facility to enable its use as a blast furnace injectant, thereby reducing the amount of PCI coal used in the ironmaking process.

3.2. Biochar (also known as Bio-coal or Torrefied Wood)

Biochar is produced via the pyrolysis of biomass which could be derived from several sources including:

- Uncontaminated wood waste, such as sawdust, wood processing offcuts or shredded clean pallets;
- Forestry residues, such as out-of-specification or unwanted timber and/or thinnings from sustainable forestry operations; and
- Other sources of waste timber rendered safe via the action of pyrolysis with appropriate safeguards regarding contaminants.

Depending on the pyrolysis temperature, biochars can have different properties and often biochars produced at lower temperatures are called bio-coals or torrefied wood products. Regardless of the name however, these products represent a more sustainable source of carbon for blast furnace injection.

The production of biochar represents a higher order usage of the materials noted above given that they would otherwise end up in landfill, be used for animal bedding and horticultural applications, be left to rot in the forest, or burnt to make way for new forest plantings.

Biochar is not regarded as a waste material with current uses extending from barbecue fuel, power generation, feedstocks for manufacturing, through to horticultural and even agricultural uses. Further, for the purposes of calculating emissions released during consumption of a fuel, biochar is considered to have a carbon content factor of 0 tonnes of carbon per tonne of fuel under Chapter 8 Schedule 3 Part 1 of the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (Refer Figure 5). Therefore, the use of biochar as a source of carbon for the reduction of iron ore is a tenable alternative application considering the net CO_2 reductions and associated environmental benefits resulting from displacing non-renewable coal with renewable biochar.

Two sources of biochar from sustainably sourced timber biomass have been acquired for use in the proposed trials. A comparison of average PCI coal composition with the composition of the biochars that will be used in the trials is shown in Table 3-1. The biochar average results are based on a 70:30 blend of the two biochar samples that will be used in the trials to reflect the anticipated blended composition, while the range is based on analytical results of the two samples. Biochar composition results are provided in Appendix B.

Table 3-1: Comparison of average PCI coal composition and composition of two biochar samples

Analysis	Units	Coal		Biochar	
		Average	Range	Average	Range
Moisture	%	10	8 - 13	16.3	5.8 - 40.7
Ash	%	9.6	5.7 - 12.2	7.1	1.6 - 17.7
Volatile Matter	%	24.3	8.8-38.99	9.2	3 – 20.7
Total Sulphur	%	0.46	0.32 – 0.83	0.01	0 – 0.1
Gross Calorific Value	kcal/kg	7550	7550-8623	7229	5947 - 7779
Carbon	%	81	73 – 89	79.5	63.1 – 87.6
Hydrogen	%	4.8	3.8-5.6	1.5	1.0– 2.3
Nitrogen	%	1.51	0.66 – 1.9	0.48	0.32 – 0.57
Antimony	mg/kg	0.09	<0.5 – 0.46	<0.5	< 0.5
Arsenic	mg/kg	0.91	<0.5 – 7.7	0.9	<0.5 - 4
Barium	mg/kg	55	<0.5 – 340	29.2	1.3 - 89
Beryllium	mg/kg	0.71	<0.5 – 6	<0.5	< 0.5
Cadmium	mg/kg	<0.5	<0.5 – 0.13	<0.5	< 0.5
Chromium	mg/kg	3.2	<0.5 – 20	7.7	3.2 - 20
Cobalt	mg/kg	3.5	<0.5 – 16	0.5	< 0.5- 1.5
Copper	mg/kg	11	2 – 18	3.7	0.91 - 7.7
Lead	mg/kg	4.4	1.7 – 7.9	2.9	1.4 - 5.35
Manganese	mg/kg	30	<0.5 – 200	31.9	8.5 - 69
Mercury	mg/kg	<0.2	<0.2 – 1.38	<0.2	< 0.2
Molybdenum	mg/kg	0.24	<0.5 – 0.67	0.12	<0.5 - 0.605
Nickel	mg/kg	7.5	0.67 - 36	0.98	< 0.5 - 2.3
Selenium	mg/kg	0.30	<0.5 - 1	<0.5	< 0.5
Silver	mg/kg	<0.5	<0.5 - 0	<0.5	< 0.5
Tin	mg/kg	0.5	<0.5 – 1	<0.5	< 0.5
Vanadium	mg/kg	11	1.4 – 47	3.5	1.16 - 5.4

Zinc	mg/kg	11	<0.5 – 28	32.2	11 - 69
Fluoride	mg/kg	1.2	100 - 270	1.3	1.2- 1.6

Note: The biochar composition provided is that of suppliers acquired for the trials and long-term suppliers of biochar are yet to be determined. All future potential biochar supplies will be analysed prior to use at the PCI Facility.

The comparison indicates limited difference in composition between the coal and biochar sources.

3.3. Trial and use of biochar

A staged trial, where the biochar is added in conjunction with coal using the existing mixing plant, will be undertaken to determine the feasibility of biochar as a replacement for PCI coal. The proposed trial consists of four stages over a period of 3 – 4 weeks which will see a gradual increase in both the amount of biochar used, and the length of time of injection to the blast furnace via the PCI plant:

Stage 1 – 5 – 8%biochar addition

This introductory stage will use approximately 53t of biochar for 2 trials at 5% biochar

addition for 1 and 2 hours respectively, followed by trials at 7% and 8% biochar addition for 4 and 8 hours respectively.

Stage 2 – 10% biochar addition

This stage will use approximately 70t and 140t of biochar for 12 and 24hours respectively.

Stage 3 – 20% biochar addition for 12 and 24 hours

This stage will use approximately 140t and 280t of biochar for 12 and 24hours respectively.

Stage 4 – 30% biochar addition for 12 and 24 hours

This stage will use approximately 210t and 422t of biochar for 12 and 24hours respectively.

Throughout each stage of the trials, process parameters will be closely monitored by control room operators to ensure early identification of deviations from normal operations. This includes a focus on the online, continuous opacity readings measured at the PCI baghouse stack. Blast furnace slag is analysed once per cast as part of process monitoring and monthly for waste exemption purposes. These analyses will continue throughout the trial periods. Small scale testing like this will ensure the addition of biochar to the PCI Plant does not result in operational, environmental or safety impacts. If any issues are identified during the trial period, they will be rectified before proceeding to the next stage of the trial. As such, the proposed trial plan is subject to change pending monitoring results acquired during each stage of the trial.

Stack emissions sampling will be conducted at the PCI Hot Gas Exhaust Stack, the PCI Facility Stacks serving the depressurising bag filters, the No 5 Blast Furnace casthouse dedusting stacks and the Blast Furnace Clean Gas Main during each of the trials for pollutants listed in condition M2.2 of EPL 6092, with the additional analysis of Type 1 and Type 2 Substances which includes antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, selenium, tin, and vanadium. Stack sampling results will be tabulated and reported once all data is received and processed.

Following the completion of the biochar trials, BlueScope will prepare and submit a Verification Report to the Department of Planning and Environment, and the EPA. Providing the results of stack testing for the biochar trial confirm that emissions meet the relevant standards and requirements, BlueScope intends to process biochar at the PCI Facility at a maximum addition rate of 30% of the feed.

The composition of biochar may differ based on the supply source of the material. As such, new biochar sources will be analysed prior to their use at the PCI Facility.

3.4. Environment Protection Licence amendments

In September 2021, a trial proposal was submitted to the EPA in relation to the proposed modification. Following this submission, EPA approval to proceed with the trials was received with the following condition added to Environment Protection Licence 6092 (EPL 6092):

U6 PRP 184 (EIP) - Trial of Biochar in the PCI Plant

U6.1 Environmental Improvement Program (EIP) - Greenhouse Gas Emission Reduction Investigation – Trial of Biochar in the Pulverised Coal Injection Plant

Background

Raw materials for iron making, including sinter, coke and flux (limestone) are charged into the top of the Blast Furnace. Hot blast air is injected through tuyeres at the base of the furnace. As chemical reactions take place in the furnace, a mixture of carbon monoxide (CO), hydrogen (H_2) and other gases are generated. The blast furnace process produces the majority of the carbon dioxide emissions at the Port Kembla Steelworks site.

BSL have made a number of changes to Blast Furnace operation over the years. In 2002 the Pulverised Coal Injection (PCI) plant commenced operation. The PCI plant injects pulverised coal directly into the blast furnace tuyeres replacing coke as a raw material and improving blast furnace productivity.

'Biochar' is produced when wood-based biomass undergoes a pyrolysis process. In this trial, it is proposed to replace some of the coal injected by the PCI Plant in to the Blast Furnace, with biochar. The biochar serves as a substitute raw material (for coal) and also provides an associated fuel benefit. The result of using biochar will be to reduce net CO_2 emissions from Blast Furnace operations, and to decrease fossil fuel consumption.

The licensee proposes to undertake a number of trials (proposed 4 trials) utilising up to 1,000 tonnes of biochar over a number of days (proposed 4 days). These initial trials will primarily evaluate materials handling and assess any other constraints of using biochar in the PCI production process, and determine if any process changes are required to enable biochar use in this way. The licensee has advised the trial is likely to commence in April 2022.

Aim

To undertake preliminary materials handling trials at the PCI Plant and Number 5 Blast Furnace to:

1. *assess handling, drying and grinding characteristics of biochar for PCI use; and*
2. *assess any changes to blast furnace performance when using biochar combined with PCI coal.*

U6.2 Requirements

1. *The licensee must undertake the trial as listed in the BSL Biochar Use at BlueScope Steel Port Kembla dated 10 September 2021 (the Trial Plan) held on EPA file DOC21/797992.*
2. *The licensee must notify the EPA and the BSL Community Consultative Committee in advance of the trial start date, and the EPA at the completion of the trial.*
3. *A detailed air emissions testing schedule at the PCI licensed discharge point must be provided to the EPA at least 1 month prior to the trial. The schedule must include, at a minimum, current licence monitoring analytes and temperature, oxygen content, moisture content and discharge stack pressure.*
4. *At the completion of the trial the licensee must submit a report on:*
   a) *The results per the elements listed in the Trial Plan;*
   b) *Details on any changes recorded, or potential changes to carbon emissions from the iron making process;*
   c) *A raw material comparison provided by the biochar as compared to PCI coal. That is the carbon quantity provided by both materials; and*
   d) *A fuel value comparison provided by the biochar compared to PCI coal. That is the calorific value of both materials.*

4. Statutory context

4.1. Environmental Planning and Assessment Act 1979 (NSW)

Section 4.55(1A) of the EP&A Act allows a consent authority to modify a consent if certain requirements are met, including that the consent authority:

(a) is satisfied that the proposed modification is of minimal environmental impact;
(b) Is satisfied that the development to which the consent as modified relates is substantially the same development for which consent was originally granted, prior to any modification of that consent;
(c) It has notified the application in accordance with the regulations and/or any relevant development control plan; and
(d) It has considered any submissions made in relation to the proposed modification within the time prescribed by the regulations or any relevant development control plan.

Section 4.55(3) requires the consent authority, in determining an application for modification of a consent, to take into account such of the matters referred to in section 4.15(1) of the EP&A Act as are of relevance to the development the subject of the application. The consent authority must also take into consideration the reasons given by the consent authority for the original grant of consent.

The matters set out in section 4.55(3) consist of, relevantly:

(a) The provisions of any relevant environmental planning instrument;
(b) The likely impacts of the development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality;
(c) The suitability of the site for the development;
(d) Any submissions made in relation to the application;
(e) The public interest.

The sections below discuss the relevant environmental planning instruments.

4.1.1. State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP) is the primary planning instrument which applies to the PKSW site, including the PCI Facility, with Chapter 5 of that SEPP being the chapter of particular relevance. The land on which the PCI Facility is located is zoned IN3 Heavy Industrial under the T&I SEPP. Part 5.2 of the T&I SEPP includes the land use table which specifies the following objectives for the IN3 zone:

(a) To provide suitable areas for those industries that need to be separated from other land uses.
(b) To encourage employment opportunities.
(c) To minimise any adverse effect of heavy industry on other land uses.
(d) To provide transport infrastructure and intermodal facilities.
(e) To allow a diversity of activities that will not significantly detract from the operation of existing or proposed industries.

The proposal is considered consistent with each of these objectives.

4.1.2. State Environmental Planning Policy (Resilience and Hazards) 2021

Each of Chapters 2 (Coastal Management), 3 (Hazardous and Offensive Development) and 4 (Remediation of Land) of State Environmental Planning Policy (Resilience and Hazards) 2021 (R&H SEPP) are of potential relevance to the proposal.

Coastal Management

The PCI facility is located on land which falls partly within the coastal environment area and partly within the coastal use area under Chapter 2, Coastal Management, of the R&H SEPP. The consent authority must not grant consent unless it has considered whether or not the proposed development is likely to cause an adverse impact on, relevantly:

- the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,
- coastal environmental values and natural coastal processes,
- the water quality of the marine estate as defined in the *Marine Estate Management Act 2014*,
- marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,
- Aboriginal cultural heritage, practices and places, and
- the cultural and built environmental heritage.

In addition, the consent authority must not grant development consent unless satisfied that—

- the development is designed, sited and will be managed to avoid an adverse impact of the kinds referred to in the SEPP, or
- if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or
- if that impact cannot be minimised—the development will be managed to mitigate that impact.

The potential environmental impacts of the proposed modification are discussed in section 6 of this SEE, but are considered to be minimal, and in particular are considered unlikely to cause any adverse impacts on the matters dealt with in Chapter 2 of the R&H SEPP.

Hazardous and Offen*sive Development*

Chapter 3 of the R&H SEPP requires a person who makes a development application to carry out development for the purpose of a potentially hazardous industry to prepare a preliminary hazard analysis (PHA). "Potentially hazardous industry" is defined to mean:

"a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality—

(a) to human health, life or property, or

(b) to the biophysical environment,

and includes a hazardous industry and a hazardous storage establishment."

Hazards currently present at the PCI plant include electrical and vehicular hazards, as well as the hazards arising from the use of moving mechanical equipment and the presence confined spaces. Additional hazards which could potentially give rise to an impact on the locality and/or human health, life or property, if not properly managed, are those associated with pressure energy and the use of toxic and asphyxiant gases. All of these hazards have been managed safely at the PCI plant since it commenced operation following the grant of the initial development consent in 2000. The subject of this modification application, that is, the proposal to trial the use of biochar in the PCI plant, will not change the hazard profile of the development and as such, preparation of a PHA is not required.

"Potentially offensive industry" is defined to mean:

"a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or

on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment."

The potential impacts of the proposed modification are discussed in section 6 below, allowing consideration of the matters which the consent authority is required to take into account pursuant to clause 3.12 of the R&H SEPP.

Remediation of Land

Clause 4.6 of the R&H SEPP provides that a consent authority must not consent to the carrying out of any development of land unless, relevantly:

- it has considered whether the land is contaminated, and
- if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and
- if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

The land on which the PKSW is situated has been declared to be contaminated land. BlueScope has carried out investigation of and reporting to the EPA of the contamination status of PKSW over more than a decade and the EPA has formally advised that it is appropriate for the contamination to be managed under the conditions of the EPL which applies to the land. The proposed modification will not result in any change in the way in which the PCI plant interacts with land on which it is located, and it is considered that the consent authority may be satisfied that the requirements of clause 4.6 of the R&H SEPP have been met.

4.2. Other NSW legislation

4.2.1. Protection of the Environment Operations Act 1997

The Protection of the Environment Operations Act 1997 is the key piece of environmental protection legislation in NSW. As well as provisions relating to air, noise, land and water pollution, it contains provisions requiring certain activities and premises to be the subject of environment protection licences. The PKSW, including the existing PCI Plant, is covered by environmental protection licence number 6092.

4.2.2. Biodiversity Conservation Act 2016

The Biodiversity Conservation Act 2016 (BC Act) establishes a framework to avoid, minimise and offset impacts of proposed development and land use change on biodiversity. Section 7.9(2) of the BC Act requires an application for development consent for SSD under Part 4 of the EP&A Act to be accompanied by a Biodiversity Development Assessment Report unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values.

Clause 30 of the Biodiversity Conservation (Saving & Transitional) Regulation provides that the BC Act applies to modification of planning approvals granted before commencement of the BC Act.

The proposed modification does not involve the removal of any native vegetation and the PCI Plant site does not provide potential habitat for any threatened fauna species. Therefore, no assessment of threatened species or ecological communities is required.

4.2.3. Heritage Act 1977

The Heritage Act 1977 provides protection of the environmental heritage of the State which includes places, buildings, works, relics, movable objects or precincts that are of State or local heritage significance. A key measure for the identification and conservation of State significant items is listing on the State Heritage Register (SHR) under Part 3A of the Heritage Act 1977. An application for approval must be made if development may result in direct impacts on an item on the SHR, however, there are no state listed items on the PKSW site. The Heritage Act also requires a permit to be obtained prior to disturbance or excavation which is likely to discover, expose, move, damage or

destroy a relic, as defined in the Act. The nature of the proposed modification means that this requirement will not be triggered.

4.2.4. National Parks and Wildlife Act 1974

The Act aims to conserve the natural and cultural heritage of NSW. Amongst other things, where works will disturb Aboriginal objects, an Aboriginal Heritage Impact Permit is required. The nature of the proposed modification to the consent means that this requirement will not be triggered.

4.3. Commonwealth legislation

4.3.1. Environment Protection and Biodiversity Conservation Act 1999

The Environment Protection and Biodiversity Conservation Act 1999 aims to protect and manage matters of national environmental significance (MNES), including threatened species and ecological communities, migratory species (protected under international agreements), and National Heritage places. Any actions that will or are likely to have a significant impact on the MNES require referral and approval from the Australian Government Environment Minister. The nature of the proposed modification is such that this requirement is not triggered.

5. Engagement

The proposal to use biochar and ACU as pulverised coal replacements has been discussed with the EPA and DPE. A summary of the meeting purpose and issues raised are listed in Table 5-1.

Table 5-1: Summary of EPA and DPE engagement

Date	Regulator	Purpose	Issues Raised
23 July 2021	EPA	Discuss Biochar project concept	Comparison of biochar and coal to be provided. Potential impacts to process outputs to be assessed. Proposal of trial plan to be submitted to EPA.
10 September 2021	EPA	Provide trial plan for Biochar project	Biochar trial approved by EPA and EPL 6092 subsequently modified to include trial conditions
21 October 2021	EPA	Discuss ACU project concept	Potential impacts to process outputs to be assessed. Proposal of trial plan to be submitted to EPA.
22 October 2021	DPE	Discuss ACU and Biochar project concepts	DPE confirmed a modification to the existing DA will be required. Potential impacts to process outputs and Facility to be assessed in modification report.
22 July 2022	DPE & EPA	Modification application scoping meeting	All modelling in the environment impact assessment should be scaled up to the maximum future use case and should include the addition of ACU and biochar at the same time. EPA suggested the particulars of the trials be largely managed through the licence rather than the DA.

BlueScope's Community Consultative Committee (CCC) meets once per quarter to discuss the company's performance and projects. The CCC will be notified of the trial and of its progress following approval of the modification application.

6. Assessment of impacts

The proposed modification only relates to the materials processed through the existing PCI Facility and does not involve the construction of additional infrastructure. As no construction phase is required for the modification, the impacts assessed relate only to the operation of the PCI Facility.

Trace elements within materials processed at the PCI Facility will disperse across the process output streams at the PCI Facility and the Blast Furnace. The process outputs in which the elements may appear are shown in Figure 3 and include:

- PCI Hot Gas Exhaust Stack
- PCI Stacks serving the depressurising facility
- Iron
- Slag
- Blast Furnace Gas
- Casthouse stack
- Blast furnace dust
- Clarifier blowdown

The assessment of the use of biochar at the PCI Facility has been performed by using the average composition of coal and biochar (as provided in Table 3-1) to predict the concentration of potential contaminants of concern in the PCI feed at a biochar addition rate of 30% and comparing these results to existing operation.

Table 6-1- Comparison of exiting and predicted future PCI feed concentration

Analysis	Units	Average existing feed concentration (0% biochar)	Predicted future feed concentration (30% biochar)
Moisture	%	10	12
Ash	%	9.6	8.9
Volatile Matter	%	24.3	19.8
Total Sulphur	%	0.46	0.33
Carbon	%	81	81
Hydrogen	%	4.8	3.8
Nitrogen	%	1.51	1.20
Antimony	mg/kg	<0.5	<0.5
Arsenic	mg/kg	0.91	0.91
Barium	mg/kg	55	47.3
Beryllium	mg/kg	0.71	0.5
Cadmium	mg/kg	<0.5	<0.5
Chromium	mg/kg	3.2	4.6
Cobalt	mg/kg	3.5	2.6
Copper	mg/kg	11	8.8
Lead	mg/kg	4.4	4.0
Manganese	mg/kg	30	31
Mercury	mg/kg	<0.2	<0.2

Analysis	Units	Average existing feed concentration (0% biochar)	Predicted future feed concentration (30% biochar)
Molybdenum	mg/kg	0.24	0.20
Nickel	mg/kg	7.5	5.5
Selenium	mg/kg	<0.5	<0.5
Silver	mg/kg	<0.5	<0.5
Tin	mg/kg	0.5	<0.5
Vanadium	mg/kg	11	8.8
Zinc	mg/kg	11	17
Fluoride	mg/kg	1.2	1.2

Based on the PCI coal and biochar analyses presented in Table 3-1, the predicted future PCI feed indicates a slight increase in concentration is predicted for chromium, manganese, and zinc however, the predicted increase of these metals is within the historical range of concentrations for PCI coals (refer Table 3-1) and is therefore considered to be consistent with existing operation. All other contaminant concentrations are predicted to be equivalent to or lower than that of existing operation.

Note that the compositions of biochar used in the future, like any other raw material in the ironmaking process will potentially differ from that shown above. As such, all new sources of biochar will be analysed before use at the PCI Facility to ensure they are acceptable for use, per the current process for new sources of PCI feed coal.

6.1. Air Quality

6.1.1. Stack Emissions

No new stack emission sources are proposed under this modification application. Metals present in the PCI feed largely partition to the solid output streams and may be emitted from the stacks as dust in the waste gas. The waste gas will be subject to existing pollution control equipment including the bag filters at the PCI Facility and Blast Furnace casthouse stacks, and the wet scrubber used to clean the Blast Furnace Gas.

As noted in Section 3.3, the following stacks will be monitored throughout the trial period:

- PCI Hot Gas Exhaust Stack (EPL 6092 Point 105);
- PCI Facility Stacks serving the depressurising bag filters (EPL 6092 Point 106); and
- No 5 Blast Furnace casthouse dedusting stacks (EPL 6092 Points 8 and 118).

These stacks are currently subject to regular sampling and compliance in accordance with conditions M2.2 and L3.4 of EPL 6092. Further, while metals are not required to be routinely tested at these stacks under EPL 6092, analysis of metals are undertaken at the PCI Hot Gas Exhaust stack and the No 5 Blast Furnace Casthouse Dedusting Stacks for National Pollutant Inventory emission reporting and are assessed against the limits stipulated in the Protection of the Environment Operations (Clean Air) Regulation 2021 for Iron and steel primary production.

Results of recent stack testing undertaken at the PCI Facility and at the 5BF Casthouse dedusting stacks in accordance with EPL 6092 monitoring requirements, and for National Pollutant Inventory emission reporting and the respective concentration limits are provided in Tables 6-2 – 6-5. Certificates of Analysis for these results are attached as Appendix C.

Table 6-2 - PCI Hot Gas Exhaust stack (EPL 6092 Point 105) testing results

Date Sampled	Analysis	Units	Result	EPL 6092 Concentration Limit	POEO Clean Air Regulation (2021) Group 6 Limit
14 April 2022	Solid Particles	mg/m^3	5.2	20	20
14 April 2022	Nitrogen Oxides	mg/m^3	<5	200	-
6 June 2018	Type 1 and Type 2 substances (jn aggregate)	mg/m^3	0.022	-	1
6 June 2018	Cadmium	mg/m^3	<0.0004	-	0.2
6 June 2018	Mercury	mg/m^3	<0.0002	-	0.2

Table 6-3 – PCI Depressurising Bag Filter stack (EPL 6092 Point 106) testing results

Date Sampled	Analysis	Units	Result	EPL 6092 Concentration Limit	POEO Clean Air Regulation (2021) Group 6 Limit
14 April 2022	Solid Particles	mg/m^3	<2	20	20

Table 6-4 – No 5 Blast Furnace Casthouse Dedusting Stack 1 (EPL 6092 Point 8) testing results

Date Sampled	Analysis	Units	Result	EPL 6092 Concentration Limit	POEO Clean Air Regulation (2021) Group 6 Limit
9 August 2021	Solid Particles	mg/m^3	11	50	50
24 August 2017	Type 1 and Type 2 substances (jn aggregate)	mg/m^3	0.019	-	1
24 August 2017	Cadmium	mg/m^3	<0.00018	-	0.2
24 August 2017	Mercury	mg/m^3	<0.00018	-	0.2

Table 6-5 – No 5 Blast Furnace Casthouse Dedusting Stack 2 (EPL 6092 Point 118) testing results

Date Sampled	Analysis	Units	Result	EPL 6092 Concentration Limit	POEO Clean Air Regulation (2021) Group 6 Limit
3 August 2021	Solid Particles	mg/m^3	5.2	50	50
3 May 2018	Type 1 and Type 2 substances (jn aggregate)	mg/m^3	0.034	-	1
3 May 2018	Cadmium	mg/m^3	0.00062	-	0.2
3 May 2018	Mercury	mg/m^3	<0.00026	-	0.2

Analysis of the contaminant concentrations of the existing PCI coal sources and the biochar acquired for the trials (refer Table 3-1) shows little difference in chemical composition between the two carbon sources. Comparison of the predicted contaminant concentrations of the PCI feed at 30% biochar addition presented in Table 6-1 compared to the contaminant concentration ranges in the PCI feed provided in Table 3-1 shows the predicted concentration of contaminants resulting from the modification are within the range of concentrations currently used at the PCI Facility. As the concentrations in the feed will be consistent with existing operation, the emissions generated during the process are expected to be consistent.

The recent stack sampling results provided in Tables 6-2 – 6-5 demonstrate compliance with the EPL 6092 and Protection of the Environment Operations (Clean Air) Regulation 2021, with all results significantly lower than the respective prescribed emission limits. A review of sampling results over the last ten years shows the PCI Facility has a history of compliance to air emission limits, with no non-compliances identified during the period.

Between 2009 and 2012, in accordance with the requirements of Pollution Reduction Program 131 of EPL 6092, an air emissions model for the Port Kembla Steelworks site was prepared and validated by and independent third party. In the resulting report submitted to the EPA in September 2012 the results of the validated model indicated compliance to the EPA criterion at all sensitive receptors for all contaminants measured at the PCI Facility and No 5 Blast Furnace Casthouse Dedusting stacks. A copy of the report is provided in Appendix D.

As the emissions generated as a result of the modification are expected to be consistent with that of existing operations, air quality modelling was not undertaken as impacts to local receptors will remain unchanged and emissions data for existing operations used in previous air modelling demonstrated compliance to the EPA criterion for all contaminants measured at the PCI Facility stacks.

6.1.2. Fugitive Emissions

Biochar for trials will be unloaded and stored internally to minimise fugitive dust emissions from the site during this activity. Additionally, the material will be wetted following unloading. The biochar will be stored in existing warehouses on the PKSW site for the duration of the trials.

Long-term storage solutions have not been determined given long-term supply solutions are yet to be confirmed. If the biochar is to be stockpiled, it will most likely be handled and managed in line with current coal management practices, including the use of dust controls including water sprays and wind speed monitoring. Storage of future biochar supply will be assessed and determined in consultation with the EPA.

6.2. Traffic

Truck entry to the PKSW stie is provided via Springhill Road, Five Islands Road, Flinders Street, and Old Port Road. All of these are roads classified as State roads and are connected to local roads internal to the PKSW. The site can only be accessed by authorised personnel.

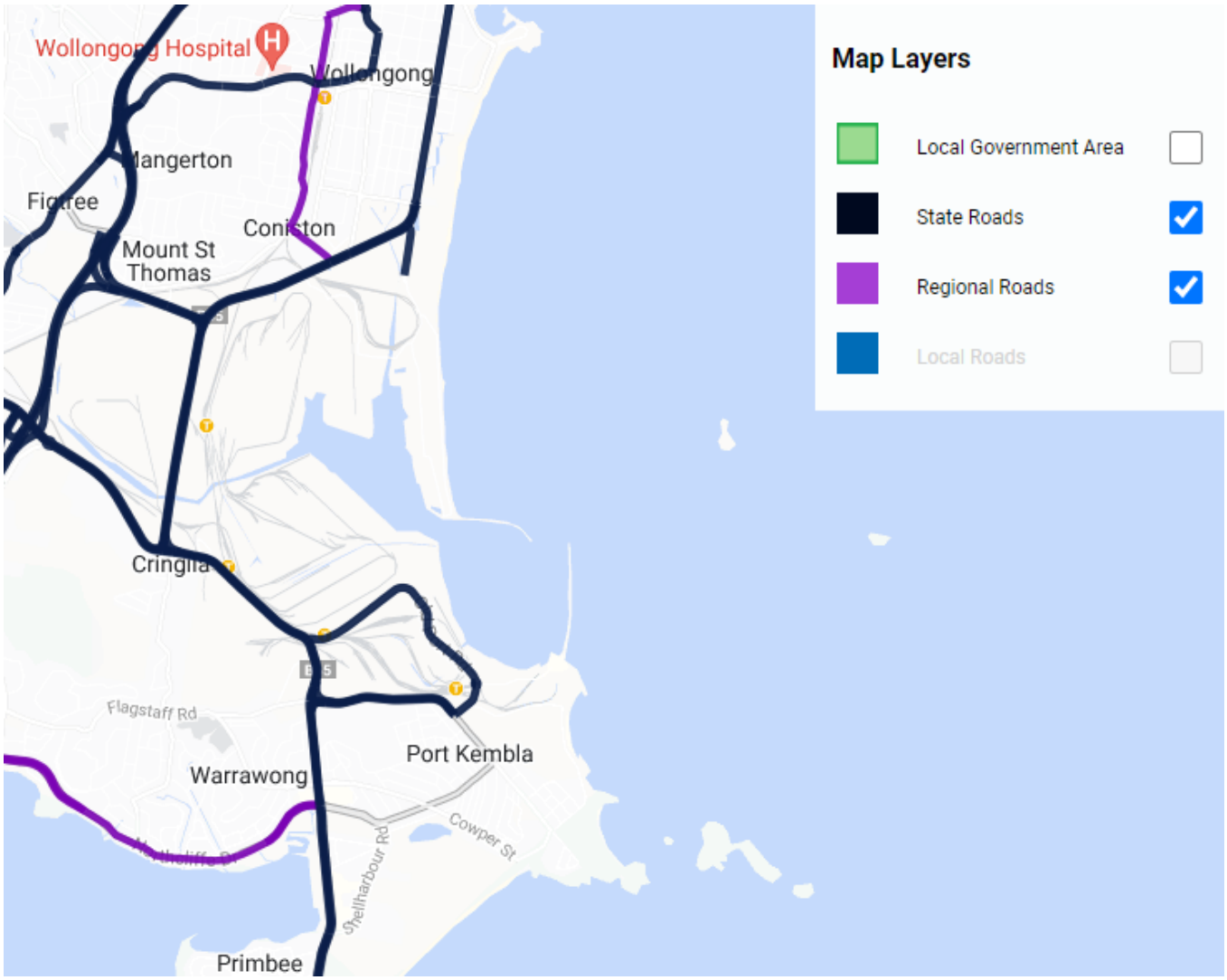


Figure 4 - Classification of roads surrounding the PKSW, extracted from Transport for NSW, 2022, *NSW Road Network Classifications*

Biochar for the trials have been trucked from suppliers within Australia to the PKSW site. This activity resulted in the utilisation of 1 truck per fortnight over 6 months and had no impact on the external traffic network.

Longer term transport options for biochar are dependent on the outcomes of the trials, BlueScope's future demand for biochar, and the availability of biochar from suppliers. Currently, the source of sustainable biochar supply in Australia for steel manufacture is limited and in future may be received by road, ship, or rail.

For the purposes of this assessment, the worst-case scenario was assumed to be transportation by truck with 30% biochar added to the PCI feed with all truck movements occurring during peak hour. This scenario would result in 14 B-doubles per day, or 28 truck movements, on the external traffic network.

Transport for NSW Roads and Maritime Service have a permanent traffic classifier located on Five Islands Road, 140m east of Lake Avenue (Station ID 07097). A review of the available peak hour data for all days between June 2011 to July 2018 is summarised in Table 6-6. The 'AM Peak' period is 06:00-10:00 while the 'PM Peak' period is 15:00-19:00.

Table 6-6 - Five Islands Road peak hour traffic data 2011 - 2018

Period	Year	All Vehicles			Heavy Vehicles			Percentage of traffic as heavy vehicles
		Minimum	Average	Maximum	Minimum	Average	Maximum	
AM Peak	2011	513	10,960	24,940	-	-	-	-
	2012	651	11,017	12,379	32	1,148	1,744	10.4%
	2013	802	11,601	13,614	44	1,279	2,021	11.0%
	2014	1,450	11,622	26,508	-	-	-	-
	2015	1,718	11,650	25,124	-	-	-	-
	2016	1,774	11,625	24,114	-	-	-	-
	2017	837	10,524	11,503	49	1,301	2,792	12.5%
	2018	832	11,614	12,496	74	1,501	2,889	12.9%
PM Peak	2011	1,883	12,285	29,258	-	-	-	-
	2012	634	12,535	15,096	26	787	1,053	6.3%
	2013	1,815	13,292	21,354	61	859	1,406	6.5%
	2014	3,828	13,437	30,212	-	-	-	-
	2015	3,298	12,977	31,468	-	-	-	-
	2016	1,638	12,443	26,236	-	-	-	-
	2017	1,210	10,967	12,751	58	939	3,454	8.6%
	2018	1,918	12,772	14,666	122	1,118	2,238	8.8%

Note: Heavy vehicle data unavailable for 2011, 2014, 2015, and 2016

Based on this data, an addition of 28 truck movements during peak hour traffic would result in an increase of less than 4% for heavy vehicles, and less than a 0.3% increase in total traffic. This increase is within the normal levels of variation for traffic on Five Islands Road and will not have an impact on the external traffic network.

A mid-block capacity analysis during morning and afternoon peak hours for the roads providing entry to the PKSW was conducted in 2022 by GHD Pty Ltd for the purpose of the 6BF Reline Environmental Impacts Statement Traffic Impact Assessment (GHD, 2022). For this assessment, a one-way mid-block capacity of 1,200 pc/h/lane was adopted for the arterial roads, including Springhill Road and Five Islands Road, in keeping with the Austroads special conditions. For Cringila Car Park Road, Loop Road, Emily Access Road, BlueScope Access Road, Flagstaff Road and Old Port Road, a one-way mid-block capacity of 900 pc/h/lane was adopted.

The following Passenger Car Units (PCU) factors were applied to the survey, based on the PCU values provided in Table 10.1 in Roads and Maritime's *Traffic Modelling Guidelines* report (Roads and Maritime, 2013):

- Passenger car = 1.0
- Light commercial vehicle = 1.0
- Rigid heavy = 2.0
- Heavy vehicles (if number of heavy articulated vehicles is unknown) = 2.5
- Bus = 2.0
- Articulated heavy = 4.0

Assuming a worst-case scenario of 14 B-doubles per day on the external traffic network occurring only during peak hour times and comparing this to the midblock volumes in the Traffic Assessment undertaken by GHD in 2022, it is

evident that the key roads providing entry to the PKSW are capable of operating within the acceptable capacity for weekday morning and afternoon peak periods with this additional load.

6.3. Waste Management

No new waste streams will be created as a result of the modification. Existing wastes include:

- Waste oils/hydrocarbon mixtures
- Sewage sludge and residues
- Slag materials
- Dust

The quantity and classification of all waste streams are anticipated to remain unchanged because of the modification. All waste streams and management processes will remain consistent with existing operation.

Biochar is not regarded as a waste material and its generation prevents wastes such as sawdust, wood processing offcuts, shredded clean pallets, and forestry residues being disposed of to landfill. This is consistent with NSW Waste Avoidance and Resource Recovery targets set out in the NSW Waste and Sustainable Materials Strategy 2041.

6.4. Greenhouse Gas and Energy Efficiency

The PCI Plant is the ideal means of introducing biochar as a partial replacement of coal in the blast furnace process to significantly decrease net CO_2 emissions from integrated steelmaking.

The calorific value of biochar is similar to that of coal. Typical PCI coal fixed carbon contents are 65 - 75%, while fixed carbon contents of biochar can vary between 50 - 95%, depending on the pyrolysis degree, and ash and volatile matter levels. As such, it is expected that 0.75t – 1.1t of biochar will be required to replace 1t of PCI coal again depending on the pyrolysis degree of the biochar. Furthermore, research has indicated that biochar has improved combustion characteristics when compared to coal. This could result in a lower overall blast furnace fuel rate or an increase in proportion of injected fuel relative to coke charged, in turn resulting in further net CO_2 emissions reductions.

Per Chapter 8 Schedule 3 Part 1 of the National Greenhouse and Energy Reporting (Measurement) Determination 2008, for the purposes of calculating emissions released during consumption of a fuel, primary solid biomass fuels have a carbon content factor of 0 tonnes of carbon per tonne of fuel as shown in Figure 5. Therefore, substituting 1t of biochar from renewable sources for 1t of non-renewable coal has the potential to reduce net CO_2 emissions by approximately 2.9t.

Item	Fuel type	Carbon content factor tC/t fuel
Solid fossil fuels		
1	Bituminous coal	0.663
1A	Sub-bituminous coal	0.515
1B	Anthracite	0.712
2	Brown coal	0.260
3	Coking coal	0.752
4	Coal briquettes	0.574
5	Coal coke	0.789
6	Coal tar	0.837
7	Solid fossil fuels other than those mentioned in items 1 to 5	0.574
Fuels derived from recycled materials		
8	Industrial materials and tyres that are derived from fossil fuels, if recycled and combusted to produce heat or electricity	0.585
9	Non-biomass municipal materials, if recycled and combusted to produce heat or electricity	0.250
Primary solid biomass fuels		
10	Dry wood	0
11	Green and air dried wood	0
12	Sulphite lyes	0
13	Bagasse	0
14	Biomass municipal and industrial materials, if recycled and combusted to produce heat or electricity	0
15	Charcoal	0
16	Primary solid biomass fuels other than those mentioned in items 10 to 15	0

Figure 5 - Carbon content of solid fuels and certain coal-based products, extracted from *National Greenhouse and Energy Reporting (Measurement) Determination 2008*

7. Justification of the modified project

Integrated steelmaking in its present-day form being inherently carbon-based will produce CO_2 emissions and waste streams. Given BlueScope has committed to continued investment in its current technology for integrated steelmaking up until well into the 2030's then CO_2 emissions reductions will become commensurately more difficult to achieve. Use of biochar as a PCI coal replacement offers one of the few means of significantly reducing the net CO_2 emissions from a blast furnace.

This assessment does not indicate any negative impacts as a result of the proposed modification. Overall, the substitution of a portion of the PCI coal with biochar has the potential to reduce net CO_2 emissions and divert waste from landfill, thereby assisting in fulfilling BlueScope's goals regarding achieving net zero by 2050 and working towards a circular economy.

References

GHD Pty Ltd, 2022, Blast Furnace No. 6 Reline Project Traffic Assessment

National Greenhouse and Energy Reporting (Measurement) Determination 2008

NSW Waste and Sustainable Materials Strategy 2041

Appendix A. Updated project description

The modified project enables BlueScope to proceed with trials and if successful, the ongoing processing of biochar at the PCI Facility.

The proposed modification only relates to the materials processed through the existing PCI Facility and does not involve the construction of additional infrastructure.

Appendix B. Biochar compositional analysis

BUREAU VERITAS MINERALS PTY LTD
ABN: 30 008 127 802
99 Mitchell Road CARDIFF NSW 2285
AUSTRALIA
TEL(02) 4902 4800

ORIGIN :	**Bluescope Steel**	**BV REF. No :**	**NE85056441**
ADDRESS:	**Laboratory Services Port Kembla Steelworks Bluescope Steel**	**DATE REC'D :**	**24.02.2020**
DESCRIPTION :	**Supplied Coke Samples for Analysis**	**BSL ORDER No :**	**3801108164**
REPORTED TO :	**Greg Ryan**		

BSL Supplied Samples

BSL Job No. **P00321-20 20-021569**

Sample Description: **Simcoa Charcoal Fines 31/1**

BV Sample Number: **2156969**

Analysis Results:		**(ad)**	**(daf)**
Inherent Moisture	**%**	**4.0**	
Ash	**%**	**2.4**	
Volatile Matter	**%**	**2.8**	
Total Sulphur	**%**	**0.01**	
Gross Calorific Value	**kcal/kg**	**7779**	**8311**
Carbon	**%**	**87.6**	
Hydrogen	**%**	**1.02**	
Nitrogen	**%**	**0.57**	
Hardgrove Grindability Index		**65**	

Analysed at BV Newcastle in accordance with Australian Standard Methods: AS1038.3(2000), AS1038.6.4(2005), AS 1038.6.3.3, AS1038.5(1998)
NATA Accreditation No. 626.
This report supersedes all previous reports.

Reported By : *Robert Morris* **FINAL REPORT** **Date :** ***March 6, 2020***

BUREAU VERITAS MINERALS PTY LTD
ABN: 30 008 127 802
99 Mitchell Road CARDIFF NSW 2285
AUSTRALIA
TEL(02) 4902 4800

ORIGIN :	**Bluescope Steel**	**BV REF. No :**	**NE85056441**
ADDRESS:	**Laboratory Services Port Kembla Steelworks Bluescope Steel**	**DATE REC'D :**	**24.02.2020**
DESCRIPTION :	**Supplied Coke Samples for Analysis**	**BSL ORDER No :**	**3801108164**
REPORTED TO :	**Greg Ryan**		

BSL Supplied Samples

BSL Job No. **P00321-20 20-021569**

Sample Description: **Simcoa Charcoal Fines 31/1**

BV Sample Number: **2156969**

Analysis Results:

Ash Analysis Results **(%db)**

SiO2	**48.4**
Al2O3	**13.2**
Fe2O3	**10.5**
CaO	**14.6**
MgO	**3.51**
Na2O	**2.66**
K2O	**1.85**
TiO2	**1.29**
Mn3O4	**0.17**
P2O5	**0.84**
SO3	**2.33**
SrO	**0.09**
BaO	**0.05**
ZnO	**0.26**
V2O5	**0.03**

Sample couriered with ice pack

Ash Analysis analysed by BV Minerals. Accreditation No. 626 Report No. L134997 Test/Method ISO 13605

NATA Accreditation No. 626.
This report supersedes all previous reports.

Reported By : *Robert Morris* **FINAL REPORT** **Date :** ***March 6, 2020***

BUREAU VERITAS MINERALS PTY LTD

99 Mitchell Road CARDIFF NSW 2285 AUSTRALIA TEL (02) 49024800 ABN: 30 008 127 802

ANALYSIS REPORT

Report Number:	NE85066890
Attention:	Matt Reilly / Greg Ryan
Client:	BLUESCOPE STEEL PTY LTD

Order Number :	3801348275
Project :	Bluescope Samples - GIDGEE BIOCHAR, SIMCOA BIOCHAR # 3 & # 4, SIMCOA BIOCHAR #5 & # 6(Prox, TS, CV, Ultimate and AA) - Rec'd 6/1/22
Samples Received :	7/01/2022
Date Reported :	12/01/2022

Results relate to the source material only to the extent that the samples as supplied are truly representative of the sample source. This report replaces any preliminary results issued.

nd = not detected (the result is below the detection limit)
DL = detection limit
Results are reported on a dry basis unless otherwise indicated.

The Report has been Authorised By:

NATA Accreditation No. 626 Site ID 619 - Accredited for compliance with ISO/IEC 17025 - Testing

BUREAU VERITAS
MINERALS PTY LTD

Job Number: NE85066890

Job Description: Bluescope Samples - GIDGEE BIOCHAR, SIMCOA BIOCHAR # 3 & # 4, SIMCOA BIOCHAR #5 & # 6(Prox, TS, CV, Ultimate and AA) - Rec'd 6/1/22

Client: BLUESCOPE STEEL PTY LTD

Analysis Results

				2993958 21-212559 RCRA Gidgee Biochar	2993959 21-242575 SIMCOA BIOCHAR # 3 & # 4	2993960 21-242689 SIMCOA BIOCHAR # 5 & # 6
Moisture - ISO						
Moisture	(ad)	%	--	7.6	3.5	3.7
Ash - ISO						
Ash	(ad)	%	--	10.1	4.9	5.0
Volatile Matter - ISO						
Volatile Matter	(ad)	%	--	19.4	3.6	3.0
Total Sulfur - ISO						
Total Sulfur	(ad)	%	--	0.01	--	--
Calorific Value - ISO						
Calorific Value	(ad)	MJ/kg	--	24.90	--	--
		kcal/kg	--	5947	--	--
CHN - ISO						
Carbon	(ad)	%	--	69.6	--	--
Hydrogen	(ad)	%	--	2.28	--	--
Nitrogen	(ad)	%	--	0.32	--	--
Oxygen (by difference)	(ad)	%	--	10.09	--	--
NQ798 - Analysis of Coal, Coke & Fly Ash by XRF						
Silicon as SiO2	(db)	%	0.02	34.7	--	58.7
Aluminium as Al2O3	(db)	%	0.02	4.7	--	17.7
Iron as Fe2O3	(db)	%	0.02	1.90	--	9.5
Calcium as CaO	(db)	%	0.02	53.1	--	5.70
Magnesium as MgO	(db)	%	0.02	2.04	--	1.66
Sodium as Na2O	(db)	%	0.02	0.29	--	1.60
Potassium as K2O	(db)	%	0.02	0.69	--	1.21
Titanium as TiO2	(db)	%	0.02	0.34	--	1.44
Manganese as Mn3O4	(db)	%	0.02	0.05	--	0.07
Phosphorus as P2O5	(db)	%	0.02	0.08	--	0.33
Sulfur as SO3	(db)	%	0.02	0.71	--	1.32
Strontium as SrO	(db)	%	0.02	0.54	--	0.05
Barium as BaO	(db)	%	0.02	nd	--	nd
Vanadium as V2O5	(db)	%	0.02	0.02	--	0.03
ZrO2*	(db)	%	--	0.02	--	0.07

BUREAU VERITAS MINERALS PTY LTD

99 Mitchell Road CARDIFF NSW 2285 AUSTRALIA TEL (02) 49024800 ABN: 30 008 127 802

ANALYSIS REPORT

Report Number:	NE85070052
Attention:	
Client:	BLUESCOPE STEEL PTY LTD

Order Number :	3801456204
Project :	Bluescope Samples - PO2226-22 22-129881-SIMCOA BIOCHAR-28/7/22 and 22-129882-RCRA BIOCHAR-27/7/22 - Prox,
Samples Received :	26/08/2022
Date Reported :	31/08/2022

Results relate to the source material only to the extent that the samples as supplied are truly representative of the sample source. This report replaces any preliminary results issued.

nd = not detected (the result is below the detection limit)
DL = detection limit
Results are reported on a dry basis unless otherwise indicated.

The Report has been Authorised By:

NATA Accreditation No. 626 Site ID 619 - Accredited for compliance with ISO/IEC 17025 - Testing

BUREAU VERITAS
MINERALS PTY LTD

Job Number: NE85070052

Job Description: Bluescope Samples - PO2226-22 22-129881-SIMCOA BIOCHAR-28/7/22 and 22-129882-RCRA BIOCHAR-27/7/22 - Prox, TS, CHN and AA- Rec'd 26/08/22

Client: BLUESCOPE STEEL PTY LTD

Analysis Results

				3296933 22-129881-SIMCOA BIOCHAR 28/7/22	3296934 22-129882-RCRA BIOCHAR 27/7/22
Moisture - ISO					
Moisture	(ad)	%	--	7.2	6.1
Ash - ISO					
Ash	(ad)	%	--	4.3	16.8
Volatile Matter - ISO					
Volatile Matter	(ad)	%	--	4.3	20.7
Fixed Carbon - ISO					
Fixed Carbon	(ad)	%	--	84.2	56.4
Total Sulfur - ISO					
Total Sulfur	(ad)	%	--	0.03	0.05
CHN - ISO					
Carbon	(ad)	%	--	82.8	63.1
Hydrogen	(ad)	%	--	1.44	2.29
Nitrogen	(ad)	%	--	0.46	0.48
NQ798 - Analysis of Coal, Coke & Fly Ash by XRF					
Silicon as SiO2	(db)	%	0.02	58.8	50.5
Aluminium as Al2O3	(db)	%	0.02	15.3	8.5
Iron as Fe2O3	(db)	%	0.02	9.22	3.16
Calcium as CaO	(db)	%	0.02	7.60	31.56
Magnesium as MgO	(db)	%	0.02	1.79	1.59
Sodium as Na2O	(db)	%	0.02	1.54	0.48
Potassium as K2O	(db)	%	0.02	1.18	1.06
Titanium as TiO2	(db)	%	0.02	1.30	0.60
Manganese as Mn3O4	(db)	%	0.02	0.09	0.07
Phosphorus as P2O5	(db)	%	0.02	0.38	0.11
Sulfur as SO3	(db)	%	0.02	2.48	0.90
Strontium as SrO	(db)	%	0.02	0.04	0.30
Barium as BaO	(db)	%	0.02	0.03	0.03
Zinc as ZnO	(db)	%	0.02	0.11	0.03
Vanadium as V2O5	(db)	%	0.02	nd	nd

REPORT OF ANALYSIS

Report No. RN1361311

Client	: BLUESCOPE STEEL LIMITED	**Job No.**	: BLUE24/220808/1
	ORGANIC INVESTIGATIONS	**Quote No.**	: QT-02018
	CENTRAL LABORATORY (017E)	**Order No.**	:
	PORT KEMBLA NSW 2505	**Date Received**	: 08-AUG-2022
Attention	: JOEL GRAHAM	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Danny Slee	**Phone**	: 02 9449 0169

Lab Reg No.	Sample Ref	Sample Description
N22/014909	P02226-22	SOLIDS 22-129881 RCRA CHARCOAL
N22/014910	P02226-22	SOLIDS 22-129882 SIMCOA BIOCHAR

Lab Reg No.		N22/014909	N22/014910			
Date Sampled		27-JUL-2022	27-JUL-2022			
Sample Reference		P02226-22	P02226-22			
	Units					Method
Total Recoverable Trace Elements by ICP						
Aluminium	mg/kg	1240	1290			NT2_49
Antimony	mg/kg	<0.5	<0.5			NT2_49
Arsenic	mg/kg	<0.5	0.56			NT2_49
Barium	mg/kg	22	89			NT2_49
Beryllium	mg/kg	<0.5	<0.5			NT2_49
Bismuth	mg/kg	<0.5	<0.5			NT2_49
Boron	mg/kg	11	7.9			NT2_49
Bromine (water soluble)	mg/kg	1.1	0.65			NT2_49
Cadmium	mg/kg	<0.5	<0.5			NT2_49
Calcium	mg/kg	42700	2520			NT2_49
Chromium	mg/kg	3.2	6.3			NT2_49
Cobalt	mg/kg	0.82	<0.5			NT2_49
Copper	mg/kg	2	7.7			NT2_49
Iodine (water soluble)	mg/kg	0.063	0.053			NT2_49
Iron	mg/kg	1440	1760			NT2_49
Lead	mg/kg	1.4	1.9			NT2_49
Magnesium	mg/kg	1100	1580			NT2_49
Manganese	mg/kg	42	16			NT2_49
Mercury	mg/kg	<0.2	<0.2			NT2_49
Molybdenum	mg/kg	<0.5	<0.5			NT2_49
Nickel	mg/kg	0.95	0.97			NT2_49
Phosphorus	mg/kg	52	51			NT2_49
Potassium	mg/kg	350	420			NT2_49
Selenium	mg/kg	<0.5	<0.5			NT2_49
Silicon (acid extractable)	mg/kg	710	240			NT2_49
Silver	mg/kg	<0.5	<0.5			NT2_49
Sodium	mg/kg	170	450			NT2_49
Tin	mg/kg	<0.5	<0.5			NT2_49
Titanium	mg/kg	15	79			NT2_49

REPORT OF ANALYSIS

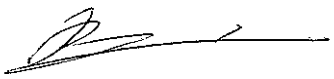
Report No. RN1361311

Lab Reg No.		N22/014909	N22/014910			
Date Sampled		27-JUL-2022	27-JUL-2022			
Sample Reference	Units	P02226-22	P02226-22			Method
Total Recoverable Trace Elements by ICP						
Vanadium	mg/kg	3.6	4.3			NT2_49
Zinc	mg/kg	24	11			NT2_49
Dates						
Date extracted		8-AUG-2022	8-AUG-2022			
Date analysed		9-AUG-2022	9-AUG-2022			

Pankaj Barai, Analyst
Inorganics - NSW
Accreditation No. 198

11-AUG-2022

Lab Reg No.		N22/014909	N22/014910			
Date Sampled		27-JUL-2022	27-JUL-2022			
Sample Reference	Units	P02226-22	P02226-22			Method
Miscellaneous						
Water Soluble Fluoride	mg/kg	1.2	1.6			NW_B3_B14
Dates						
Date extracted		9-AUG-2022	9-AUG-2022			
Date analysed		9-AUG-2022	9-AUG-2022			



Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

11-AUG-2022

All results are reported on 'as received' basis.

REPORT OF ANALYSIS

This Report supersedes reports: *RN1361185* *RN1361276*

Measurement Uncertainty is available upon request.

Note: Sampling date(s) have been provided by the client.
Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

Appendix C. Air Quality results from existing operations

Ektimo

BlueScope Steel, Port Kembla

PCI Emission Testing Report

Report Number R012719

Document Information

Template Version 211117

Client Name:	BlueScope Steel
Report Number:	R012719
Date of Issue:	13 September 2022
Attention:	Daniel List
Address:	Five Islands Road Port Kembla NSW 2505
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Authorisation

Zoe Parker **Client Manager**	NATA Accredited Laboratory No. 14601	**Aaron Davis** **Ektimo Signatory**

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

Please note that only numerical results pertaining to measurements conducted directly by Ektimo are covered by Ektimo's terms of NATA accreditation. This does not include comments, conclusions or recommendations based upon the results. Refer to 'Test Methods' for full details of testing covered by NATA accreditation.

Table of Contents

1 Executive Summary

1.1 Background

Ektimo was engaged by BlueScope Steel to perform emission testing at their Port Kembla plant. Testing was carried out in accordance with Environment Protection Licence 6092.

1.2 Project Objective

The objectives of the project were to conduct a monitoring programme to quantify emissions from two discharge points to determine compliance with BlueScope Steel's Environment Protection Licence.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA ID 105 - Hot Gas Exhaust Stack	14 April 2022	Solid particles Nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
EPA ID 106 - Depressurising Bag Filter Stack (West)		Solid particles

* Flow rate, velocity, temperature, and moisture were also determined.

All results are reported on a dry basis at STP.

Plant operating conditions have been noted in the report.

1.3 Licence Comparison

The following licence comparison table shows that all analytes highlighted in green are within the licence limit set by the NSW EPA as per licence 6092 (last amended on 28 March 2022).

EPA No.	Location Description	Pollutant	Units	Licence limit	Detected values	Detected values (corrected to 3% O_2)
105	PCI Hot Gas Exhaust Stack	Nitrogen Oxides	mg/m^3	**200**	<4	<5
		Solid Particles	mg/m^3	**20**	4.1	5.2
106	Depressurising Bag Filter Stack (West)	Solid Particles	mg/m^3	**20**	<2	NA

Please note that the measurement uncertainty associated with the test results was not considered when determining whether the results were compliant or non-compliant.

Refer to the Test Methods table for the measurement uncertainties.

2 Results

2.1 EPA ID 105 - Hot Gas Exhaust Stack

Date	14/04/2022	**Client**	BlueScope Steel Limited
Report	R012719	**Stack ID**	EPA 105 - Hot Gas Exhaust Stack
Licence No.	6092	**Location**	Port Kembla
Ektimo Staff	Scott Woods & Steven Cooper	**State**	NSW
Process Conditions	Grinding: 55 tonnes per hour		220407

Sampling Plane Details	
Sampling plane dimensions	1250 mm
Sampling plane area	1.23 m²
Sampling port size, number	6" Flange (x2)
Access & height of ports	Stairs & Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Centrifugal fan 8 D
No. traverses & points sampled	2 12
Sample plane conformance to AS4323.1 (2021)	Ideal sampling plane

Stack Parameters		
Moisture content, %v/v	12	
Gas molecular weight, g/g mole	30.2 (wet)	31.8 (dry)
Gas density at STP, kg/m³	1.35 (wet)	1.42 (dry)
Gas density at discharge conditions, kg/m³	1.01	
% Oxygen correction & Factor	3 %	1.29
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	0905 & 1015	
Temperature, °C	95	
Temperature, K	368	
Velocity at sampling plane, m/s	7	
Volumetric flow rate, actual, m³/s	8.6	
Volumetric flow rate (wet STP), m³/s	6.4	
Volumetric flow rate (dry STP), m³/s	5.7	
Mass flow rate (wet basis), kg/hour	31000	

Gas Analyser Results	Average			Minimum			Maximum		
Sampling time	0912 - 1013			0912 - 1013			0912 - 1013		
	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min
Combustion Gases									
Nitrogen oxides (as NO_2)	<4	<5	<1	<4	<5	<1	<4	<5	<1
Carbon monoxide	110	140	36	86	110	29	140	170	46
		Concentration %v/v			Concentration %v/v			Concentration %v/v	
Carbon dioxide		21.3			20.6			21.8	
Oxygen		7			6.7			7.5	

Isokinetic Results	Results		
Sampling time	0909-1011		
	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min
Solid Particles	4.1	5.2	1.4
Isokinetic Sampling Parameters			
Sampling time, min		60	
Isokinetic rate, %		103	
Gravimetric analysis date (total particulate)		22-04-2022	

2.2 EPA ID 106 - Depressurising Bag Filter Stack (West)

Date	14/04/2022	**Client**	BlueScope Steel Limited
Report	R012719	**Stack ID**	EPA 106 - Depressurising Baghouse Filter (West)
Licence No.	6092	**Location**	Port Kembla
Ektimo Staff	Scott Woods & Steven Cooper	**State**	NSW
Process Conditions	Grinding: 55 tonnes per hour		*220407*

Sampling Plane Details		
Sampling plane dimensions	480 mm	
Sampling plane area	0.181 m²	
Sampling port size, number	6" Flange (x2)	
Access & height of ports	Stairs & Elevator 50 m	
Duct orientation & shape	Horizontal Circular	
Downstream disturbance	Bend 0.5 D	
Upstream disturbance	Change in diameter 2 D	
No. traverses & points sampled	1 1	
Sample plane conformance to AS4323.1 (2021)	Non-conforming	

Comments

Sampling was undertaken from one traverse point in compliance with directions from BlueScope Steel Limited Air Quality Department, who have conducted prior emission testing at this location.
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-conforming due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The stack or duct does not have the required number of access holes (ports)
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	3.4	
Gas molecular weight, g/g mole	27.9 (wet)	28.3 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.26 (dry)
Gas density at discharge conditions, kg/m³	1.10	
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1102 & 1352	
Temperature, °C	38	
Temperature, K	311	
Velocity at sampling plane, m/s	11	
Volumetric flow rate, actual, m³/s	2	
Volumetric flow rate (wet STP), m³/s	1.7	
Volumetric flow rate (dry STP), m³/s	1.7	
Mass flow rate (wet basis), kg/hour	7800	

Isokinetic Results	Results	
Sampling time	1118-1340	
	Concentration mg/m³	Mass Rate g/min
Solid Particles	<2	<0.2
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	98	
Gravimetric analysis date (total particulate)	22-04-2022	

3 Plant Operating Conditions

See BlueScope Steel records for complete process conditions.

Grinding: 55 tonnes/hour

4 Test Methods

All sampling and analysis performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling method	Analysis method	Uncertainty*	NATA accredited Sampling	NATA accredited Analysis
Sampling points - Selection	NSW EPA TM-1 (AS 4323.1)	NA	NA	✓	NA
Flow rate, temperature and velocity	NSW EPA TM-2 (USEPA Method 2)	NSW EPA TM-2 (USEPA Method 2)	8%, 2%, 7%	NA	✓
Moisture content	NSW EPA TM-22 (USEPA Method 4)	NSW EPA TM-22 (USEPA Method 4)	8%	✓	✓
Molecular weight	NA	NSW EPA TM-23 (USEPA Method 3)	not specified	NA	✓
Dry gas density	NA	NSW EPA TM-23 (USEPA Method 3)	not specified	NA	✓
Carbon dioxide	NSW EPA TM-24 (USEPA Method 3A)	NSW EPA TM-24 (USEPA Method 3A)	13%	✓	✓
Carbon monoxide	NSW EPA TM-32 (USEPA Method 10)	NSW EPA TM-32 (USEPA Method 10)	12%	✓	✓
Nitrogen oxides	NSW EPA TM-11 (USEPA Method 7E)	NSW EPA TM-11 (USEPA Method 7E)	12%	✓	✓
Oxygen	NSW EPA TM-25 (USEPA Method 3A)	NSW EPA TM-25 (USEPA Method 3A)	13%	✓	✓
Solid particles (total)	NSW EPA TM-15 (AS 4323.2)	NSW EPA TM-15 (AS 4323.2)	3%	✓	✓††

220427

* Uncertainties cited in this table are estimated using typical values and are calculated at the 95% confidence level (coverage factor = 2).

†† Gravimetric analysis conducted at the Ektimo Unanderra, NSW laboratory, NATA accreditation number 14601.

5 Quality Assurance/Quality Control Information

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

Ektimo is accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing 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 Director.

NATA is a member of APAC (Asia Pacific Accreditation Co-operation) and of ILAC (International Laboratory Accreditation Co-operation). Through mutual recognition arrangements with these organisations, NATA accreditation is recognised worldwide.

6 Definitions

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

% v/v	Volume to volume ratio, dry or wet basis
~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American Public Health Association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM/CEMS	Continuous Emission Monitoring/Continuous Emission Monitoring System
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
D_{50}	'Cut size' of a cyclone is defined as the particle diameter at which the cyclone achieves a 50% collection efficiency i.e. half of the particles are retained by the cyclone and half pass through it. 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.
DECC	Department of Environment & Climate Change (NSW)
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.
DWER	Department of Water and Environmental Regulation (WA)
DEHP	Department of Environment and Heritage Protection (QLD)
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra-red
ISC	Intersociety Committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
ITE	Individual threshold estimate
Lower bound	When an analyte is not present above the detection limit, the result is assumed to be equal to zero.
Medium bound	When an analyte is not present above the detection limit, the result is assumed to be equal to half of the detection limit.
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
OU	Odour unit. One OU is that concentration of odorant(s) at standard conditions that elicits a physiological response from a panel equivalent to that elicited by one Reference Odour Mass (ROM), evaporated in one cubic metre of neutral gas at standard conditions.
PM_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PSA	Particle size analysis. PSA provides a distribution of geometric diameters, for a given sample, determined using laser diffraction.
RATA	Relative accuracy test audit
Semi-quantified VOCs	Unknown VOCs (those not matching a standard compound), are identified by matching the mass spectrum of the chromatographic peak to the NIST Standard Reference Database (version 14.0), with a match quality exceeding 70%. An estimated concentration is determined by matching the area of the peak with the nearest suitable compound in the analytical calibration standard mixture.
STP	Standard 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.
TM	Test method
TOC	The sum of all compounds of carbon which contain at least one carbon-to-carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Velocity difference	The percentage difference between the average of initial flows and after flows.
Vic EPA	Victorian Environment Protection Authority
VOC	Volatile organic compound. A carbon-based chemical compound with a vapour pressure of at least 0.010 kPa at 25°C or having a corresponding volatility under the given conditions of use. VOCs may contain oxygen, nitrogen and other elements. VOCs do not include carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonate salts.
XRD	X-ray diffractometry
Upper bound	When an analyte is not present above the detection limit, the result is assumed to be equal to the detection limit.
95% confidence interval	Range of values that contains the true result with 95% certainty. This means there is a 5% risk that the true result is outside this range.

7 Appendix 1: Site Photos

Figure 1 – EPA ID 105 - Hot Gas Exhaust Stack

Figure 2 – EPA ID 106 - Depressurising Bag Filter Stack (West)

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Report Number R005991

Emission Testing Report
BlueScope Steel, Port Kembla

Document Information

Client Name:	BlueScope Steel
Report Number:	R005991
Date of Issue:	6 June 2018
Attention:	Miroslaw Gudz
Address:	Five Islands Road Port Kembla NSW 2505
Testing Laboratory:	Ektimo Pty Ltd, ABN 86 600 381 413

Report Status

Format	Document Number	Report Date	Prepared By	Reviewed By (1)	Reviewed By (2)
Preliminary Report	-	-	-	-	-
Draft Report	R005991[DRAFT]	5/06/2018	JWe	DHi	ADa
Final Report	R005991	6/06/2018	JWe	DHi	ADa
Amend Report	-	-	-	-	-

Template Version: 220318

Amendment Record

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

Report Authorisation

David Hill **Client Manager**	NATA Accredited Laboratory No. 14601	**Aaron Davis** **Ektimo Signatory**

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC mutual recognition arrangement for the mutual recognition of the equivalence of testing, calibration and inspection reports.

Table of Contents

1 EXECUTIVE SUMMARY

Ektimo was engaged by BlueScope Steel to determine emissions to air from two source emission points.

Results from this stack emission monitoring program indicate that BlueScope Steel was compliant with requirements of Licence 6092 during the sampling period.

Monitoring was performed as follows:

Location	Test Date	Test Parameters*
EPA ID 105 - Hot Gas Exhaust Stack	22 May 2018	Solid particles, metals type 1 & 2 substances (Sb, As, Be, Cd, Cr, Co, Pb, Mn, Hg, Ni, Sn, Se, V), nitrogen oxides, carbon monoxide, carbon dioxide, oxygen
EPA ID 106 - Depressurising Bag Filter Stack (West)	22 May 2018	Solid particles

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

All results are reported on a dry basis at STP. Unless otherwise indicated, the methods cited in this report have been performed without deviation.

Plant operating conditions have been noted in the report.

2 LICENCE COMPARISON

The following licence comparison table shows that all analytes highlighted in green are below the licence limit set by the NSW EPA as per licence 6092 (last amended on 10 May 2018).

EPA No.	Location Description	Pollutant	Units	Licence limit	Detected values	Detected values (corrected to 3% O_2)
105	PCI Hot Gas Exhaust Stack	Nitrogen Oxides	mg/m^3	**200**	<3	<5
		Solid Particles	mg/m^3	**20**	6.8	11
106	PCI Facility-Stacks serving the depressurising bag filters (East)	Solid Particles	mg/m^3	**20**	3.1	NA

3 RESULTS

3.1 EPA ID 105 – Hot Gas Exhaust Stack

Date	22/05/2018	**Client**	BlueScope Steel Limited
Report	R005991	**Stack ID**	EPA 105 - Hot Gas Exhaust Stack
Licence No.	6092	**Location**	Port Kembla
Ektimo Staff	David Hill & Ryan Collins	**State**	NSW
Process Conditions	Please refer to client records.		180430

Sampling Plane Details	
Sampling plane dimensions	1250 mm
Sampling plane area	1.23 m²
Sampling port size, number	6" Flange (x2)
Access & height of ports	Stairs & Elevator 30 m
Duct orientation & shape	Vertical Circular
Downstream disturbance	Exit 8 D
Upstream disturbance	Centrifugal fan 8 D
No. traverses & points sampled	2 12
Sample plane compliance to AS4323.1	Ideal

Stack Parameters		
Moisture content, %v/v	9.7	
Gas molecular weight, g/g mole	30.0 (wet)	31.3 (dry)
Gas density at STP, kg/m³	1.34 (wet)	1.39 (dry)
% Oxygen correction & Factor	3 %	1.58
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1055 & 1238	
Temperature, °C	92	
Temperature, K	365	
Velocity at sampling plane, m/s	6.9	
Volumetric flow rate, discharge, m³/s	8.5	
Volumetric flow rate (wet STP), m³/s	6.3	
Volumetric flow rate (dry STP), m³/s	5.7	
Mass flow rate (wet basis), kg/hour	31000	

Gas Analyser Results	Average			Minimum			Maximum		
Sampling time	1125 - 1232			1125 - 1232			1125 - 1232		
	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min
Combustion Gases									
Nitrogen oxides (as NO_2)	<3	<5	<1	<3	<5	<1	4.1	6.5	1.4
Carbon monoxide	380	610	130	280	440	96	480	760	160
	Concentration %			Concentration %			Concentration %		
Carbon dioxide	17.2			16.5			18		
Oxygen	9.6			9.1			10		

Isokinetic Results	Results		
Sampling time	1125-1232		
	Concentration mg/m³	Corrected to 3% O2 mg/m³	Mass Rate g/min
Solid Particles	6.8	11	2.3
Antimony	<0.004	<0.007	<0.001
Arsenic	<0.002	<0.003	<0.0006
Beryllium	<0.0009	<0.001	<0.0003
Cadmium	<0.0004	<0.0007	<0.0001
Chromium	0.0026	0.0042	0.00091
Cobalt	<0.0006	<0.001	<0.0002
Lead	<0.001	<0.002	<0.0004
Manganese	<0.002	<0.002	<0.0005
Mercury	<0.0002	<0.0004	<0.00008
Nickel	<0.001	<0.002	<0.0004
Selenium	<0.004	<0.007	<0.001
Tin	<0.002	<0.003	<0.0006
Vanadium	<0.001	<0.002	<0.0004
Type 1 & 2 Substances			
Upper Bound			
Total Type 1 Substances	<0.008	<0.01	<0.003
Total Type 2 Substances	≤0.014	≤0.022	≤0.0049
Total Type 1 & 2 Substances	≤0.022	≤0.035	≤0.0076
Isokinetic Sampling Parameters			
Sampling time, min	60		
Isokinetic rate, %	100		
Velocity difference, %	-3		

3.2 EPA ID 106 – Depressurising Bag Filter Stack (West)

Date	22/05/2018	**Client**	BlueScope Steel Limited
Report	R005991	**Stack ID**	EPA 106 - Depressurising Baghouse Filter (West)
Licence No.	6092	**Location**	Port Kembla
Ektimo Staff	David Hill & Ryan Collins	**State**	NSW
Process Conditions	Please refer to client records.		180430

Sampling Plane Details		
Sampling plane dimensions	480 mm	
Sampling plane area	0.181 m²	
Sampling port size, number	6" Flange (x2)	
Access & height of ports	Stairs & Elevator	50 m
Duct orientation & shape	Horizontal	Circular
Downstream disturbance	Bend	0.5 D
Upstream disturbance	Change in diameter	2 D
No. traverses & points sampled	1	1
Sample plane compliance to AS4323.1	Non-compliant	

Comments

Sampling was undertaken from one traverse point in compliance with directions from BlueScope Steel Limited Air Quality Department, who have conducted prior emission testing at this location
The number of traverses sampled is less than the requirement
The number of points sampled is less than the requirement

The sampling plane is deemed to be non-compliant due to the following reasons:
The downstream disturbance is <1D from the sampling plane
The sampling plane is too near to the upstream disturbance but is greater than or equal to 2D

Stack Parameters		
Moisture content, %v/v	3.2	
Gas molecular weight, g/g mole	28.1 (wet)	28.4 (dry)
Gas density at STP, kg/m³	1.25 (wet)	1.27 (dry)
Gas Flow Parameters		
Flow measurement time(s) (hhmm)	1131 & 1434	
Temperature, °C	38	
Temperature, K	311	
Velocity at sampling plane, m/s	15	
Volumetric flow rate, discharge, m³/s	2.8	
Volumetric flow rate (wet STP), m³/s	2.5	
Volumetric flow rate (dry STP), m³/s	2.4	
Mass flow rate (wet basis), kg/hour	11000	

Isokinetic Results	Results	
Sampling time	1131-1434	
	Concentration mg/m³	Mass Rate g/min
Solid Particles	3.1	0.44
Isokinetic Sampling Parameters		
Sampling time, min	60	
Isokinetic rate, %	99	
Velocity difference, %	<1	

4 PLANT OPERATING CONDITIONS

Unless otherwise stated, the plant operating conditions were normal at the time of testing. See BlueScope Steel's records for complete process conditions.

Normal Operations: 1 Grinding Mill operational - 67 Tonnes/hr

5 TEST METHODS

All sampling and analysis was performed by Ektimo unless otherwise specified. Specific details of the methods are available upon request.

Parameter	Sampling Method	Analysis Method	Uncertainty*	NATA Accredited	
				Sampling	Analysis
Sample plane criteria	NSW TM-1	NA	-	✓	NA
Flow rate, temperature and velocity	NSW TM-2	NA	8%, 2%, 7%	✓	NA
Moisture content	NSW TM-22	NSW TM-22	8%	✓	✓
Carbon dioxide	NSW TM-24	NSW TM-24	13%	✓	✓
Carbon monoxide	NSW TM-32	NSW TM-32	12%	✓	✓
Nitrogen oxides (NO_x)	NSW TM-11	NSW TM-11	12%	✓	✓
Oxygen	NSW TM-25	NSW TM-25	13%	✓	✓
Particulate matter	NSW TM-15	NSW TM-15	5%	✓	✓
Total (gaseous and particulate) metals and metallic compounds	NSW TM-12, NSW TM-13, NSW TM-14	Envirolab inhouse	15%	✓	✓‡
Type 1 substances (Sb, As, Cd, Pb, Hg)	NSW TM-12	Envirolab inhouse	15%	✓	✓‡
Type 2 substances (Be, Cr, Co, Mn, Ni, Se, Sn, V)	NSW TM-13	Envirolab inhouse	15%	✓	✓‡

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

‡ Analysis performed by Envirolab, NATA accreditation number 2901. Results were reported to Ektimo on 1 June 2018 in report number 192536.

6 QUALITY ASSURANCE/QUALITY CONTROL INFORMATION

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

Ektimo is accredited by NATA (National Association of Testing Authorities) to ISO/IEC 17025 - Testing. ISO/IEC 17025 - Testing 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 Director.

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 worldwide.

A formal Quality Control program is in place at Ektimo 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.

7 DEFINITIONS

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

~	Approximately
<	Less than
>	Greater than
≥	Greater than or equal to
APHA	American public health association, Standard Methods for the Examination of Water and Waste Water
AS	Australian Standard
BSP	British standard pipe
CARB	Californian Air Resources Board
CEM	Continuous Emission Monitoring
CEMS	Continuous Emission Monitoring System
CTM	Conditional test method
D	Duct diameter or equivalent duct diameter for rectangular ducts
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.
DECC	Department of Environment & Climate Change (NSW)
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.
DWER	Department of Water and Environmental Regulation
EPA	Environment Protection Authority
FTIR	Fourier Transform Infra Red
ISC	Intersociety committee, Methods of Air Sampling and Analysis
ISO	International Organisation for Standardisation
NA	Not applicable
NATA	National Association of Testing Authorities
NIOSH	National Institute of Occupational Safety and Health
NT	Not tested or results not required
OM	Other approved method
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_{10}	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 10 microns (µm).
$PM_{2.5}$	Atmospheric suspended particulate matter having an equivalent aerodynamic diameter of less than approximately 2.5 microns (µm).
PSA	Particle size analysis
RATA	Relative Accuracy Test Audit
STP	Standard 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.
TM	Test Method
TOC	The sum of all compounds of carbon which contain at least one carbon to carbon bond, plus methane and its derivatives.
USEPA	United States Environmental Protection Agency
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
Vic EPA	Victorian Environment Protection Authority
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.
XRD	X-ray Diffractometry

Sample Point		No 5 BF Cast House Dedust Stack 2 (ID8b)	No 5 BF Cast House Dedust Stack 1 (ID8a)
Date Sampled		3/08/2021	9/08/2021
Time Sampled		10:30:00	9:30:00
Lab Reference		21-142392	21-146483
Barometric Pressure	kPa	100.8	100.8
Stack cross-sectional area	m^2	6.25	8.3
Stack temperature	°C	61	69
Static pressure (relative to Barometric)	kPa	-0.13	-0.14
Dry gas density	kg/m^3	1.29	1.29
Molecular Weight	grams per gram mole	28.9	28.9
Velocity	m/s	15	15
Volume Flow-rate Actual	m^3/s	93	130
Volume Flow-rate Dry	m^3/s (0°C,101.3,dry	75	99
Moisture	%	0.95	0.7
Sample volume Actual	m^3	2.49	2.46
Sample volume Dry	m^3 (0°C,101.3,dry)	2.31	2.32
TPM	mg/m^3	1	11

Sample Point		No 5 BF Cast House Dedust Stack 2 (ID8b)	No 5 BF Cast House Dedust Stack 2 (ID8b)
Date Sampled		3/05/2018	3/05/2018
Time Sampled		9:30:00	9:31:00
Lab Reference		18-077893; N18/013189	18-077894; N18/013190
Barometric Pressure	kPa	101.4	101.4
Stack cross-sectional area	m^2	6.25	6.25
Stack temperature	°C	65	65
Static pressure (relative to Barometric)	kPa	-0.1	-0.1
Dry gas density	kg/m^3	1.29	1.29
Molecular Weight	grams per gram mole	28.9	28.9
Velocity	m/s	15	15
Volume Flow-rate Actual	m^3/s	92	92
Volume Flow-rate Dry	m^3/s (0°C,101.3,dry	74	73
Moisture	%	1.2	1.4
Sample volume Actual	m^3	2.09	2.22
Sample volume Dry	m3 (0°C,101.3,dry)	1.93	2.05
Total Particulate Matter	mg/m^3	5.7	5.4
Antimony	mg/m^3	<0.00026	<0.00024
Arsenic	mg/m^3	<0.00026	<0.00024
Beryllium	mg/m^3	<0.00026	<0.00024
Cadmium	mg/m^3	0.00062	<0.00024
Chromium	mg/m^3	0.0038	0.0048
Cobalt	mg/m^3	<0.00026	<0.00024
Copper	mg/m^3	0.0083	0.0023
Lead	mg/m^3	0.00088	0.00078
Magnesium	mg/m^3	0.017	0.014
Manganese	mg/m^3	0.027	0.015
Mercury	mg/m^3	<0.00026	<0.00024
Nickel	mg/m^3	0.00093	0.0037
Selenium	mg/m^3	0.0016	0.0015
Tin	mg/m^3	<0.00026	<0.00024
Vanadium	mg/m^3	0.0013	0.0011
Zinc	mg/m^3	0.036	0.032
Type 1 substance	mg/m^3	0.0023	0.0018
Type 2 substance	mg/m^3	0.036	0.027
Type 1 and 2 substance total	mg/m^3	0.038	0.029

Sample Point		No 5 BF Cast House Dedust Stack 1 (ID8a)	No 5 BF Cast House Dedust Stack 1 (ID8a)
Date Sampled		24/08/2017	24/08/2017
Time Sampled		10:29:00	10:30:00
Lab Reference		17-144742; N17/025382	17-144743; N17-025383
Barometric Pressure	kPa	101.2	101.2
Stack cross-sectional area	m^2	8.3	8.3
Stack temperature	°C	47	47
Static pressure (relative to Barometric)	kPa	-0.24	-0.24
Dry gas density	kg/m^3	1.29	1.29
Molecular Weight	grams per gram mole	28.9	28.9
Velocity	m/s	20	20
Volume Flow-rate Actual	m^3/s	160	160
Volume Flow-rate Dry	m^3/s (0°C,101.3,dry	140	140
Moisture	%	1.1	<1
Sample volume Actual	m^3	2.93	2.98
Sample volume Dry	m^3 (0°C,101.3,dry)	2.75	2.79
Aluminium	mg/m^3	0.013	0.025
Antimony	mg/m^3	<0.00018	<0.00018
Arsenic	mg/m^3	<0.00018	0.00023
Barium	mg/m^3	0.00036	0.0021
Beryllium	mg/m^3	<0.00018	<0.00018
Cadmium	mg/m^3	<0.00018	<0.00018
Calcium	mg/m^3	0.095	0.24
Chromium	mg/m^3	0.00076	0.0012
Cobalt	mg/m^3	<0.00018	<0.00018
Copper	mg/m^3	0.00062	0.0035
Iron	mg/m^3	0.95	0.67
Lead	mg/m^3	0.00073	0.0019
Magnesium	mg/m^3	0.0095	0.043
Manganese	mg/m^3	0.012	0.013
Mercury	mg/m^3	<0.00018	<0.00018
Molybdenum	mg/m^3	<0.00018	0.0005
Nickel	mg/m^3	0.00058	0.0013
Phosphorus	mg/m^3	0.0025	0.021
Potassium	mg/m^3	0.035	0.061
Selenium	mg/m^3	0.00021	0.0009
Silver	mg/m^3	<0.00018	0.00018
Sodium	mg/m^3	0.051	1.5
Thallium	mg/m^3	<0.00018	<0.00018
Tin	mg/m^3	0.00062	0.00043
Vanadium	mg/m^3	0.00091	0.001
Zinc	mg/m^3	0.036	0.032
Type 1 substance	mg/m^3	0.0015	0.0027
Type 2 substance	mg/m^3	0.015	0.018
Type 1 and 2 substance total	mg/m^3	0.017	0.02

Appendix D. PRP 131 Air emissions modelling

BLUESCOPE STEEL

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14 September 2012

Manager Illawarra
Environment Protection Authority
PO Box 513
WOLLONGONG NSW 2520

Attention: Mr. Peter Bloem

Dear Sir

POLLUTION REDUCTION PROGRAM 131 – DEVELOP SITE AIR EMISSIONS MODEL: PART A-E

In accordance with requirements of condition U3.3-3.7 of BlueScope Steel Environmental Protection Licence 6092, please find attached the required remodelling report titled "*BlueScope Steel, Port Kembla. Site Air Emissions Modelling – PRP131*", prepared by Environ Australia Pty Ltd. This report is based primarily on the validated Site Air Emissions Model reports submitted to the EPA on 18/12/2009 and 26/3/2010. Note that the model validation and confirmation of existing ambient air quality monitors was completed in these two previously submitted reports.

The objectives of the appended report were to:

- Integrate the data from additional validation testing and
- Assess the air quality impacts of recent changes to the plant configuration (5.2Mtpa and 2.6Mtpa molten steel production scenarios),

In addition to this appended report, the following information has been provided to specifically address condition U3.7: Part E Mitigation Works and provide a discussion on the hydrogen sulphide assessment criteria and proposed limits.

PRP131 - PART E: MITIGATION WORKS

1. Mitigation Works 2007-2012

The initial air modelling report, submitted in 2010 was based on a 2007 emissions inventory of the sources from the site. Many changes and improvements to plant processes have been implemented over the last 5 years, these changes prompted a review and validation of the emissions inventory used in the model. The review and re-modelling exercise captured the most significant changes made to the plant, including the reduction in molten steel production,from 5.2Mtpa to 2.6Mtpa, which commenced in October 2011. The following is a summary of the emission reductions that resulted from the main process changes -

- March 2008 to March 2010 – Gas Processing Vapour Recovery System

The project involved collection and recycling of vapours from the process vessels in Gas Processing. The vapours were previously discharged to atmosphere from No.4 and No.5 Battery heating stacks. At a cost of $8.5 million, this project has successfully reduced the discharge of organic vapours from the Gas Processing plant by approximately 95% (refer to PRP85 for detail).

- January to August 2009 - No 5 Blast Furnace Reline.

The project involved relining the interior of No 5 Blast Furnace, however a number of additional improvements and repairs were made during the period that No 5 Blast Furnace was off-line. These included repairs to the furnace charging system, repairs to the stockhouse and stockhouse storage bins, the replacement or repair of gas mains and service infrastructure, replacement of top gas system bleeders, enhancement of the dustcatcher, replacement of the Venturi scrubber, upgrade of the gas scrubber thickener and water treatment system, repairs to casthouse dedusting equipment and the installation of a recirculated gas cleaning water system.

In addition to these $372 million improvements, the No 5 Blast Furnace slag granulator was replaced with a cold water granulation system. The primary objective of this system was to reduce the hydrogen sulphide concentration emitted from the process. The granulation equipment was installed at a cost of $36 million. Stack testing results have demonstrated a significant reduction in H_2S emission from this plant (refer to PRP155 for detail).

- October 2009 – Ore Preparation Upgrade

Upgrades to the Ore Preparation Area during October 2009 resulted in an increase in the production capacity of the Sinter Plant from 5.5 million tonnes to 6.6 million tonnes per annum. The cost of the project was $142 million. The work included construction of new infrastructure to improve efficiency of operations, repair and refurbishment of equipment such as the room dedusting duct work, waste gas mains and attached dust hoppers, rebuilding of the Sinter Plant Cooler and modification to the three existing fans, extension of the Sinter Plant building and increasing the handling and storage capacity of the Raw Materials Handling Area.

- From October 2011 - Reduction of production rate from 5.2Mtpa to 2.6Mtpa molten steel production

The changes to the production rate that commenced in October 2011 has resulted in reductions in emissions across the plant, refer to Table 24 in the appended report for detail. The following provides an overview of the more significant process changes and the resultant contribution to emissions reduction and improved environmental performance:

- *No 6 Blast Furnace Shutdown* – resulted in the elimination of emissions from 4 point sources (including Point 104: No 6 Blast Furnace slag granulator stack) and the No 6 Blast Furnace slag pit area, a significant hydrogen sulphide fugitive source.

- *Coke Ovens 4 Battery Shutdown* – resulted in the closure of the oldest working Coke Ovens battery at Port Kembla Steelworks which in turn has resulted in the reduction of Cokemaking oven fugitive emissions by approximately 23%, the elimination of emissions from 1 point source (Point 13: No 4 Coke oven battery heating stack) and a 50% reduction in emissions from Point 18: 4/5 quench stack.

- *No 3 BOS Steelmaking Furnace Shutdown* – resulted in the elimination of emissions from 3 point sources and improved slag processing operations in the BOS slag pit area as a result of a 50% reduction in production hours (details available in PRP132).

- *No 1 Slab Caster Shutdown* – the elimination of emissions from 2 point sources.

- *Energy Services 21 and 22 Boiler Shutdown* – the elimination of emissions from 2 point sources

- *Reduced operating hours resulting in reduced emissions from* – 5 point sources at the Lime Kiln, 2 point sources at PCI, 2 point sources at the Hot Strip Mill, fugitive sources at the Recycling Area - Metal Recovery Plant and Crushing and Screening plant.

It should also be noted that routine stack monitoring continues to be undertaken in accordance with the sites Environment Protection Licence 6092, Load-Based Licence and National Pollution Inventory monitoring requirements.

2. Modelling Predictions for the Current 2.6Mtpa Production Scenario

As a result of the changes and improvements listed above, it follows that there will be a reduced impact at the selected receptor sites. In summary, the following predictions were determined:

Total Suspended Particulate (TSP) and PM_{10}

Cumulative annual average PM10 concentrations are predicted to be within the EPA criterion of 30µg/m3, this includes a background concentration of 12.8µg/m^3. Maximum 24-hour average PM_{10} concentrations were predicted to exceed the EPA criterion of 50µg/m^3 at four of the six receptors (2 to 9 times per year). The maximum concentrations and number of exceedances are projected to be reduced given the lower (2.6Mtpa) production rate.

The cumulative annual average TSP concentrations were predicted to be within the EPA criterion of 90µg/m^3, with the maximum annual average concentration reduced by approximately 3µg/m^3 under the 2.6Mtpa scenario.

The point sources that impacted ground level TSP & PM_{10} concentrations most significantly at the selected sensitive receptor sites are

1. *Point 23: Coke Screening House Dedusting stack*
2. *Point 27: BOS No2 Secondary dedusting stack and*
3. *Point 8: No 5 Blast Furnace Casthouse Dedusting stack.*

The point sources that most significantly contribute to the TSP & PM_{10} load are

1. *Point 27: BOS No2 Secondary dedusting stack*
2. *Point 2: Sinter Machine Room Dedusting stack and*
3. *Point 107: Sinter Plant Waste Gas Cleaning Plant stack*.

The fugitive sources that impacted ground level TSP & PM_{10} concentrations most significantly at the sensitive receptor sites are the:

1. *BOS slag cooling pit and slag stockpile area*
2. *BOS roof vents and*
3. *Coke Oven batteries.*

The fugitive sources that most significantly contribute to the TSP & PM_{10} load are

1. *Sinter Plant fugitives*
2. *BOS roof vents and*
3. *BOS slag cooling pit and slag stockpile area.*

Nitrogen Dioxide (NO_2)

Cumulative annual average NO_2 concentrations are predicted to be within the EPA air quality impact assessment criterion of 62µg/m^3. No exceedances are predicted at the sensitive receptors.

The point or fugitive sources that impacted ground level concentrations most significantly at the selected receptor sites are

1. *Point 93: Lime Kiln Discharge Building Baghouse stack*
2. *Points 47,48,49,120 Furnace stacks and*
3. *Point 30: Lime Kiln Waste Heat stack*

Sulphur Dioxide (SO_2)

Cumulative concentrations were not presented as the background SO_2 concentrations were considered to be low. No exceedances of the EPA air quality criteria for SO_2 are predicted.

The point or fugitive sources that impacted ground level concentrations most significantly at the selected receptor sites are

1. *Points 47,48,49,120 Furnace stacks*
2. *Coke Oven Battery fugitives and*
3. *Points 38, 39, 40: Blower Station Boiler stacks*

PCDD/F

PCDD/F concentrations predicted to occur at selected receptors are well below the EPA air quality impact assessment criterion of 0.002ng/m^3. No exceedances are predicted at the sensitive receptors.

The point or fugitive sources that impacted ground level concentrations most significantly at the selected receptor sites are

1. *Point 27: BOS Secondary Dedusting stack*

Benzene, Toluene, Ethylbenzene, Xylene (BTEX) & Styrene

BTEX and Styrene concentrations predicted to occur at selected receptors are below the EPA air quality impact assessment criterion for each substance. No exceedances are predicted at the sensitive receptors.

The point or fugitive sources that impacted ground level concentrations most significantly at the selected receptor sites:

Benzene

1. *Points 14,15: Coke Oven Battery Heating stacks*
2. *SP 12,13: Springhill stacks and*
3. *Coke Oven Battery fugitives*

Toluene

1. *Point 14: Coke Oven Battery Heating stacks*
2. *SP13: Springhill stacks and*
3. *Springhill building fugitives*

Xylene

1. *SP13: Springhill stacks and*
2. *Springhill building fugitives*

Benzo(a)pyrene (B(a)P)

B(a)P and B(a)P equivalent concentrations predicted to occur at selected receptors are below the EPA air quality impact assessment criterion and NEPM air toxic investigation level. No exceedances are predicted at the sensitive receptors.

The point or fugitive sources that impacted ground level concentrations most significantly at the selected receptor sites are:

1. *Coke Oven Battery fugitives (leaks and standpipes), and*
2. *Points 18,19,20: Quench Tower stack*

Hydrogen Sulphide (H_2S)

Incremental nose-response-time (1 second) H_2S concentrations are predicted to exceed the EPA odour assessment criterion for urban areas of 1.38µg/m^3 at four of the six selected sensitive receptor sites.

The point or fugitive sources that impacted ground level concentrations most significantly at the selected receptor sites are

1. *Points 10, 11, 129: No 5 Blast Furnace slag granulator stacks and*
2. *Points 18, 19, 20: Coke Ovens Quench tower stacks*

3. Hydrogen Sulphide (H_2S)

BlueScope Steel has been engaged with the EPA on an on-going basis regarding the stringent NSW H_2S odour assessment criterion of 1.38µg/m^3. Details of the discussions have been reported in correspondence relating to PRP155 - No 5 Blast Furnace Air Emissions Performance Verification, on 31 May 2011 and 26 July 2011. The recommendations detailed in this report were as follows:

- The stack hydrogen sulphide mass emission limits for No. 5 Blast Furnace and No. 6 Blast Furnace Slag Granulators be reviewed within the scope and objectives of PRP 131.
- Until the outcome of PRP131 is finalised, the stack mass emission licence limit for hydrogen sulphide at No.5 Blast Furnace Slag Granulator will remain at 1.2g/s.

As previously mentioned in Section 2 above, there has been a significant reduction in H_2S generation across the site with the closure of No 6 Blast Furnace granulator, the subsequent elimination of H_2S emissions from No 6 Blast Furnace Slag Pits, the upgrade of No 5 Blast Furnace to cold water granulation and the closure of the Coke Ovens 4 Battery and subsequent reduction in the number of coke quenches per day.

BlueScope Steel engaged Environ to undertake a review of ambient H_2S air quality assessment criteria published by other jurisdictions, both inter-state and abroad. The review is detailed in Appendix A of the appended report. In brief the following opinion is described: *"The NSW EPA and Victoria EPA odour criteria appear to be more reflective of odour detection levels rather than demonstrated odour annoyance. Given the stringency of the EPA odour criteria, the applicability of such criteria to proposed developments, and the fact that compliance with the H_2S criterion is impractical given the scale of BSL's operations and their proximity to sensitive receptors, it has been recommended that an alternative ambient H_2S criterion be established."*

Environ have recommended that the Californian EPA 1-hour average odour (public welfare) criterion of 42µg/m^3 be considered for adoption for the assessment of cumulative impacts from all sources in the region (including BlueScope Steel sources). As stated in section 2.5 of the appended report, *"Given the uncertainty in short-term measured and modelled concentrations, the longer 1-hour averaging period is considered to provide a more robust basis for a criterion".*

The projected cumulative maximum 1-hour average H_2S concentrations, taking into account a background concentration of 1µg/m^3, are well below the Californian Acute REL of 42µg/m^3 at all the selected sensitive receptors.

It is proposed that BlueScope Steel adopt a 1-hour average H_2S cumulative limit of 42µg/m^3 from all sources (including background and BSL sources).

It is also proposed that individual stack emission limits be adopted for the highest emitting sources, namely *Points 10, 11, 129: No 5 Blast Furnace slag granulator stacks* and *Points 18, 19, 20: Coke Ovens Quench tower stacks*. Currently *Points 10 & 11*: *No 5 Blast Furnace slag granulator stacks* have a special limit condition detailed in condition E1.2 of the EPL 6092. It is submitted that this limit remains appropriate.

An outcome of PRP131 is to develop a stack specific limit for point 18: 4/5 Coke Oven Battery Quench tower stack. The intermittent quenching process and subsequent modified H_2S stack testing method does not allow a direct comparison to the POEO (Clean Air) limit for H_2S of 5mg/m^3. This limit is applicable to a process with a constant emission over a 1 hour period. Based on the appended model and the predicted ground level concentrations at the selected receptor sites, and on acceptance of the

alternate H_2S limit, it is proposed a mass limit is determined for *Points 18, 19, 20: Coke Ovens Quench tower stacks* which will be measured at *Point 18: 4/5 Coke Oven Battery Quench towers stack* (as representative of Points 19 and 20).

4. Conclusion

Since the commencement of PRP131 five years ago, BlueScope Steel has continued to upgrade pollution control equipment, optimise the performance of the plant processes and implement robust maintenance plans for equipment. The benefits of this are demonstrated by comparison of the initial modelling outcomes submitted in the 2010 report and the results for the current 2.6Mtpa production scenario in the appended report.

All assessment criteria are predicted to be met with the exception of PM_{10} and H_2S. Cumulative annual average PM_{10} predictions are well below the EPA criteria. Cumulative maximum 24-hour average PM_{10} predictions exceed at four of the six receptors and are predicted to exceed 2 to 9 days per year. This is a significant improvement from the 2010 model where all six receptors were predicted to exceed between 1 to 24 times per year. BlueScope Steel does not propose any significant mitigation works. However, BlueScope Steel will continue to make all reasonably practicable adjustments to minimise the contribution of PM_{10} to the ground level concentration. Furthermore, the sources that most significantly influence the PM_{10} ground level concentration are well below the relevant POEO or EPL limit.

Regarding H_2S, BlueScope Steel is requesting the adoption of the cumulative Californian Acute Reference Exposure Level for hydrogen sulphide of 42µg/m^3, as the assessment criteria under EPL 6092. Subject to EPA approval, a specific mass load limit for Point 18: 4/5 quench stack will be developed that will reflect proper and efficient operation of the quenching process with an aim to protect the health and amenity of the surrounding community, and in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.*

Should you have any enquiries with respect to the attached report, please contact Natasha Porteous on (02) 4275 5992

Yours faithfully

Natasha Porteous
ACTING ENVIRONMENT MANAGER – PORT KEMBLA STEELWORKS

ATTACHED: *BlueScope Steel, Port Kembla. Site Air Emissions Modelling-PRP131*
Prepared by Environ Australia Pty Ltd, September 2012

BlueScope Steel, Port Kembla Site Air Emissions Modelling - PRP131

Prepared for:
BSL (Australia) Pty Ltd

Prepared by:
ENVIRON Australia Pty Ltd

Date:
September 2012

Project Number:
AS121507

ENVIRON

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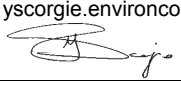
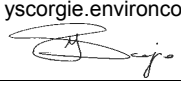
Signature:		Date:	13/9/2012	Signature:		Date:	13/9/2012

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1 Introduction

1.1 Study Objective

ENVIRON Australia Pty Ltd (ENVIRON) was commissioned by BlueScope Steel Limited (BSL) to undertake further development and verification of the Site Air Emissions Model established for the BSL Facility at Port Kembla (**Figure 1**). The work is being conducted to meet requirements of Pollution Reduction Program (PRP) 131 incorporated within the facility's Environmental Protection License (EPL License 6092), and inform work being undertaken by BSL in respect of PRP 140.

PRP 131 comprises a staged five year (2008-2013) program aimed at the development and verification of a Site Air Emissions Model for the BlueScope Steelworks at Port Kembla. To date the site model has been developed and validated for several pollutants, namely particulate matter less than 10 microns in aerodynamic diameter, (PM_{10}), total suspended particles (TSP), nitrogen oxides (NO_X), sulphur oxides (SO_X), polychlorinated dibenzo-p-dioxins and -furans (PCDD/F), volatile organic compounds (VOCs), hydrogen sulphide (H_2S) and polycyclic aromatic hydrocarbons (PAH) (ENVIRON, 2009, 2010). The model encompasses the quantification of site emissions, including point and major fugitive sources, and the simulation of resultant off-site air quality impacts through dispersion model application.

Additional source validation testing has been undertaken by BSL under PRP131 since the completion of the previous modelling. Such testing includes further stack monitoring results, and downwind monitoring of fugitive emission sources to verify emission estimates. Furthermore, there have been significant changes to BSL Port Kembla facility operations over the past year; notably the reduction in molten steel throughput from 5.2 Mtpa to 2.6 Mtpa since mid-October 2011. This has necessitated further modelling work to integrate the results from the additional validation testing and to assess the air quality implications of recent changes in the plant configuration.

Based primarily on the validated Site Air Emissions Model established for the BSL Port Kembla Facility previously (ENVIRON 2009, 2010), the objectives of the current study are as follows:

- Emissions inventory revision, integrating the data from additional validation testing undertaken by BSL under PRP131 for previously modelled and additional air pollutants;
- Simulation of 5.2 Mtpa and 2.6 Mtpa molten steel production scenarios, to assess the air quality implications of recent changes in the BSL Port Kembla plant configuration, through the application of the previously validated hourly time-step AERMOD model; and
- Evaluation of selected ambient monitoring data against relevant air quality criteria, and trends analysis to assess recent changes in air pollutant concentrations.

Specific air pollutants inventoried, modelled and assessed include: particulates (TSP and PM_{10}), ammonia, Benzo-a-pyrene (BaP), BaP equivalent, benzene, chlorine, hydrogen cyanide, ethylbenzene, hydrogen sulphide (H_2S), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), sulphur trioxide (SO_3), phenol, styrene, toluene, xylene and polychlorinated dibenzo-p-dioxins and -furans (PCDD/F).

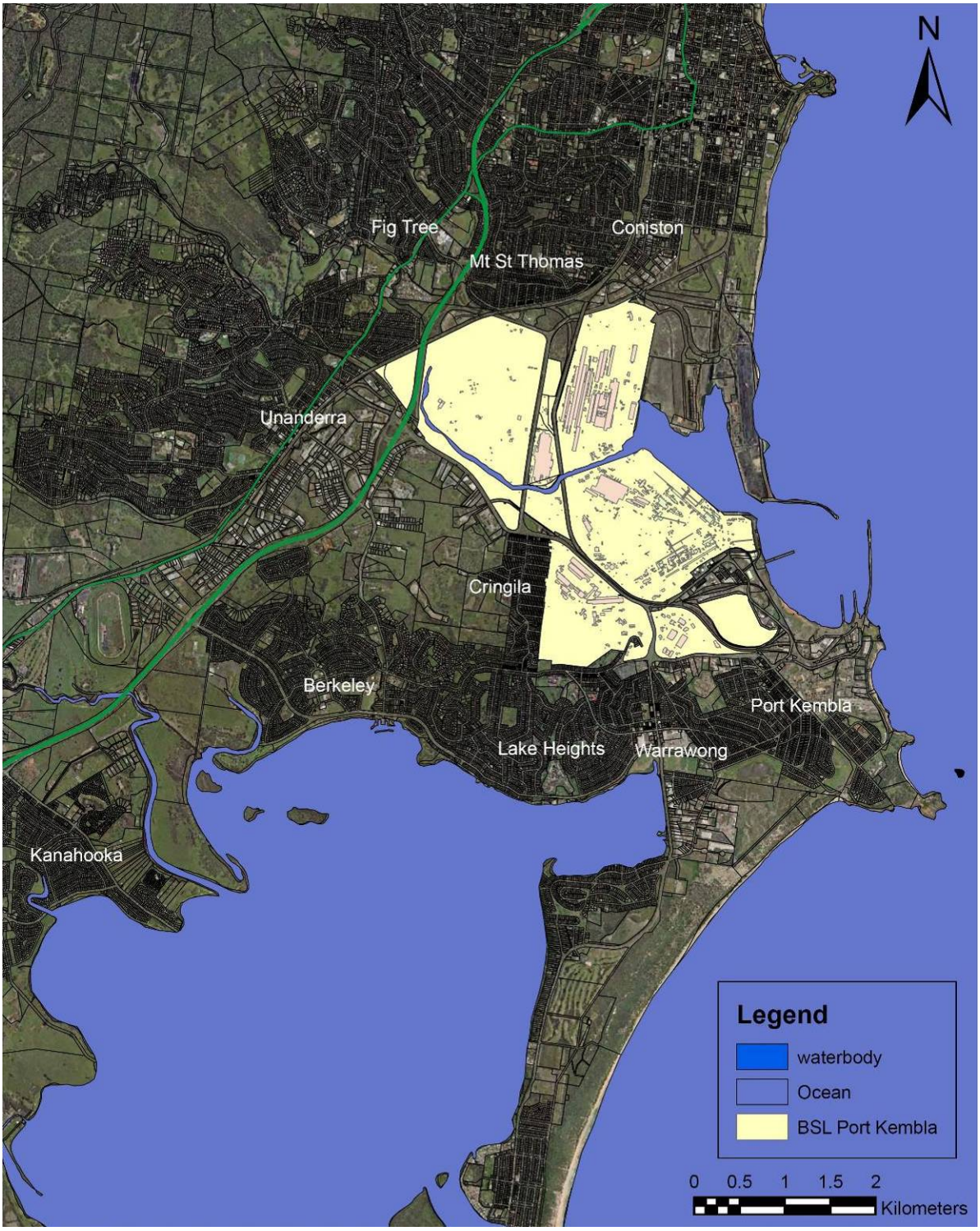


Figure 1. BSL Port Kembla Locality Map

1.2 Dispersion Meteorology

An understanding of the prevailing dispersion meteorology is necessary when interpreting trends in measured and predicted ambient air pollutant concentrations. A comprehensive description of the regional climate and local meteorology was provided in previous reports (ENVIRON 2009; ENVIRON 2010). The influence of the local terrain on the local meteorology is briefly described in this section and a description provided of the prevailing airflow patterns, atmospheric stability regime and mixing depth.

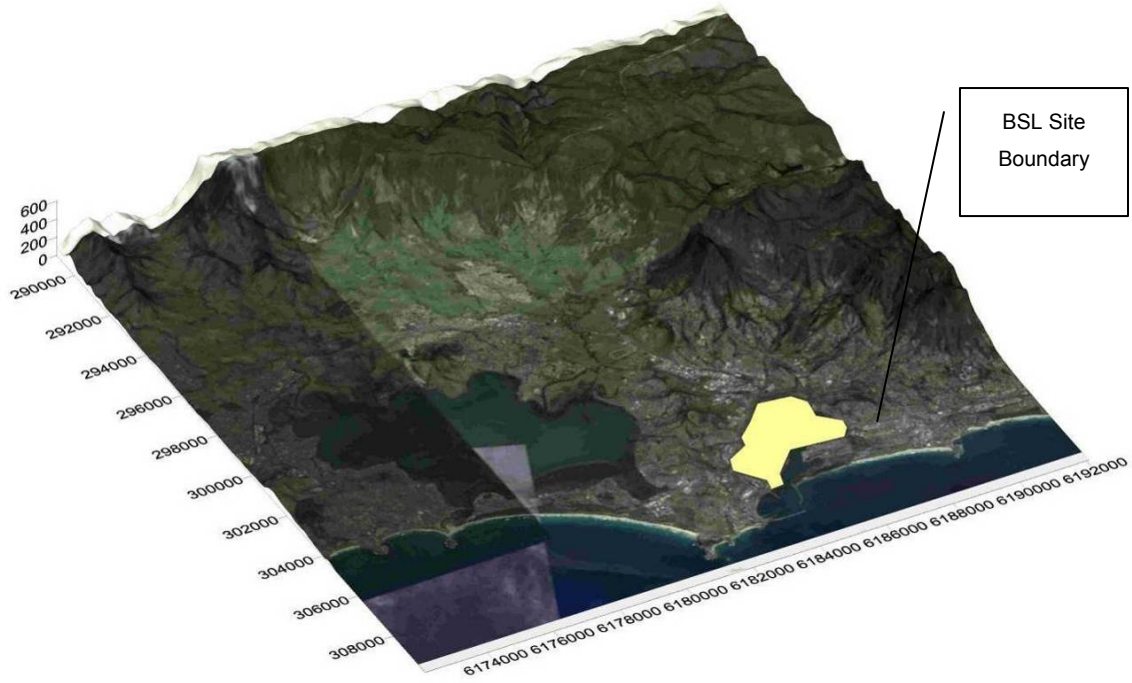
In describing the dispersion meteorology reference is made to wind field measurements from the BSL meteorological monitoring station and to atmospheric stability and mixing depth projections from CALMET modelling undertaken for the site previously (ENVIRON, 2011).

1.2.1 Local Terrain

BSL Port Kembla facility is located south of the town of Wollongong on the East Coast of NSW. The facility is situated on the coast and is approximately at sea level. The BSL steelworks is bounded by the Pacific Ocean and inner harbour on the east, residential areas to the south and west, and a grain handling and coal terminal to the north.

The area surrounding the facility is both industrial and residential, with some low dense shrub land close to the coast. The urban region of Wollongong lies to the north of the facility. Dense bushland lies approximately 7km to the west of the facility. In this region, there is a steep escarpment, where the elevation increases from approximately sea level to 500m over approximately 8km. Lake Illawarra, an inland lake at sea level, which occupies approximately 3000ha, lies approximately 3km to the south of the BSL facility.

A three-dimensional representation of the topography of the region surrounding the BSL site is presented in **Figure 2**.



Note: Vertical Exaggeration = 3

Figure 2. Topography in the vicinity of the BSL facility

The meteorology and hence the air quality of the region is significantly influenced by the presence of the escarpment to the west and the proximity to the coast. The presence of the escarpment can result in the deflection of surface winds and in the decoupling of winds above and below the escarpment. As a result an inversion can form at the top of the escarpment, limiting the dispersion of pollutants in the region (Hyde et al., 1997).

The region is also influenced by land-sea breeze circulation systems, with the interface between land and marine air masses impacting significantly on the vertical structure of the atmosphere. In the north of the region local winds tend to be steered by the topography to become north-north-easterly to north-easterly in direction. In the south of the region sea breezes tend to result in more north-easterly to easterly near the surface. Return-flow has been observed above the sea breeze in the region. At night, westerly drainage flows have been observed to develop over the region (Hyde and Prescott, 1984).

1.2.2 Prevailing Wind Regime

The BSL weather station is situated near the south western corner of the facility, near the border of BSL and the neighbouring suburb, Cringila. Annual, seasonal and diurnal wind roses generate based on data from this station are presented in **Figure 3** and **Figure 4**.

On an annual basis airflow is characterised by the prevalence of wind from the west-southwest to south-eastern sector. North-easterly airflow represents a more distinct but less frequent flow component. Average wind speeds of 4m/s are experienced, with a peak 3-minute average wind speed of 27.5m/s having been recorded during 2008.

Analysis of the meteorological data from the BSL weather station, indicates distinct seasonal shifts in the wind field which reflect broader synoptic scale circulation patterns. During the winter, winds from the south-westerly quadrant prevail and specifically west-south-westerly wind. Airflow becomes increasingly more varied during spring, with the wind field during both spring and autumn being similar and indicative of annual flow patterns. The exception being the distinct strong northerly winds recorded during spring. During summer a distinct increase in the prevalence of north-easterly airflow is apparent, with south-south-easterly winds being prevalent.

Day-time and night-time wind roses illustrate the combined influence of land-sea breeze and regional circulations. For periods when the land and sea breezes are enhanced by regional winds, day time flows are dominated by north-easterly flow with south-westerly airflow occurring overnight.

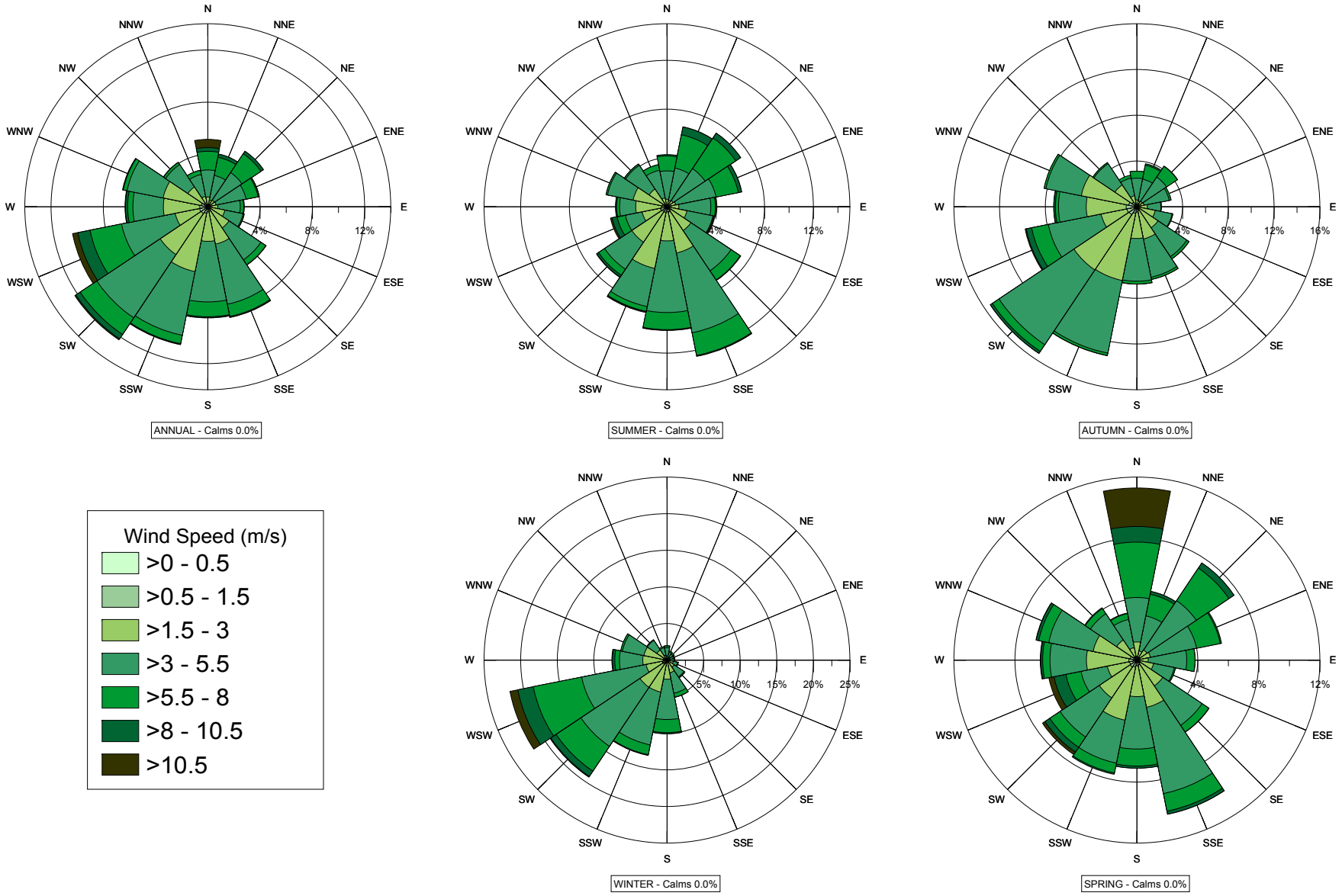


Figure 3. Annual and Seasonal Wind Roses – BSL Meteorological Station (2008)

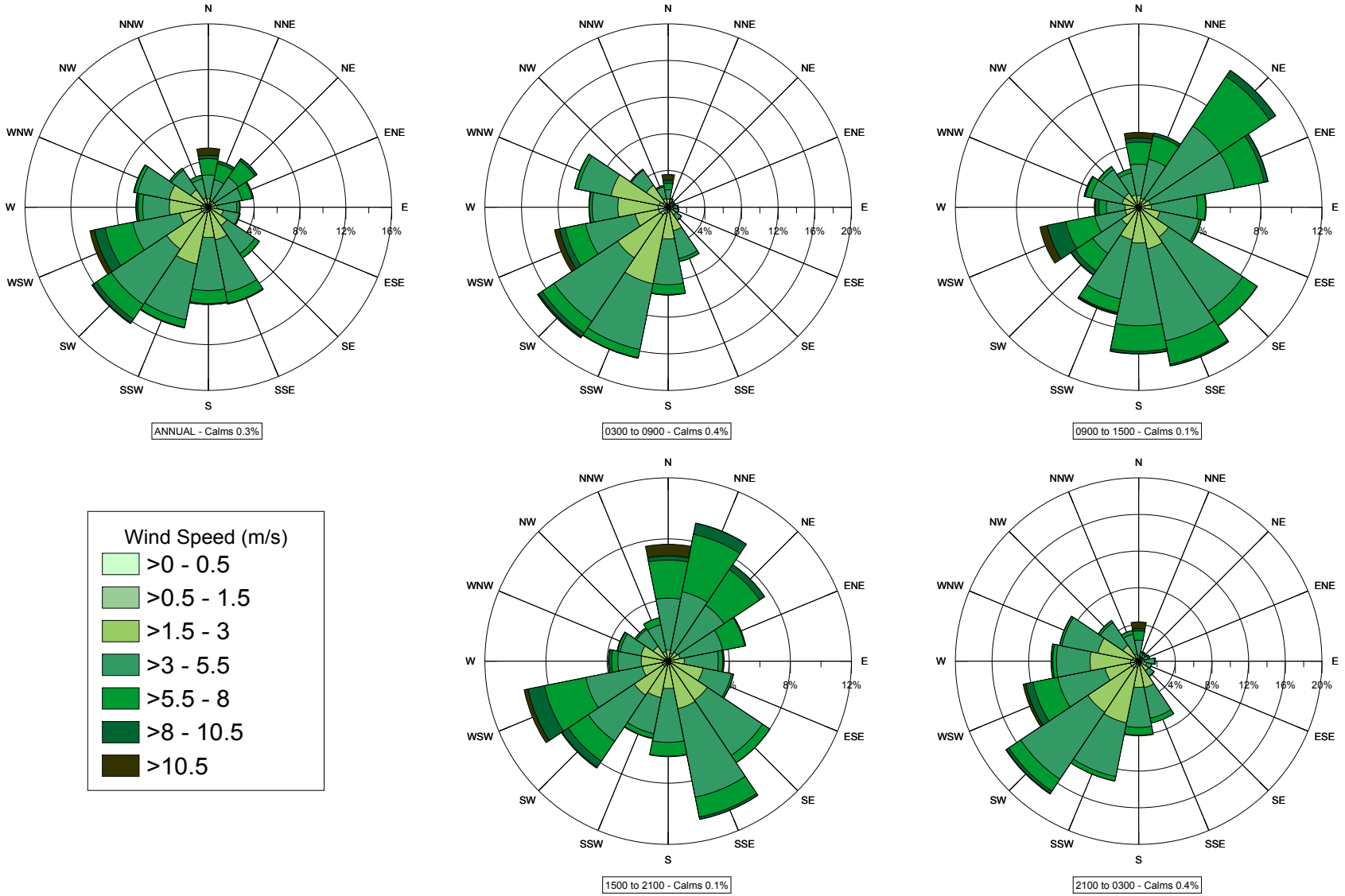


Figure 4. Annual-average Diurnal Wind Roses – BSL Meteorological Station (2008)

1.2.3 Atmospheric Stability and Mixing Depth

The atmospheric boundary layer constitutes the first few hundred metres of the atmosphere. This layer is directly affected by the earth's surface, either through the retardation of flow due to the frictional drag of the earth's surface, or as result of the heat and moisture exchanges that take place at the surface (Stull, 1997; Oke, 2003). During the daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface and the extension of the mixing layer to the lowest elevated subsidence inversion. Elevated inversions may occur for a variety of reasons including anticyclonic subsidence, land-sea breeze interfaces and the passage of frontal systems.

Radiative flux divergence during the night usually results in the establishment of ground-based inversions and the erosion of the mixing layer. Nighttimes are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds, hence less dilution potential. The mixed layer thus ranges in depth from a few metres (i.e. stable or neutral layers) during nighttimes to the base of the lowest-level elevated subsidence inversion during unstable, daytime conditions.

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion, a controlling factor in the level of atmospheric dispersion of pollutants. The Pasquill-Turner assignment scheme identifies six Stability Classes, "A" to "F", to categorise the degree of atmospheric stability prevailing at a given time (defined in **Table 1**).

Table 1: Description of Atmospheric Stability Classes

Atmospheric Stability Class	Category	Description
A	Very unstable	Low wind, clear skies, hot daytime conditions
B	Unstable	Clear skies, daytime conditions
C	Moderately unstable	Moderate wind, slightly overcast daytime conditions
D	Neutral	High winds or cloudy days and nights
E	Stable	Moderate wind, slightly overcast night-time conditions
F	Very stable	Low winds, clear skies, cold night-time conditions

The frequency of occurrence for each atmospheric stability class predicted by CALMET for the BSL Site during 2008 is illustrated in **Figure 5**. Stability class D, corresponding to a neutral atmosphere, was predicted to occur approximately 36% of the time. Stability classes E and F, corresponding to a stable atmosphere, were predicted to occur cumulatively 37% of the time.

The predicted seasonal variation in atmospheric stability at the BSL Site is presented in **Figure 6**. Autumn is predicted to have a higher percentage of stable atmospheric conditions (stability class E and F) than the other three seasons throughout 2008.

Diurnal variation in atmospheric mixing depth for the BSL Site is illustrated in **Figure 7**. The atmospheric mixing depth increases during the day with maximum depths occurring between 1pm and 4pm at the time of peak solar energy. Mixing depth reduces as the sun sets and solar energy decreases.

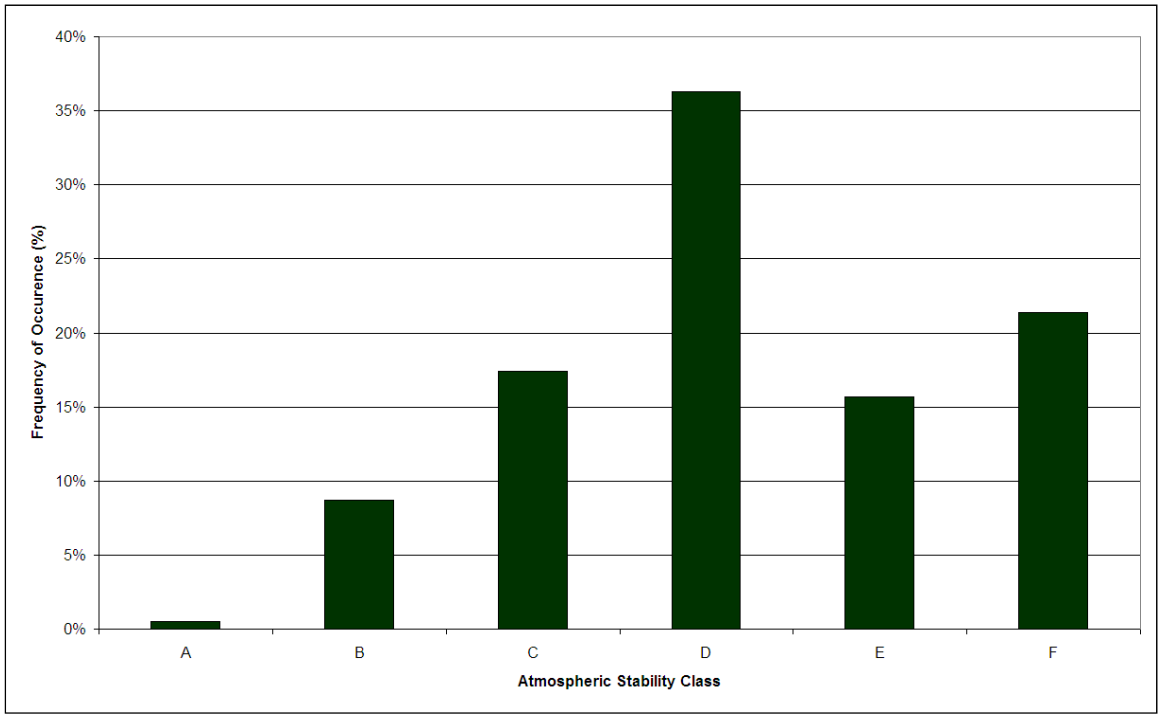


Figure 5. CALMET Predicted Annual Occurrence of Atmospheric Stability Class – BSL Site - 2008

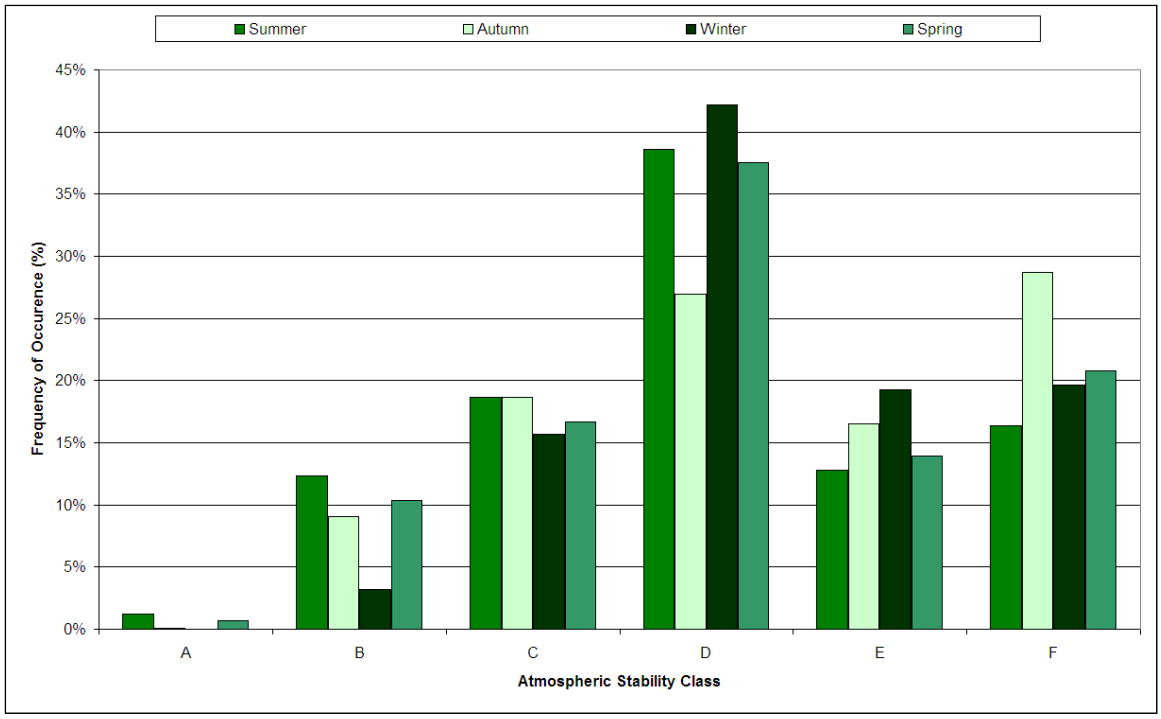


Figure 6. CALMET Predicted Seasonal Occurrence of Atmospheric Stability Class – BSL Site - 2008

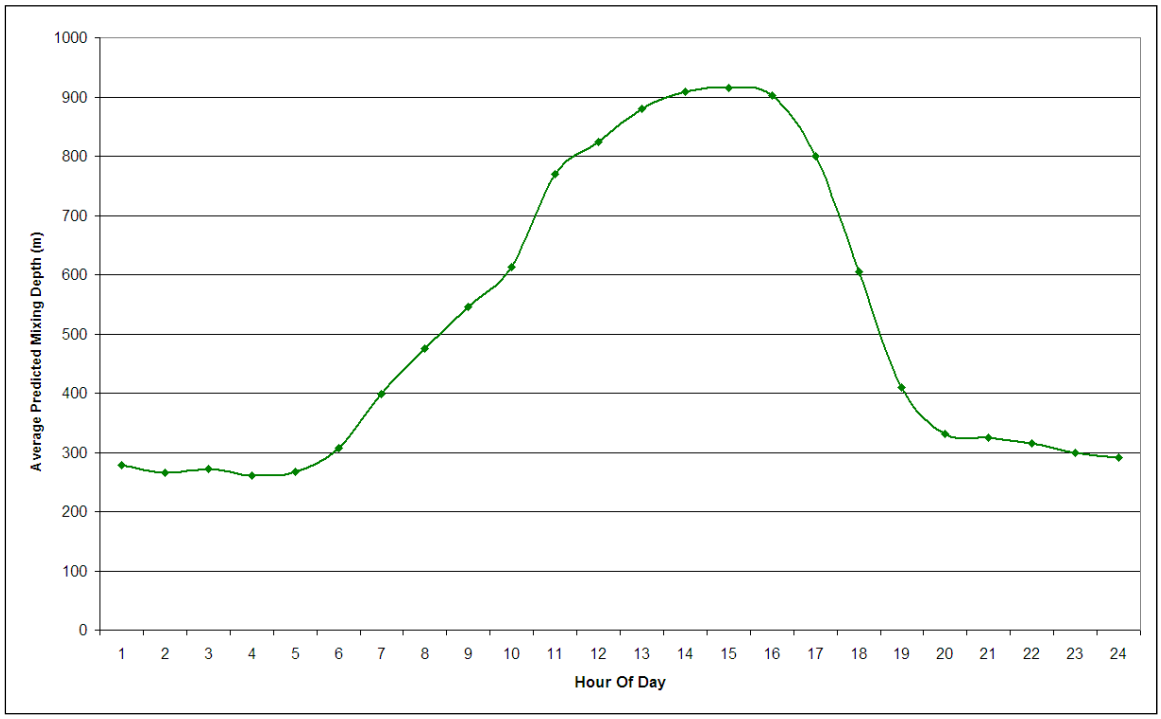


Figure 7. Predicted Diurnal Variation in Atmospheric Mixing Depth – BSL Site - 2008

2 Ambient Air Quality Criteria

In evaluating measured and predicted ambient air pollutant concentrations reference is made to ambient air quality criteria as summarised in this section. Such criteria are primarily drawn from the Office of Environment and Heritage (OEH) guideline document (2005) *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (hereafter the 'Approved Methods for Modelling'). Reference is also made to air quality standards published by federal government within the *National Environmental Protection Measure (Ambient Air Quality) Measure* dated July 2003 (hereafter the 'Air Quality NEPM') and the *National Environmental Protection Measure (Air Toxics) Measure* dated December 2004 (hereafter the 'Air Toxics NEPM').

2.1 Airborne Particulate Matter

Air quality criteria for particulate matter are published for different particulate matter size fractions, including TSP and inhalable particulate or PM_{10} (**Table 2**). The NSW OEH 24-hour average PM_{10} assessment criterion threshold of 50µg/m^3 is numerically identical to the NEPM reporting standard threshold. However, whereas the NEPM reporting standard makes provision for five exceedances per year, no such provision is made within the NSW *Approved Methods for Modelling*.

Table 2: Air Quality Assessment Criteria for Airborne Particulate Matter

Pollutant	Averaging Period	Concentration (µg/m^3)	Source
TSP	Annual	90	OEH[(1)(2)]
PM_{10}	24-hour	50	OEH[(1)]
	24-hour	50[(4)]	NEPM[(3)]
	Annual	30	OEH[(1)]

Notes:
[1] OEH, 2005 Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.
[2] OEH impact assessment criterion based on the subsequently rescinded National Health and Medical Research Council (NHMRC) recommended goal.
[3] NEPC, 2003, National Environment Protection (Ambient Air Quality) Measure, as amended.
[4] Provision made for up to five exceedances of the limit per year.

The air quality impact assessment criteria for airborne particulate concentrations are applicable at the nearest existing or likely future off-site dwellings or establishments. Such places are termed sensitive receptors by the *Approved Methods for Modelling*. In assessing against these criteria, the total air pollutant concentration (incremental plus background concentration) must be reported as the 100th percentile in concentration units consistent with the impact assessment criteria and compared with the relevant impact assessment criteria.

2.2 Common Gaseous Air Pollutants

Air quality criteria for common gaseous air pollutants are documented in **Table 3**. The air quality impact assessment criteria for SO_2 and NO_2 are applicable at the nearest existing or likely future off-site dwellings or establishments. In assessing against these criteria, the total concentration (incremental plus background concentration) must be reported as the 100th percentile in concentration units consistent with the impact assessment criteria and compared with the relevant impact assessment criteria (OEH, 2005).

Table 3: Air Quality Assessment Criteria for Common Gaseous Air Pollutants				
Pollutant	**Averaging Period**	**Concentration**		**Source**
		µg/m³	**pphm**	
NO_2	1-hour	246	12	OEH(1)
		-	12	NEPM(2)
	Annual	62	3	OEH(1)
		-	3	NEPM
SO_2	10-minute	712	25	OEH(1)
	1-hour	570	20	OEH(1)
		-	20	NEPM(2)
	24-hour	228	8	OEH(1)
		-	8	NEPM(2)
	Annual	60	2	OEH(1)
		-	2	NEPM

Notes:

[1] NSW OEH, 2005 Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.

[2] Provision made for one exceedance of the limit per year.

2.3 Air Toxics

2.3.1 NSW Impact Assessment Criteria

Individual toxic air pollutants are classified in the OEH *Approved Methods for Modelling* into two categories, namely principal toxic air pollutants and other individual air toxic pollutants.

'Principal toxic air pollutants' are defined on the basis that they are carcinogenic, mutagenic, teratogenic, highly toxic or highly persistent in the environment. Air quality criteria for principal toxic air pollutants assessed in this study are summarized in **Table 4**. Criteria for other individual toxic air pollutants assessed in the current study are shown in **Table 5**.

Table 4: Impact Assessment Criteria for Principal Toxic Air Pollutants (*NSW Approved Methods 2005*)			
Substance	**Averaging Period**	**Concentration**	
		µg/m³	**ppb**
Benzene	1 hour	29	9
Dioxins and furans(a)	1 hour	0.000002	N/A
Polycyclic aromatic hydrocarbons, PAHs (as benzo[a]pyrene)(b)	1 hour	0.4	N/A

Notes:

(a) Toxic equivalent as defined in Clause 29 of the NSW Protection of the Environment Operations (Clean Air) Regulation 2002, last modified on 13 August 2010.

(b) Potency equivalency factors (PEFs) for PAHs are as per OEHHA (1994)(1) (Refer to **Table 10**)

Definitions and Reference Conditions:

- Gas volumes are expressed at 25 degrees Celsius and at an absolute pressure of 1 atmosphere (101.325 kPa).
- *ppb* means parts per billion by volume
- *µg/m³* means microgram per cubic metre

[1] OEHHA 1994, *Benzo[a]pyrene as a Toxic Air Contaminant, Executive Summary*, California Air Resources Board and the Office of Environmental Health Hazard Assessment, Sacramento.

– *The 1-hour average is given as a 1 hour clock average.*

Table 5: Impact Assessment Criteria for Individual Toxic Air Pollutants (NSW Approved Methods 2005)

Substance	Averaging Period	Concentration	
		mg/m³	ppm
Ammonia	1 hour	0.33	0.46
Chlorine	1 hour	0.05	0.018
Cyanide (as CN)	1 hour	0.09	N/A
Ethylbenzene	1 hour	8	1.8

Definitions and Reference Conditions:

– Gas volumes are expressed at 25 degrees Celsius and at an absolute pressure of 1 atmosphere (101.325 kPa).
– *ppm* means parts per million by volume
– *mg/m³* means milligram per cubic metre
– *The 1-hour average is given as a 1 hour clock average.*

The impact assessment criteria in **Table 4** and **Table 5** are applicable at and beyond the boundary of the facility, to *incremental* concentrations (i.e. predicted air pollutant concentrations due exclusively to the source being assessed). The 100th percentile of the dispersion model predictions are compared to the criteria for Level 1 impact assessments. The 99.9th percentile of the dispersion model predictions are compared to the criteria for Level 2 impact assessments. The dispersion modelling undertaken in the current study is in accordance with a Level 2 impact assessment, and hence model results are expressed as 99.9th percentiles for comparison with air quality criteria.

2.3.2 National Air Toxics Investigation Levels

The aim of the Air Toxics NEPM issued in April 2004 provides a framework for monitoring, assessing and reporting on ambient levels of five air toxics, viz. benzene, toluene, xylene, formaldehyde and polycyclic aromatic hydrocarbons (PAHs). Monitoring investigation levels published for these air toxics is documented in **Table 6**. The purpose being to assist in the collection of information for the future development of national air quality standards for these pollutants.

Table 6: Monitoring Investigation Levels for Air Toxics (Air Toxics NEPM)

Pollutant	Averaging Period	Maximum Concentration	Goal
Benzene	Annual average	0.003 ppm	8-year goal is to gather sufficient data nationally to facilitate development of a standard
Benzo(a)pyrene as a marker for Polycyclic Aromatic Hydrocarbons	Annual average	0.3 ng/m³	
Formaldehyde	24 hours	0.04 ppm	
Toluene	24 hours Annual average	1 ppm 0.1 ppm	
Xylenes (at total of ortho, meta and para isomers)	24 hours Annual average	0.25 ppm 0.2 ppm	

Definitions and Notes applicable to the Air Toxics NEPM:

– *ppm* means parts per million by volume

- *ng/m³* means nanogram per cubic metre referenced to a temperature of 0 degrees Celsius and an absolute pressure of 101.325 kilopascals
- Annual average concentrations are the arithmetic mean concentrations of 24-hour monitoring results.
- A 24-hour period is to be conducted from midnight to midnight.
- For toluene and xylenes the annual average and 24-hour monitoring investigation levels have been derived independently for different (chronic and acute) health endpoints.
- The 24-hour monitoring investigation levels have been derived from health based guidelines of shorter averaging periods as follows:
  - For formaldehyde, the health based guideline is 0.08 ppm for a 1 hour averaging period;
  - For toluene, the health based guideline is 4 ppm for a 6 hour averaging period; and
  - For xylene the health based guideline is 1 ppm for a 30 minute averaging period.

The Air Toxics NEPM applies to areas where emissions from cumulative sources give rise to elevated levels of air toxics. Although industries may contribute to ambient levels in a specific area, the Air Toxics NEPM is not aimed at direct monitoring or control of industrial emissions.

2.4 Individual Odorous Air Pollutants

Impact assessment criteria for individual odorous air pollutants are given in **Table 7**. The assessment criteria for hydrogen sulfide is given as a function of population density as documented in **Table 8**. Given the urban nature of the study area a H_2S criterion of 1.38 µg/m³ has been indicated to be applicable for the assessment of ambient H_2S concentrations in the vicinity of the BSL facility.

The impact assessment criteria for individual odorous air pollutants is applicable at the nearest existing or likely future off-site sensitive receptor. A 'sensitive receptor' is defined as a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area.

The impact assessment criteria are applied to **incremental** concentrations (i.e. predicted air pollutant concentrations due exclusively to the source being assessed). The dispersion modelling undertaken in the current study is in accordance with a Level 2 impact assessment, and hence modelled *incremental* concentrations are expressed as 99.9th percentiles for all individual odorous air pollutants, except for H_2S, for comparison with air quality criteria. Modelled incremental H_2S concentrations, expressed as 99th percentiles are compared to the impact assessment criteria given for this air pollutant.

Table 7: Impact Assessment Criteria for Individual Odorous Air Pollutants (NSW Approved Methods 2005)

Substance	Averaging Period	Concentration	
		mg/m³	ppm
Phenol	1 hour	0.02	0.0052
Styrene (monomer)	1 hour	0.12	0.027
Toluene	1 hour	0.36	0.09
Xylenes	1 hour	0.19	0.04

Definitions and Reference Conditions:

- Gas volumes are expressed at 25 degrees Celsius and at an absolute pressure of 1 atmosphere (101.325 kPa).
- *ppm* means parts per million by volume
- *mg/m³* means milligram per cubic metre
- *The 1-hour average is given as a 1 hour clock average.*

Table 8: Impact Assessment Criteria for Hydrogen Sulfide (NSW Approved Methods 2005)	
Population of Affected Community	**Impact Assessment Criteria for Hydrogen Sulphide (µg/m³)**
Urban area (≥ 2000)	1.38
500 – 2000	2.07
125 – 500	2.76
30 – 125	3.45
10-30	4.14
Single residence (≤ 2)	4.83

Definitions and Reference Conditions:

- Percentile/Averaging Period: 99th percentile of the 'nose-response-time average', i.e. 99th percentile of the 1-second average.
- Gas volumes are expressed at 25 degrees Celsius and at an absolute pressure of 1 atmosphere (101.325 kPa).
- *µg/m³* means microgram per cubic metre

2.5 Health and Amenity Criteria for H_2S

An overview is provided of the odour assessment criteria for H_2S contained within the OEH (2005) *Approved Methods for Modelling* is discussed in the preceding subsection. Given that BSL facility emissions have previously been predicted to exceed the stringent OEH criterion given for urban areas, a detailed review was undertaken of ambient air quality assessment criteria published by other jurisdictions, both inter-state and abroad, for the protection of human health and amenity. This review is documented in **Appendix A**, with key findings noted below.

Whereas the OEH odour assessment criteria are specified for a nose-response-time (1-second average), most other jurisdictions reviewed express odour criterion for 3-minute, 30-minute, 1-hour or 24-hour averaging periods. The OEH criteria are however typically applied to the assessment of proposed developments.

Odour criteria adopted in NSW, Victoria and Tasmania are substantially lower than those specified in Queensland, New Zealand, and in the Unites States and Canadian states reviewed. The values included in the NSW OEH and Victoria EPA criteria appear to be more reflective of odour detection levels rather than demonstrated odour annoyance.

Toxicity values for H_2S based on respiratory effects are notably higher than criteria set for odour due to adverse response in the respiratory system occurring at higher concentrations than are associated with odour detection and annoyance.

Criteria adopted by some jurisdictions are based on the protection of headache, nausea and other effects that might be related to odour rather than on odour detection levels (e.g. California EPA 1-hour criteria).

Based on the review the following recommendations were made:

- An ambient H_2S criterion should be decided for the BSL facility. Given the stringency of the OEH odour criteria, the applicability of such criteria to proposed developments, and

the fact that compliance with the H_2S criterion is impractical given the scale of BSL's operations and their proximity to sensitive receptors, it is recommended that an alternative ambient H_2S criterion be established.

- Following the review of ambient H_2S criterion inter-state and abroad, it is recommended that the Californian EPA 1-hour average odour (public welfare) criterion of 42 µg/m³ be considered for adoption for the assessment of *cumulative impacts due to all sources* in the region including BSL sources. Given the uncertainty in short-term measured and modelled concentrations, the longer 1-hour averaging period is considered to provide a more robust basis for a criterion.
- Odour surveys and odour mapping studies within neighbouring areas could be useful to assess the site applicability of generic odour criteria.

2.6 Summary of Air Quality Criteria

A summary of the air quality impact assessment criteria applied to evaluate measured and predicted air pollutant concentrations is given in **Table 9**.

Table 9: Summary of Air Quality Criteria Referenced in the Study

Air Pollutant	Classification / Reference	Averaging Period	Concentration (µg/m³)	Incremental / Cumulative	Percentile
Ammonia	Individual Air Toxic, NSW	1 hour	330	Incremental	99.9th
Benzene	Principal Air Toxic, NSW	1 hour	29	Incremental	99.9th
	Air Toxic NEPM	Annual	10	Cumulative	100th
Benzo[a]pyrene equivalent(a)	Principal Air Toxic, NSW	1 hour	0.4	Incremental	99.9th
Benzo[a]pyrene	Air Toxic NEPM	Annual	0.0003	Cumulative	100th
Chlorine	Individual Air Toxic, NSW	1 hour	50	Incremental	99.9th
Cyanide (as CN)	Individual Air Toxic, NSW	1 hour	90	Incremental	99.9th
Dioxins and furans, PCDD/F(b)	Principal Air Toxic, NSW	1 hour	0.000002	Incremental	99.9th
Ethylbenzene	Individual Air Toxic, NSW	1 hour	8000	Incremental	99.9th
H_2S	Odorous Air Pollutant, NSW	1 second	1.38	Incremental	99th
	California Acute Reference Exposure Level	1 hour	42	Cumulative	100th
NO_2	Approved Methods, NSW	1 hour	246	Cumulative	100th
	Approved Methods, NSW	Annual	62	Cumulative	100th
Phenol	Odorous Air Pollutant, NSW	1 hour	20	Incremental	99.9th
PM_{10}	Approved Methods, NSW	24 hour	50	Cumulative	100th
	Approved Methods, NSW	Annual	30	Cumulative	100th
SO_2	Approved Methods, NSW	10 minute	712	Cumulative	100th
	Approved Methods, NSW	1 hour	570	Cumulative	100th
	Approved Methods, NSW	24 hour	228	Cumulative	100th
	Approved Methods, NSW	Annual	60	Cumulative	100th
Styrene	Odorous Air Pollutant, NSW	1 hour	120	Incremental	99.9th
Toluene	Odorous Air Pollutant, NSW	1 hour	360	Incremental	99.9th
	Air Toxic NEPM	24 hour	3,766	Cumulative	100th
	Air Toxic NEPM	Annual	377	Cumulative	100th
TSP	Approved Methods, NSW	Annual	90	Cumulative	100th
Xylenes	Odorous Air Pollutant, NSW	1 hour	190	Incremental	99.9th
	Air Toxic NEPM	24 hour	1,085	Cumulative	100th
	Air Toxic NEPM	Annual	868	Cumulative	100th

(a) The potency equivalency factors for specific PAHs applied in the current study are given in **Table 10**.
(b) WHO 2005 toxic equivalency factors are applied in calculating PCDD/F, as given in **Table 11**.
(c) Range given based on population density; refer to **Table 8**.

Polycyclic Aromatic Hydrocarbons (PAHs) are expressed as a Potency Equivalency, which is a numerical index that is used to compare toxicity of different PAHs. Benzo[a]pyrene is used as a marker for all PAHs and is assigned a Potency Equivalency factor (PEF) of 1.0. Other substances are then assigned PEFs that range from 0.01 to 21.8, expressing their potency relative to Benzo[a]pyrene. The OEH references Potency Equivalency Factors developed by the staffs of the California Air Resources Board and the Office of Environmental Health Hazard Assessment (CARB/OEHHA, 1994). The PEF of specific PAHs of interest in the current study are detailed in **Table 10**.

Table 10: Potency equivalency factor (PEF) for Specific PAHs

Pollutant	PEF	Reference
Benzo(a)pyrene	1	OEH(1)
Benzo(b)fluoranthene	0.1	OEH(1)
Benzo(k)fluoranthene	0.1	OEH(1)
Dibenz(a,h)anthracene	0.4	OEH(1)
Indeno(1,2,3-cd)pyrene	0.1	OEH[1]
Chrysene	0.01	OEH[1]
Benzo(a)anthracene	0.1	OEH[1]

Note 1: OEH, 2005, Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales

Polychlorinated dibenzo-p-dioxins and -furans (PCDD/F) typically occur as a mixture of several kinds of dioxins and dioxin-like compounds, each having its own degree of toxicity. To express the overall toxicity of such a mixture as a single number, reference is made to 'Toxic Equivalents'. The 'Toxic Equivalent' (TEQ) scheme weighs the toxicity of less toxic compounds as fractions of the toxicity of the most toxic (2,3,7,8-Tetrachloro-dibenzodioxin, TCDD). Each compound is attributed a specific Toxic Equivalency Factor (TEF), indicating its toxicity relative to 2,3,7,8-TCDD, which is given a reference value of 1. BSL is required to express its PCDD/F emission based on WHO (2005) TEFs. These TEFs are reproduced in **Table 11**. To calculate the total TCDD toxic equivalent (TEQ) of a dioxin mixture, the amounts of each toxic compound are multiplied with their TEF and then added together.

Table 11: Toxic Equivalence Factors (TEFs) for PCDD/Fs (WHO, 2005)

Substance	Toxic Equivalence Factor
Polychlorinated dibenzo-p-dioxins (PCDDs)	
2,3,7,8 tetrachlorodibenzodioxin (TCDD)	1
1,2,3,7,8 pentachlorodibenzodioxin (PeCDD)	1
1,2,3,4,7,8 hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,6,7,8 hexachlorodibenzodioxin (HxCDD)	0.1

Table 11: Toxic Equivalence Factors (TEFs) for PCDD/Fs (WHO, 2005)	
Substance	**Toxic Equivalence Factor**
1,2,3,7,8,9 hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,4,6,7,8 heptachlorodibenzodioxin (HpCDD)	0.01
octachlorodibenzodioxin (OCDD)	0.0003
Polychlorinated dibenzo-p-furans (PCDFs)	
2,3,7,8 tetrachlorodibenzofuran (TCDF)	0.1
1,2,3,7,8 pentachlorodibenzofuran (PeCDF)	0.03
2,3,4,7,8 pentachlorodibenzofuran (PeCDF)	0.3
1,2,3,4,7,8 hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,6,7,8 hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,7,8,9 hexachlorodibenzofuran (HxCDF)	0.1
2,3,4,6,7,8 hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,4,6,7,8 heptachlorodibenzofuran (HpCDF)	0.01
1,2,3,4,7,8,9 heptachlorodibenzofuran (HpCDF)	0.01
octachlorodibenzofuran (OCDF)	0.0003

3 Air Quality Monitoring Data Analysis

3.1 Monitoring Stations

Air quality data from BSL monitoring stations were analysed to summarise longer-term trends and to assess changes in air pollutant concentrations during the post-October 2011 period which may be associated with reduced production at the BSL facility.

Monitoring station locations are tabulated in **Table 12**, with the location of the BSL monitoring stations illustrated in **Figure 8**.

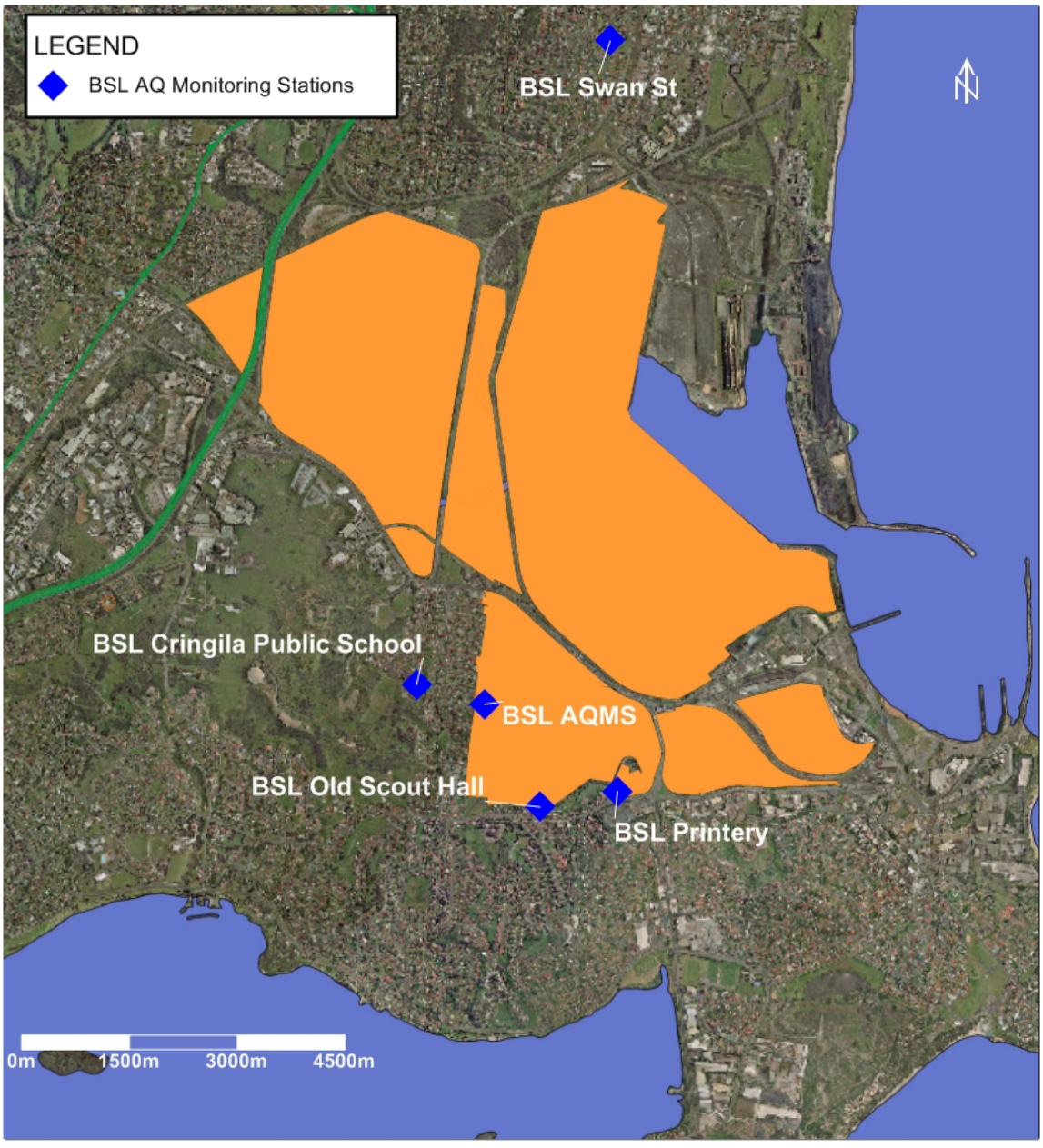
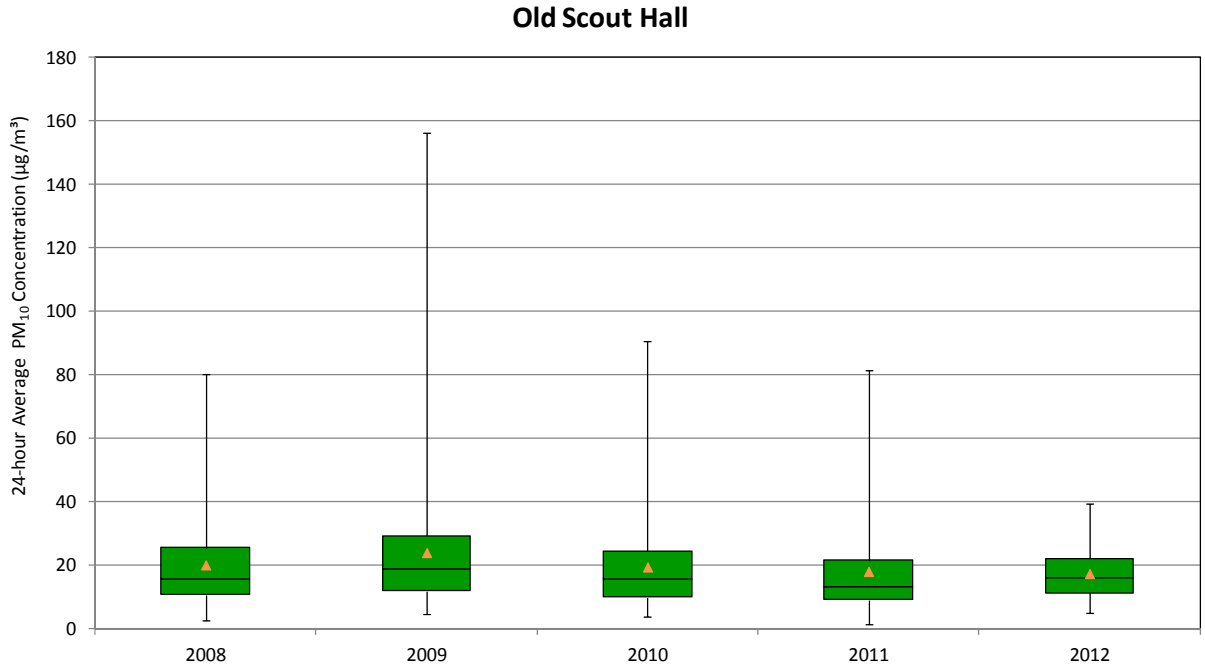


Figure 8. BSL Air Quality Monitoring Stations

Table 12. Ambient Air Quality Monitoring Stations			
Station	**Location (m, MGA56)**		**Pollutants Monitored**
	Easting	**Northing**	
BSL AQMS, Fitzgerald Street	304839	6183372	TSP
BSL Cringila Public School	304396	6183489	H_2S
BSL Swan Street, Wollongong	306769	6187512	TSP
BSL Printery	305693	6182805	TSP, Benzene, PAH
BSL Old Scout Hall	305210	6182702	TSP, PM_{10}, Benzene, PAH, H_2S

3.2 PM_{10} Concentrations

PM_{10} concentrations recorded at the BSL Old Scout Hall continuous monitoring station (TEOM) during the January 2008 to June 2012 period is illustrated in **Figure 9** with summary statistics provided in **Table 13**. The TEOM was offline between 11 August 2011 and 14 March 2012. Concentrations recorded during 2008, 2010 and 2011 are comparable. Higher concentrations were recorded during 2009, primarily as a result of regional dust storm events. Only three months of data were available for 2012 at the time of assessment (14 March to 30 June 2012).



Note: Top, middle and bottom lines of the boxes indicate 25th, 50th and 75th percentile; triangle indicates average while the top and bottom whiskers indicate the maxima and minima of the dataset.

2012 – includes only data from 14 March to 30 June 2012

Figure 9. Box and Whisker Plot for PM_{10} Concentrations for Old Scouts Hall (2008-2012)

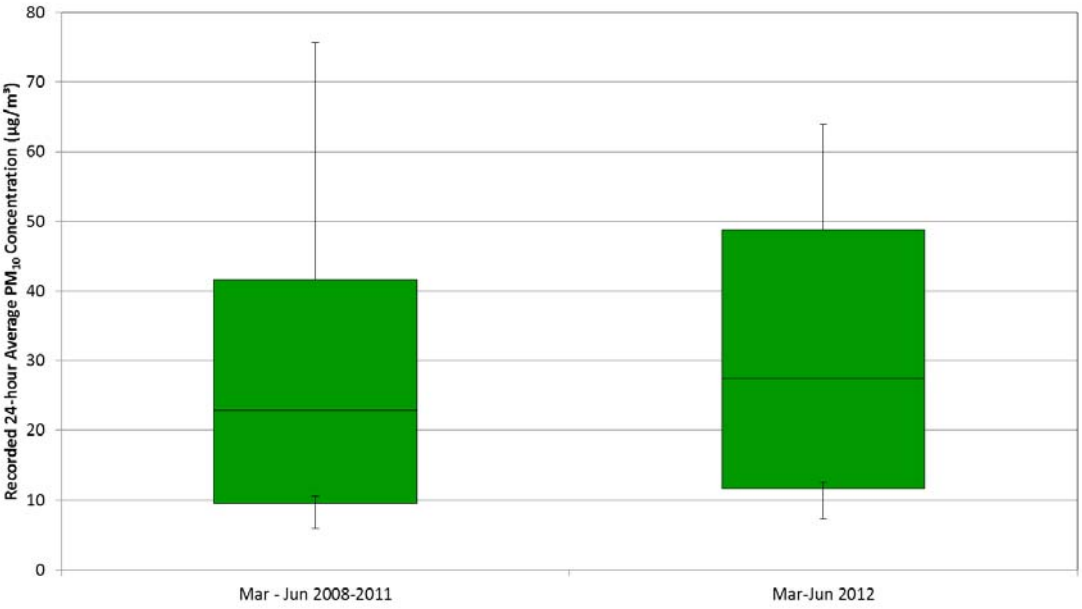
Table 13. Statistics for PM_{10} Concentrations Measured at BSL Old Scouts Hall					
	2008	**2009**	**2010**	**2011(a)**	**2012(b)**
Minimum (µg/m³)	2.7	4.8	4.0	1.4	4.9
Maximum (µg/m³)	80.4	156.2	90.5	81.4	39.5
Average (µg/m³)	20.2	24.0	19.5	18.1	17.4
25th Percentile (µg/m³)	10.7	11.9	10.0	9.1	11.4
Median (µg/m³)	15.5	18.9	15.5	13.2	16.0
75th percentile (µg/m³)	25.6	29.3	24.6	21.6	22.2
No. of days > 50 µg/m³	15	34	15	10	0
No. of data days	365	355	361	216	109
Data Completeness	100%	97%	99%	59%	30%

(a) January to 10 August 2012.

(b) March to 30 June 2012.

Post-October 2011 the BSL facility scaled down its production from 5.2 Mtpa to 2.6 Mtpa. To assess whether the reduction in ambient PM_{10} concentrations was evident within the monitoring data from the BSL Old Scouts Hall station, PM_{10} concentrations recorded during March to June 2012 were compared to concentrations measured in previous years. Summary statistics are presented in **Table 14** and illustrated in **Figure 10**. Overall average, median, 25th percentile and 75th percentile PM_{10} concentrations were higher during March to June 2012 compared to the March to June 2008 to 2011 period. However, fewer peak PM_{10} concentrations were evident during 2012 with no exceedances of the OEH 24-hour criterion of 50µg/m³, compared to 2 to 4 days exceeding during previous years.

Table 14. PM_{10} Concentration Statistics – BSL Old Scouts Hall (March – June)		
Statistics	**2008-2011**	**2012**
Minimum	3.6	4.3
Maximum	166.5	41.7
Average	16.7	17.3
25th Percentile	9.6	11.6
Median	13.3	15.7
No. of days > 50 µg/m³	2 days (2008) 4 days (2009) 2 days (2010)	0 days (2012)
75th percentile	18.8	21.5
Data Completeness	97.1%	88.5%



Note: Top, middle and bottom lines of the boxes indicate 25th, 50th and 75th percentile while the top and bottom whiskers indicate the maxima and minima of the dataset.

Figure 10. Comparison of PM_{10} Levels Recorded at BSL Old Scout Hall during March to June 2012 and March to June 2008-2011

Figure 11 illustrates the directional distribution of 10-minute average PM_{10} data from BSL Old Scouts Hall. Higher PM_{10} levels were generally recorded when the station was downwind from BSL operations, although less frequent peaks coincided with airflow from other sectors.

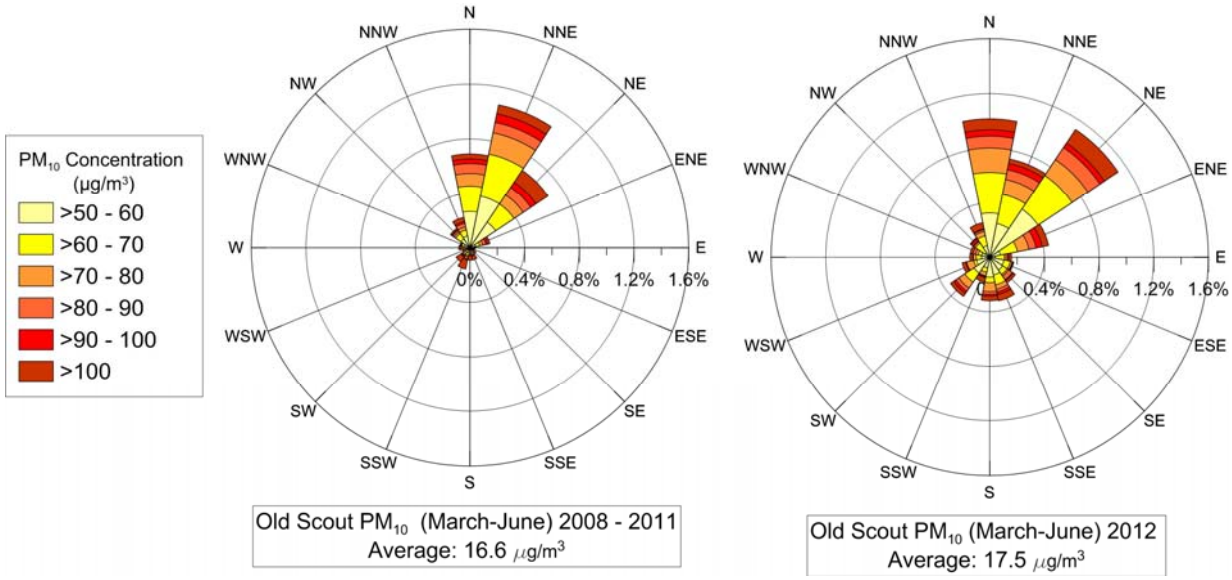


Figure 11. PM_{10} Pollution Roses – BSL Old Scout Hall

NOTE: PM_{10} data were only available for the March to June 2012 period on which to assess Post-October 2011 trends. During this time of the year, airflow is predominantly from the southwesterly quadrant (ref to **Figure 3**), with the BSL Old Scouts Hall monitoring station therefore being situated generally upwind of the BSL facility (**Figure 8**). The comparative analysis will be more effective if applied during summer and spring months during which time there is a higher frequently of northerly and northeasterly airflow (ref to **Figure 3**).

3.2.1 TSP

Monthly average TSP concentrations recorded at the four BSL AQMS, monitoring stations are illustrated in **Figure 12**, **Figure 13**, **Figure 15** and **Figure 14** for the period 2008 to 2012. Distinctly lower concentrations are recorded during the months of April to July across all years. At this time of the year, airflow is predominantly from the southwestern quadrant with the AQMS, Printery and Old Scouts Hall monitoring stations being situated generally upwind of the BSL facility.

Pre- and post-October 2011 TSP concentrations were compared to assess whether reductions in ambient TSP levels were apparent during the later period which coincided with downscaled operations at the BSL facility. For the pre-October 2011 period, TSP concentrations were averaged on a monthly basis for 2008 to 2010 years. Results are presented in **Figure 16**, **Figure 17**, **Figure 18** and **Figure 19**. During months when the prevailing wind was towards the monitoring stations, distinctly lower TSP concentrations were recorded during the post-October 2011 period with the exception of February 2012. Elevated TSP concentrations were recorded in February 2012 across all monitoring stations. The reason for the elevated concentrations is not known to the author.

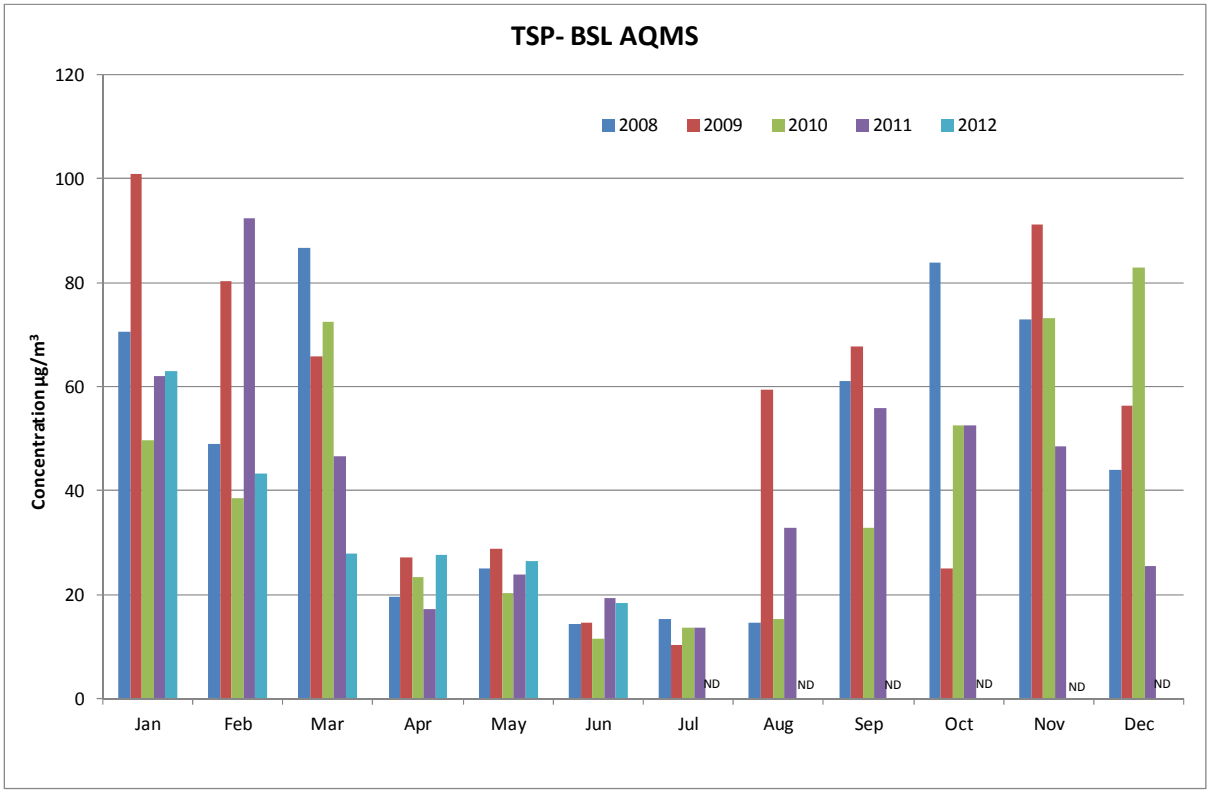


Figure 12. TSP Concentrations Recorded at BSL AQMS

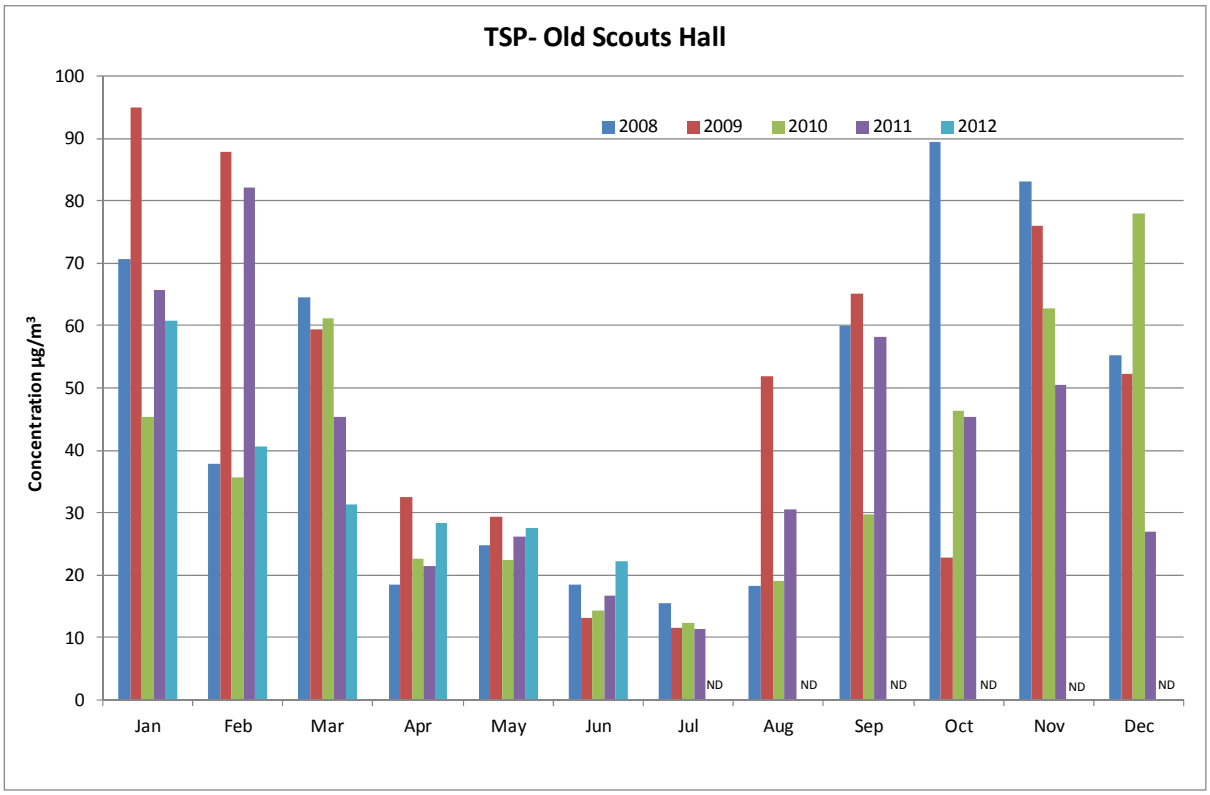


Figure 13. TSP Concentrations Recorded at BSL Old Scouts Hall Station

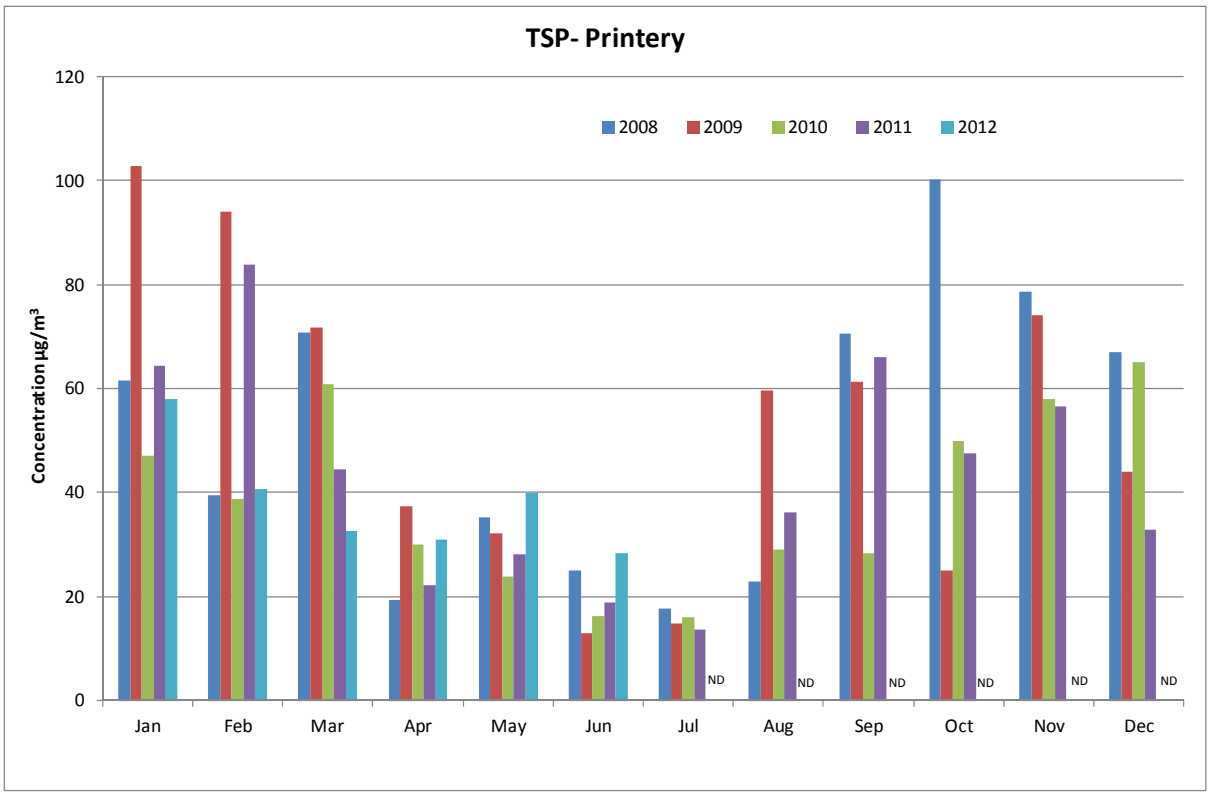


Figure 14. TSP Concentrations Recorded at BSL Printery Station

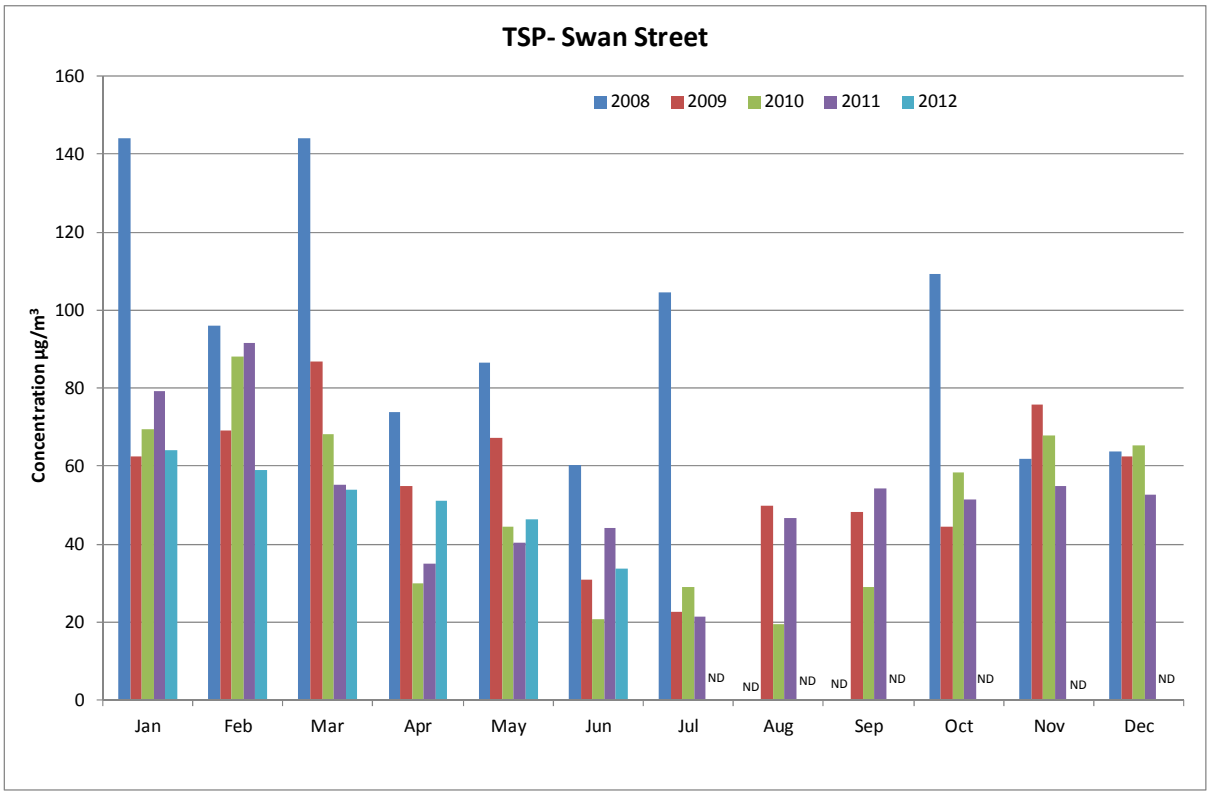


Figure 15. TSP Concentrations Recorded at BSL Swan Street Station

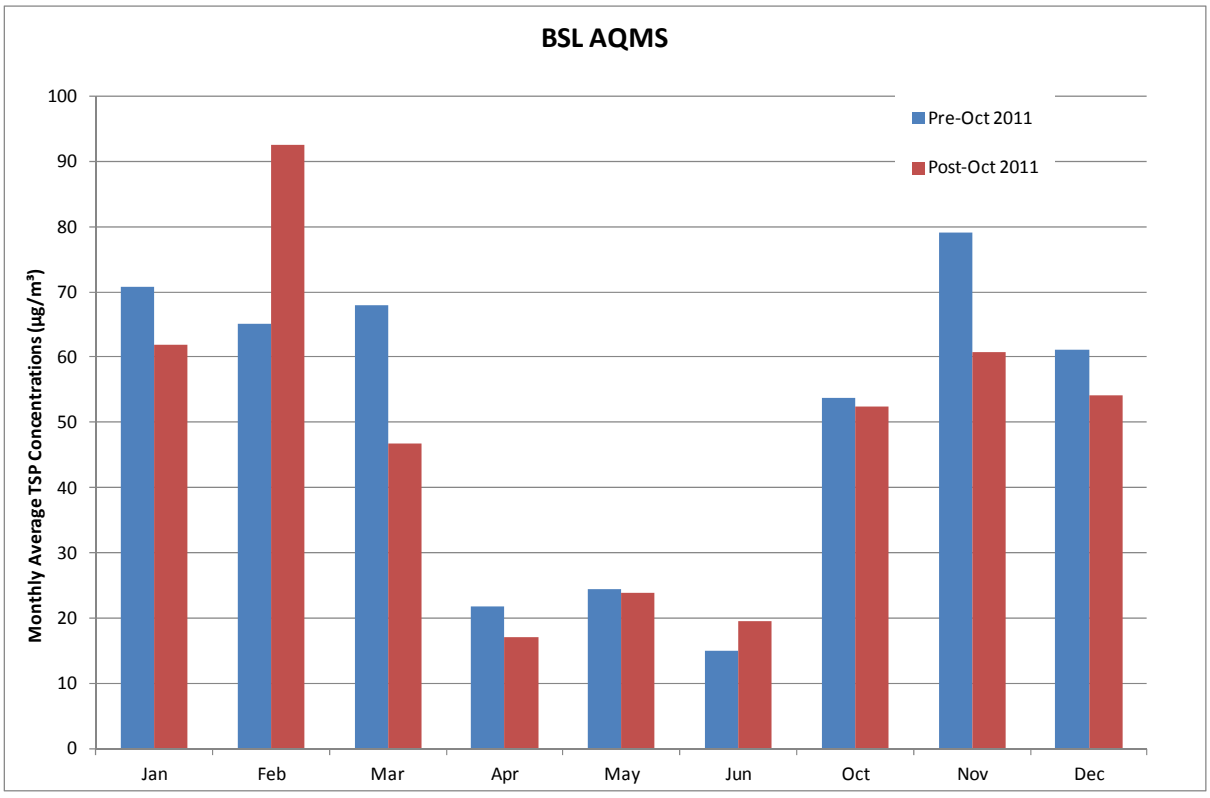


Figure 16. Pre- and Post-October 2011 TSP Concentrations Recorded at BSL AQMS

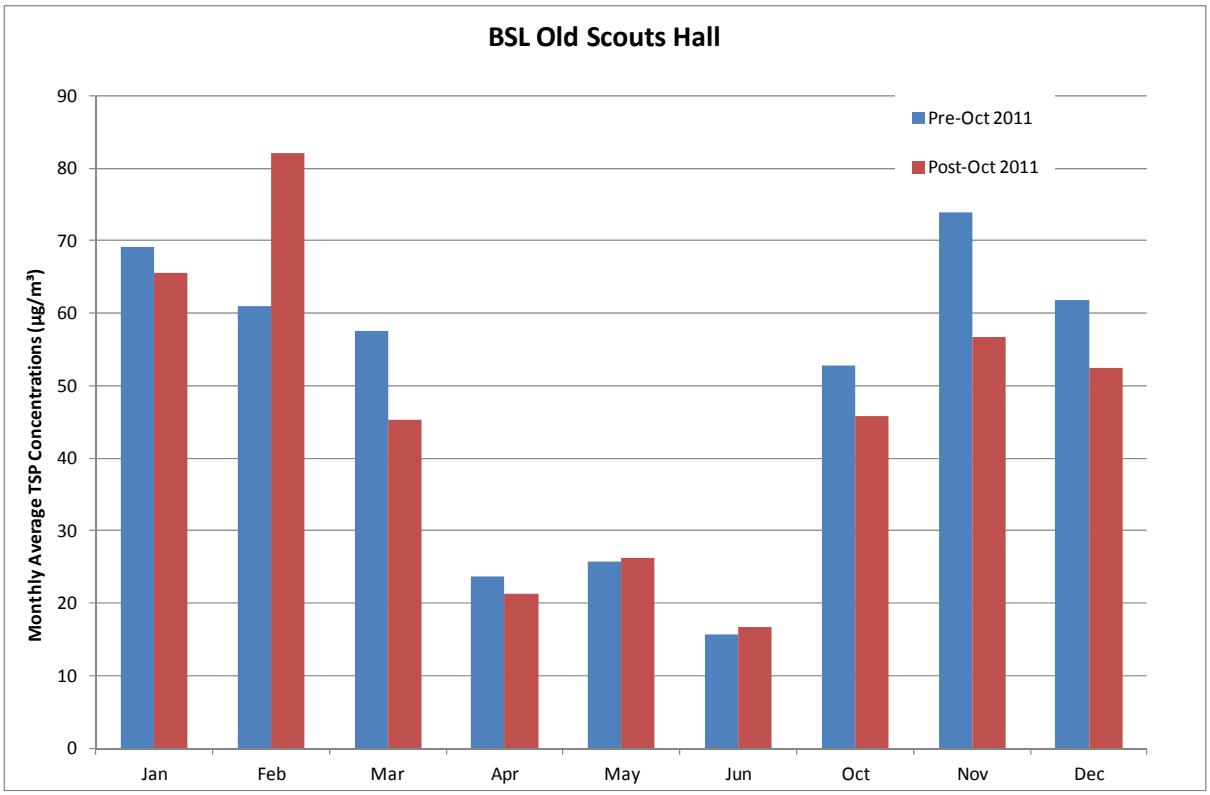


Figure 17. Pre- and Post-October 2011 TSP Concentrations Recorded at BSL Old Scouts Hall Station

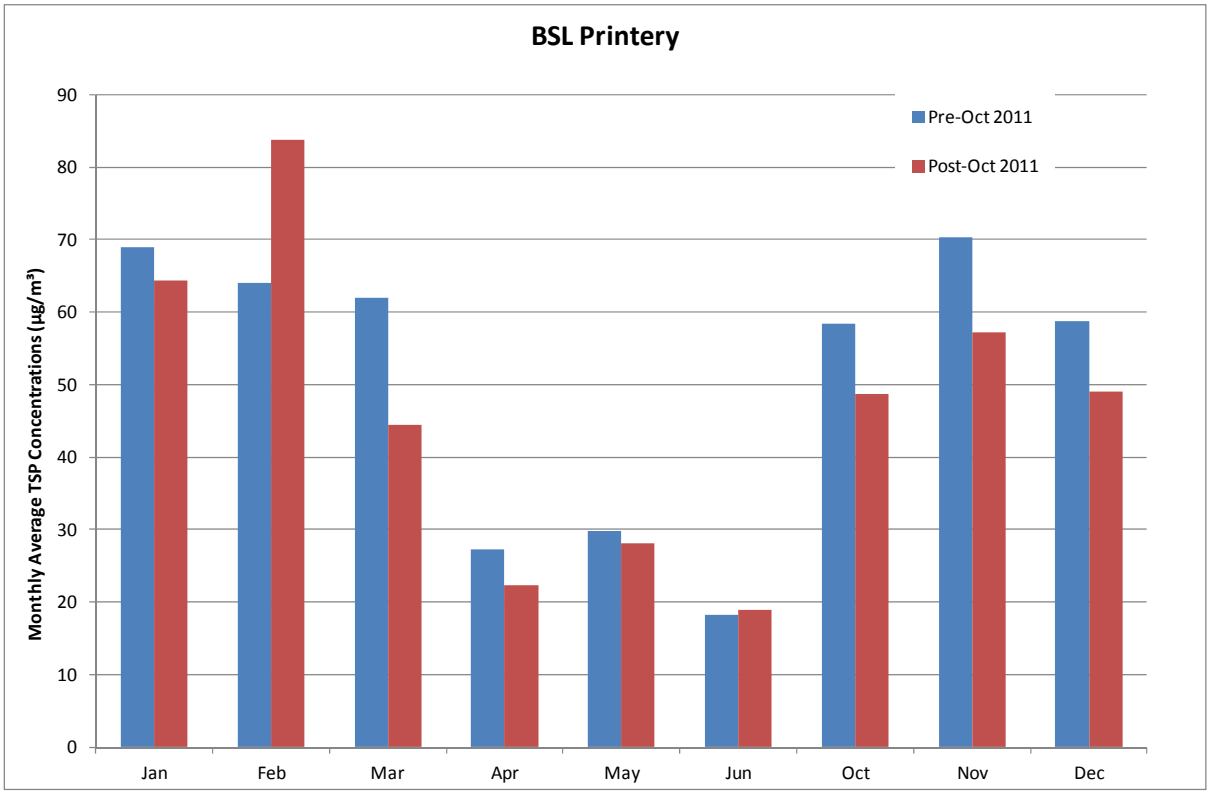


Figure 18. Pre- and Post-October 2011 TSP Concentrations Recorded at BSL Printery Station

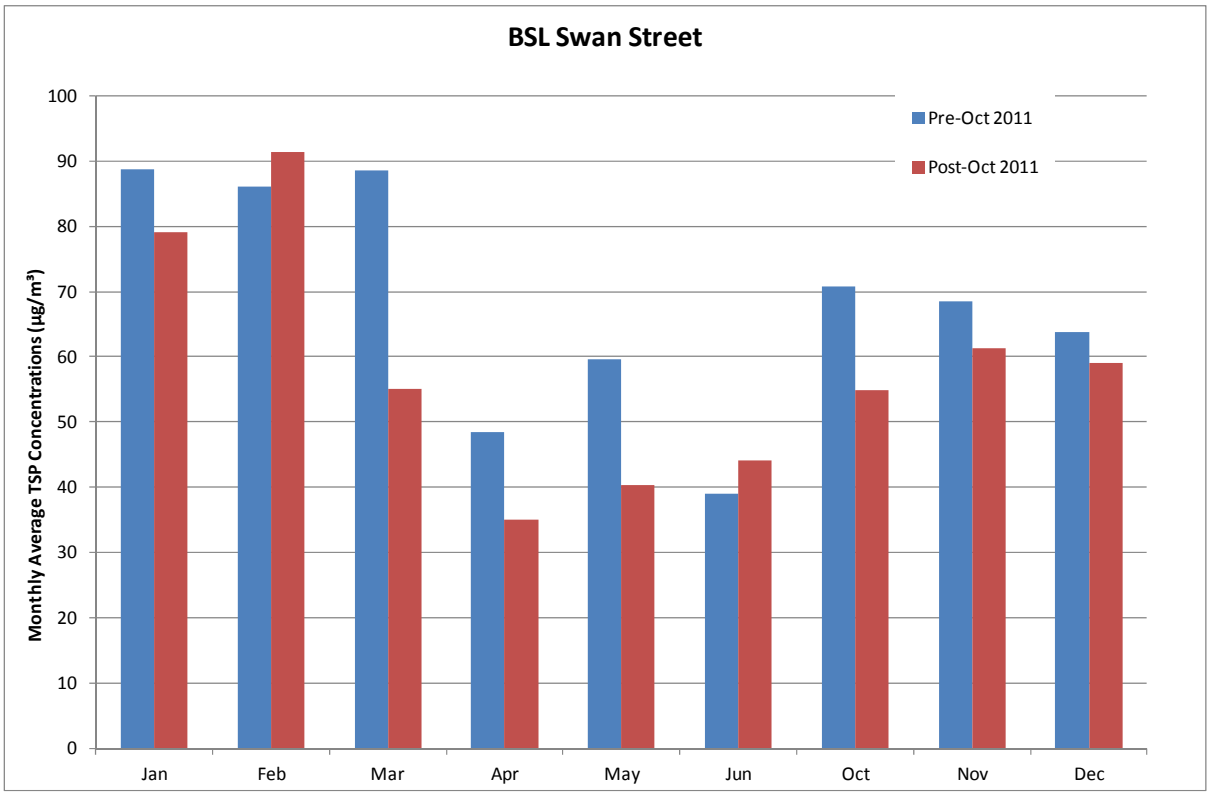


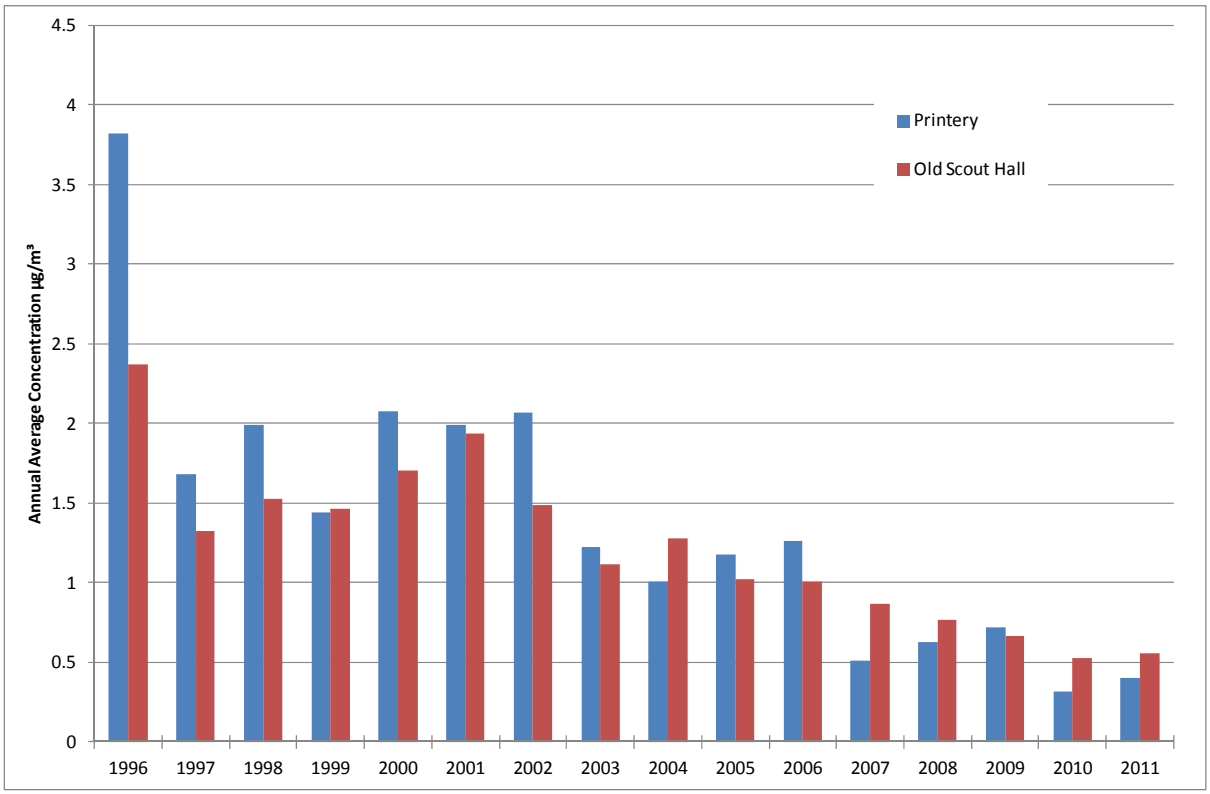
Figure 19. Pre- and Post-October 2011 TSP Concentrations Recorded at BSL Swan Street Station

3.2.2 Benzene Concentrations

24-hour average benzene concentrations are measured at the Old Scout Hall and Printery stations on a one-in-six-day sampling cycle. Annual average benzene concentrations recorded during the 1996 to 2011 period are illustrated in **Figure 20**.

Ambient benzene concentrations have been gradually decreasing since 2001, with concentrations measured since 2010 being significantly below the NEPM monitoring investigation level of 10 µg/m³.

It is notable that the benzene concentrations recorded at the Printery and Old Scout Hall stations are below the average benzene concentrations recorded generally at roadside monitoring stations (3.2 µg/m³) (NEPC, 2010).



NEPM Monitoring Investigation Level for Annual Average Benzene = 10 µg/m³

Figure 20. Annual Average Benzene Concentrations – BSL Printery and Old Scout Hall

Taking into account historical trends in benzene concentrations, attention was paid to more recent measurements (2008-2012) to assess potential trends arising due to production changes at the BSL facility. October 2011 to June 2012 benzene concentrations were compared to concentrations measured during the previous year (October 2010 to June 2011). Average benzene concentrations recorded at the Printery monitoring station during the 2011/2012 period (0.4 µg/m³) were comparable to the average concentration recorded during 2010/2011 (0.42 µg/m³). Marginally higher benzene concentrations were recorded at the Old Scout Hall station during 2011/2012 (0.63 µg/m³) compared to the 2010/2011 average (0.58 µg/m³).

3.2.3 Hydrogen Sulphide

Negative values were apparent in the H_2S monitoring data sets. Based on the analysis of these data sets it was determined that such negatives do not coincide with significant negative spikes indicative of potential instrument error. Rather the negative values are likely to coincide with periods of very low ambient concentration, with the negative values being generally within the uncertainty range typical of H_2S analysers.

There are three methods of dealing with such negative data points: (i) removing all negative data; (ii) replacing the negative data with zero; or (iii) retaining the negative values. The first method artificially increases the ambient concentration significantly. The second method also increases the ambient concentrations, albeit by a lesser amount, and is therefore also conservative (i.e. likely to give an upper bound approximation of concentrations). The third

method is expected to provide a lower bound approximation of concentrations. For the purpose of the current study, the second method was adopted with negative values being replaced with zeros.

It is noted that the applicable standard for H_2S sampling requires instrumentation accuracy to be ±5ppb. The instrumentation installed around BSL has an accuracy to ±3ppb. About 90% of the H_2S values recorded at Old Scouts Hall and Cringila Public School are within the ±3ppb range. It is therefore apparent that that the bulk of the data recorded is within the "noise" levels of the instrument. The analysis thus focuses primarily on trends in peak H_2S concentrations likely to be due to BSL sources. Given that the OEH odour criterion is expressed for a 1-second averaging period with a threshold level within the noise of the instrumentation, the analysis focused on the WHO 30-minute average odour criterion with reference also made to the California acute reference exposure level.

The percentage of the time that the WHO 30-minute average odour criterion of 7 µg/m³ was calculated to have been exceeded during the January 2008 to June 2012 period is tabulated in **Table 15**. The California EPA 1-hour odour criterion of 42 µg/m³ was only exceeded once at Old Scouts Hall during 2010, and one to two hours across monitoring stations during 2011.

Table 15. Frequency of Exceedance of H_2S Air Quality Criteria

	% of Time 30-minute Average H_2S Concentrations Exceeds the WHO 30-minute average odour criterion of 7 µg/m³		
	BSL Old Scout Hall	**BSL Cringila Public School**	**BSL WinTV**
2008	3.5	1.4	0.3
2009	2.2	0.7	0.0
2010	2.8	1.7	0.0
2011	1.1	0.9	0.0
2012 (Jan to June)	0.1	0.0	ND
	No. of Hours H_2S Concentrations Exceed the California Acute Reference Exposure Limits of 42 µg/m³		
	BSL Old Scout Hall	**BSL Cringila Public School**	**BSL WinTV**
2008	0	0	0
2009	0	0	0
2010	1	0	0
2011	2	1	1
2012 (Jan to June)	0	0	0

The frequency of exceedance of the WHO odour criterion is illustrated for the Pre- and Post-October 2011 periods to assess whether reductions in ambient levels were apparent during the later period which coincided with downscaled operations at the BSL facility. Greater frequencies of exceedance during the Pre-October 2011 period (comprising data from January 2008 to October 2011) coincided with spring and summer months during which time the monitoring stations are downwind of BSL operations for a greater amount of time (refer to **Figure 3**). Significantly lower exceedances where noted to occur during the Post-October 2011 period at both monitoring stations.

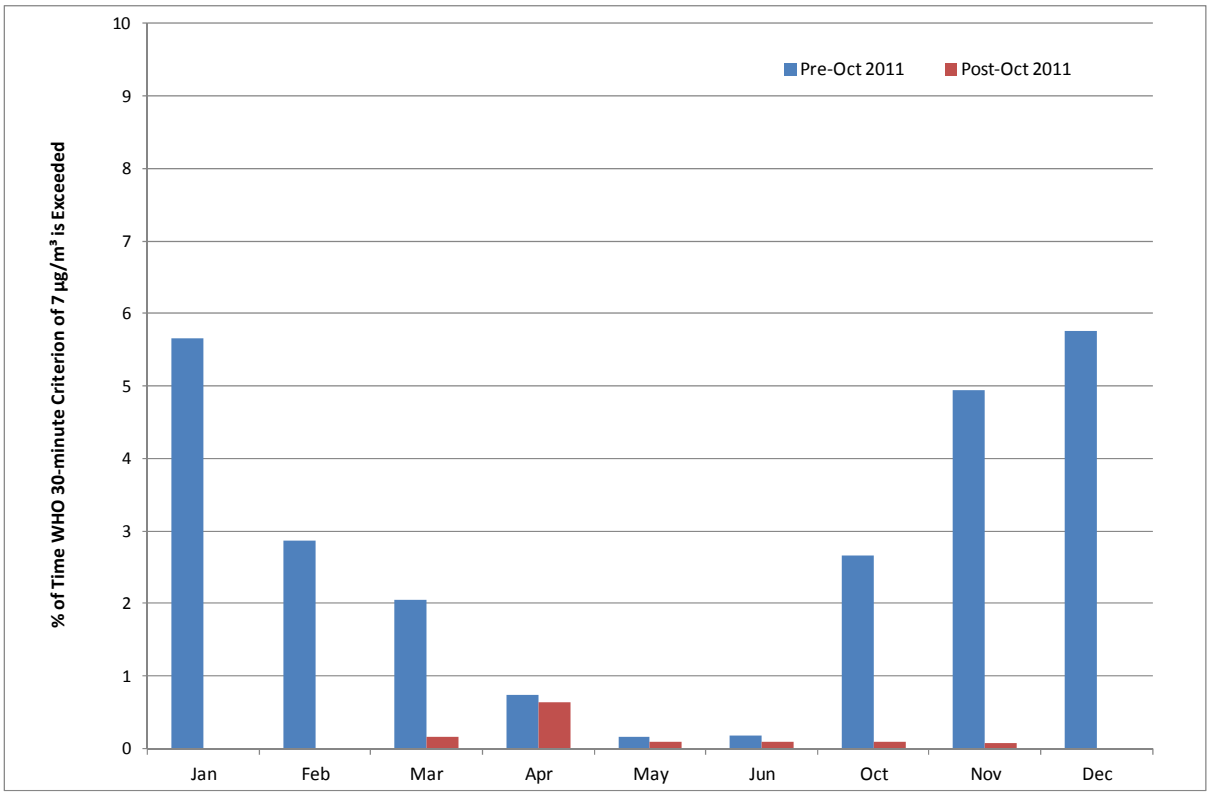


Figure 21. Percentage of Time the WHO 30-minute Odour Criterion for H_2S is Exceeded Pre- and Post-October 2012 at BSL Old Scout Hall

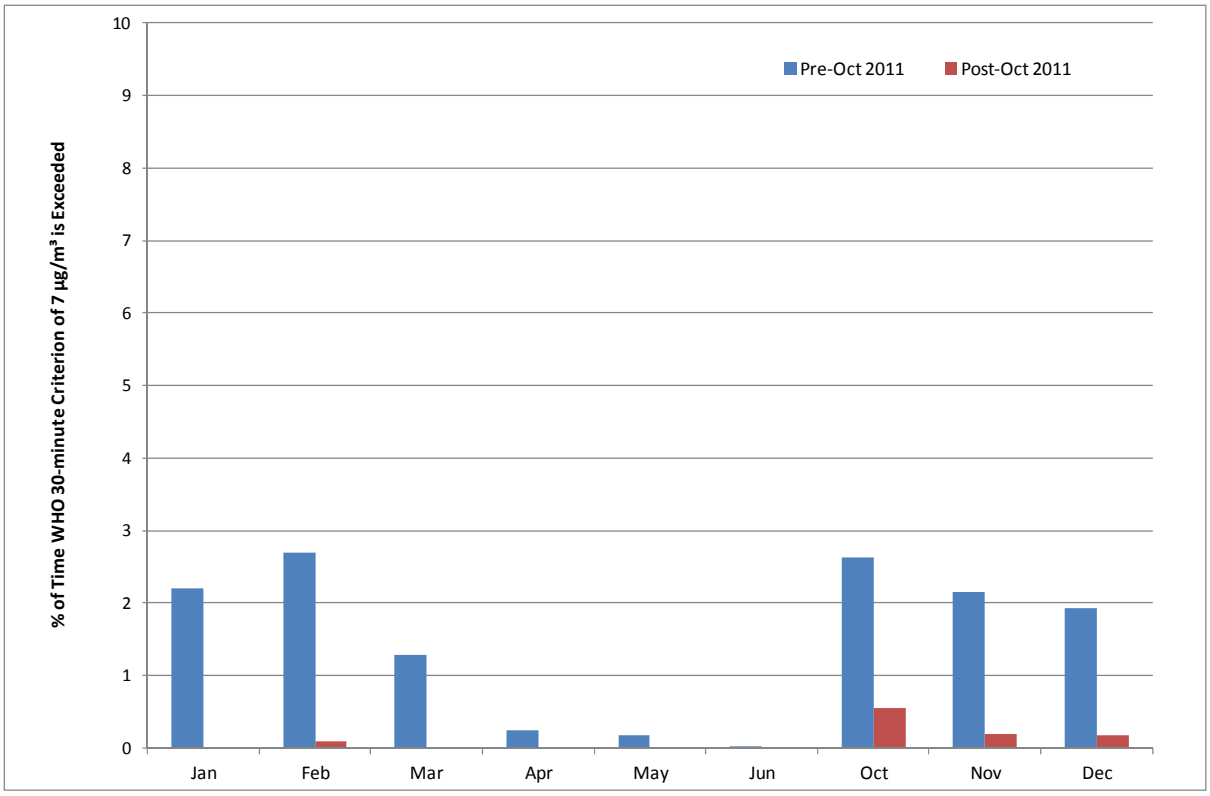


Figure 22. Percentage of Time the WHO 30-minute Odour Criterion for H_2S is Exceeded Pre- and Post-October 2012 at BSL Cringila Public School

3.2.4 Total Polycyclic Aromatic Hydrocarbons

24-hour average ambient concentrations of total PAHs were monitored at the Old Scout Hall and Printery stations on a one-day-in-six sampling. Annual average total PAH concentrations recorded during the 1990 to 2011 period are illustrated in **Figure 23**. Ambient PAH concentrations have been gradually decreasing over the past decade, with concentrations measured since 2007 being below 4 ng/m³ at both stations.

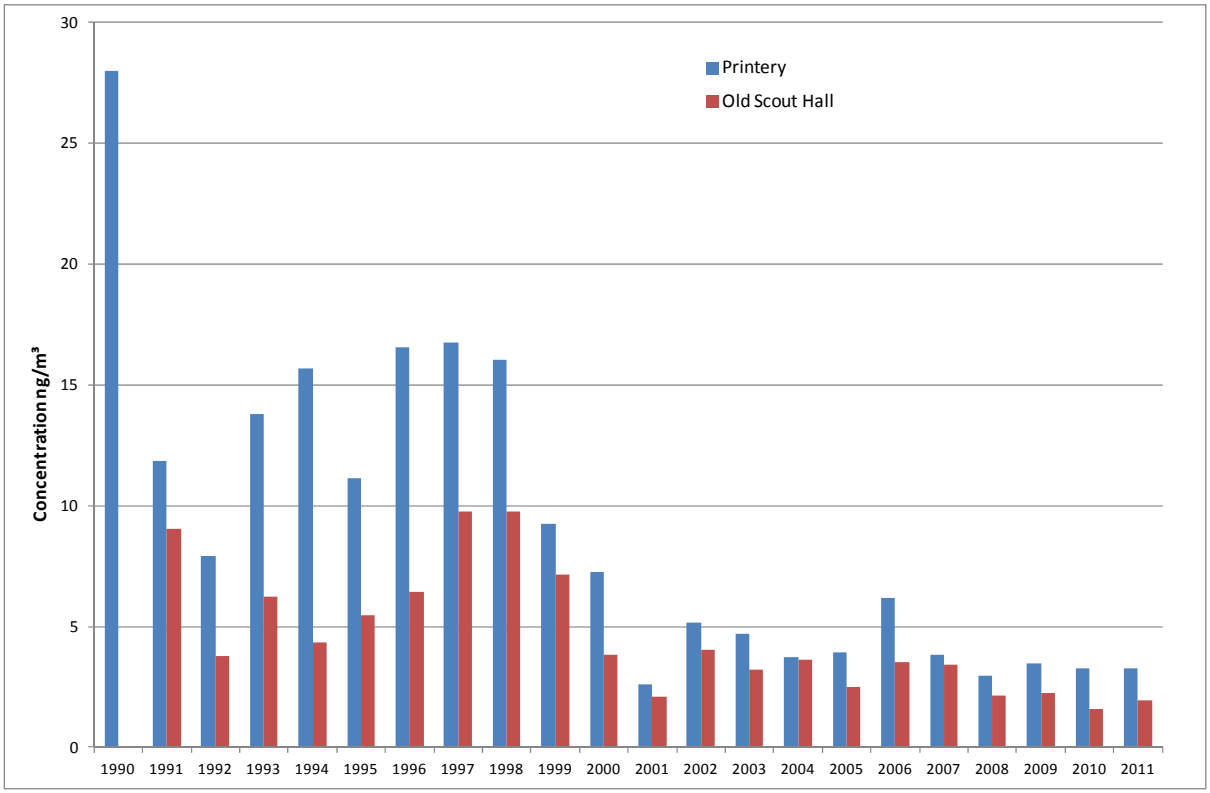


Figure 23. Annual Average total PAH Concentrations – BSL Printery and Old Scout Hall

Taking into account historical trends in PAH concentrations, attention was paid to more recent measurements (2008-2012) to assess potential trends arising due to production changes at the BSL facility. October 2011 to June 2012 total PAH concentrations were compared to concentrations measured during the previous years (Jan 2008 to October 2011) (**Figure 24**, **Figure 25**). Generally lower total PAH concentrations were recorded at both stations during summer and spring months when both stations were more frequently downwind of the BSL facility.

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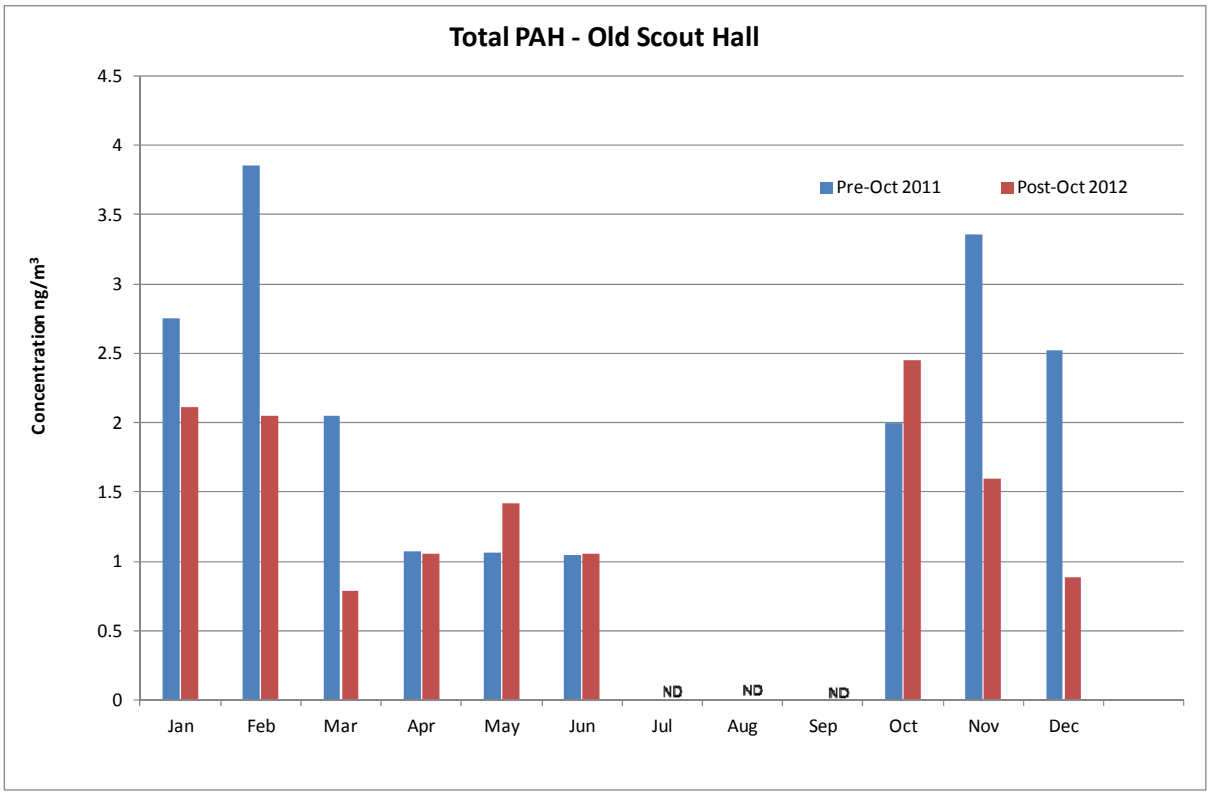

Figure 24. BSL Old Scout Hall - Monthly-average Total PAH during Pre-Oct 2011 (based on 2008 to Oct 2011 data) and Post-Oct 2011 (Oct 2011 to June 2012 data)

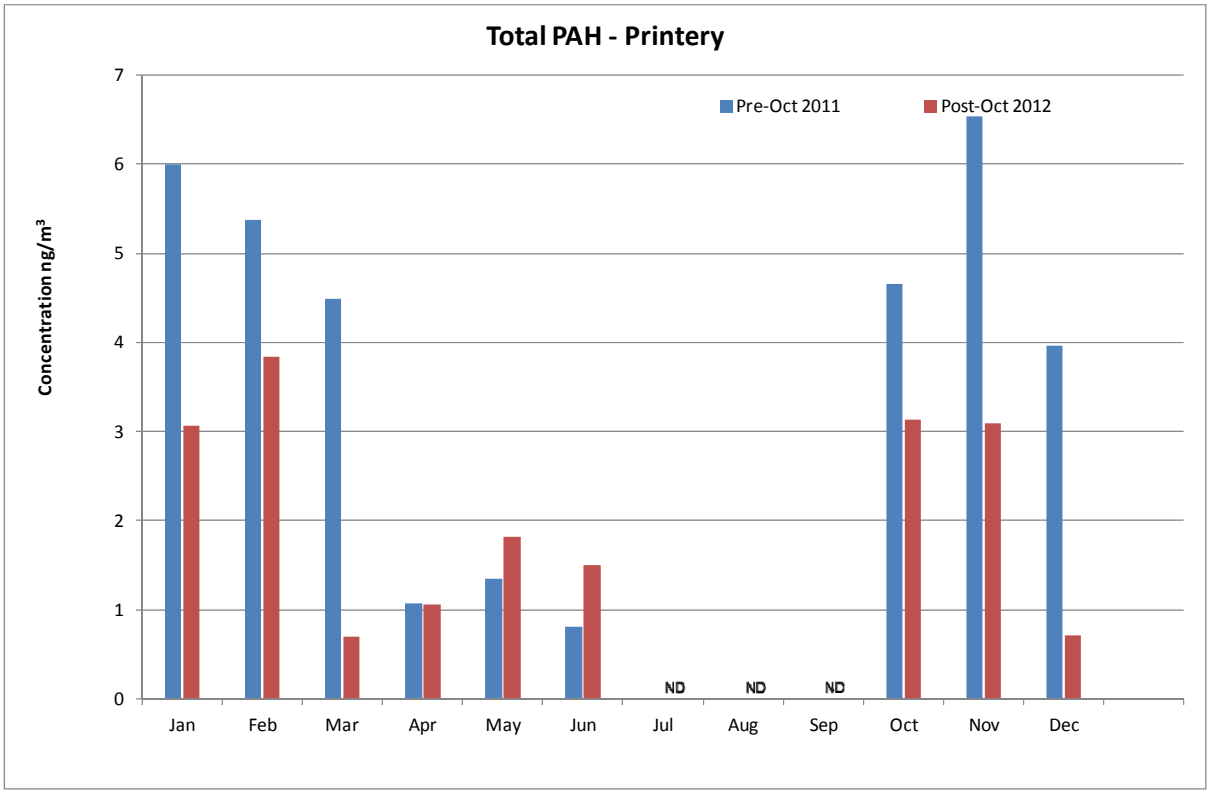

Figure 25. BSL Printery - Monthly-average Total PAH during Pre-Oct 2011 (based on 2008 to Oct 2011 data) and Post-Oct 2011 (Oct 2011 to June 2012 data)

3.2.5 Benzo[a]pyrene Equivalent

24-hour average ambient concentrations of 12 speciated PAHs are monitored at the Old Scout Hall and Printery stations on a one-day-in-six sampling. The speciated PAHs recorded at these two locations are as follows:

- Anthracene;
- Benzo[a]anthracene;
- Benzo[a]pyrene;
- Benzo[b]fluoranthene;
- Benzo[g,h,i]perylene;
- Benzo[k]fluoranthene;
- Chrysene;
- Dibenz[a,h]anthracene;
- Fluoranthene;
- Indeno[1,2,3-c,d]pyrene;
- Phenanthrene; and
- Pyrene.

Speciated concentrations are measured using high performance chromatography using method EHL-18, which is a BSL in-house method. This in-house method was approved for use by the OEH on 8 September 1995 (reference EPA169/95).

From the 12 speciated PAHs monitored, those that have a Potency Equivalency Factor listed in Table 7.2(c) OEH Approved Methods were multiplied by their respective concentrations and summed to obtain a BaP equivalent value.

October 2011 to June 2012 BaP Equivalent were compared to concentrations measured during the previous years (Jan 2008 to October 2011) (**Figure 26, Figure 27**). Generally lower total BaP Equivalent concentrations were recorded at both stations during summer and spring months when both stations were more frequently downwind of the BSL facility.

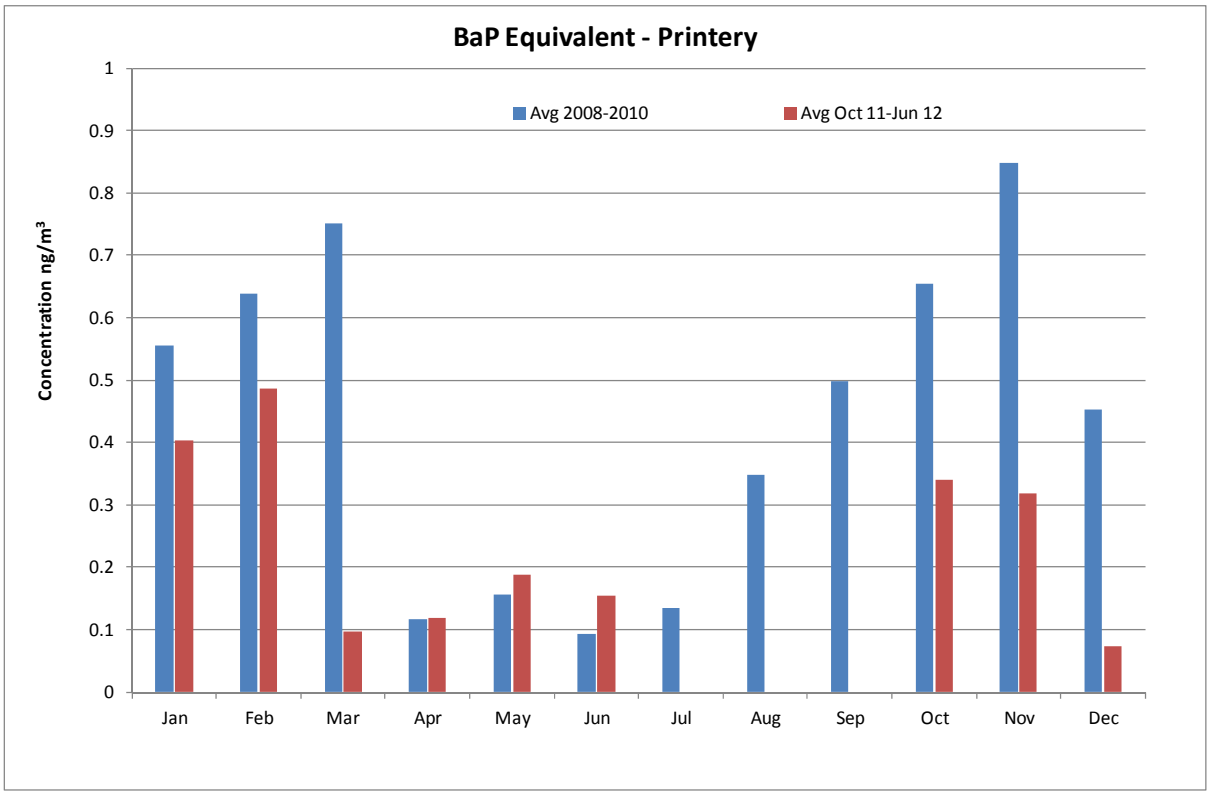

Figure 26. BSL Printery – Pre- and Post-October 2011 Trends in BaP Equivalent

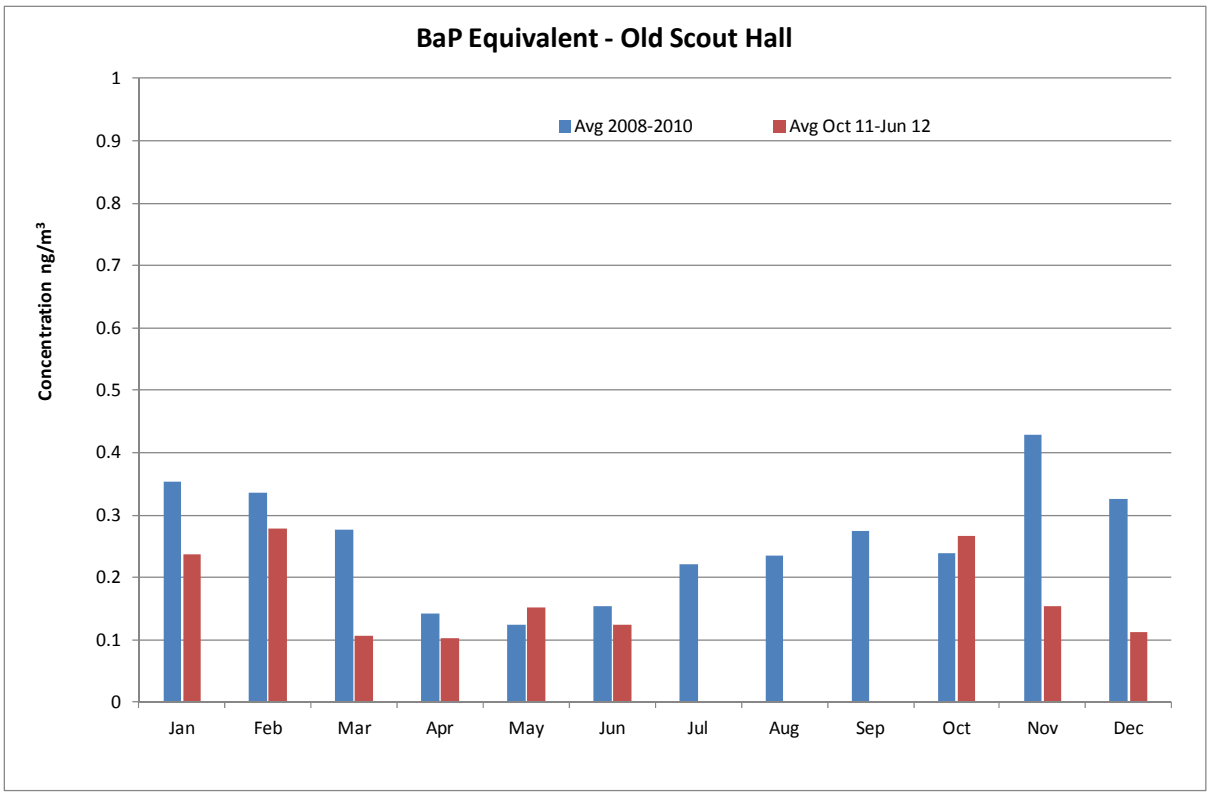

Figure 27. BSL Old Scout Hall – Pre- and Post-October 2011 Trends in BaP Equivalent

3.2.6 Benzo[a]pyrene

Annual average benzo[a]pyrene concentrations recorded during the 1990 to 2011 period are illustrated in **Figure 28**. Ambient concentrations have been decreasing over the past decade, with the NEPM Monitoring Investigation Level of 0.3 ng/m³ not measured to have been exceeded at either station from 2008 onwards.

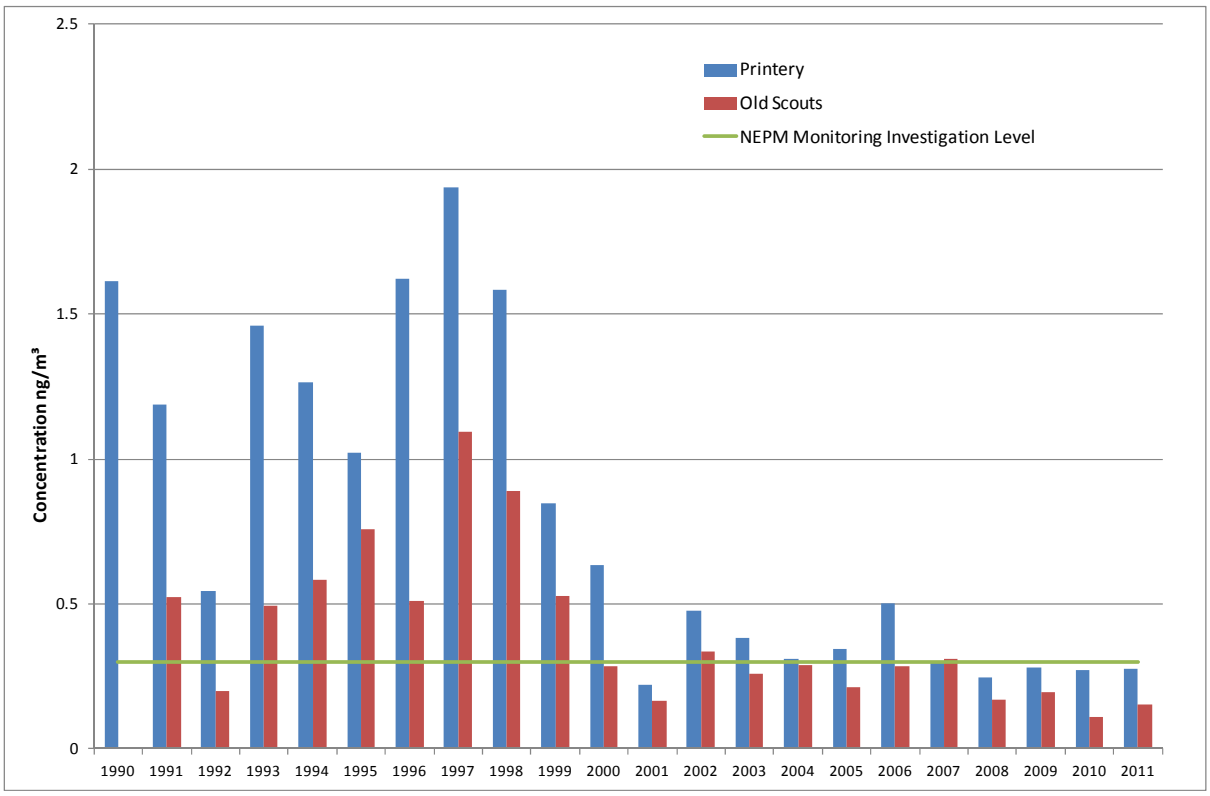

Figure 28. Annual Average total beno[a]pyrene Concentrations – BSL Printery and Old Scout Hall

October 2011 to June 2012 BaP Equivalent were compared to concentrations measured during the previous years (Jan 2008 to October 2011) (**Figure 29, Figure 30**). Generally lower total BaP concentrations were recorded at both stations during summer and spring months when both stations were more frequently downwind of the BSL facility.

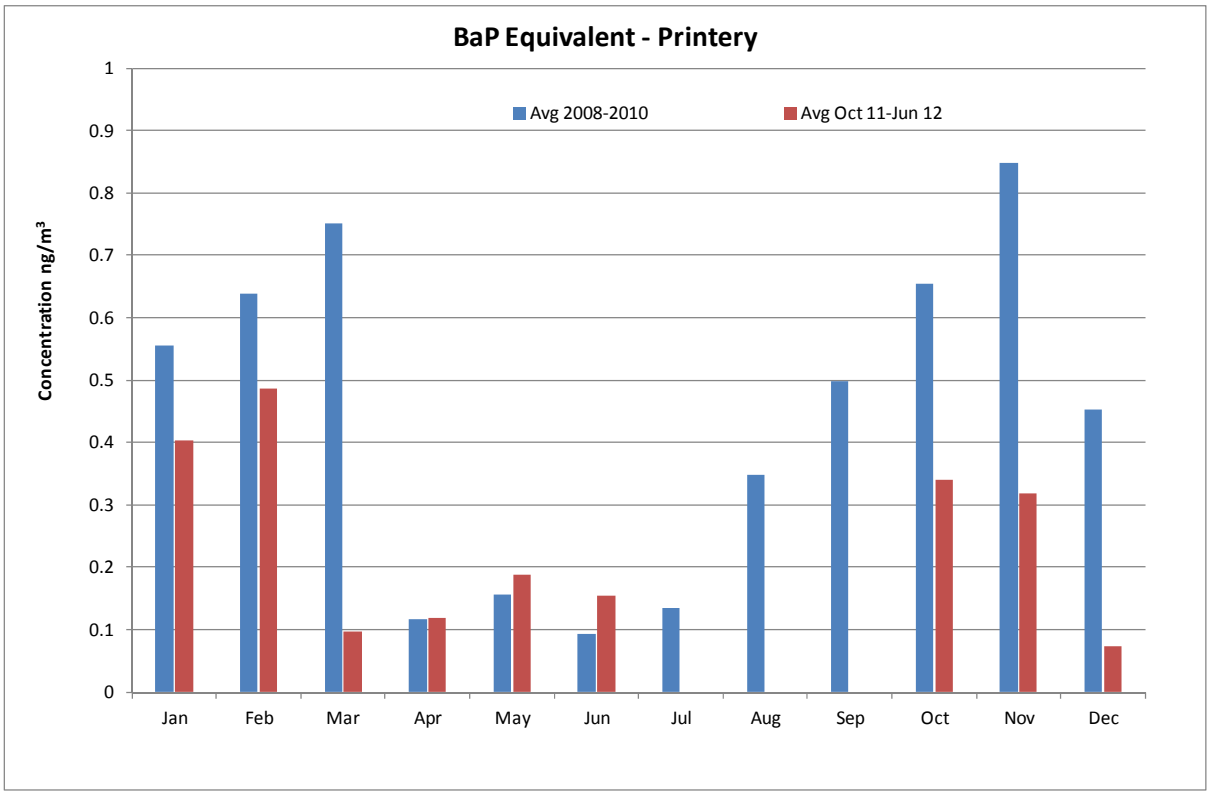

Figure 29. BSL Printery – Pre- and Post-October 2011 Trends in BaP

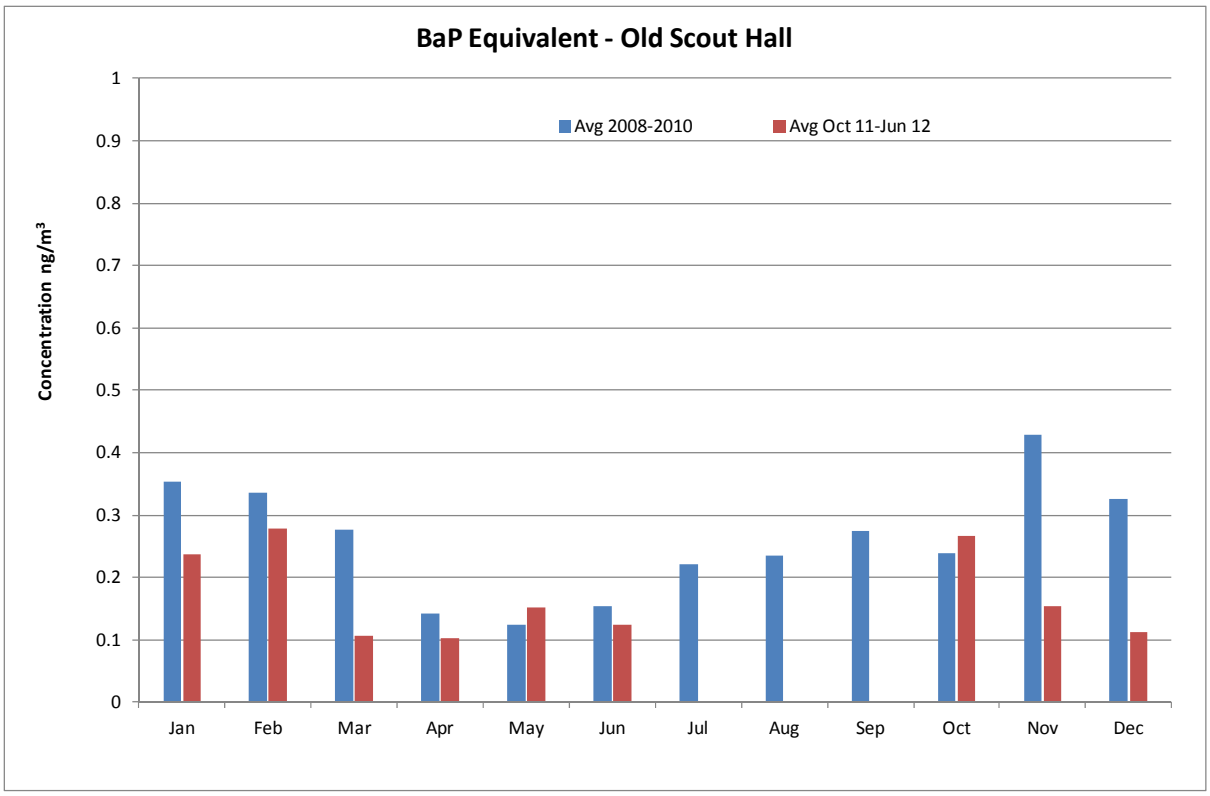

Figure 30. BSL Old Scout Hall – Pre- and Post-October 2011 Trends in BaP

4 Emissions Inventory

The BSL Port Kembla facility comprises a number of stack emissions, flare emission sources, fugitive releases from buildings and diffuse releases from outdoor sources. A comprehensive emissions inventory was compiled for the facility, as documented in ENVIRON (2009) and ENVIRON (2010). This emissions inventory was based on stack monitoring data undertaken either during or prior to 2007, and emission estimates calculated through the application of emission factors based on 2007 raw material inputs and production data. During 2007 the facility produced 5.2 Mtpa molten steel.

The 2007 Emissions Inventory underpinning the Site Air Model for PRP131 required a number of assumptions and the use of reference data from the US-EPA AP42 data base. Subsequently, BSL reviewed the basis for the current model and identified potential opportunities for sampling and testing of plant emissions to either validate or improve the reference data used. Additional stack monitoring data were also obtained for use in a revised emissions inventory.

4.1 Revised 5.2 Mtpa Emissions Inventory

A revised 5.2 Mtpa production emissions inventory was compiled integrating additional stack monitoring data from the pre-October 2011 period, and taking into account validation test results as discussed in **Appendix B**. A summary of the additional data referenced and other changes incorporated in the compilation of the revised 5.2 Mtpa emissions inventory is given in **Table 16**.

Table 16: Summary of additional data referenced for revised 5.2 Mtpa emissions inventory

Type	Source ID	Source Description	Summary of Additional Data
Stack	EPA_002	Sinter Machine Room Dedusting Stack	Stack monitoring data from 2009, 2010 and 2011 (pre Oct 2011)
Stack	EPA_010	No 5 Blast Furnace - No 2 Slag Granulator Stack	Stack monitoring data for H2S from May and Sep 2011
Stack	EPA_011	No 5 Blast Furnace - No 1 Slag Granulator Stack	Stack monitoring data for H2S from May and Sep 2011
Stack	EPA_128	No 5 Blast Furnace - No 3 Slag Granulator Stack	New stack. Reference made to Stack monitoring data for H2S from May and Sep 2011 for EPA10.
Stack	EPA_013	No 4 Coke Oven Battery Heating Stack	Stack monitoring data from 2009, 2010 and 2011 (pre Oct 2011); PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_014	No 5 Coke Oven Battery Heating Stack	Stack monitoring data from 2009, 2010 and 2011 (pre Oct 2011); PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_015	No 6 Coke Oven Battery Heating Stack	Stack monitoring data from 2009, 2010 and 2011 (pre Oct 2011); PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_016	No 7a Coke Oven Battery Heating Stack	Stack monitoring data from 2009, 2010 and 2011 (pre Oct 2011); PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_018	No 4/5 Coke Oven Battery Quench Tower Stack	Stack monitoring data from 2009, 2010 and 2011 (pre Oct 2011); PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_019	No 6 Coke Oven Battery Quench Tower Stack	Stack monitoring data from 2009, 2010 and 2011 (pre Oct 2011); PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_020	No 7a Coke Oven Battery Quench Tower Stack	Stack monitoring data from 2009, 2010 and 2011 (pre Oct 2011); PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_024	BOS No 1 Vessel Flare Stack	Stack monitoring data from 2010 and 2011 (pre Oct 2011); PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_025	BOS No 2 Vessel Flare Stack	Stack monitoring data from 2010 and 2011 (pre Oct 2011); PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_026	BOS No 3 Vessel Flare Stack	Stack monitoring data from 2010 and 2011 (pre Oct 2011); PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_027	BOS No 2 Secondary Dedusting Stack	PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_028	BOS No 3 Secondary Dedusting Stack	PCDD/F calculated based on WHO 2005 TEFs

Table 16: Summary of additional data referenced for revised 5.2 Mtpa emissions inventory

Type	Source ID	Source Description	Summary of Additional Data
Stack	EPA_030	Lime Kiln Waste Heat Stack	PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_037	No 2 Blower Station 21/22 Boiler Stack	PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_038	No 2 Blower Station 23 Boiler Stack	PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_039	No 2 Blower Station 24 Boiler Stack	PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_040	No 2 Blower Station 25 Boiler Stack	PCDD/F calculated based on WHO 2005 TEFs
Stack	EPA_048	3500mm Furnace No 1 Stack	Stack monitoring data from 2011 (pre Oct 2011)
Stack	EPA_049	3500mm Furnace No 2 Stack	Stack monitoring data from 2011 (pre Oct 2011)
Stack	EPA_104	No 6 Blast Furnace - Slag Granulator Stack	Additional stack monitoring data for H2S
Stack	EPA_107	Sinter Plant Waste Gas Cleaning	PCDD/F calculated based on WHO 2005 TEFs
Fugitive	SINTC	Sinter Cooler Fugitive Emissions	PM monitoring data from within the sinter cooler building during 2010
Fugitive	MRP	Recycling Area - Metal Recovery Plant	Comparison made to validation testing data
Fugitive	CSP	Recycling Area - Crushing/Screening Plants	Comparison made to validation testing data
Fugitive	SP05	Springhill 5 (MCL1 Selas Stack)	Average SO2 and NOx Emission Concentration based 3 years of Stack Monitoring Reports
Fugitive	SP06	Springhill 6 (MCL2 Selas Stack)'	Average SO2 and NOx Emission Concentration based 3 years of Stack Monitoring Reports
Fugitive	SP07	Springhill 7 (MCL2 Selas Stack)	Average SO2 and NOx Emission Concentration based 3 years of Stack Monitoring Reports
Fugitive	SP11	Springhill 11 (MCL1 Resin Coater Exhaust)	Source removed as stack is within the building. Emissions accounted for through addition of 'Springhill building fugitives' volume source
Fugitive	SP12	Springhill 12 (CPL3 Prime Oven Incinerator)	Average TPM, SO2 and NOx Emission Concentration based 3 years of Stack Monitoring Reports. PM10 assumed to be equivalent to TPM.
Fugitive	SP13	Springhill 13 (CPL3 Finish Oven Incinerator)	Average TPM, SO2 and NOx Emission Concentration based 3 years of Stack Monitoring Reports. PM10 assumed to be equivalent to TPM.
Fugitive	SP15	Springhill 15 (CPL3 Finish coater ventilation)	Source removed as stack is within the building. Emissions accounted for through addition of 'Springhill building fugitives' volume source
Fugitive	SP16	Springhill 16 (CPL3 Prime Coater Ventilation (vents inside building))	Source removed as stack is within the building. Emissions accounted for through addition of 'Springhill building fugitives' volume source
Fugitive	SPBLG	Springhill Building Fugitives	New source added to represent Springhill Building Fugitives
Fugitive	BF5SLAG	BF No. 5 Slag Pits	Source configurations changed from volume sources to polygon area sources, with H2S emission rates back-modelled based on downwind H2S measurements undertaken in the immediate vicinity of the slag pits during Aug to Oct 2011.
Fugitive	BF6SLAG	BF No. 6 Slag Pits	
Fugitive	B4	Battery 4	Battery lid and door leak fugitives were previously modelled with battery standpipe emissions. In the revised inventory lid and door leaks are modelled separately. The gas exit velocity is reduced from >9m/s to 1m/s in the case of lid and door leaks and to 6m/s in the case of standpipe emissions.
Fugitive	B5	Battery 5	
Fugitive	B6	Batter 6	
Fugitive	B7a	Battery 7A	
Fugitive	HMP	Hot Metal Pit	Comparison made to validation testing data

Annual average emission rates for stack and fugitive emission sources are given in **Table 17** and **Table 18** respectively. Source configuration and efflux parameters for each source are documented in **Appendix C**. Ammonia, phenol, cyanide and chlorine emissions were only quantified for the Coke Oven Battery Quench Tower Stacks for the purpose of this assessment. No other sources of there pollutants were considered.

Table 17: Average Annual Emission Rates for Stack Sources – 5.2 Mtpa Scenario

ID	Description	TSP g/s	PM_{10} g/s	SO_2 g/s	SO_3 g/s	NOx g/s	H_2S g/s	Benzene g/s	Styrene g/s	Toluene g/s	Xylene g/s	Ethyl-benzene g/s	Phenol g/s	Cyanide g/s	Chlorine g/s	Ammonia g/s	BaP Equivalent g/s	PCDD/F g/s	BaP g/s
EPA002	Sinter Machine Room Dedusting Stack	2.77	1.65																
EPA003	No 6 Blast Furnace Stove Heating Stack	1.10	0.85	19.93		6.07	0.02												
EPA004	No 6 Blast Furnace Cast House Dedusting Stack	2.73	1.27																
EPA005	No 6 Blast Furnace Stock House Dedusting Stack	8.44	1.30																
EPA006	No 6 Blast Furnace Highline Dedusting Stack	0.02	0.02																
EPA007	No 5 Blast Furnace Stove Heating Stack	1.10	0.85	20.37		9.23	0.02												
EPA008	No 5 Blast Furnace Cast House Dedusting Stack	0.87	0.61																
EPA009	No 5 Blast Furnace Stock House Dedusting Stack	1.02	0.33																
EPA010	No 5 Blast Furnace - No 2 Slag Granulator Stack	1.11	0.95				0.63												
EPA011	No 5 Blast Furnace - No 1 Slag Granulator Stack																		
EPA128	No 5 Blast Furnace - No 3 Slag Granulator Stack																		
EPA013	No 4 Coke Oven Battery Heating Stack	0.68	0.50	5.78	0.19	11.74	0.40	7.9E-01	8.2E-03	9.2E-02	1.5E-02	4.0E-04					1.2E-05	4.8E-10	5.8E-06
EPA014	No 5 Coke Oven Battery Heating Stack	0.22	0.18	5.13	0.22	14.53	0.08	5.5E-01	8.1E-03	7.2E-02	1.4E-02	4.3E-04					2.6E-06	4.8E-10	9.8E-07
EPA015	No 6 Coke Oven Battery Heating Stack	0.47	0.40	6.28	0.81	15.94	0.10	3.6E-01	1.1E-03	4.0E-02	7.0E-03	2.8E-04					3.4E-06	4.5E-10	1.9E-06
EPA016	No 7a Coke Oven Battery Heating Stack	1.08	0.63	7.57	0.72	13.22	0.02	5.4E-02	7.9E-04	1.1E-02	5.5E-03	7.9E-04					3.1E-06	4.0E-10	1.7E-06
EPA018	No 4/5 Coke Oven Battery Quench Tower Stack	2.63	0.84	0.34	0.07	0.09	0.39	3.0E-03	5.3E-04	6.1E-03	1.3E-03	5.3E-04	1.3E-03	3.9E-02	2.3E-02	5.7E+00	7.3E-05	1.6E-11	4.5E-05
EPA019	No 6 Coke Oven Battery Quench Tower Stack	1.94	0.62	0.19	0.05	0.05	0.28	2.2E-03	3.9E-04	4.5E-03	9.8E-04	3.9E-04	9.7E-04	2.9E-02	1.7E-02	4.2E+00	5.4E-05	1.2E-11	3.3E-05
EPA020	No 7a Coke Oven Battery Quench Tower Stack	1.72	0.32	0.09	0.05	0.02	0.25	2.0E-03	3.5E-04	4.0E-03	8.7E-04	3.5E-04	8.6E-04	2.6E-02	1.5E-02	3.7E+00	4.8E-05	1.1E-11	3.0E-05
EPA021	No 7a Battery Fume Suppression Plant No 1 Stack	0.07	0.06	0.10	0.09	0.18	0.02	3.1E-02	7.6E-04	8.6E-03	3.0E-03	4.0E-04					5.2E-06		2.0E-06
EPA022	No 7a Battery Fume Suppression Plant No 2 Stack	0.07	0.06	0.10	0.09	0.18	0.02	3.1E-02	7.6E-04	8.6E-03	3.0E-03	4.0E-04					5.2E-06		2.0E-06
EPA023	Coke Screen House Dedusting Stack	2.50	1.33																
EPA024	BOS No 1 Vessel Flare Stack	1.03	0.57	0.12	0.01	2.62												8.2E-11	
EPA025	BOS No 2 Vessel Flare Stack	1.03	0.57	0.12	0.01	2.62												8.2E-11	
EPA026	BOS No 3 Vessel Flare Stack	1.03	0.57	0.12	0.01	2.62												8.2E-11	
EPA027	BOS No 2 Secondary Dedusting Stack	2.94	1.56															9.3E-09	
EPA028	BOS No 3 Secondary Dedusting Stack	0.62	0.26	0.97	0.01	0.23												1.8E-09	
EPA030	Lime Kiln Waste Heat Stack	0.93	0.57	0.82		6.59	0.02	3.5E-04	2.5E-04	4.5E-04	6.9E-04	3.5E-04					1.6E-06	9.7E-11	7.3E-07
EPA031	Lime Kiln Storage bins - Enacon Baghouse Stack	0.30	0.16																
EPA032	Lime Kiln Storage bins - Bahco Baghouse Stack	0.27	0.16																
EPA033	Lime Kiln Transfer House Stack	0.00	0.00																

Table 17: Average Annual Emission Rates for Stack Sources – 5.2 Mtpa Scenario

ID	Description	TSP	PM_{10}	SO_2	SO_3	NOx	H_2S	Benzene	Styrene	Toluene	Xylene	Ethyl-benzene	Phenol	Cyanide	Chlorine	Ammonia	BaP Equivalent	PCDD/F	BaP
		g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s
EPA034	Slab Handling - Slab Scarfing Machine Stack	0.56	0.48	0.08		0.16													
EPA035	Raw Material Road Rail Dump Station Stack	0.06	0.03																
EPA037	No 2 Blower Station 21/22 Boiler Stack	1.10	0.85	16.08		5.16	0.01	7.4E-04	2.6E-04	8.6E-04	5.3E-04	2.8E-04					6.6E-07	5.3E-11	3.3E-07
EPA038	No 2 Blower Station 23 Boiler Stack	1.10	0.85	15.40		5.38	0.01	7.1E-04	2.4E-04	8.3E-04	5.1E-04	2.7E-04					6.9E-07	5.3E-11	3.4E-07
EPA039	No 2 Blower Station 24 Boiler Stack	1.10	0.85	15.40		5.38	0.01	7.1E-04	2.4E-04	8.3E-04	5.1E-04	2.7E-04					6.9E-07	5.3E-11	3.4E-07
EPA040	No 2 Blower Station 25 Boiler Stack	1.10	0.85	21.06	0.40	11.61	0.02	9.7E-04	3.3E-04	1.1E-03	7.0E-04	3.7E-04					1.5E-06	5.3E-11	7.4E-07
EPA046	Hydrogen Reformer Furnace Stack			0.003		0.13													
EPA047	No 1 Walking Beam Furnace Stack	1.10	0.85	16.51	0.38	10.92		2.1E-04	2.1E-04	2.1E-04	4.1E-04	2.1E-04							
EPA048	3500mm Furnace No 1 Stack	0.03	0.02	3.49	0.38	1.92		6.5E-05	6.5E-05	6.5E-05	1.3E-04	6.5E-05							
EPA049	3500mm Furnace No 2 Stack	0.03	0.02	3.49	0.52	1.92		6.5E-05	6.5E-05	6.5E-05	1.3E-04	6.5E-05							
EPA052	GEGA M/C Cut to Length Stack	0.07	0.06	0.05		0.04													
EPA076	No 4/5 Battery Fume Control Stack	0.08	0.08	0.32	0.09	0.19	0.01	4.0E-02	6.0E-04	6.7E-03	2.1E-03	3.7E-04					1.6E-06		5.6E-07
EPA077	No 6 Battery Fume Control Stack	0.11	0.07	0.34	0.07	0.22	0.02	4.6E-03	3.8E-04	6.8E-03	1.4E-03	5.8E-03					1.6E-06		5.5E-07
EPA090	No 5 & 6 Hammer Mills Dedusting Stack	0.05	0.03																
EPA092	CAS Baghouse Stack	0.09	0.09			0.02													
EPA093	Lime Kiln Discharge Building Baghouse Stack	0.02	0.01			1.29													
EPA100	Gas Processing Sulphate Plant Stack	0.06	0.04																
EPA104	No 6 Blast Furnace - Slag Granulator Stack	1.11	0.95	0.09		0.06	0.98												
EPA105	PCI Hot Gas Exhaust Stack	0.098	0.098	0.001		0.015													
EPA106	PCI Facility - Stacks Serving Depressurising Bag Filters	0.00	0.00																
EPA107	Sinter Plant Waste Gas Cleaning	7.58	2.99	105.95	1.78	112.18		9.2E-02		1.8E-02	7.9E-03	2.3E-03					8.4E-06	8.5E-09	3.1E-06
EPA108	Scrap Cutting Dust Collector Baghouse	0.02	0.02																
EPA112	Roll Service Technology Stack - Round	0.00	0.00																
EPA113	Ecocem Slag Dryer Dust Collector	0.04	0.03	0.03		0.05													
EPA115	Metserv Iron Dumping/Cutting Shed Baghouse Stack	0.15	0.13			0.10													
EPA117	No 1, 2 & 3 Slab Caster Stacks	0.23	0.20																
EPA117A	No 1, 2 & 3 Slab Caster Stacks	0.23	0.20																
EPA117B	No 1, 2 & 3 Slab Caster Stacks	0.23	0.20																
EPA117C	No 1, 2 & 3 Slab Caster Stacks	0.23	0.20																
EPA117D	No 1, 2 & 3 Slab Caster Stacks	0.23	0.20																

Table 17: Average Annual Emission Rates for Stack Sources – 5.2 Mtpa Scenario

ID	Description	TSP g/s	PM_{10} g/s	SO_2 g/s	SO_3 g/s	NOx g/s	H_2S g/s	Benzene g/s	Styrene g/s	Toluene g/s	Xylene g/s	Ethyl-benzene g/s	Phenol g/s	Cyanide g/s	Chlorine g/s	Ammonia g/s	BaP Equivalent g/s	PCDD/F g/s	BaP g/s
EPA117E	No 1, 2 & 3 Slab Caster Stacks	0.23	0.20																
EPA118	No 5 Blast Furnace Casthouse Dedusting Stack	0.18	0.14																
EPA120	No 2 Walking Beam Furnace Stack	1.90	1.50	16.51		10.92		2.1E-04	2.1E-04	2.1E-04	4.1E-04	2.1E-04							
EPA121	Briquetting Southern Scrubber	0.027	0.027			0.013													
EPA122	Briquetting Northern Scrubber	0.004	0.004			0.004													
EPA123	Briquetting Blast Furnace Screening Baghouse	0.005	0.005																
SP05	Springhill 5 (MCL1 Selas Stack)			0.035		0.214		8.8E-04	2.1E-04	2.1E-04	4.1E-04	2.1E-04							
SP06	Springhill 6 (MCL2 Selas Stack)			0.052		0.309		8.0E-04	8.0E-04	8.0E-04	1.6E-03	8.0E-04							
SP07	Springhill 7 (MCL2 Selas Stack)			0.009		0.212		3.9E-04	3.9E-04	3.9E-04	7.8E-04	3.9E-04							
SP09	Springhill 9 (MCL2 Passivation Stack)							3.7E-05	3.4E-05	4.9E-05	6.8E-05	3.4E-05							
SP10	Springhill 10 (MCL1 Passivation Exhaust)							5.2E-05	5.2E-05	5.2E-05	1.7E-04	5.2E-05							
SP12	Springhill 12 (CPL3 Prime Oven Incinerator)	0.030	0.030	0.015		0.301		9.7E-03	5.0E-04	8.7E-04	2.0E-03	5.0E-04							
SP13	Springhill 13 (CPL3 Finish Oven Incinerator)	0.055	0.055	0.130		0.214		2.9E-02	2.9E-03	2.5E-02	1.3E-01	1.1E-02							

Table 18: Average Annual Emission Rates for Fugitive Sources – 5.2 Mtpa Scenario

	TSP	PM_{10}	SO_2	NOx	H_2S	Benzene	Styrene	Toluene	Xylene	Ethyl-benzene	BaP Equivalent	BaP
	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s
Sinter Plant Fugitives	60.574	2.132										
BOS Roof Vents	16.488	8.400										
Crusher	1.040	0.420										
Hot Metal Pit	0.010	0.008										
Materials Handling	0.039	0.039										
Recycling Area - Crushing/Screening	1.135	0.579										
Recycling Area - Metal Recovery Plant	1.135	0.579										
Slag Cooling Pot	11.000	5.830										
Slag Stockpile	11.000	5.832										
Springhill Building Fugitives	0.059	0.059				0.004	0.003	0.024	0.083	0.006		
Coke Oven Batteries - Charging	0.121	0.059			0.001							
Coke Oven Batteries - Doors and Leaks	0.500	0.500	2.117	0.074	0.083	0.278					0.006	0.005
Coke Oven Batteries - Pushing	3.471	1.500	3.636	0.720								
Coke Oven Batteries - Standpipe Emissions	0.353	0.353	4.411	0.812	0.010							
BF No. 5 Slag Pits					0.006							
BF No. 6 Slag Pits					0.023							

The sinter plant annular cooler emissions occur as a diffuse release from the building. Quantification of this source can not robustly be done through the application of stack monitoring methods. Given the absence of an emission factor for this source, emissions were provisionally estimated based on particulate concentration monitoring within the building. TSP and PM_{10} concentrations measured (mg/m³) were multiplied by the volumetric flow through the fans (Nm³/min) and the total bed area (480 m²) accounted for to estimate emission rates. Measured concentrations were within the broad ranges documented by the IPPC (2012), however the emission rates calculated using these measurements are assigned a low confidence level. Alternative methods should be considered to quantify sinter plant annular cooler emissions.

The majority of sources are assumed to emit at a constant rate over the entire year given that such sources are associated with generally continuous operations or with batch processes characterised by primarily sub-hourly emission variations (e.g. quench tower stacks). Variable emission rates were however applied for the following sources:

- H_2S emissions from granulation stacks. On average, granulation takes place over 23 hours and 20 minutes per day. For modelling purposes one granulation stack was assumed to be emitting continuously (EPA10). The sub-hourly granulation process results in sub-hourly variations in H_2S emissions, and concurrent variations in gas exit velocity and gas exit temperature. 15-minute average H_2S emission rates were measured during 2011 to range from 0.47 g/s to 0.98 g/s (average of 0.63 g/s). Despite these variations being sub-hourly, a sequence of emission rates in this range – together with concurrently measured gas exit temperatures and velocities – were modelled as hourly average emission rates to more accurately reflect potential peaks in H_2S concentrations.
- H_2S emissions from slag pits. Emissions from 6BF slag pits were restricted to between the hours of 5pm and 6am, to coincide with permissible watering times. Emissions from 5BF slag pits were assumed to occur over 1 hour per day, with the hour of day being varied on each consecutive day.
- TSP and PM_{10} emissions from the Metal Recovery Plant and Crushing and Screening operations within the Recycling Area were scheduled to coincide with plant operations, i.e. 6am to 10pm, over 5 days per week.
- TSP and PM_{10} emissions from Materials Handling varied on an hourly basis, given that such emissions are wind dependent.

A summary of total annual emissions by source grouping is given in **Table 19**. Average annual TSP and PM_{10} emission rates by source are illustrated in **Figure 31** and **Figure 32** for stacks and fugitive sources respectively. Annual average SO_2, SO_3, NO_x, H_2S, BTEX, PCDD/F and BaP emission rates by source are illustrated in **Figure 33**, **Figure 34**, **Figure 35**, **Figure 36**, **Figure 37**, **Figure 38** and **Figure 39** respectively.

The Sinter Plant Waste Gas Cleaning Stack (EPA107) is the most significant source of SO_x, NO_x and PCDD/F emissions. Other significant sources of PCDD/F emissions are the BOS No. 2 and 3 Secondary Dedusting Stacks (EPA27 and EPA28).

Significant stack sources of H_2S include the Granulation Stacks (EPA104, EPA10, EPA11 and EPA128), Quench Tower Stacks (EPA18, EPA19, EPA20), and the Battery Heating

Stacks (EPA13, EPA14, EPA15, EPA16). The coke oven batteries and blast furnace slag pits represent notable sources of low level H_2S emissions.

The Battery Heating Stacks, Springhill CPL3 Finish Oven Incinerator and the Sinter Plant Waste Gas Cleaning Stack represent significant stack emissions of BTEX, with Springhill building fugitives and the Coke Oven Batteries contributing to low level BTEX emissions.

The Coke Oven Batteries represent the largest source of BaP emissions, with the Quench Tower Stacks (EPA18, EPA19, EPA20) representing the predominant stack release.

Table 19: Total Annual Emissions by Source Group – 5.2 Mtpa Scenario

	TSP	PM_{10}	SO_2	SO_3	NOx	H_2S	Benzene	Ammonia	Toluene
	tpa	tpa	tpa	tpa	tpa	tpa	tpa	tpa	tpa
Stacks	1828	931	8926	188	8037	105	63.3	428.1	9.8
BOS Roof Vents	520	265							
Coke Oven Battery Fugitives	140	76	321		51	3	8.8		
Crushing	33	13							
Recycling Area	73	38							
Sinter Plant Fugitives	1910	67							
Slag Cooling Pot, Slag Stockpile	694	368							
Slag Pits						1			
Springhill Building Fugitives	2	2					0.1		0.8
Total	5200	1760	9247	188	8087	109	72.2	428.1	10.6
	Styrene	Xylene	Ethyl-benzene	Phenol	Cyanide	Chlorine	BaP Equiv.	BaP	PCDD/F
	tpa	tpa	tpa	tpa	tpa	tpa	kg/annum	kg/annum	g/annum
Stacks	0.905	6.317	0.855	0.099	2.971	1.767	7.0	4.0	0.7
BOS Roof Vents									
Coke Oven Battery Fugitives							195.0	146.3	
Crushing									
Recycling Area									
Sinter Plant Fugitives									
Slag Cooling Pot, Slag Stockpile									
Slag Pits									
Springhill Building Fugitives	0.105	2.618	0.189						
Total	1.011	8.935	1.044	0.099	2.971	1.767	202.0	150.3	0.7

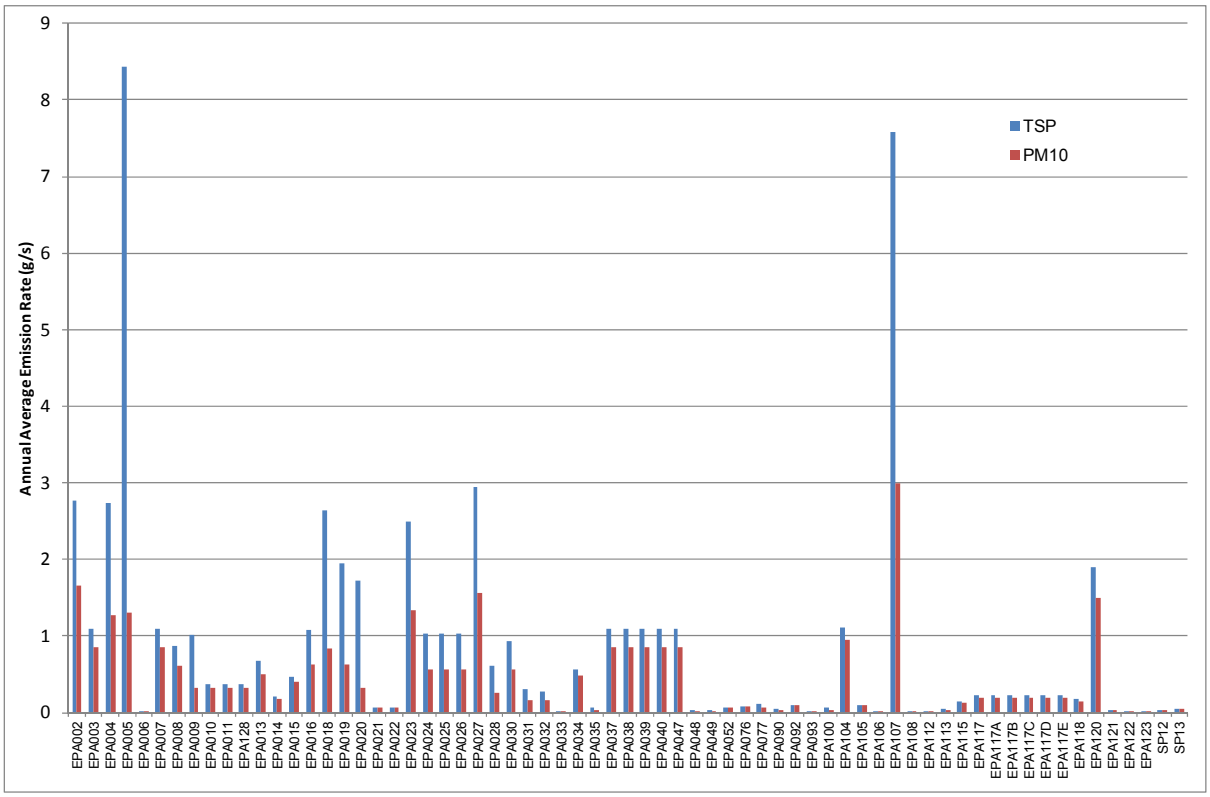

Figure 31: 5.2Mtpa Scenario – Annual average TSP and PM_{10} emission rates for Stacks

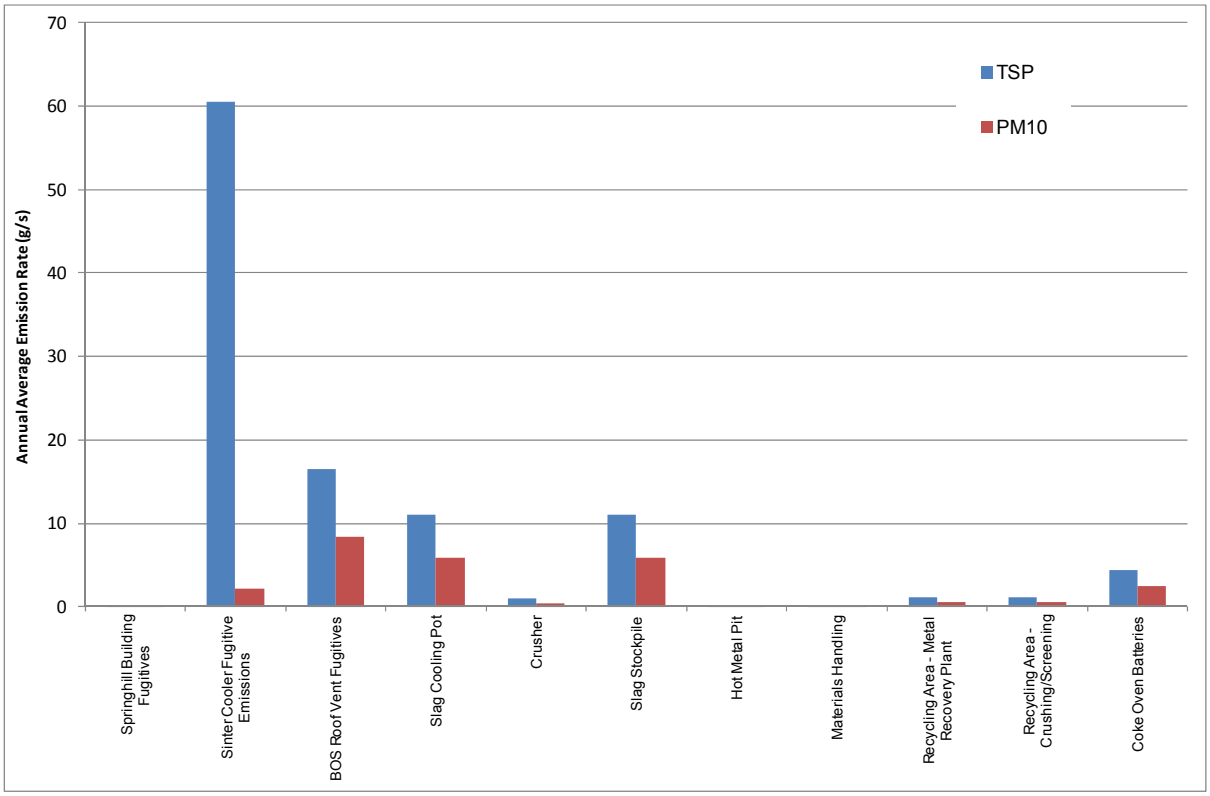

Figure 32: 5.2Mtpa Scenario – Annual average TSP and PM_{10} emission rates for Fugitive Sources

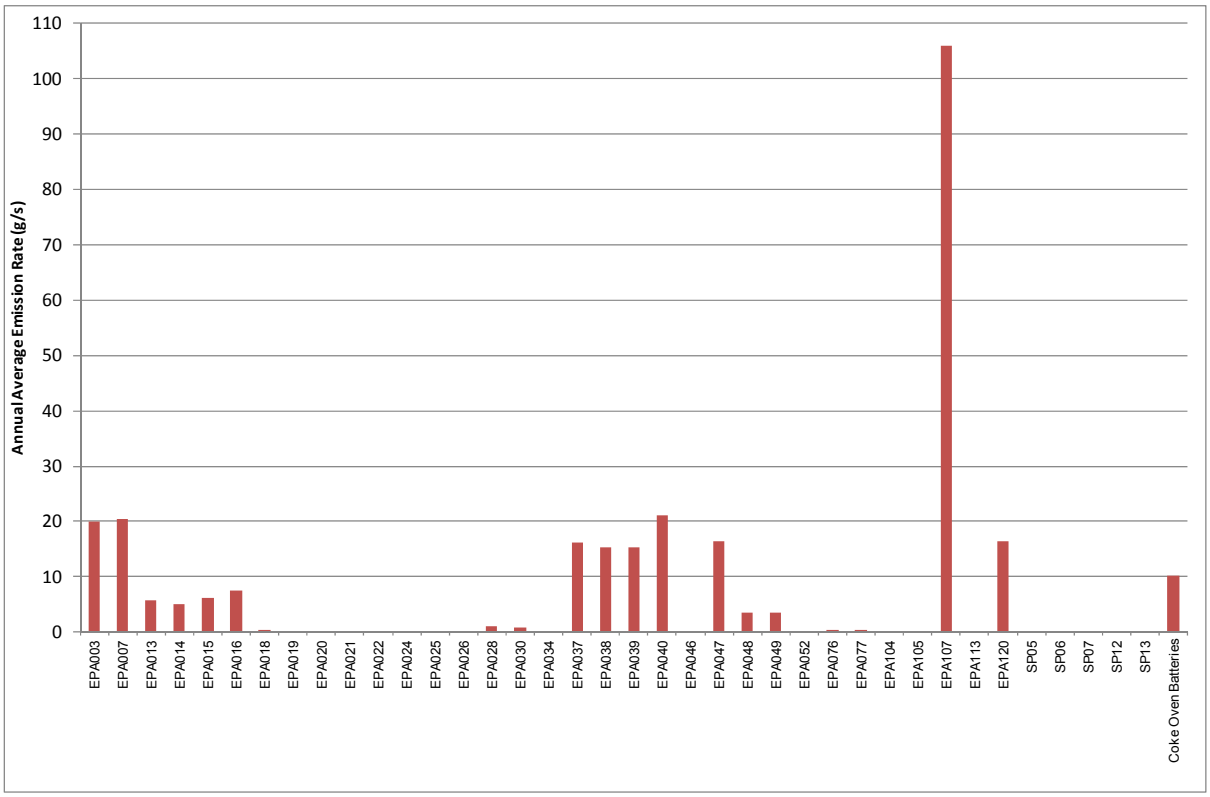

Figure 33: 5.2Mtpa Scenario – Annual average SO_2 emission rates by Source

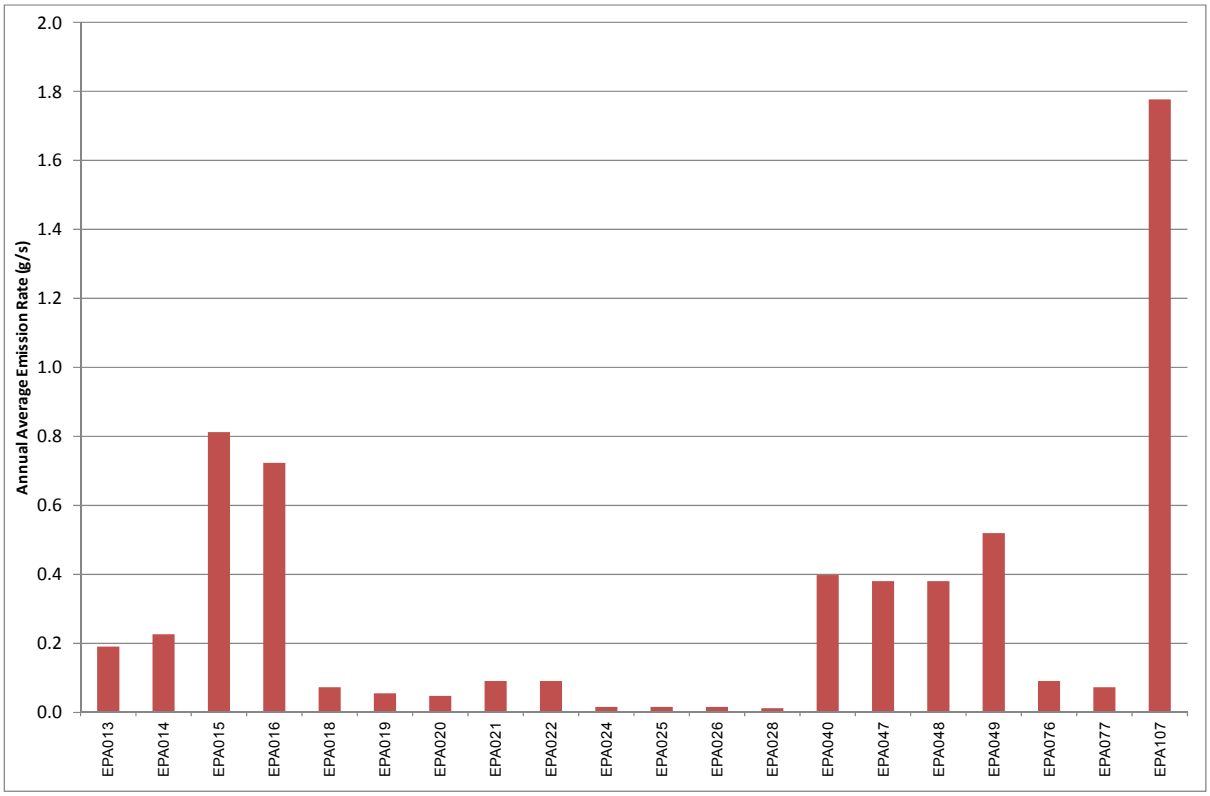

Figure 34: 5.2Mtpa Scenario – Annual average SO_3 emission rates by Source

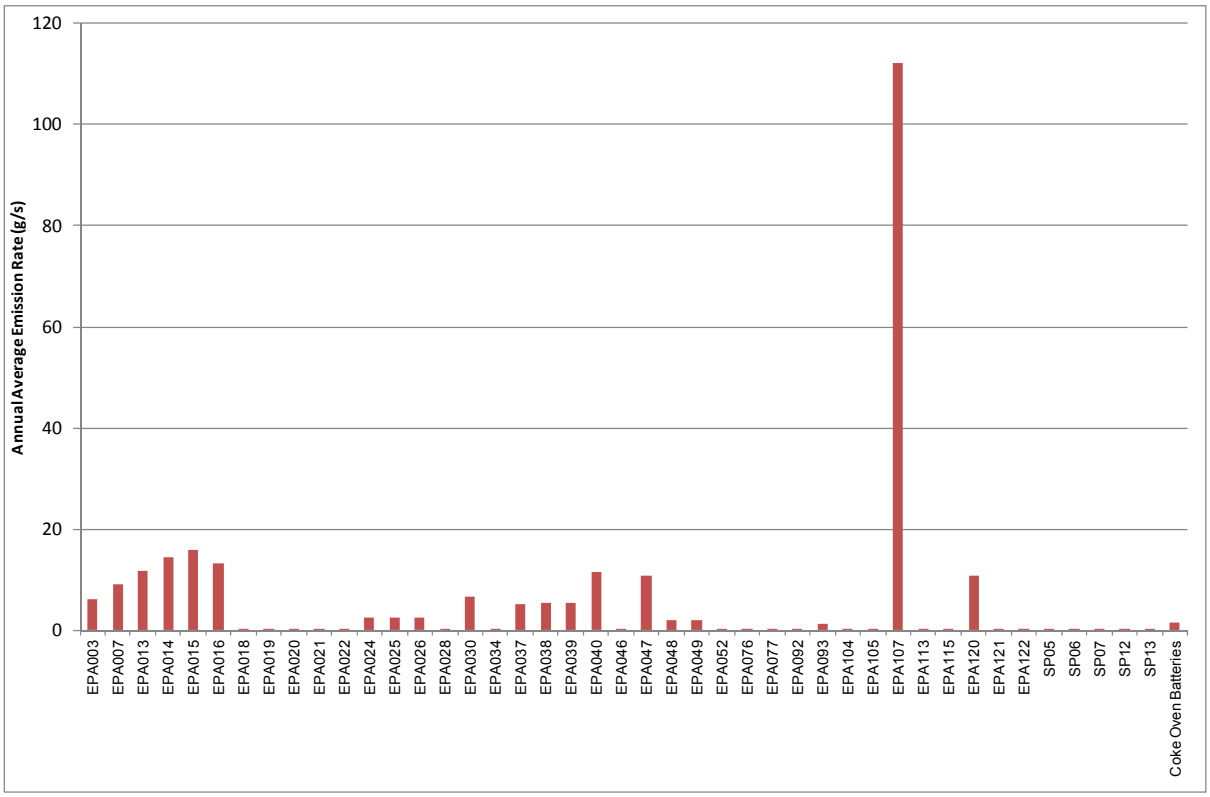

Figure 35: 5.2Mtpa Scenario – Annual average NO_x emission rates by Source

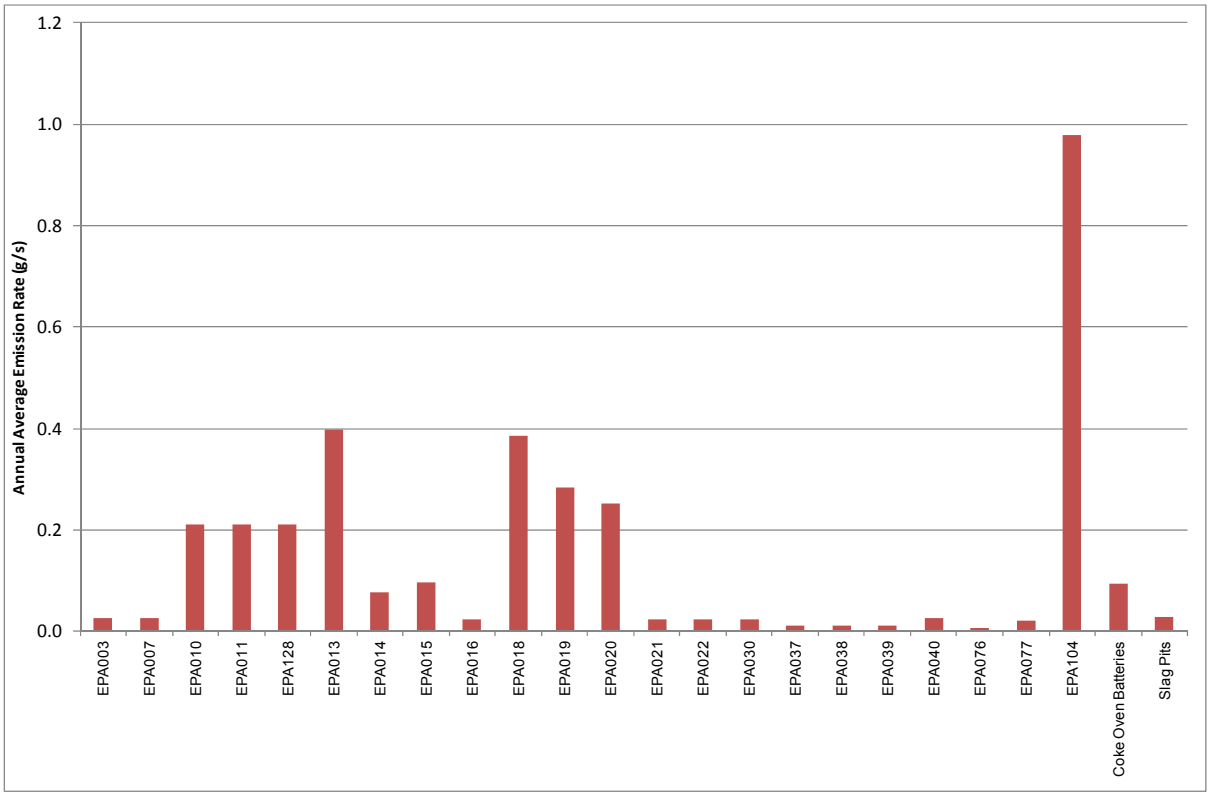

Figure 36: 5.2Mtpa Scenario – Annual average H_2S emission rates by Source

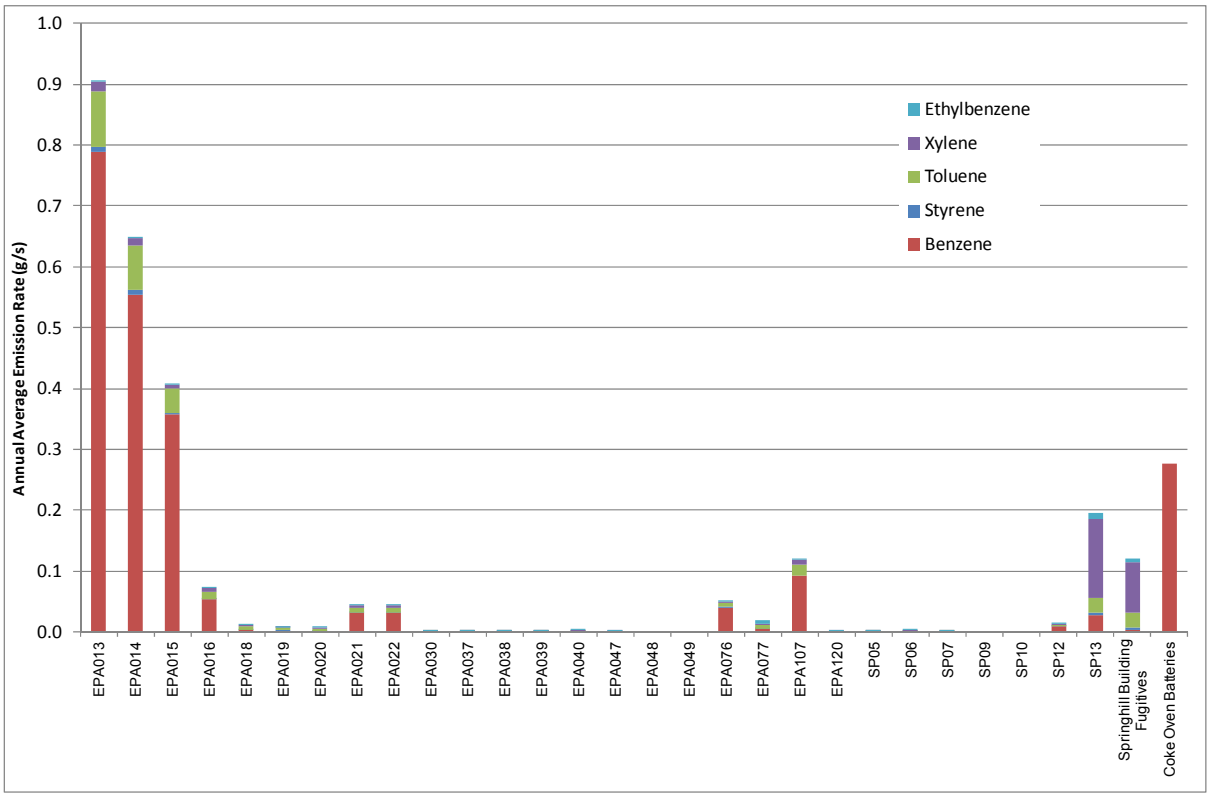

Figure 37: 5.2Mtpa Scenario – Annual average Benzene, Toluene, Xylene, Ethylbenzene and Styrene emission rates by Source

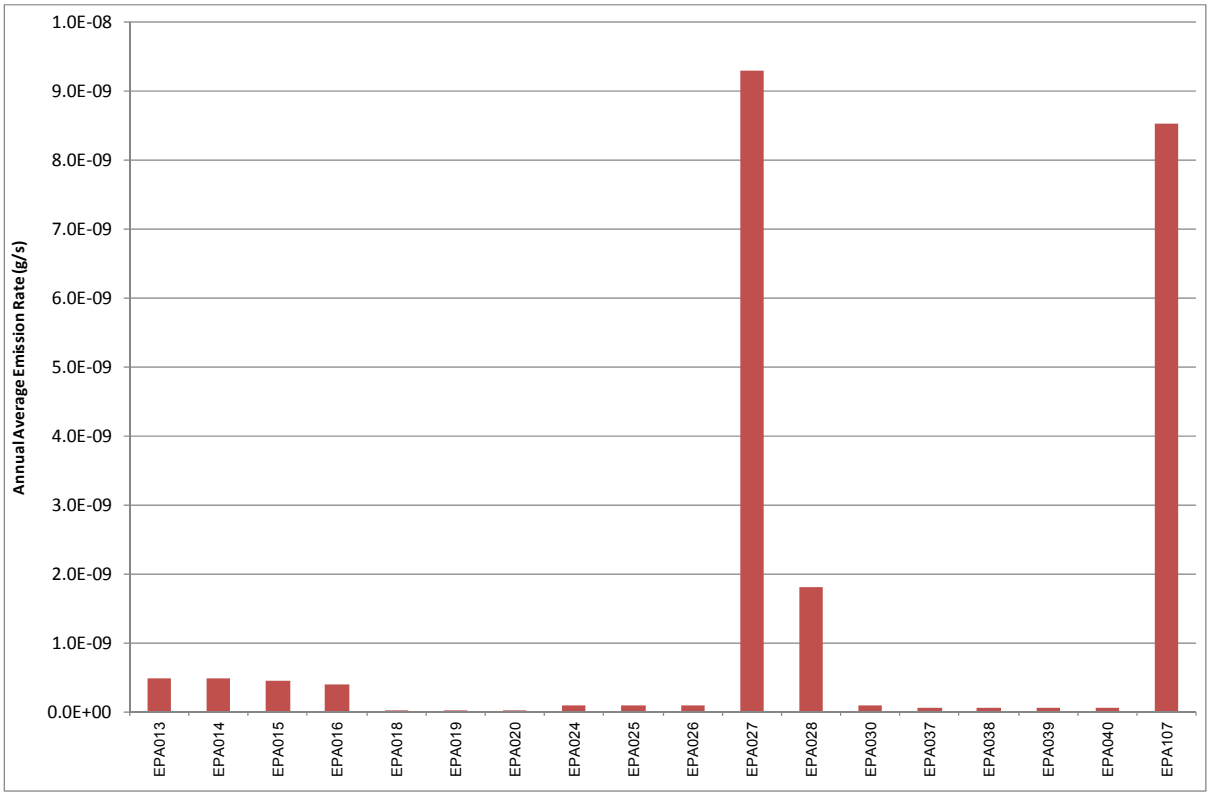

Figure 38: 5.2Mtpa Scenario – Annual average PCDD/F emission rates by Source

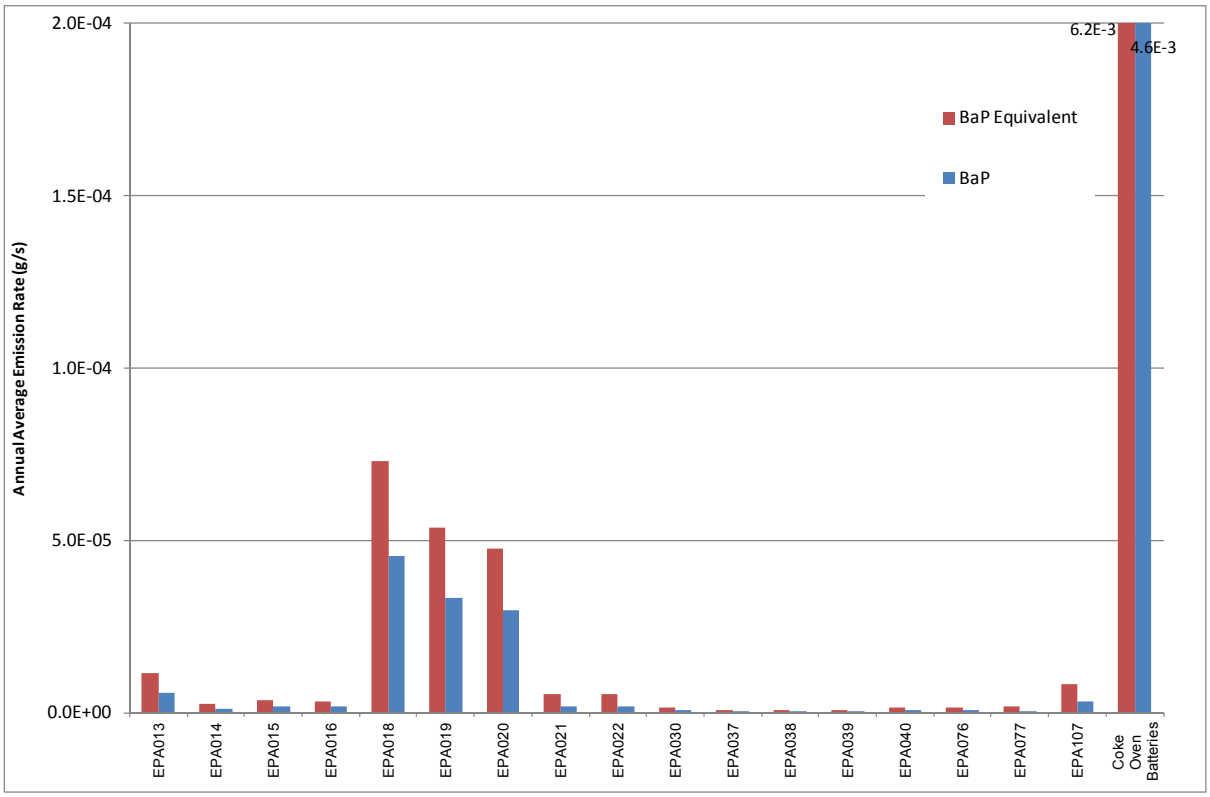

Figure 39: 5.2Mtpa Scenario – Annual average BaP emission rates by Source

4.2 2.6 Mtpa Emissions Inventory

In October 2011 operations at the BlueScope Steel Port Kembla facility were significantly altered with an overall reduction in molten steel production capacity from 5.2 Mtpa to 2.6 Mtpa. The change in operations included the following:

- Shut-down of the No. 6 Blast Furnace, with production reduced to 2.6 Mtpa.
- Closure of No. 4 cokemaking battery, No. 3 BOS steelmaking furnace and No. 1 slab caster. The PKSW hot strip and cold rolling mills, metal coating and paint lines have continued to operate.

A 2.6 mtpa production emissions inventory was compiled to reflect the changed facility operations. A summary of the changes is given in **Table 20**.

Table 20: Changes in facility operations reflected in 2.6 Mtpa emissions inventory

Type	Source ID	Source Description	Summary of Additional Data
Stack	EPA_003	No 6 Blast Furnace Stove Heating Stack	Shut down
Stack	EPA_004	No 6 Blast Furnace Cast House Dedusting Stack	Shut down
Stack	EPA_005	No 6 Blast Furnace Stock House Dedusting Stack	Shut down
Stack	EPA_010	No 5 Blast Furnace - No 2 Slag Granulator Stack	Reduction in granulation time by 60% i.e. 14hrs instead of 23hrs 20 min per day.
Stack	EPA_011	No 5 Blast Furnace - No 1 Slag Granulator Stack	

Table 20: Changes in facility operations reflected in 2.6 Mtpa emissions inventory

Type	Source ID	Source Description	Summary of Additional Data
Stack	EPA128	No 5 Blast Furnace - No 3 Slag Granulator Stack	
Stack	EPA_013	No 4 Coke Oven Battery Heating Stack	Shut down
Stack	EPA_014	No 5 Coke Oven Battery Heating Stack	Post-October 2011 stack monitoring data used
Stack	EPA_018	No 4/5 Coke Oven Battery Quench Tower Stack	Post-October 2011 stack monitoring data used
Stack	EPA_023	Coke Screen House Dedusting Stack	Post-October 2011 stack monitoring data used
Stack	EPA_024	BOS No 1 Vessel Flare Stack	Only one BOS flare stack operating at once. (Assumed EPA24 operating continuously.)
Stack	EPA_025	BOS No 2 Vessel Flare Stack	
Stack	EPA_026	BOS No 3 Vessel Flare Stack	Shut down
Stack	EPA_028	BOS No 3 Secondary Dedusting Stack	Shut down
Stack	EPA_030	Lime Kiln Waste Heat Stack	Reduction in operating hours to 93% hrs of operation
Stack	EPA_031	Lime Kiln Storage bins - Enacon Baghouse Stack	Reduction in operating hours to 95% hrs of operation
Stack	EPA_032	Lime Kiln Storage bins - Bahco Baghouse Stack	Reduction in operating hours to 95% hrs of operation
Stack	EPA_033	Lime Kiln Transfer House Stack	Reduction in operating hours to 40% hrs of operation
Stack	EPA_034	Slab Handling - Slab Scarfing Machine Stack	Reduction in operating hours to 1.8hrs/day
Stack	EPA_035	Raw Material Road Rail Dump Station Stack	Reduction in operating hours to 83% hrs of operation (reduced from 28hrs/week train and 43hrs/week road - to 16hrs/week train and 43hrs/week road)
Stack	EPA_037	No 2 Blower Station 21/22 Boiler Stack	Shut down
Stack	EPA_047	No 1 Walking Beam Furnace Stack	Reduction in operating hours to 75% hrs/year
Stack	EPA_090	No 5 & 6 Hammer Mills Dedusting Stack	Post-October 2011 stack monitoring data used
Stack	EPA_092	CAS Baghouse Stack	Reduction in operating hours to 4.17 hrs/day
Stack	EPA_093	Lime Kiln Discharge Building Baghouse Stack	Reduction in operating hours to 93% hrs of operation
Stack	EPA_104	No 6 Blast Furnace - Slag Granulator Stack	Shut down
Stack	EPA_105	PCI Hot Gas Exhaust Stack	Reduction in operating hours to 68% hrs of operation
Stack	EPA_106	PCI Facility - Stacks Serving Depressurising Bag Filters	Reduction in operating hours to 15% hrs of operation
Stack	EPA_107	Sinter Plant Waste Gas Cleaning	Post-October 2011 stack monitoring data used
Stack	EPA_112	Roll Service Technology Stack - Round	Shut down
Stack	EPA_117D	No 1, 2 & 3 Slab Caster Stacks	No. 1 slab caster shutdown
Stack	EPA_117E	No 1, 2 & 3 Slab Caster Stacks	No. 1 slab caster shutdown
Stack	EPA_120	No 2 Walking Beam Furnace Stack	Reduction in operating hours to 25% hrs/year
Stack	EPA_121	Briquetting Southern Scrubber	Shut down
Stack	EPA_122	Briquetting Northern Scrubber	Shut down
Stack	EPA_123	Briquetting Blast Furnace Screening Baghouse	Shut down
Stack	EPA_138	No2 Blower Station Package Boiler No. 11	Post-October 2011 stack monitoring data used
Stack	EPA_139	No2 Blower Station Package Boiler No. 12	Post-October 2011 stack monitoring data used
Fugitives	B4	Cokemaking Battery 4	Shut down
Fugitives	BOS	BOS Roof Vent Fugitive Emissions (EPA91)	Post-October 2011 stack monitoring data used
Fugitives	SCP	Slag Cooling Pots	50% reduction in production rates. Validation monitoring in vicinity of source Sept/Oct 2011.
Fugitives	SlagSP	Slag Stockpile	50% reduction in production rates.
Fugitives	MRP	Recycling Area - Metal Recovery Plant	Reduction in operating hours to 28.5% hrs/year (seven shifts per week at 6.8 hrs/day = 52 x 7 x 6.8 hrs = 2475.2 hrs)
Fugitives	CSP1	Recycling Area - Crushing/Screening Plant 01	Reduction in operating hours to 22% hrs/year (five to six shifts per week at 6.8 hrs/day = 52 x 5.5 x 6.8 hrs = 1944.8 hrs)
Fugitives	CSP2	Recycling Area - Crushing/Screening Plant 02	Reduction in operating hours to 22% hrs/year (five to six shifts per week at 6.8 hrs/day = 52 x 5.5 x 6.8 hrs = 1944.8 hrs)

Table 20: Changes in facility operations reflected in 2.6 Mtpa emissions inventory			
Type	Source ID	Source Description	Summary of Additional Data
Fugitives	BF6SLAG	BF No. 6 Slag Pits	Shut down

Annual average emission rates for stack and fugitive emission sources are given in **Table 21** and **Table 18** respectively. Source configuration and efflux parameters for each source are documented in **Appendix C**. Ammonia, phenol, cyanide and chlorine emissions were only quantified for the Coke Oven Battery Quench Tower Stacks for the purpose of this assessment. No other sources of there pollutants were considered.

Table 21: Average Annual Emission Rates for Stack Sources – 2.6 Mtpa Scenario

ID	Description	TSP g/s	PM_{10} g/s	SO_2 g/s	SO_3 g/s	NOx g/s	H_2S g/s	Benzene g/s	Styrene g/s	Toluene g/s	Xylene g/s	Ethyl-benzene g/s	Phenol g/s	Cyanide g/s	Chlorine g/s	Ammonia g/s	BaP Equivalent g/s	PCDD/F g/s	BaP g/s
EPA002	Sinter Machine Room Dedusting Stack	2.18	1.68																
EPA006	No 6 Blast Furnace Highline Dedusting Stack	0.02	0.02																
EPA007	No 5 Blast Furnace Stove Heating Stack	1.10	0.85	20.37		9.23	0.02												
EPA008	No 5 Blast Furnace Cast House Dedusting Stack	0.87	0.61																
EPA009	No 5 Blast Furnace Stock House Dedusting Stack	1.02	0.33																
EPA010	No 5 Blast Furnace - No 2 Slag Granulator Stack	0.22	0.19				0.11												
EPA011	No 5 Blast Furnace - No 1 Slag Granulator Stack	0.22	0.19				0.11												
EPA128	No 5 Blast Furnace - No 3 Slag Granulator Stack	0.22	0.19				0.11												
EPA014	No 5 Coke Oven Battery Heating Stack	0.22	0.18	6.04	0.22	12.96	0.08	4.6E-01	1.0E-02	8.4E-02	2.2E-02	5.5E-04					2.6E-06	4.8E-10	9.8E-07
EPA015	No 6 Coke Oven Battery Heating Stack	0.47	0.40	6.28	0.81	15.94	0.10	3.6E-01	1.1E-03	4.0E-02	7.0E-03	2.8E-04					3.4E-06	4.5E-10	1.9E-06
EPA016	No 7a Coke Oven Battery Heating Stack	1.08	0.63	7.57	0.72	13.22	0.02	5.4E-02	7.9E-04	1.1E-02	5.5E-03	7.9E-04					3.1E-06	4.0E-10	1.7E-06
EPA018	No 4/5 Coke Oven Battery Quench Tower Stack	1.21	0.39	0.16	0.03	0.04	0.15	1.4E-03	2.4E-04	2.8E-03	6.1E-04	2.4E-04	6.0E-04	1.8E-02	1.1E-02	2.6E+00	3.4E-05	7.5E-12	2.1E-05
EPA019	No 6 Coke Oven Battery Quench Tower Stack	1.85	0.59	0.18	0.05	0.05	0.24	2.1E-03	3.7E-04	4.3E-03	9.3E-04	3.7E-04	9.2E-04	2.8E-02	1.6E-02	4.0E+00	5.1E-05	1.2E-11	3.2E-05
EPA020	No 7a Coke Oven Battery Quench Tower Stack	1.74	0.32	0.09	0.05	0.02	0.22	2.0E-03	3.5E-04	4.0E-03	8.8E-04	3.5E-04	8.7E-04	2.6E-02	1.5E-02	3.8E+00	4.8E-05	1.1E-11	3.0E-05
EPA021	No 7a Battery Fume Suppression Plant No 1 Stack	0.07	0.06	0.10	0.09	0.18	0.02	3.1E-02	7.6E-04	8.6E-03	3.0E-03	4.0E-04					5.2E-06		2.0E-06
EPA022	No 7a Battery Fume Suppression Plant No 2 Stack	0.07	0.06	0.10	0.09	0.18	0.02	3.1E-02	7.6E-04	8.6E-03	3.0E-03	4.0E-04					5.2E-06		2.0E-06
EPA023	Coke Screen House Dedusting Stack	1.42	0.88																
EPA024	BOS No 1 Vessel Flare Stack	0.52	0.29	0.06	0.01	1.31												6.1E-11	
EPA025	BOS No 2 Vessel Flare Stack	0.52	0.29	0.06	0.01	1.31												6.1E-11	
EPA027	BOS No 2 Secondary Dedusting Stack	2.94	1.56															5.8E-09	
EPA030	Lime Kiln Waste Heat Stack	0.86	0.53	0.77		6.13	0.02	3.2E-04	2.3E-04	4.2E-04	6.4E-04	3.2E-04					1.5E-06	9.0E-11	6.8E-07
EPA031	Lime Kiln Storage bins - Enacon Baghouse Stack	0.29	0.15																
EPA032	Lime Kiln Storage bins - Bahco Baghouse Stack	0.26	0.15																
EPA033	Lime Kiln Transfer House Stack	0.00	0.00																
EPA034	Slab Handling - Slab Scarfing Machine Stack	0.04	0.04	0.01		0.01													
EPA035	Raw Material Road Rail Dump Station Stack	0.05	0.02																
EPA038	No 2 Blower Station 23 Boiler Stack	1.10	0.85	15.40		5.38	0.01	7.1E-04	2.4E-04	8.3E-04	5.1E-04	2.7E-04					6.9E-07	5.3E-11	3.4E-07
EPA039	No 2 Blower Station 24 Boiler Stack	1.10	0.85	15.40		5.38	0.01	7.1E-04	2.4E-04	8.3E-04	5.1E-04	2.7E-04					6.9E-07	5.3E-11	3.4E-07
EPA040	No 2 Blower Station 25 Boiler Stack	1.10	0.85	21.06	0.40	11.61	0.02	9.7E-04	3.3E-04	1.1E-03	7.0E-04	3.7E-04					1.5E-06	5.3E-11	7.4E-07
EPA046	Hydrogen Reformer Furnace Stack			0.00		0.13													

Table 21: Average Annual Emission Rates for Stack Sources – 2.6 Mtpa Scenario

ID	Description	TSP g/s	PM_{10} g/s	SO_2 g/s	SO_3 g/s	NOx g/s	H_2S g/s	Benzene g/s	Styrene g/s	Toluene g/s	Xylene g/s	Ethyl-benzene g/s	Phenol g/s	Cyanide g/s	Chlorine g/s	Ammonia g/s	BaP Equivalent g/s	PCDD/F g/s	BaP g/s
EPA047	No 1 Walking Beam Furnace Stack	0.83	0.64	12.38	0.28	8.19		1.5E-04	1.5E-04	1.5E-04	3.1E-04	1.5E-04							
EPA048	3500mm Furnace No 1 Stack	0.03	0.02	3.49	0.38	1.92		6.5E-05	6.5E-05	6.5E-05	1.3E-04	6.5E-05							
EPA049	3500mm Furnace No 2 Stack	0.03	0.02	3.49	0.52	1.92		6.5E-05	6.5E-05	6.5E-05	1.3E-04	6.5E-05							
EPA052	GEGA M/C Cut to Length Stack	0.07	0.06	0.05		0.04													
EPA076	No 4/5 Battery Fume Control Stack	0.08	0.08	0.32	0.09	0.19	0.01	4.0E-02	6.0E-04	6.7E-03	2.1E-03	3.7E-04					1.6E-06		5.6E-07
EPA077	No 6 Battery Fume Control Stack	0.11	0.07	0.34	0.07	0.22	0.02	4.6E-03	3.8E-04	6.8E-03	1.4E-03	5.8E-03					1.6E-06		5.5E-07
EPA090	No 5 & 6 Hammer Mills Dedusting Stack	0.01	0.01																
EPA092	CAS Baghouse Stack	0.02	0.02			0.00													
EPA093	Lime Kiln Discharge Building Baghouse Stack	0.02	0.01			1.20													
EPA100	Gas Processing Sulphate Plant Stack	0.06	0.04																
EPA105	PCI Hot Gas Exhaust Stack	0.07	0.07	0.00		0.01													
EPA106	PCI Facility - Stacks Serving Depressurising Bag Filters	0.00	0.00																
EPA107	Sinter Plant Waste Gas Cleaning	2.48	1.28	32.24	0.85	62.86		6.0E-02	0.0E+00	1.2E-03	2.3E-03	1.2E-03			1.7E-03		8.4E-06	7.4E-10	3.1E-06
EPA108	Scrap Cutting Dust Collector Baghouse	0.02	0.02																
EPA113	Ecocem Slag Dryer Dust Collector	0.04	0.03	0.03		0.05													
EPA115	Metserv Iron Dumping/Cutting Shed Baghouse Stack	0.15	0.13			0.10													
EPA117	No 1, 2 & 3 Slab Caster Stacks	0.21	0.18																
EPA117A	No 1, 2 & 3 Slab Caster Stacks	0.21	0.18																
EPA117B	No 1, 2 & 3 Slab Caster Stacks	0.21	0.18																
EPA117C	No 1, 2 & 3 Slab Caster Stacks	0.21	0.18																
EPA118	No 5 Blast Furnace Casthouse Dedusting Stack	0.18	0.14																
EPA120	No 2 Walking Beam Furnace Stack	0.48	0.38	4.13		2.73		5.1E-05	5.1E-05	5.1E-05	1.0E-04	5.1E-05							
EPA138	No2 Blower Station Package Boiler No. 11	0.02	0.01	0.08	0.00	1.31	0.03	2.8E-02	1.4E-04	1.4E-04	2.8E-04	1.4E-04					2.5E-06		1.5E-06
EPA139	No2 Blower Station Package Boiler No. 12	0.01	0.00	0.03	0.00	0.45	0.01	9.4E-03	4.7E-05	4.7E-05	9.4E-05	4.7E-05					8.4E-07		5.2E-07
SP05	Springhill 5 (MCL1 Selas Stack)			0.04		0.21		8.8E-04	2.1E-04	2.1E-04	4.1E-04	2.1E-04							
SP06	Springhill 6 (MCL2 Selas Stack)'			0.05		0.31		8.0E-04	8.0E-04	8.0E-04	1.6E-03	8.0E-04							
SP07	Springhill 7 (MCL2 Selas Stack)			0.01		0.21		3.9E-04	3.9E-04	3.9E-04	7.8E-04	3.9E-04							
SP09	Springhill 9 (MCL2 Passivation Stack)							3.7E-05	3.4E-05	4.9E-05	6.8E-05	3.4E-05							

Table 21: Average Annual Emission Rates for Stack Sources – 2.6 Mtpa Scenario

ID	Description	TSP g/s	PM_{10} g/s	SO_2 g/s	SO_3 g/s	NOx g/s	H_2S g/s	Benzene g/s	Styrene g/s	Toluene g/s	Xylene g/s	Ethyl-benzene g/s	Phenol g/s	Cyanide g/s	Chlorine g/s	Ammonia g/s	BaP Equivalent g/s	PCDD/F g/s	BaP g/s
SP10	Springhill 10 (MCL1 Passivation Exhaust)							5.2E-05	5.2E-05	5.2E-05	1.7E-04	5.2E-05							
SP12	Springhill 12 (CPL3 Prime Oven Incinerator)	0.03	0.03	0.02		0.30		9.7E-03	5.0E-04	8.7E-04	2.0E-03	5.0E-04							
SP13	Springhill 13 (CPL3 Finish Oven Incinerator)	0.05	0.05	0.13		0.21		2.9E-02	2.9E-03	2.5E-02	1.3E-01	1.1E-02							

Table 22: Average Annual Emission Rates for Fugitive Sources – 2.6 Mtpa Scenario

	TSP	PM_{10}	SO_2	NOx	H_2S	Benzene	Styrene	Toluene	Xylene	Ethyl-benzene	BaP Equivalent	BaP
	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s
Sinter Plant Fugitives	30.287	1.066										
BOS Roof Vents	12.807	2.390										
Crusher	1.040	0.420										
Hot Metal Pit	0.010	0.008										
Materials Handling	0.039	0.039										
Recycling Area - Crushing/Screening	0.531	0.271										
Recycling Area - Metal Recovery Plant	0.675	0.345										
Slag Cooling Pot	5.5	2.915										
Slag Stockpile	5.5	2.916										
Springhill Building Fugitives	0.059	0.059				0.004	0.003	0.024	0.083	0.006		
Coke Oven Batteries - Charging	0.084	0.041			0.001							
Coke Oven Batteries - Doors and Leaks	0.385	0.385	1.699	0.059	0.064	0.214					0.005	0.004
Coke Oven Batteries - Pushing	2.661	1.150	2.884	0.571								
Coke Oven Batteries - Standpipe Emissions	0.270	0.270	3.382	0.623	0.008							
BF No. 5 Slag Pits					0.006							

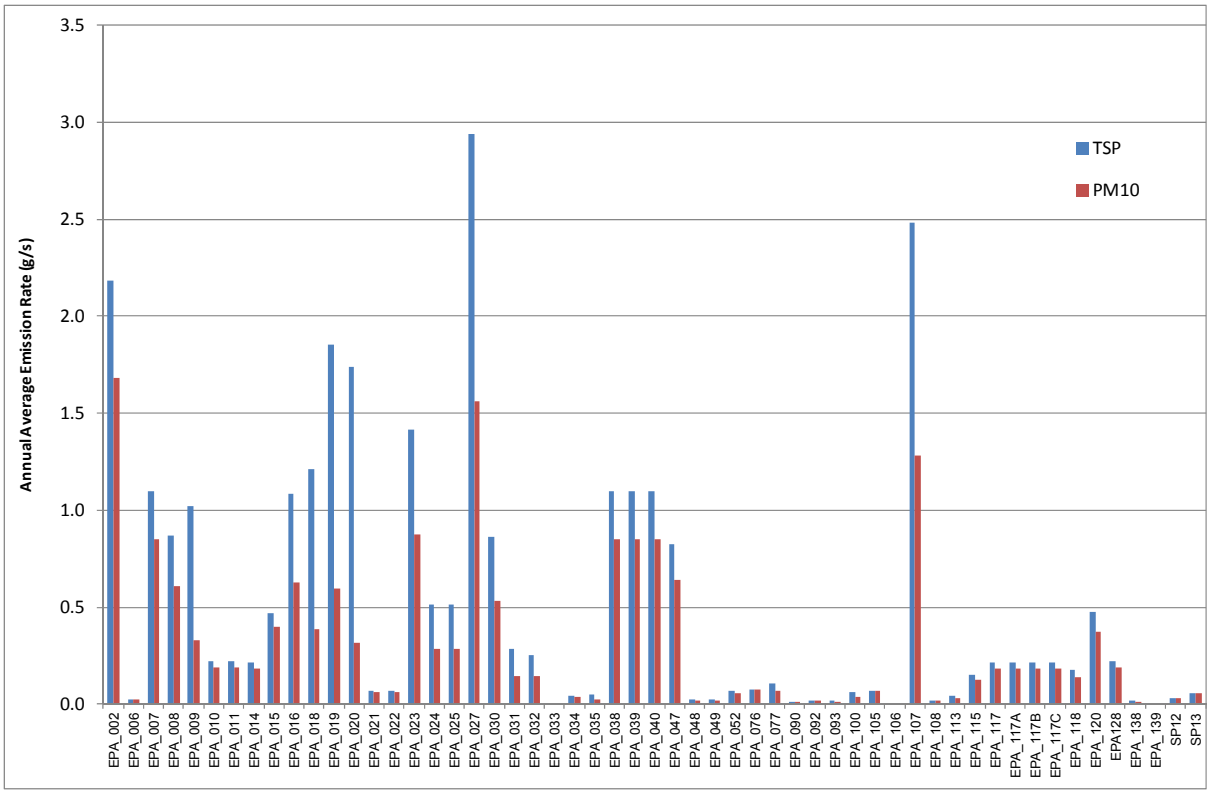

Figure 40: 2.6Mtpa Scenario – Annual average TSP and PM_{10} emission rates for Stacks

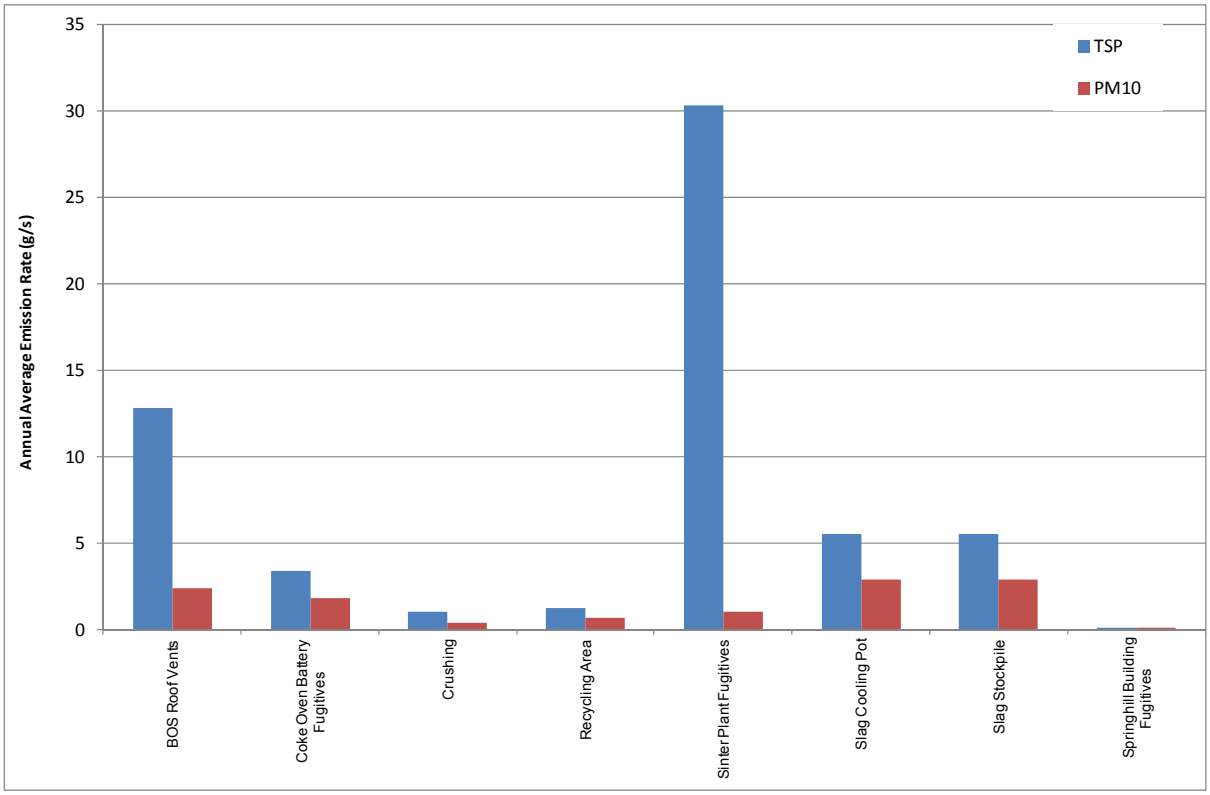

Figure 41: 2.6Mtpa Scenario – Annual average TSP and PM_{10} emission rates for Fugitive Sources

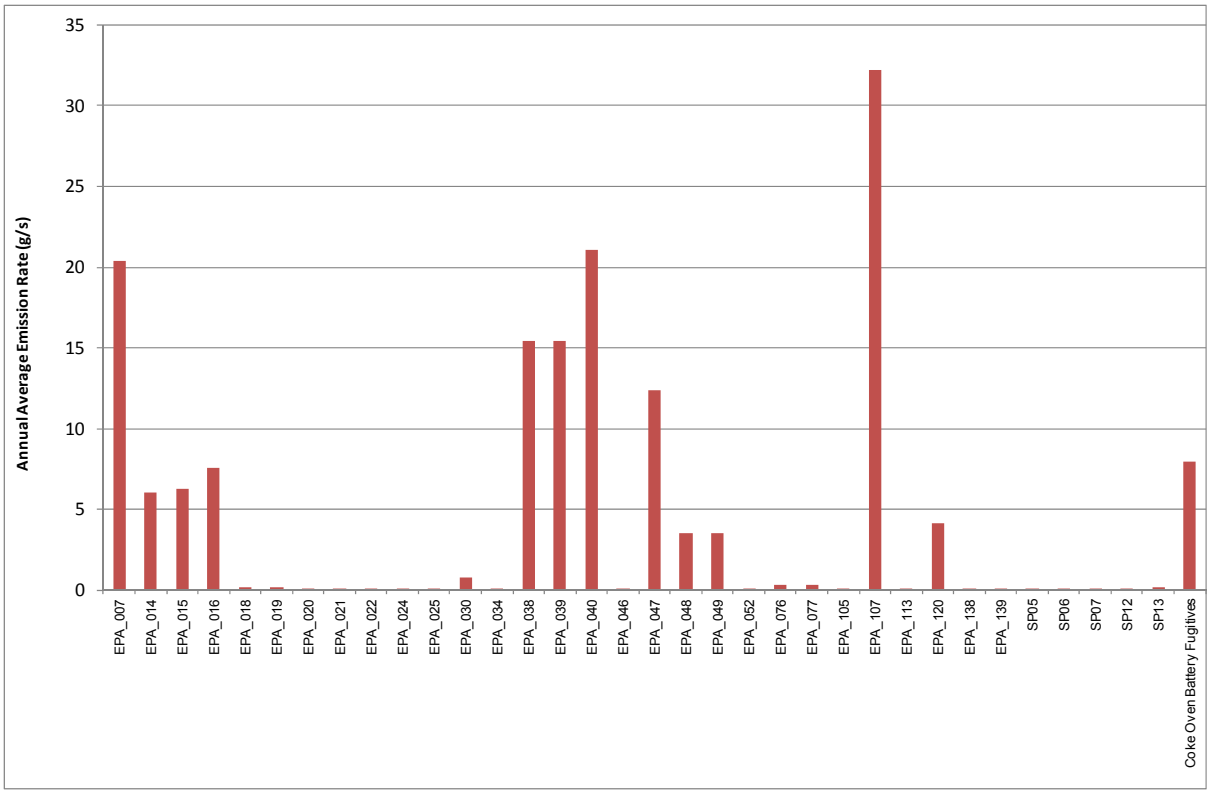

Figure 42: 2.6Mtpa Scenario – Annual average SO_2 emission rates by Source

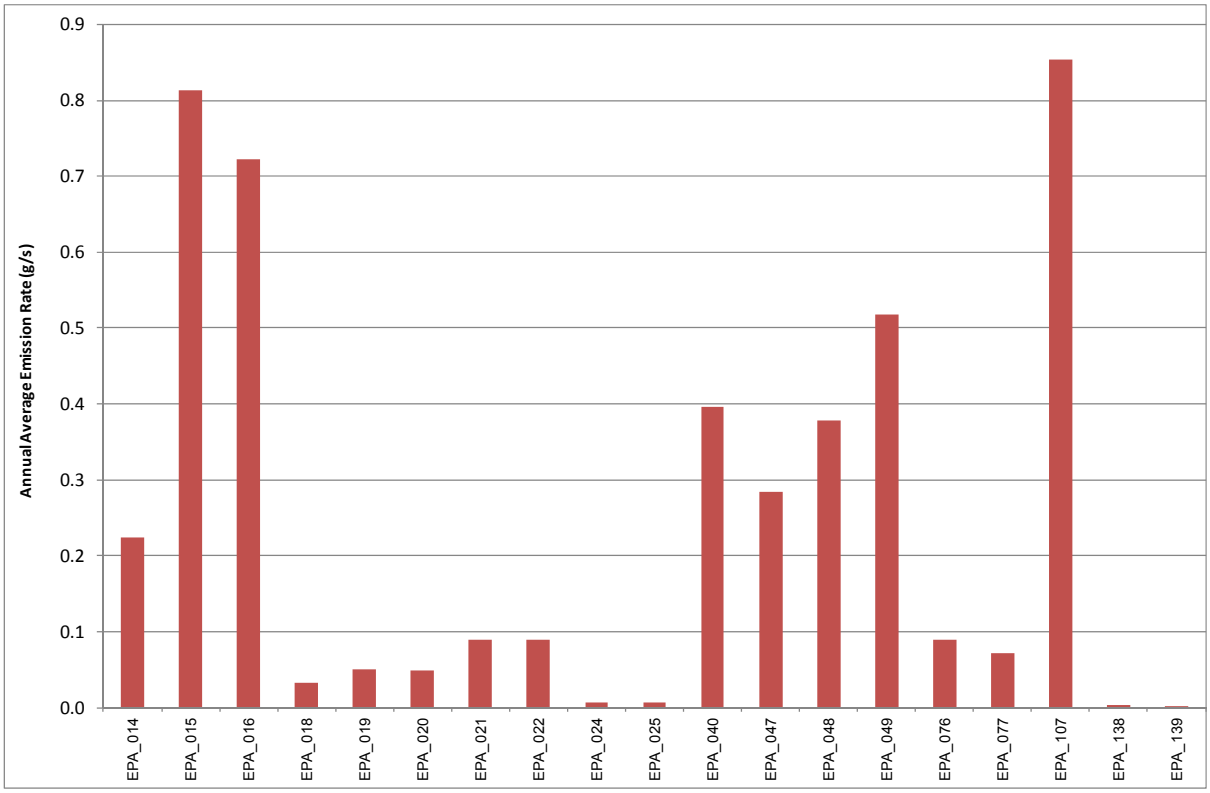

Figure 43: 2.6Mtpa Scenario – Annual average SO_3 emission rates by Source

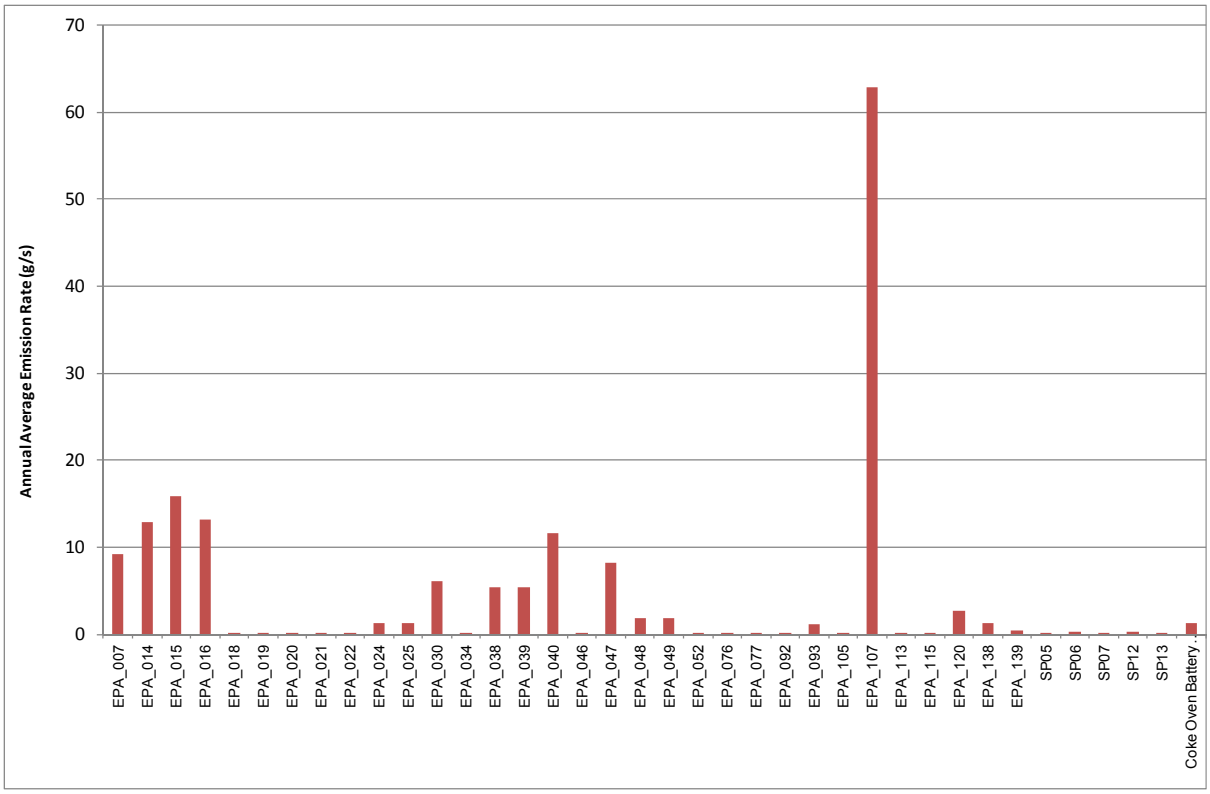

Figure 44: 2.6Mtpa Scenario – Annual average NO_x emission rates by Source

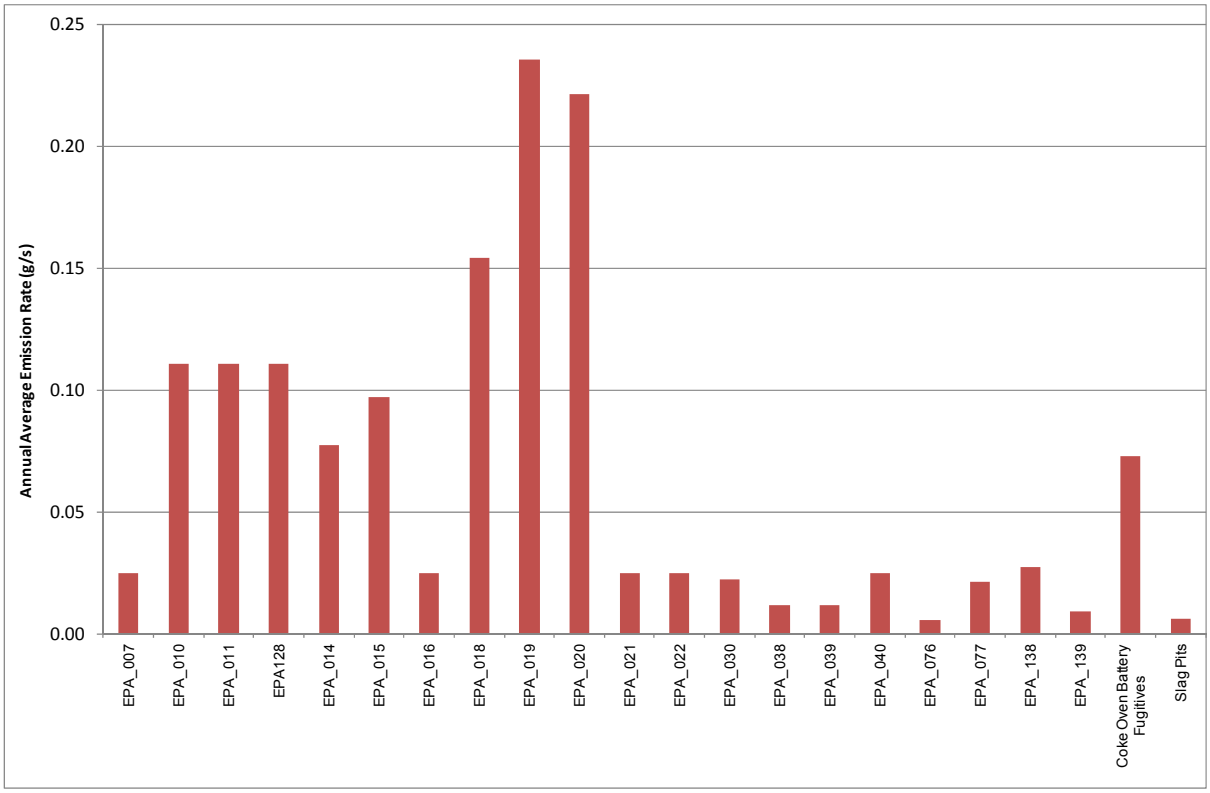

Figure 45: 2.6Mtpa Scenario – Annual average H_2S emission rates by Source

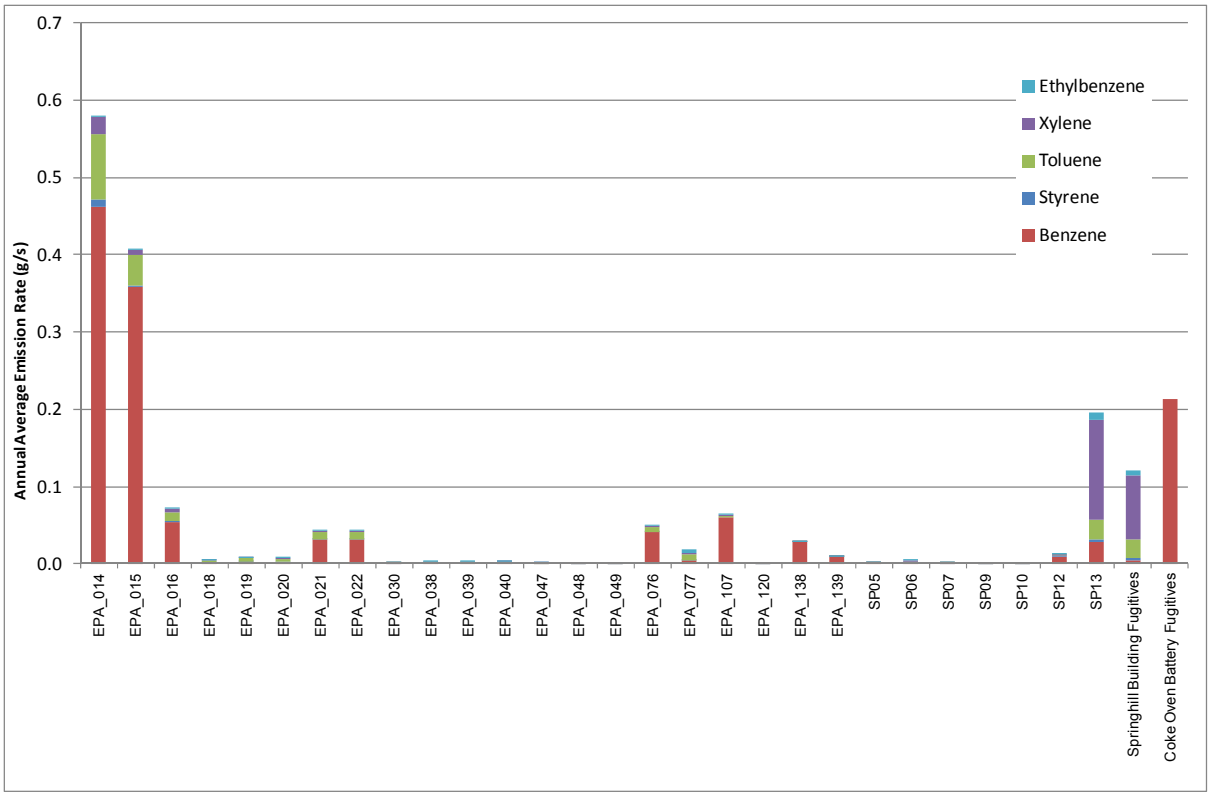

Figure 46: 2.6Mtpa Scenario – Annual average Benzene, Toluene, Xylene, Ethylbenzene and Styrene emission rates by Source

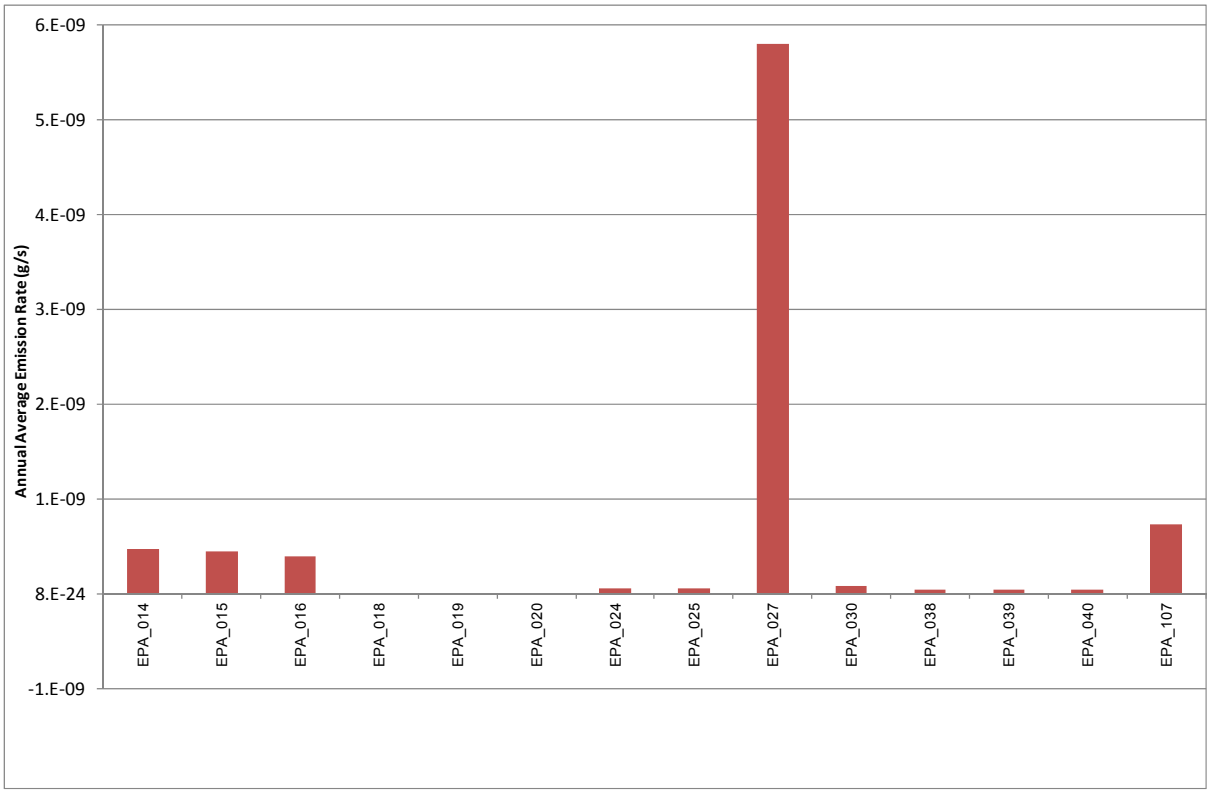

Figure 47: 2.6Mtpa Scenario – Annual average PCDD/F emission rates by Source

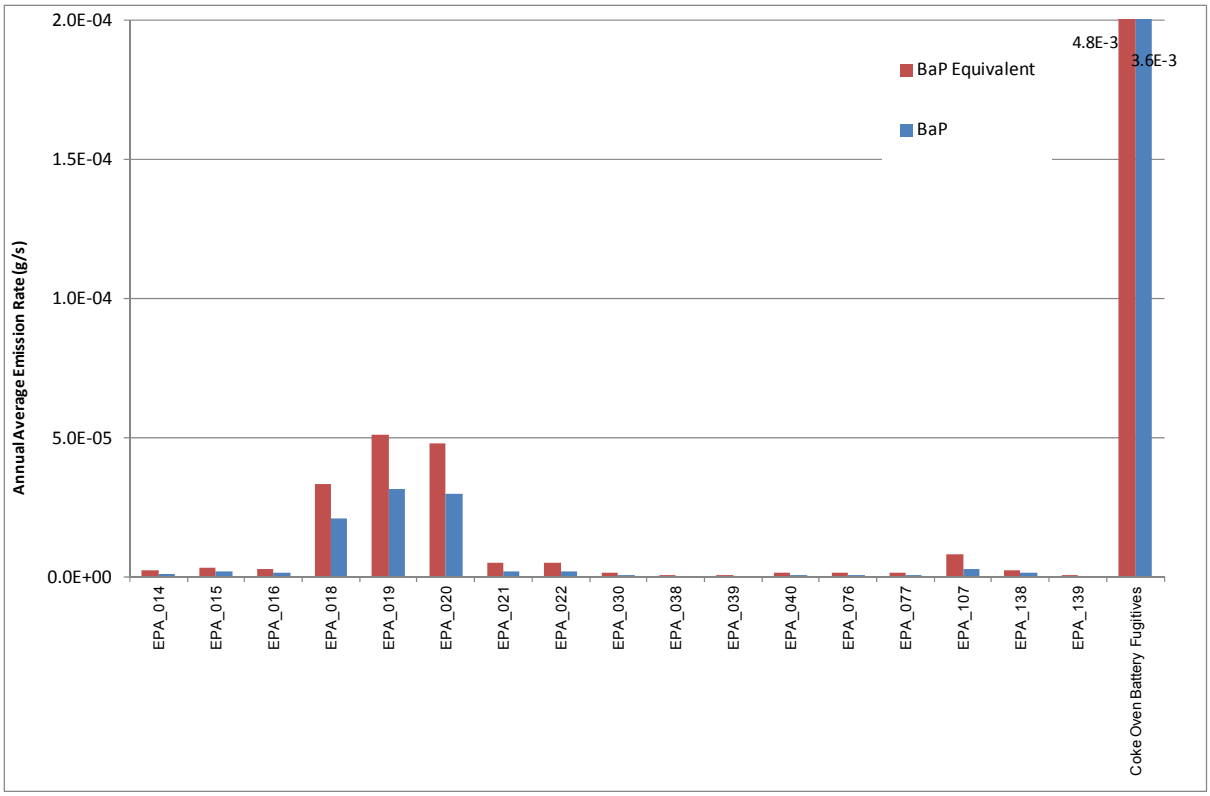

Figure 48: 2.6Mtpa Scenario – Annual average BaP emission rates by Source

A summary of total annual emissions by source grouping is given in **Table 23**.

Table 23: Total Annual Emissions by Source Group – 2.6 Mtpa Scenario

	TSP	PM_{10}	SO_2	SO_3	NOx	H_2S	Benzene	Ammonia	Toluene
	tpa	tpa	tpa	tpa	tpa	tpa	tpa	tpa	tpa
Stacks	895	535	4744	148	5220	42.7	35.5	326.6	6.6
BOS Roof Vents	404	75							
Coke Oven Battery Fugitives	107	58	251		40	2.3	6.7		
Crushing	33	13							
Recycling Area	40	21							
Sinter Plant Fugitives	955	34							
Slag Cooling Pot, Slag Stockpile	347	184							
Slag Pits						0.2			
Springhill Building Fugitives	2	2					0.1		0.8
Total	2782	922	4995	148	5259	45.1	42.4	326.6	7.4
	Styrene	Xylene	Ethyl-benzene	Phenol	Cyanide	Chlorine	BaP Equiv.	BaP	PCDD/F
	tpa	tpa	tpa	tpa	tpa	tpa	kg/annum	kg/annum	g/annum
Stacks	0.69	5.88	0.79	0.08	2.27	1.40	5.4	3.1425	0.3
BOS Roof Vents									
Coke Oven Battery Fugitives							150.0	112.5	
Crushing									
Recycling Area									
Sinter Plant Fugitives									
Slag Cooling Pot, Slag Stockpile									
Slag Pits									
Springhill Building Fugitives	0.105	2.618	0.189						
Total	0.80	8.50	0.98	0.08	2.27	1.40	155.4	115.6	0.3

The projected reduction in annual emissions given the change in operations from 5.2 Mtpa to 2.6 Mtpa is summarized in **Table 24**.

Table 24: Reduction in Annual Emissions due to Reduced Production

	TSP	PM_{10}	SO_2	SO_3	NOx	H_2S	Benzene	Ammonia	Toluene
	tpa	tpa	tpa	tpa	tpa	tpa	tpa	tpa	tpa
Stacks	933	396	4182	40	2817	62.35	27.75	101.50	3.20
BOS Roof Vents	116	190							
Coke Oven Battery Fugitives	33	18	70		11	0.71	2.06		
Recycling Area	33	17							
Sinter Plant Fugitives	955	33							
Slag Cooling Pot, Slag Stockpile	347	184							
Slag Pits						0.80			
Total	2417	838	4252	40	2829	63.86	29.81	101.50	3.20
	Styrene	Xylene	Ethyl-benzene	Phenol	Cyanide	Chlorine	BaP Equiv.	BaP	PCDD/F
	tpa	tpa	tpa	tpa	tpa	tpa	kg/annum	kg/annum	g/annum
Stacks	0.21	0.43	0.07	0.02	0.70	0.36	1.58	0.86	0.44
Coke Oven Battery Fugitives							45.00	33.80	
Total	0.21	0.43	0.07	0.02	0.70	0.36	46.58	34.66	0.44

5 Dispersion Model Method and Results

5.1 Modelling Method

A detailed description of the dispersion model selection and validation process has been given in previous reports and is not repeated in this report (ENVIRON, 2009, 2010). Instead a brief overview is provided of the overall dispersion modelling approach and any changes to the modelling approach from previous assessments noted.

The US-EPA regulatory model AERMOD version 7.6.1 was applied in the simulations, using as input the meteorological data set generated previously using AERMET for the calendar year 2007. Source and emissions data for the 5.2 mtpa and 2.6 mtpa production scenarios were input into the model, as documented in **Section 4** and **Appendix C**.

5.1.1 Modelling of NO_2

The atmospheric transformation of NO to NO_2 was accounted for through the application of the US-EPA's Ozone Limiting Method (OLM), in accordance with the OEH *Approved Methods for Modelling*. The OLM assumes that all available O_3 in the atmosphere will react with NO in the plume until either all O_3 or all NO is used up. This approach is conservative as the transformation is assumed to occur instantly, whereas in reality, transformation will occur over a period of hours.

5.1.2 Building Wake Effects

The influence of building wake effects on plume dispersion was accounted for through the application of the Building Profile Input Program (BPIP). BPIP incorporates the concepts and procedures expressed in the USEPA document *Guideline for the Determination of Good Engineering Practice Stack Height* (1985), building downwash guidance, and other related references that correctly calculate building heights and projected building widths for simple, multi-tiered, and groups of structures. By referencing the outputs of the BPIP, this information is automatically entered into AERMOD's Plume Rise and Building Downwash Model (PRIME) algorithm. Over 1,000 buildings and structures at the BSL facility were evaluated by the BPIP program to accurately account for building downwash effects.

5.1.3 Projection of Sub-hourly Peak Concentrations

The evaluation of H_2S odour impacts requires an estimation of short or peak concentrations on the time scale of less than one second, whereas the model predictions are confined to averaging periods of one hour or longer. To estimate such peaks, peak-to-mean ratios (P/M60) from the OEH *Approved Method for Modelling* were applied. A P/M60 of 2.3 was applied to all model predictions, consistent with near field assessments of wake-affected point sources and volume sources.

5.1.4 Representative Sensitive Receptors

Sensitive receptors selected from the most affected properties or community facilities within adjacent suburbs during the previous assessments were retained for this modelling study, as listed in **Table 25**.

Table 25: Sensitive Receptors in the vicinity of the BSL facility			
Sensitive Receptor	**Receptor Type**	**Receptor Location (GDA)**	
		Easting (m)	**Northing (m)**
Receptor 1	Residence	303054	6186079
Receptor 2	Residence	304458	6186662
Coniston Primary School	Primary School	303835	6187128
Unanderra Community Centre	Community Centre	301769	6185029
Cringila Primary School	Primary School	304332	6183457
Warrawong Community Centre	Community Centre	307138	6182455

5.1.5 Representative Background Concentrations

To project cumulative air pollutant concentrations (i.e. background concentrations plus the increment due to BSL emissions) for comparison with air quality criteria applicable to cumulative air pollutant concentrations (Refer to **Section** 2), it is necessary to derive representative background levels. Air quality criteria for TSP, PM10, NO_2 and SO_2 are applicable to cumulative concentrations, as are the national air toxics investigation levels published for toluene, xylene, benzene and benzo(a)pyrene. Reference was made to background concentrations derived in the previous assessments for TSP, PM10, NO_2, H_2S and SO_2 (ENVIRON 2010, 2011) as summarised in **Table 26**.

Table 26: Sensitive Receptors in the vicinity of the BSL facility		
Pollutant	**Basis for Background Concentration**	**Background Concentration (µg/m³)**
PM_{10}	BSL Old Scouts Hall TEOM measurements. Median concentration based on measurements taken when wind direction was between 180° and 270° (i.e. when monitoring site was upwind of BSL facility).	12.8µg/m³
TSP	Application of a median PM_{10}/TSP ratio of 0.47.	27 µg/m³
SO_2	Based on analysis of SO_2 data from OEH Albion Park and Wollongong stations, noting concentrations when stations were likely not to be impacted by BSL facility emissions.	Negligible
NO_2	OEH Wollongong, Kembla Grange and Albion Park NO_2 monitoring stations. Average NO_2 concentrations across the three data sets during the period when these stations were not directly downwind of the BSL facility.	10.8 µg/m³
H_2S	BSL WIN TV, Cringila and Old Scouts Hall SO_2 monitoring stations.	1 µg/m³

During a previous study background concentration of H_2S were derived based on a detailed analysis of ambient H_2S measurements and concurrent wind data (ENVIRON, 2010). Average background concentrations were estimated to be 0.4 µg/m³ at WIN TV, 0.75 µg/m³ at Cringila and 1.4 µg/m³ at Old Scouts Hall. Hourly-average H_2S concentrations that may occur in the vicinity of the BSL facility, excluding the contribution of BSL operations, were thus considered to be of the order of 1 µg/m^3 (ENVIRON, 2011). The contribution of Lake Illawarra to ambient H_2S concentrations however varies in significance based on localised meteorological conditions, tidal patterns and other phenomenon and consequently may cause variations in such estimated background H_2S concentrations.

5.2 Model Results

Dispersion model results are presented in this section including:

- Predicted air pollutant concentrations at selected sensitive receptors;
- Isopleth plots illustrating spatial patterns in predicted air pollutant concentrations; and
- Source contributions to predicted annual average air pollutant concentrations at selected sensitive receptor sites.

Model results are presented concurrently for the 5.2 Mtpa and 2.6 Mtpa production scenarios to facilitate comparisons.

The remodeling involved significant changes to source configurations and to temporal variations in emission rates compared to the previously validated Site Air Emissions Model. Consequently, despite reductions having occurred in the overall emissions of a number of sources within the revised 5.2 Mtpa scenario, increases in ground level concentrations were predicted in some instances due to changes in the manner in which source configurations were modelled and/or to altered emission profiles within the variable emission rate files.

By example, a new emission rate time series comprising a range of reoccurring emissions was established for BF5 Granulation Stacks based on additional monitoring data sets. Despite overall granulation stack emissions being reduced, peak emission rates within the arbitrarily reoccurring set of emission rates may have coincided with adverse meteorological periods resulting in relatively higher peaks in GLCs compared the previous model results.

5.2.1 PM_{10} Concentrations

Cumulative PM_{10} concentrations predicted to occur at selected sensitive receptors are given in **Table 27** and **Table 28** . To provide an estimate of cumulative PM_{10} concentrations, a derived background PM_{10} concentration (refer **Section 5.1.5**) of 12.8 µg/m³ has been incorporated into the results.

Table 27: Cumulative PM_{10} Concentrations – 5.2 Mtpa Scenario

Sensitive Receptor	Annual Average PM_{10} (µg/m^3)	Maximum 24 hour Average PM_{10} (µg/m^3)	No. of Exceedences of 50µg/m^3 (24-hour average)
Residence 1	16.4	103	3
Residence 2	17.9	166	7
Coniston Primary School	16.5	54	1
Unanderra Community Centre	15.1	64	2
Cringila Primary School	21.2	134	16
Warrawong Community Centre	18.5	102	5

OEH Criteria: 24-hour – 50µg/m³; Annual - 90 µg/m^3

Cumulative annual average PM_{10} concentrations are predicted to be within the OEH criterion of 30 µg/m^3, with the maximum annual average concentration reduced by about 2 µg/m³ given the 2.6 Mtpa production scenario.

Maximum 24-hour average PM_{10} concentrations are predicted to exceed the OEH criterion of 50µg/m³ at all sensitive receptors for the 5.2 Mtpa scenario, with the greatest number of exceedances being predicted at Cringila Primary School (16 days per year). Maximum

concentrations and numbers of exceedances are projected to have been reduced given the 2.6 Mtpa scenario, with no exceedances predicted at Coniston Primary School and Unanderra Community Centre, and seven fewer exceedance days at Cringila Primary School.

Table 28: Cumulative PM_{10} Concentrations – 2.6 Mtpa Scenario

Sensitive Receptor	Annual Average PM_{10} ($\mu g/m^3$)	Maximum 24 hour Average PM_{10} ($\mu g/m^3$)	No. of Exceedences of 50$\mu g/m^3$ (24-hour average)
Residence 1	14.9	80	3
Residence 2	15.9	118	2
Coniston Primary School	15.1	39	0
Unanderra Community Centre	14.2	49	0
Cringila Primary School	18.0	94	9
Warrawong Community Centre	16.4	72	2

OEH Criteria: 24-hour – 50µg/m³; Annual - 90 $\mu g/m^3$

Isopleth plots depicting spatial patterns in predicted incremental concentrations are given in **Appendix D** for both BSL emission scenarios. The OEH 24-hour criterion is predicted to be exceeded for distances of over 5 km from the BSL facility boundary for both emission scenarios.

Annual average concentrations predicted to occur at three of sensitive receptor sites (Residence 2, Cringilla Primary School, Warrawong Community Centre) due to BSL sources are illustrated in **Figure 49**.

The most significant fugitive sources contributing to particulate matter GLCs at sensitive receptor sites for both the 5.2 Mtpa and 2.6 Mtpa scenarios were identified as:

- Slag cooling pit and slag stockpile
- BOS roof vents
- Coke oven batteries
- Crushing plants

The most significant stack emissions contributing to particulate matter GLCs at sensitive receptor sites for the 5.2 Mtpa scenario were identified as:

- Coke Screening House Dedusting Stack (EPA23)
- No. 6 Blast Furnace Stock House Dedusting Stack (EPA5)
- BOS No. 2 Dedusting Stack (EPA27)
- No. 2 Walking Beam Furnace Stack (EPA120)
- Slab Handling – Slab Scarfing Machine Stack (EPA34)

For the 2.6 Mtpa scenario EPA5 has been shut down and emissions from EPA120 and EPA34 significantly reduced. For this scenario EPA23, EPA27 and EPA32 (Line Kiln Storage bins – Bahco Baghouse Stack) are most significant for stack contributions to GLCs.

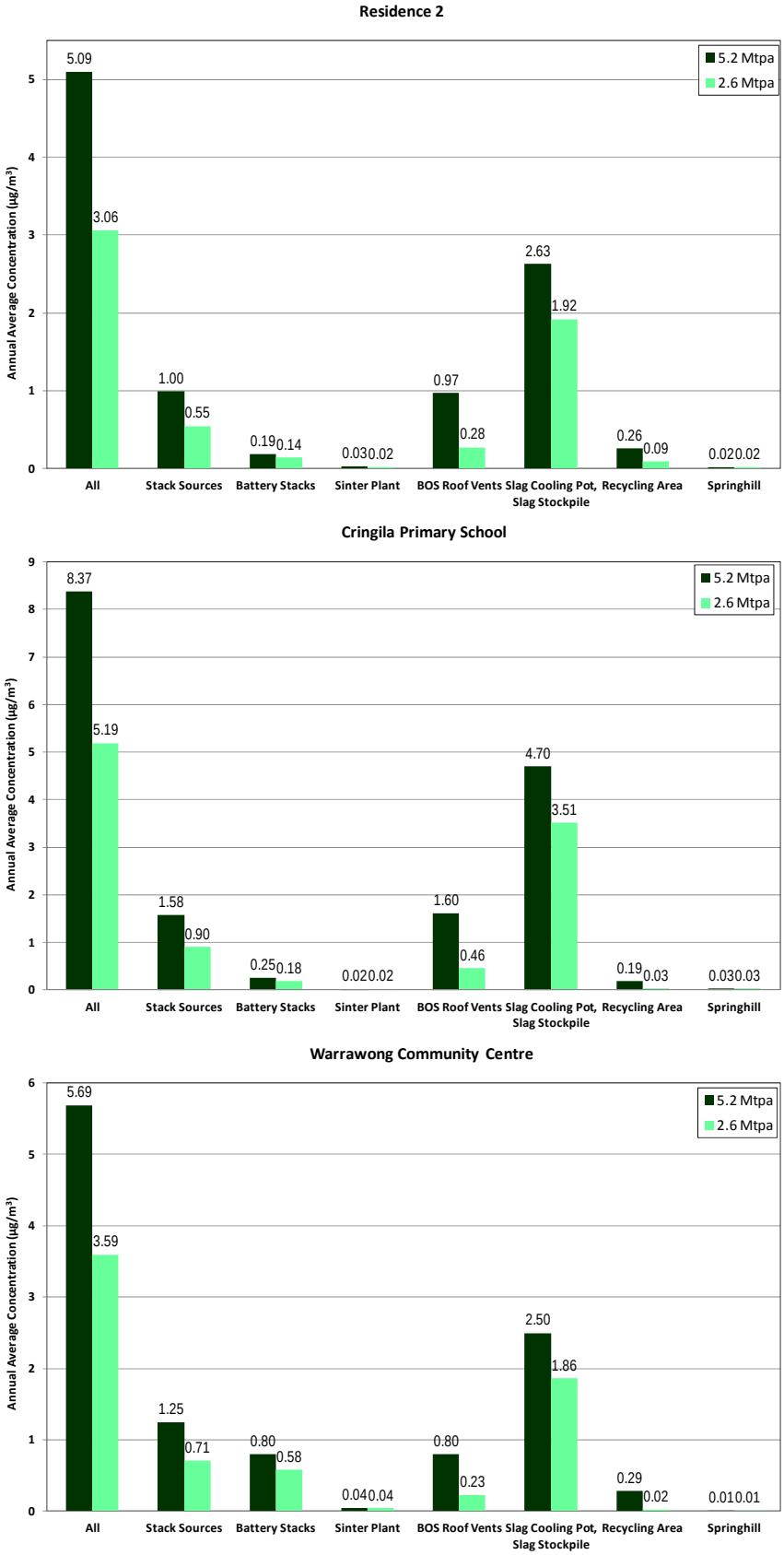

Figure 49: Annual Average PM_{10} Concentrations by Source at Selected Sensitive Receptors

5.2.2 TSP Concentrations

Cumulative TSP concentrations predicted to occur at selected sensitive receptors are given in **Table 29** and **Table 30**. To provide an estimate of cumulative TSP concentrations, a derived background TSP concentration (refer **Section 5.1.5**) of 27 µg/m³ has been incorporated into the results.

Table 29: Cumulative TSP Concentrations – 5.2 Mtpa Scenario

Sensitive Receptor	Annual Average (µg/m^3)
Residence 1	33
Residence 2	36
Coniston Primary School	34
Unanderra Community Centre	31
Cringila Primary School	42
Warrawong Community Centre	38

OEH Criteria: Annual - 90 µg/m^3

Table 30: Cumulative TSP Concentrations – 2.6 Mtpa Scenario

Sensitive Receptor	Annual Average PM_{10} (µg/m^3)
Residence 1	31
Residence 2	33
Coniston Primary School	32
Unanderra Community Centre	30
Cringila Primary School	37
Warrawong Community Centre	35

OEH Criteria: Annual - 90 µg/m^3

Cumulative annual average TSP concentrations are predicted to be within the OEH criterion of 90 µg/m^3, with the maximum annual average concentration reduced by about 3 µg/m³ given the 2.6 Mtpa production scenario.

Isopleth plots depicting spatial patterns in predicted incremental concentrations are given in **Appendix D** for both BSL emission scenarios.

Annual average concentrations predicted to occur at three of sensitive receptor sites (Residence 2, Cringilla Primary School, Warrawong Community Centre) due to BSL sources are illustrated in **Figure 50**. Source significance rankings discussed for PM_{10} in the previous section are also relevant for TSP.

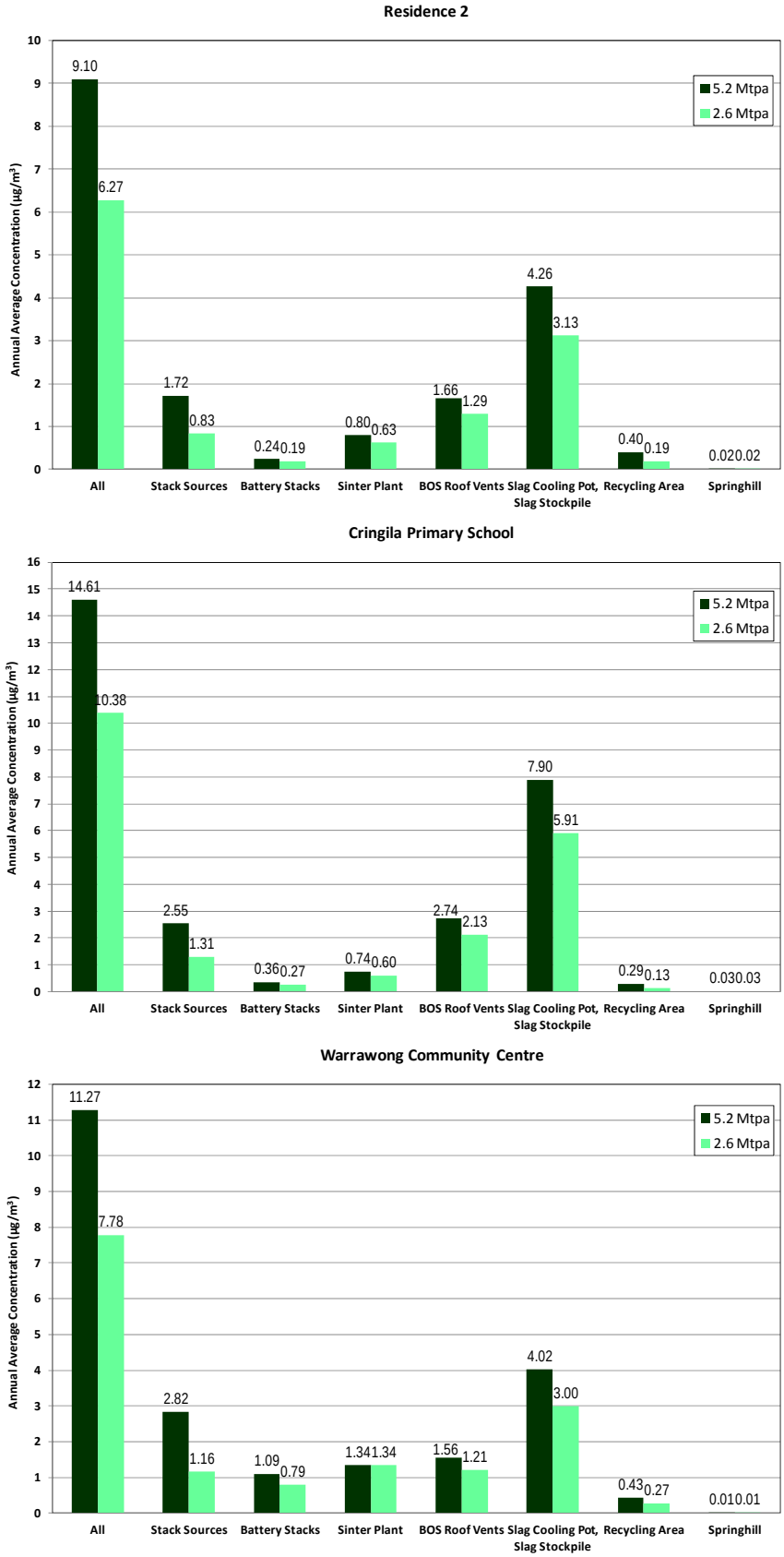

Figure 50: Annual Average TSP Concentrations by Source at Selected Sensitive Receptors

5.2.3 NO_2 Concentrations

Cumulative NO_2 concentrations predicted to occur at selected sensitive receptors are given in **Table 31** and **Table 32**. To provide an estimate of cumulative NO_2 concentrations, a derived background NO_2 concentration (refer **Section 5.1.5**) of 10.8 µg/m³ has been incorporated into the results. The transformation of NO to NO_2 has been accounted for by utilising the US-EPA OLM to provide a conservative (upper bound) estimate of NO_2 concentrations.

Table 31: Cumulative NO_2 Concentrations – 5.2 Mtpa Scenario

Sensitive Receptor	Annual Average (µg/m^3)	Maximum 1-hour Average (µg/m^3)
Residence 1	12.6	136
Residence 2	15.3	241
Coniston Primary School	14.4	158
Unanderra Community Centre	12.0	114
Cringila Primary School (CPS)	16.5	116
Warrawong Community Centre (WCC)	14.0	**286**

OEH Criteria: 1-hour - 246 µg/m^3; Annual - 62 µg/m^3

Table 32: Cumulative NO_2 Concentrations – 2.6 Mtpa Scenario

Sensitive Receptor	Annual Average (µg/m^3)	Maximum 1-hour Average (µg/m^3)
Residence 1	12.2	100
Residence 2	14.0	223
Coniston Primary School	13.5	130
Unanderra Community Centre	11.7	88
Cringila Primary School (CPS)	15.1	96
Warrawong Community Centre (WCC)	13.2	190

OEH Criteria: 1-hour - 246 µg/m^3; Annual - 62 µg/m^3

Cumulative annual average NO_2 concentrations are predicted to be within the OEH criterion of 62 µg/m^3. Maximum 1-hour average NO_2 concentrations are predicted to exceed the OEH criterion of 246 µg/m³ at the WCC receptor given the 5.2 Mtpa scenario. No exceedances are predicted at the sensitive receptors for the 2.6 Mtpa scenario.

Isopleth plots depicting spatial patterns in predicted incremental concentrations are given in **Appendix D** for both BSL emission scenarios. The OEH 1-hour NO_2 criterion is predicted to be exceeded to the southeast of the BSL facility boundary.

Annual average concentrations predicted to occur at three of sensitive receptor sites (Residence 2, Cringilla Primary School, Warrawong Community Centre) due to BSL sources are illustrated in **Figure 51** by source type and in **Figure 52, Figure 53** and **Figure 54** for all sources.

The most significant sources contributing to NO_2 GLCs at sensitive receptor sites were identified as follows for the 5.2 Mtpa scenario:

- Lime Kiln Discharge Building Baghouse Stack (EPA93)
- Furnace Stacks (EPA47, 48, 49, 120)
- Blower Station Boiler Stacks (EPA37, 38, 39, 40)
- Lime Kiln Waste Heat Stack (EPA30)
- Blast Furnace Stove Heating Stacks (EPA3, EPA7)
- Battery Heating Stacks (EPA 13, 14, 15, 16)
- Sinter Plant Exhaust Stack (EPA 107)

The most significant sources contributing to NO_2 GLCs at sensitive receptor sites were identified as follows for the 2.6 Mtpa scenario:

- Lime Kiln Discharge Building Baghouse Stack (EPA93)
- Furnace Stacks (EPA47, 48, 49, 120)
- Lime Kiln Waste Heat Stack (EPA30)
- Blower Station Boiler Stacks (EPA38, 39, 40)
- Blast Furnace Stove Heating Stacks (EPA7)
- Coke oven batteries
- Battery Heating Stacks (EPA14, 15, 16)

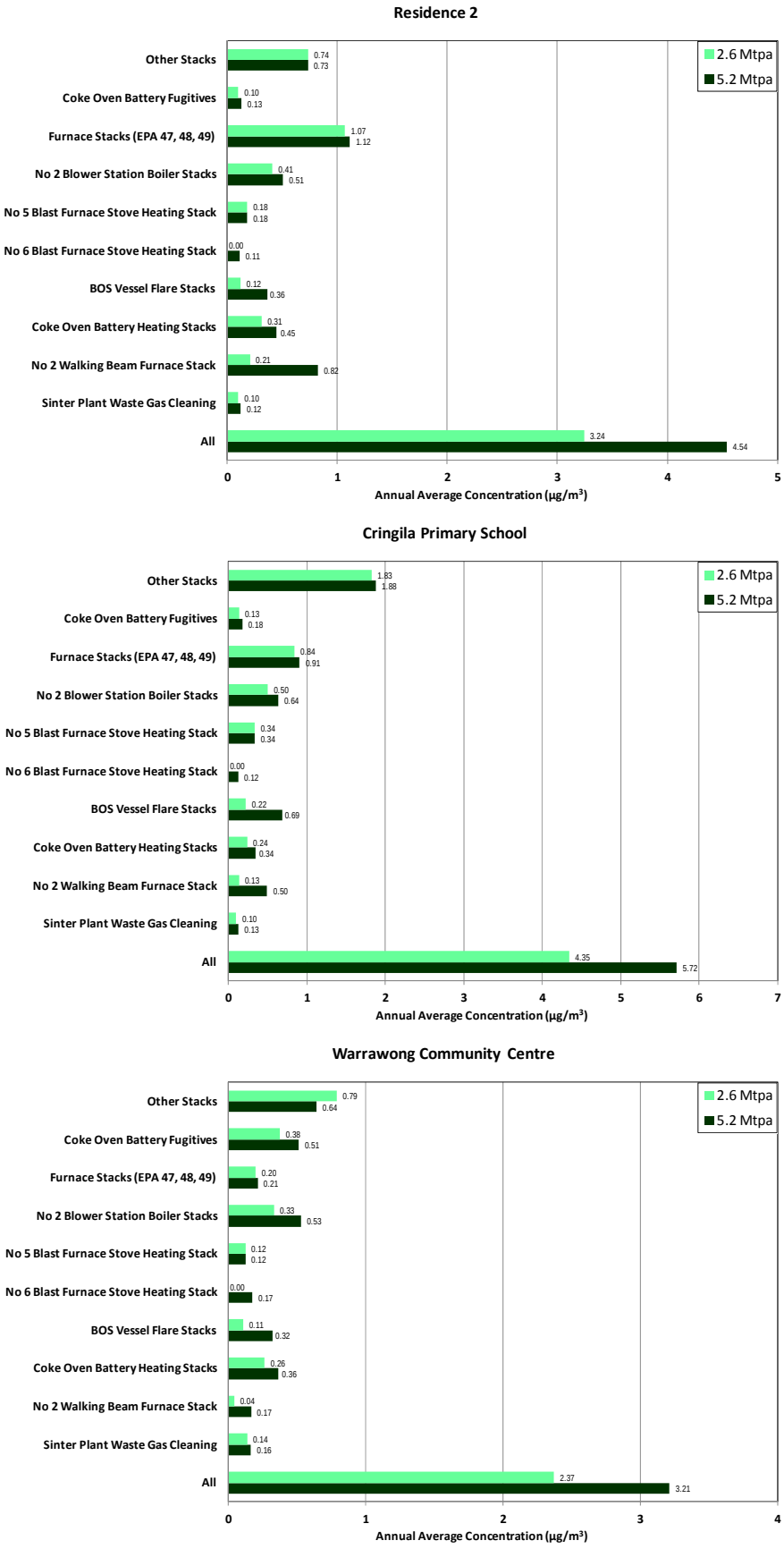

Figure 51: Annual Average NO_2 by Source at Selected Sensitive Receptors

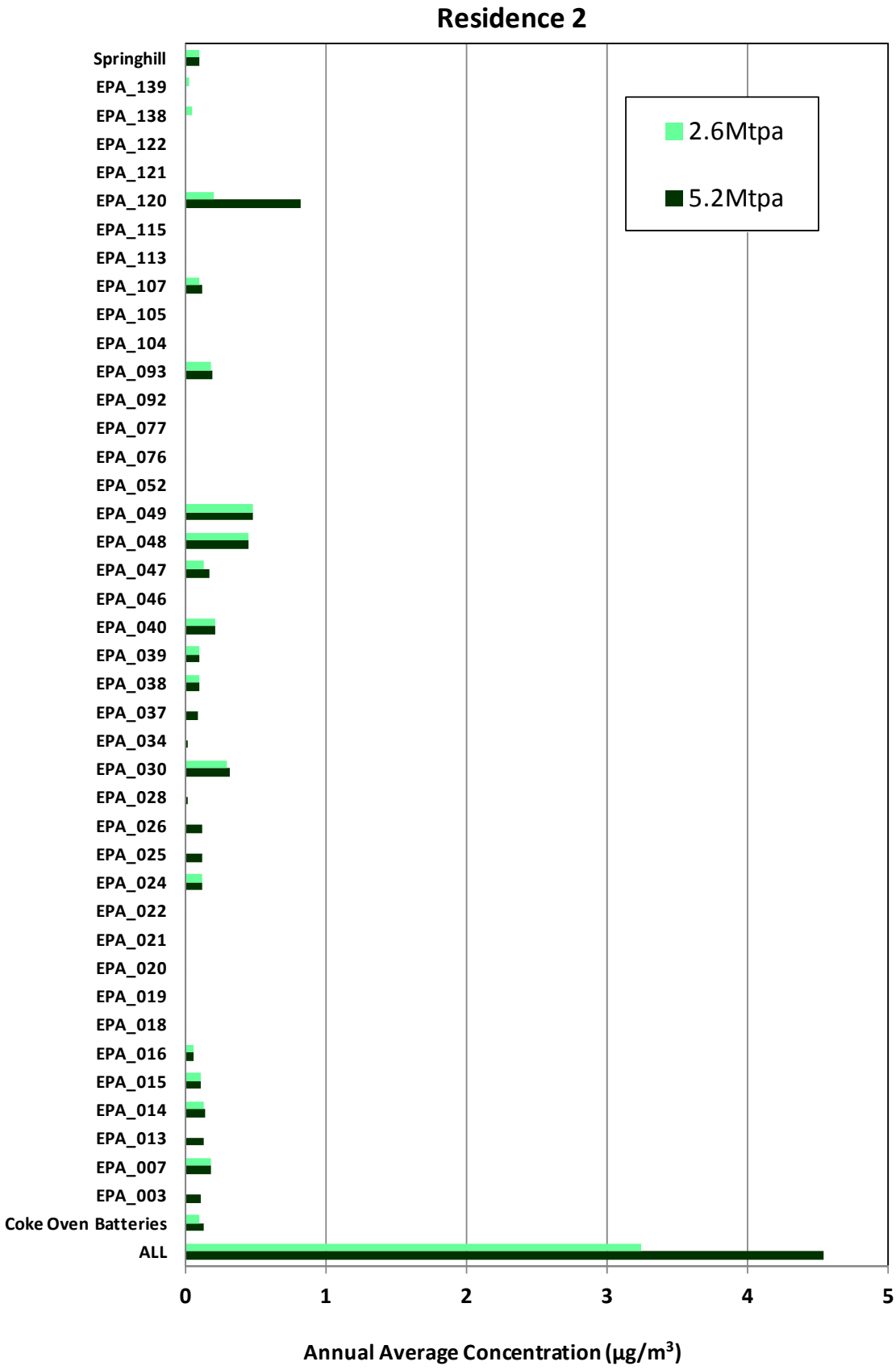

Figure 52: Annual Average NO_2 by Stack Number at Residence 2

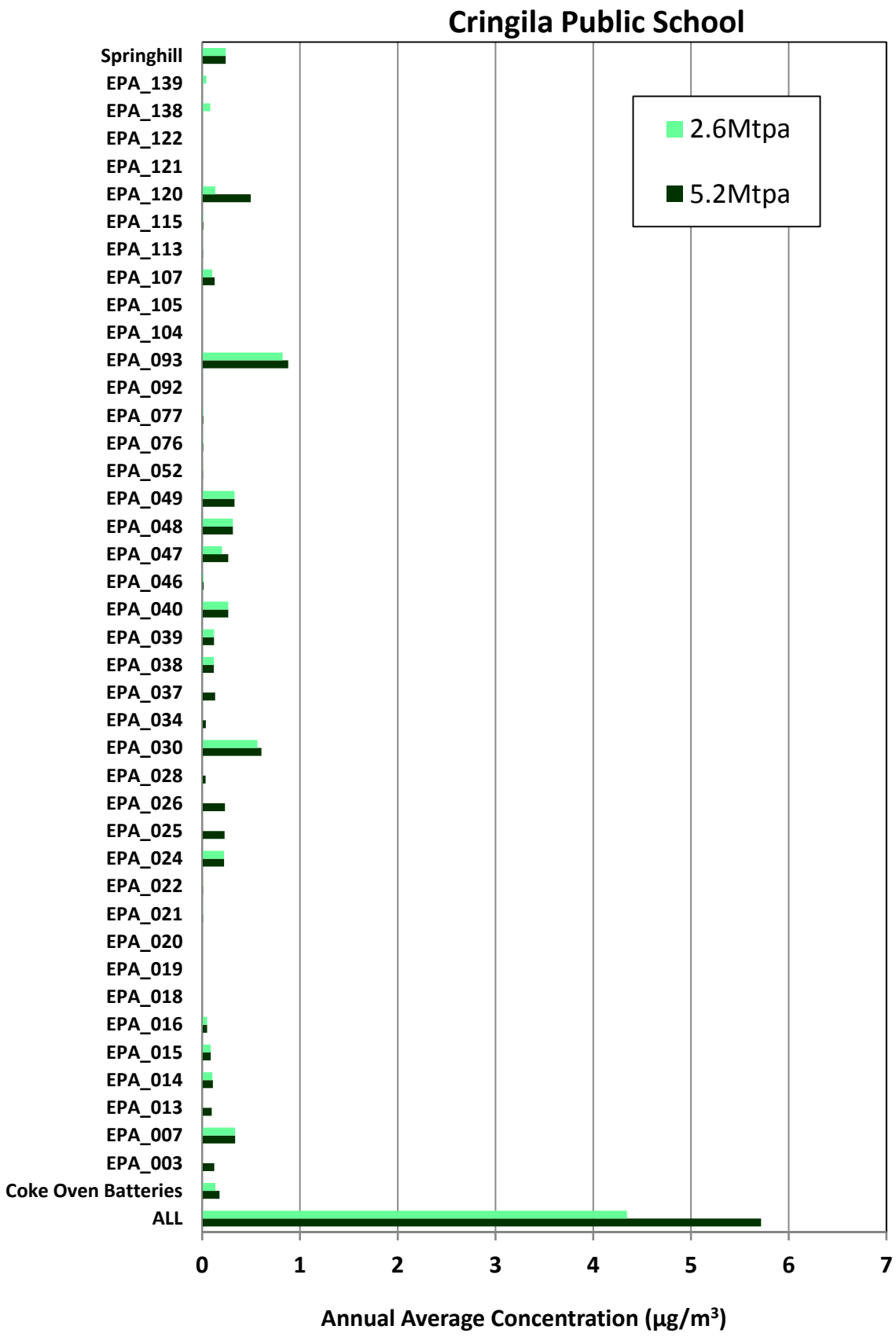

Figure 53: Annual Average NO_2 by Stack Number at Cringila Public School

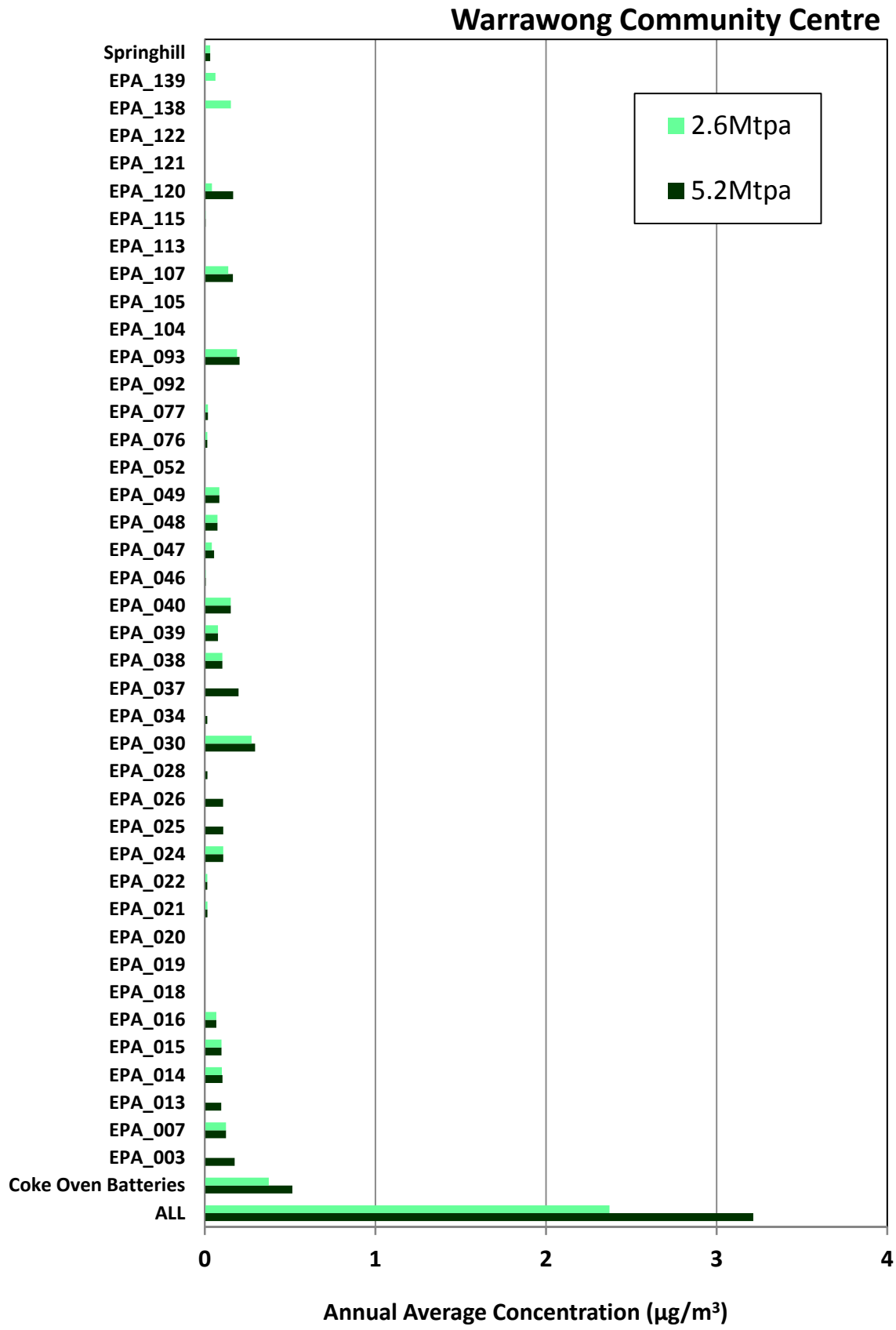

Figure 54: Annual Average NO_2 by Stack Number at Warrawong Community Centre

5.2.4 SO_2 Concentrations

SO_2 concentrations predicted to occur at selected sensitive receptors are given in **Table 33** and **Table 34**. Background SO_2 concentrations are considered low and therefore cumulative concentrations are not presented (refer **Section 5.1.5**). No exceedances of the OEH air quality criteria for SO_2 are predicted for either the 5.2 Mpta or the 2.6 Mtpa scenarios.

Table 33: Predicted SO_2 Concentrations – 5.2 Mtpa Scenario

Sensitive Receptor	Annual Average (µg/m^3)	Maximum 24-hour Average (µg/m^3)	Maximum 1-hour Average (µg/m^3)
Residence 1	2.6	45	169
Residence 2	6.5	80	305
Coniston Primary School	5.5	56	290
Unanderra Community Centre	1.7	18	145
Cringila Primary School (CPS)	6.8	63	227
Warrawong Community Centre (WCC)	6.2	69	540

OEH Criteria: 1-hour - 570 µg/m^3; 24-hour - 228 µg/m^3; Annual - 60 µg/m^3

Table 34: Predicted SO_2 Concentrations – 2.6 Mtpa Scenario

Sensitive Receptor	Annual Average (µg/m^3)	Maximum 24-hour Average (µg/m^3)	Maximum 1-hour Average (µg/m^3)
Residence 1	1.9	32	118
Residence 2	4.4	52	246
Coniston Primary School	3.7	37	240
Unanderra Community Centre	1.2	12	99
Cringila Primary School (CPS)	4.7	43	168
Warrawong Community Centre (WCC)	3.8	53	431

OEH Criteria: 1-hour - 570 µg/m^3; 24-hour - 228 µg/m^3; Annual - 60 µg/m^3

Isopleth plots depicting spatial patterns in predicted incremental concentrations are given in **Appendix D** for both BSL emission scenarios.

Annual average concentrations predicted to occur at three of sensitive receptor sites (Residence 2, Cringilla Primary School, Warrawong Community Centre) due to BSL sources are illustrated in **Figure 55**.

The most significant sources contributing to SO_2 GLCs at sensitive receptor sites were identified as follows for the 5.2 Mtpa scenario:

- Furnace Stacks (EPA 47, 48, 49, 120)
- Coke oven battery fugitives
- Blower Station Boiler Stacks (EPA 37, 38, 39, 40)
- Blast Furnace Stove Heating Stacks (EPA 3, 7)

The most significant sources contributing to SO_2 GLCs at sensitive receptor sites were identified as follows for the 2.6 Mtpa scenario:

- Furnace Stacks (EPA 47, 48, 49, 120)
- Coke oven battery fugitives
- Blower Station Boiler Stacks (EPA 38, 39, 40)
- Blast Furnace Stove Heating Stacks (EPA7)

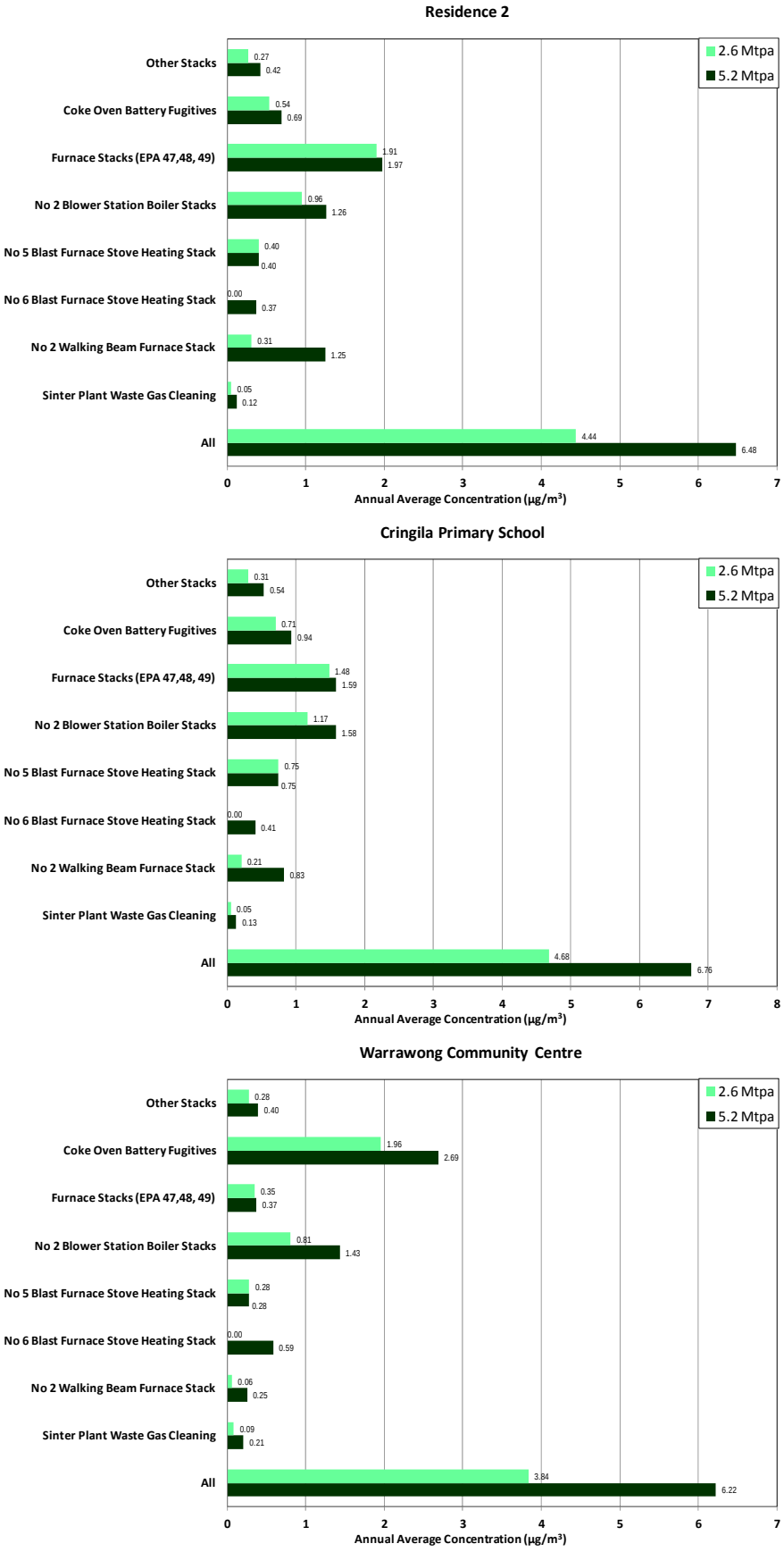

Figure 55: Annual Average SO_2 Concentrations by Source at Selected Sensitive Receptors

5.2.5 Ammonia, Phenol, Cyanide and Chlorine

Ammonia, phenol, cyanide and chlorine emissions were only quantified and modelled for the Coke Oven Battery Quench Tower Stacks for the purpose of this assessment. No other sources were considered.

Predicted concentrations occurring due to the Coke Oven Battery Quench Tower Stacks are given in **Table 35** and **Table 36**. No exceedances of the OEH air quality impact assessment criteria are predicted.

Table 35: Predicted Ammonia, Phenol, Cyanide and Chlorine – 5.2 Mtpa Scenario

Sensitive Receptor	Ammonia (99.9th Percentile, 1-hour) (µg/m^3)	Chlorine (99.9th Percentile, 1-hour) (µg/m^3)	Cyanide (99.9th Percentile, 1-hour) (µg/m^3)	Phenol (99.9th Percentile, 1-hour) (µg/m^3)
Residence 1	7.0	0.03	0.05	0.002
Residence 2	8.0	0.03	0.06	0.002
Coniston Primary School	12.6	0.05	0.09	0.003
Unanderra Community Centre	6.5	0.03	0.04	0.001
Cringila Primary School (CPS)	12.2	0.05	0.08	0.003
Warrawong Community Centre	25.4	0.10	0.18	0.006
OEH Criteria	**330**	**50**	**90**	**20**

Table 36: Predicted Ammonia, Phenol, Cyanide and Chlorine – 5.2 Mtpa Scenario

Sensitive Receptor	Ammonia (99.9th Percentile, 1-hour) (µg/m^3)	Chlorine (99.9th Percentile, 1-hour) (µg/m^3)	Cyanide (99.9th Percentile, 1-hour) (µg/m^3)	Phenol (99.9th Percentile, 1-hour) (µg/m^3)
Residence 1	5.5	0.02	0.04	0.001
Residence 2	6.6	0.03	0.05	0.002
Coniston Primary School	10.9	0.04	0.08	0.003
Unanderra Community Centre	5.1	0.02	0.04	0.001
Cringila Primary School (CPS)	9.6	0.04	0.07	0.002
Warrawong Community Centre	22.8	0.09	0.16	0.005
OEH Criteria	**330**	**50**	**90**	**20**

Isopleth plots depicting spatial patterns in predicted incremental concentrations are given in **Appendix D** for both BSL emission scenarios.

5.2.6 BTEX and Styrene Concentrations

Benzene, toluene, ethylbenzene, xylene (BTEX) and styrene concentrations predicted to occur at selected sensitive receptors are given in **Table 37** and **Table 38**. No exceedances of OEH air quality impact assessment criteria or the NEPM air toxic investigation levels are predicted for either the 5.2 Mpta or the 2.6 Mtpa scenarios.

Table 37: Predicted BTEX and Styrene – 5.2 Mtpa Scenario

	Benzene 1-hour	Benzene Annual	Styrene 1-hour	Toluene 1-hour	Toluene 24-hour	Toluene Annual	Xylene 1-hour	Xylene 24-hour	Xylene Annual	EthylBenzene 1-hour
Receptor 1	0.994	0.017	0.034	0.262	0.105	0.007	0.767	0.319	0.019	0.058
Receptor 2	1.112	0.028	0.049	0.352	0.099	0.011	1.222	0.369	0.029	0.095
Coniston Primary School	1.263	0.034	0.025	0.199	0.075	0.008	0.606	0.142	0.013	0.046
Unanderra Community Centre	0.859	0.013	0.037	0.267	0.063	0.004	0.904	0.215	0.011	0.066
Cringila Primary School	1.439	0.029	0.079	0.561	0.102	0.015	1.902	0.415	0.049	0.141
Warrawong Community Centre	2.660	0.030	0.055	0.424	0.083	0.009	1.321	0.220	0.016	0.097
Air Quality Criteria	29(a)	10(b)	120(a)	360(a)	3,766(b)	377(b)	190(a)	1,085(b)	868(b)	8,000(a)

1-hour averages represent the 99.9th percentile maximum hourly averages predicted.
24-hour averages represent the maximum 24-hour concentrations predicted.
(a) OEH Air Quality Impact Assessment Criterion
(b) NEPM Air Toxic Monitoring Investigation Level

Table 38: Predicted BTEX and Styrene – 2.6 Mtpa Scenario

	Benzene 1-hour	Benzene Annual	Styrene 1-hour	Toluene 1-hour	Toluene 24-hour	Toluene Annual	Xylene 1-hour	Xylene 24-hour	Xylene Annual	EthylBenzene 1-hour
Receptor 1	0.611	0.012	0.032	0.241	0.100	0.006	0.767	0.319	0.019	0.058
Receptor 2	0.692	0.020	0.049	0.352	0.098	0.010	1.222	0.369	0.029	0.095
Coniston Primary School	0.719	0.023	0.025	0.165	0.055	0.006	0.606	0.142	0.013	0.046
Unanderra Community Centre	0.504	0.008	0.037	0.267	0.063	0.004	0.904	0.215	0.011	0.066
Cringila Primary School	0.779	0.024	0.079	0.561	0.102	0.014	1.902	0.415	0.049	0.141
Warrawong Community Centre	1.499	0.025	0.055	0.392	0.081	0.008	1.322	0.220	0.016	0.097
Air Quality Criteria	29(a)	10(b)	120(a)	360(a)	3,766(b)	377(b)	190(a)	1,085(b)	868(b)	8,000(a)

1-hour averages represent the 99.9th percentile maximum hourly averages predicted.
24-hour averages represent the maximum 24-hour concentrations predicted.
(a) OEH Air Quality Impact Assessment Criterion
(b) NEPM Air Toxic Monitoring Investigation Level

Isopleth plots depicting spatial patterns in predicted incremental concentrations are given in **Appendix D** for both BSL emission scenarios.

Annual average benzene concentrations predicted to occur at three of sensitive receptor sites (Residence 2, Cringilla Primary School, Warrawong Community Centre) due to BSL sources are illustrated in **Figure 56**.

The most significant sources contributing to GLCs at sensitive receptor sites were identified as follows for the **5.2 Mtpa scenario** are as follows:

Benzene:

- Coke oven battery heating stacks (specifically EPA 13 and EPA 14)
- Springhill stacks (SP13, SP12)
- Coke oven battery fugitives
- Coke oven battery fume suppression plant stacks (EPA21, EPA22).
- No 4/5 Battery Fume Control Stack (EPA76)

Toluene:

- Coke oven battery heating stacks (specifically EPA13 and EPA14)
- Springhill Stacks (especially SP13)
- Springhill Building fugitives

Xylene:

- Springhill Stacks (SP13)
- Springhill Building fugitives

The most significant sources contributing to GLCs at sensitive receptor sites were identified as follows for the **2.6 Mtpa scenario** are as follows:

Benzene:

- Coke oven battery heating stacks (EPA 14, 15)
- Springhill stacks (SP13, SP12)
- Coke oven battery fugitives
- Coke oven battery fume suppression plant stacks (EPA21, EPA22).
- No. 2 Blower Station Package Boiler No. 11 (EPA138)
- No 4/5 Battery Fume Control Stack (EPA76)

Toluene:

- Coke oven battery heating stacks (EPA14)
- Springhill Stacks (especially SP13)
- Springhill Building fugitives

Xylene:

- Springhill Stacks (SP13)
- Springhill Building fugitives

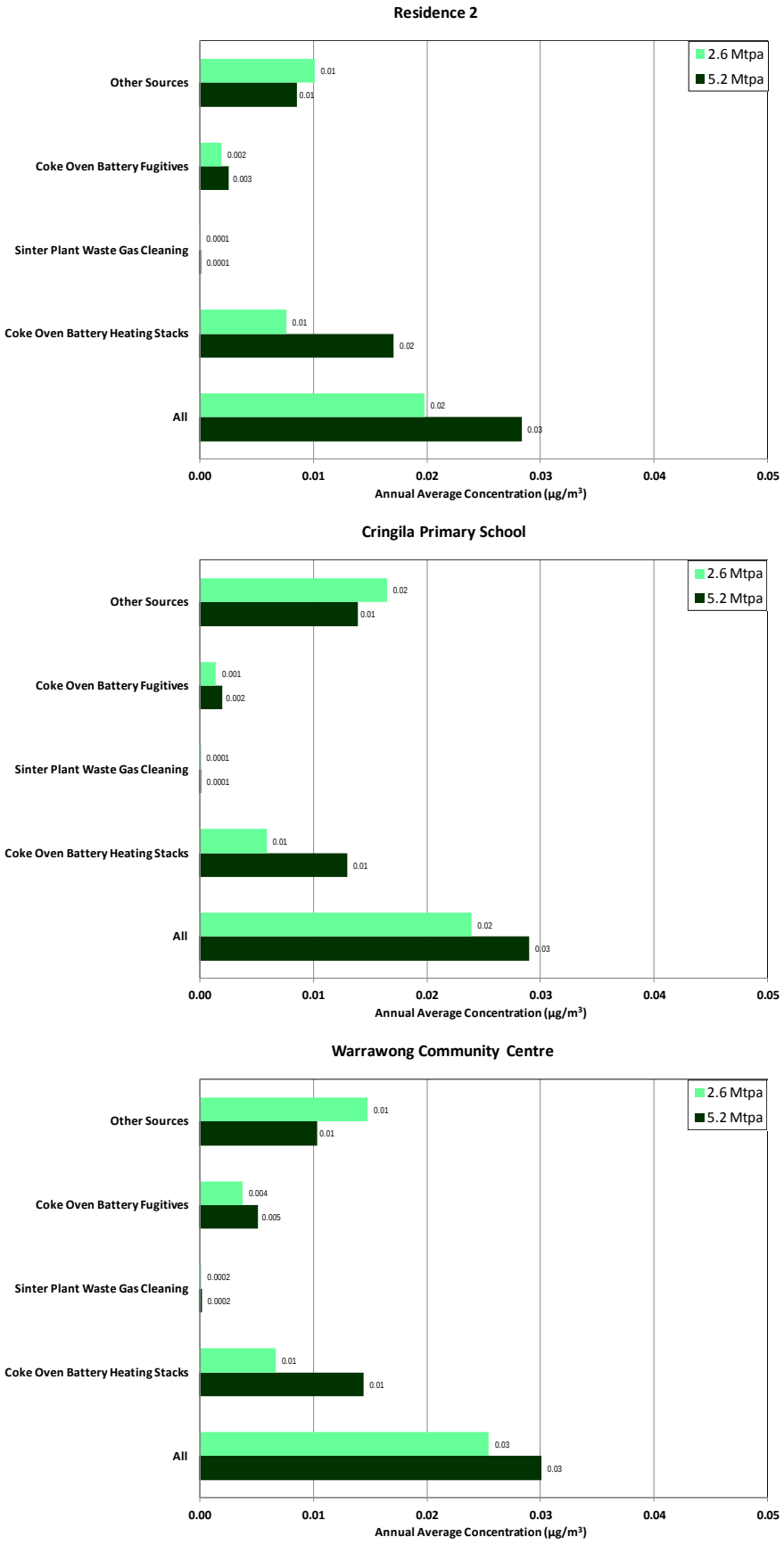

Figure 56: Annual Average Benzene Concentrations by Source at Selected Sensitive Receptors

5.2.7 Benzo[a]pyrene Concentrations

Benzo[a]pyrene and Benzo[a]pyrene Equivalent concentrations predicted to occur at selected sensitive receptors are given in **Table 39** and **Table 40**. No exceedances of OEH air quality impact assessment criterion or the NEPM air toxic investigation level are predicted for either the 5.2 Mpta or the 2.6 Mtpa scenarios.

Table 39: Predicted B[a]P and B[a]P Equivalent Concentrations – 5.2 Mtpa Scenario

Sensitive Receptor	B[a]P Equivalent 99.9th Percentile, 1-hour (µg/m^3)	B[a]P Annual Average (ng/m^3)
Residence 1	0.003	0.028
Residence 2	0.004	0.045
Coniston Primary School	0.006	0.067
Unanderra Community Centre	0.003	0.023
Cringila Primary School (CPS)	0.005	0.035
Warrawong Community Centre (WCC)	0.012	0.089
Air Quality Criteria	**0.4(a)**	**0.3(b)**

(a) OEH Air Quality Impact Assessment Criterion

(b) NEPM Air Toxic Monitoring Investigation Level

Table 40: Predicted B[a]P and B[a]P Equivalent Concentrations – 2.6 Mtpa Scenario

Sensitive Receptor	B[a]P Equivalent 99.9th Percentile, 1-hour (µg/m^3)	B[a]P Annual Average (ng/m^3)
Residence 1	0.002	0.020
Residence 2	0.003	0.033
Coniston Primary School	0.004	0.050
Unanderra Community Centre	0.002	0.017
Cringila Primary School (CPS)	0.003	0.026
Warrawong Community Centre (WCC)	0.010	0.066
Air Quality Criteria	**0.4(a)**	**0.3(b)**

(a) OEH Air Quality Impact Assessment Criterion

(b) NEPM Air Toxic Monitoring Investigation Level

Isopleth plots depicting spatial patterns in predicted incremental concentrations are given in **Appendix D** for both BSL emission scenarios.

Annual average B[a]P Equivalent concentrations predicted to occur at three of sensitive receptor sites (Residence 2, Cringilla Primary School, Warrawong Community Centre) due to BSL sources are illustrated in **Figure 57**.

The most significant sources contributing to B[a]P equivalent GLCs at sensitive receptor sites were identified as follows for the 5.2 Mtpa scenario:

- Coke oven batter fugitives (Leaks and Standpipes)
- Quench Tower Stacks (EPA18, EPA19 and EPA20)
- Coke oven battery fume suppression plant stacks (EPA21, EPA22).

The most significant sources contributing to B[a]P equivalent GLCs at sensitive receptor sites were identified as follows for the 2.6 Mtpa scenario:

- Coke oven batter fugitives (Leaks and Standpipes)
- Quench Tower Stacks (EPA18, EPA19 and EPA20)

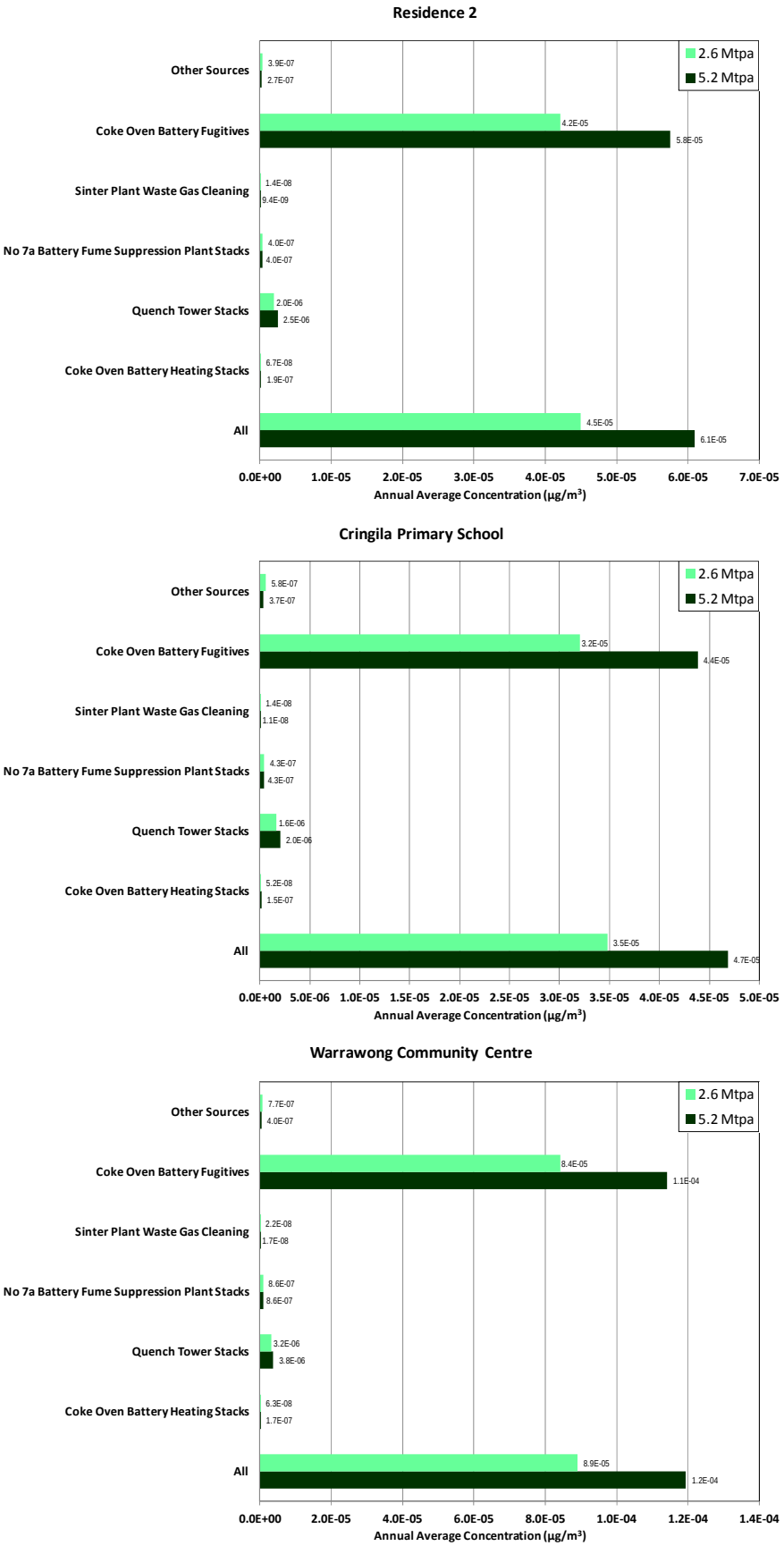

Figure 57: Annual Average Benzo[a]Pyrene Equivalent Concentrations by Source at Selected Sensitive Receptors

5.2.8 PCDD/F Concentrations

PCDD/F concentrations predicted to occur at selected sensitive receptors are given in **Table 41**. No exceedances of OEH air quality impact assessment are predicted for either the 5.2 Mpta or the 2.6 Mtpa scenarios.

Table 41: Predicted PCDD/F Concentrations

Sensitive Receptor	PCDD/F Concentrations 99.9th Percentile, 1-hour (ng/m^3)	
	5.2 Mtpa Scenario	2.6 Mtpa Scenario
Residence 1	1.2×10^{-5}	6.0×10^{-6}
Residence 2	1.4×10^{-5}	7.2×10^{-6}
Coniston Primary School	2.7×10^{-5}	1.5×10^{-5}
Unanderra Community Centre	8.0×10^{-6}	4.5×10^{-6}
Cringila Primary School (CPS)	4.2×10^{-5}	2.3×10^{-5}
Warrawong Community Centre (WCC)	5.4×10^{-5}	2.9×10^{-5}
OEH Criterion	**0.002**	

Isopleth plots depicting spatial patterns in predicted incremental concentrations are given in **Appendix D** for both BSL emission scenarios.

Annual average PCDD/F concentrations predicted to occur at three of sensitive receptor sites (Residence 2, Cringilla Primary School, Warrawong Community Centre) due to BSL sources are illustrated in **Figure 58**.

The most significant sources contributing to PCDD/F GLCs at sensitive receptor sites were identified as follows for the 5.2 Mtpa scenario:

- BOS Secondary Dedusting Stacks (EPA27, EPA28)
- Sinter Plant Exhaust Stack (EPA 107)

The most significant sources contributing to PCDD/F GLCs at sensitive receptor sites were identified as follows for the 2.6 Mtpa scenario:

- BOS Secondary Dedusting Stacks (EPA27)

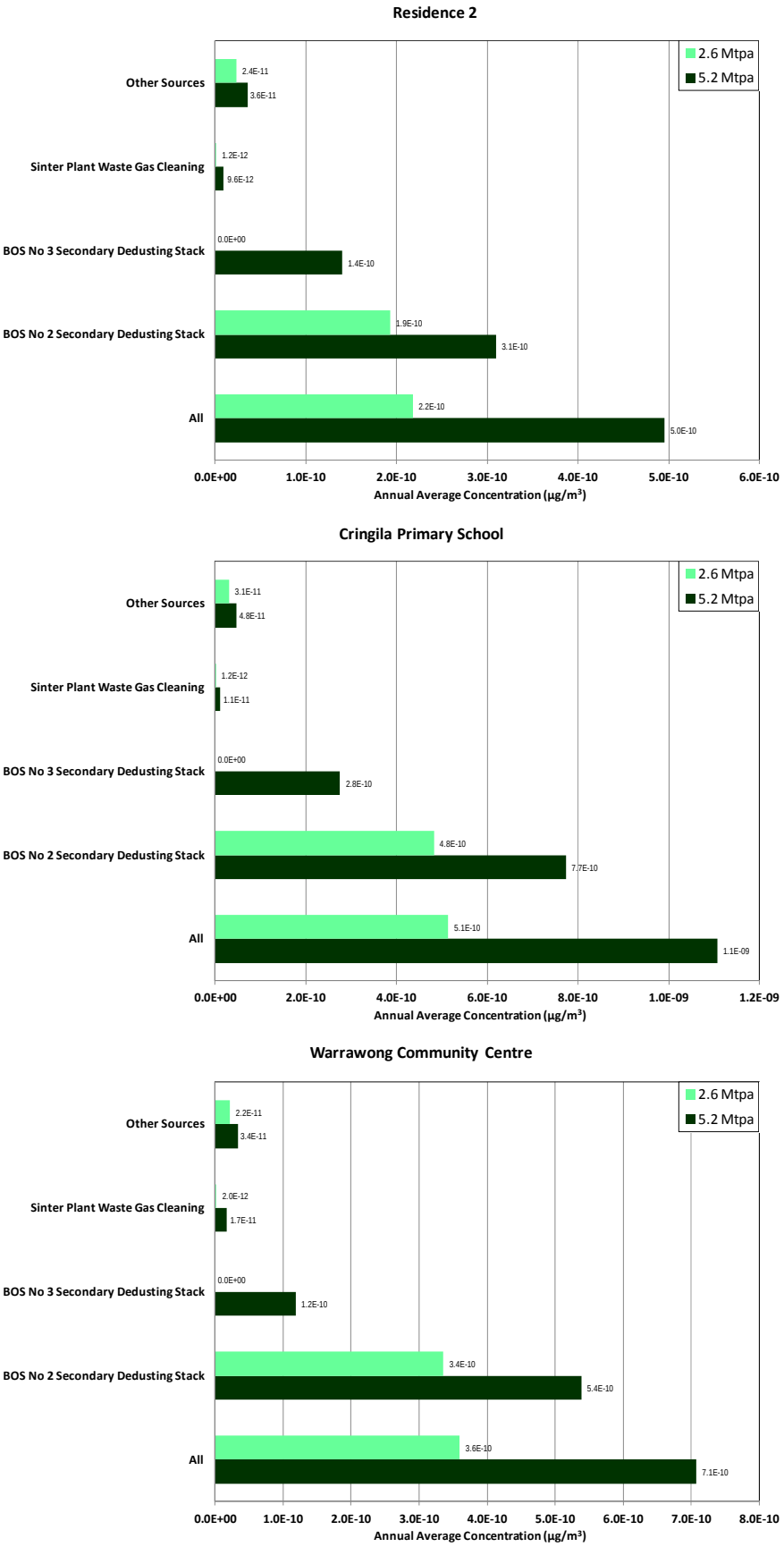

Figure 58: Annual Average PCDD/F Concentrations by Source at Selected Sensitive Receptors

5.2.9 H_2S Concentrations

Incremental nose-response-time (1-second) H_2S concentrations predicted due to BSL facility emissions are provided in **Table 42**, and compared to the OEH odour assessment criterion for urban areas. The project cumulative maximum 1-hour average H_2S concentrations, taking into account a background concentration of 1µg/m³ (refer **Section 5.1.5**), is given in **Table 43**, and compared to the California Acute Reference Exposure Level (REL).

Table 42: Predicted Incremental H_2S Concentrations due to BSL Emissions

Sensitive Receptor	H_2S Concentrations 99th Percentile, Nose-response-time (1-second) Average (µg/m³)	
	5.2 Mtpa	2.6 Mtpa
Residence 1	2.7	1.0
Residence 2	4.6	2.0
Coniston Primary School	4.5	1.9
Unanderra Community Centre	2.2	0.8
Cringila Primary School (CPS)	4.3	2.1
Warrawong Community Centre (WCC)	6.0	2.6
OEH Odour Criterion	**1.38**	

Table 43: Predicted Cumulative H_2S Concentrations due to BSL Emissions

Sensitive Receptor	H_2S Concentrations 1-hour Average (µg/m³)	
	5.2 Mtpa	2.6 Mtpa
Residence 1	4.5	3.0
Residence 2	5.3	5.0
Coniston Primary School	7.9	4.0
Unanderra Community Centre	3.8	2.8
Cringila Primary School (CPS)	8.8	5.7
Warrawong Community Centre (WCC)	8.2	4.7
California Acute REL	**42**	

The OEH odour criterion was predicted to be exceeded at all selected sensitive receptors for the 5.2 Mtpa scenario. Despite reduced concentrations predicted due to the 2.6 Mtpa scenario, criterion exceedances are still predicted to occur at Residence 2, Coniston Primary School, Cringila Primary School and The Warrawong Community Centre. No exceedances of the California Acute REL were predicted to occur due to either emission scenario.

Isopleth plots depicting spatial patterns in predicted incremental concentrations are given in **Appendix D** for both BSL emission scenarios. Given the 5.2 Mtpa scenario, the OEH odour criterion of 1.38 µg/m³ is predicted to be exceeded over most of the modelling domain (i.e. extending over 5 km from the BSL facility boundary). Although the spatial extent of the exceedance is significantly reduced for the 2.6 Mtpa scenario, the criterion is still predicted to be exceeded for over 1 km from the northern and western boundary of the facility, and for approaching 5 km from the southern boundary of the facility.

Isopleth plots illustrating spatial patterns in predicted incremental concentrations due to several individual BSL sources are also given in **Appendix D**. Base on the assessment of predicted concentrations due to individual source groups it was determined that the following sources individually resulted in OEH odour criterion exceedances beyond the BSL facility boundary:

- Coke Oven Battery Quench Tower Stacks (5.2 Mtpa and 2.6 Mtpa scenarios)
- No. 5 Blast Furnace Granulation Stacks (5.2 Mtpa and 2.6 Mtpa scenarios)
- No. 6 Blast Furnace Granulation Stacks (5.2 Mtpa scenario only; shut down)
- No. 6 Blast Furnace Slag Pit Fugitives (5.2 Mtpa scenario only; shut down)

Annual average H_2S Equivalent concentrations predicted to occur at the three sensitive receptor sites (Residence 2, Cringilla Primary School, Warrawong Community Centre) due to BSL sources are illustrated in **Figure 59**.

Peak nose-response-time average H_2S concentrations occurring at these three receptor sites due to major BSL sources are illustrated in **Figure 60**. In the case of the 5.2 Mtpa emission scenario the OEH odour criterion of 1.38 µg/m³ was predicted to be exceeded at each of the three selected sensitive receptors by the following sources individually:

- No. 5 Blast Furnace Granulation Stacks
- No. 6 Blast Furnace Granulation Stacks

When taken individually, the Quench Tower Stacks, Coke Oven Battery Heating Stacks, Slag Pits and Coke Oven Battery Fugitives source groups were not predicted to exceed the OEH odour criterion at the three selected sensitive receptor sites.

For the 2.6 Mtpa emission scenario, the No. 5 Blast Furnace Granulation Stacks represented the only source group predicted to result in an exceedance of the odour criterion on its own at any of the selected receptor sites. Furthermore, this exceedance was restricted to the Cringila Primary School receptor with no exceedances predicted for the other two receptor sites considered (**Figure 60**).

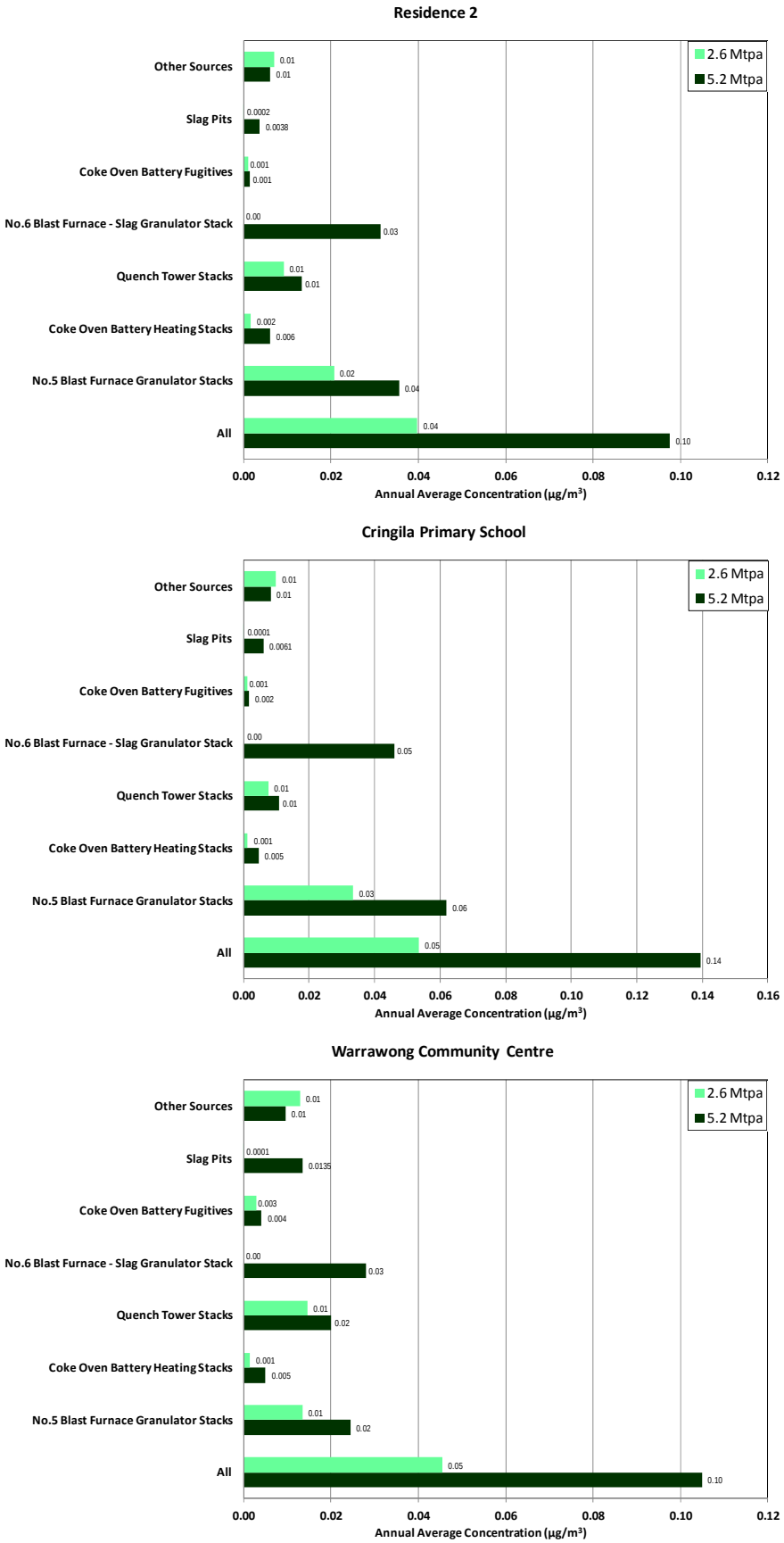

Figure 59: Annual Average H_2S Concentrations by Source at Selected Sensitive Receptors

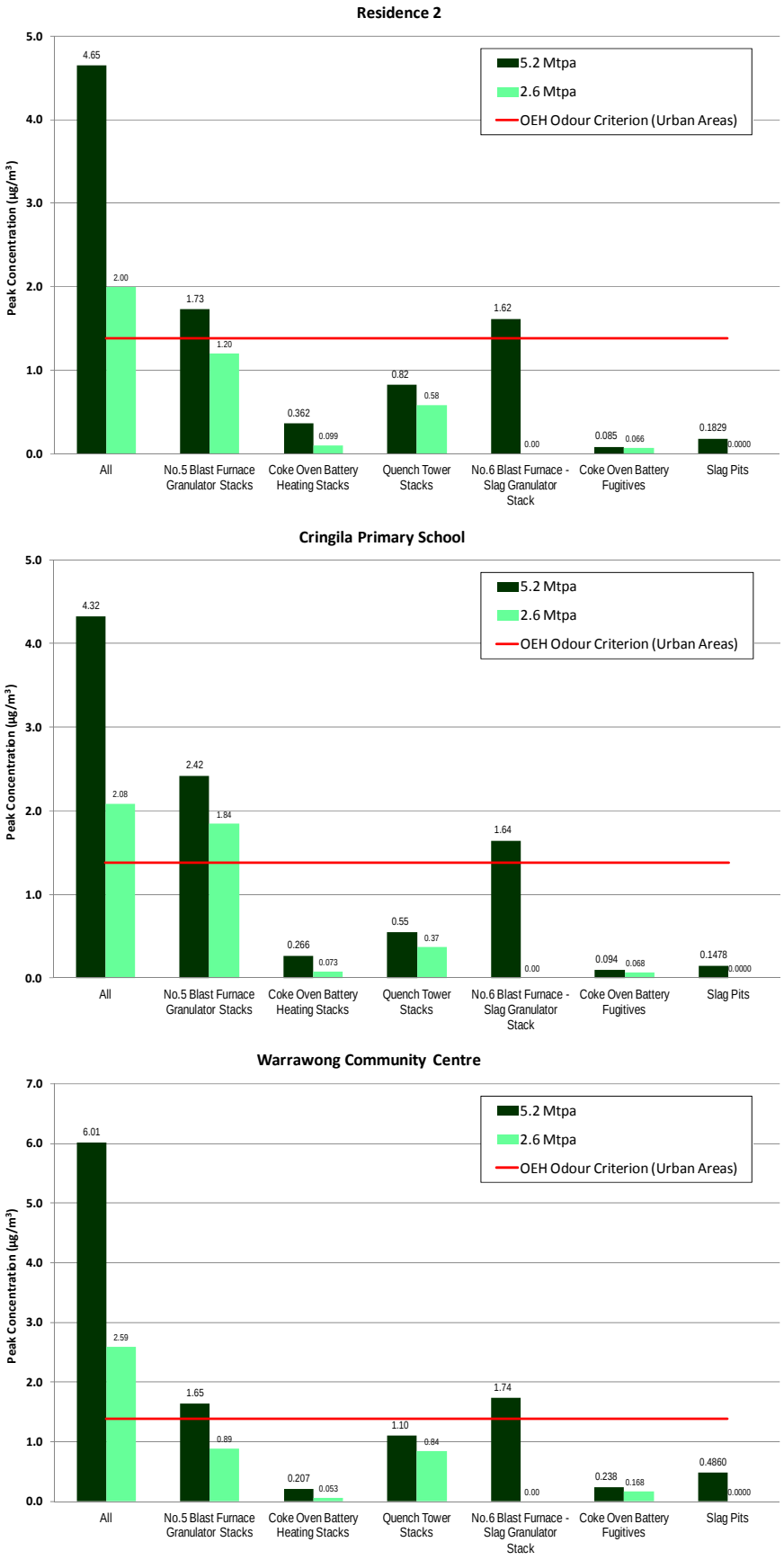

Figure 60: Maximum 99th Percentile Nose-response-time (1-second) Average H_2S Concentrations by Major Source

6 Summary of Key Findings

6.1 Air Quality Monitoring Data Analysis

Air quality monitoring data from BSL monitoring stations were analysed for longer-term trends in air pollutant concentrations and differences in pre- and post-October 2011 concentrations coinciding with scaled down production at the BSL facility. Given that historical air pollutant concentrations are generally significantly higher than more recent levels, the pre-October 2011 period was confined to data recorded from 2008 onwards.

Lower total PAH, benzo[a]pyrene, benzo[a]pyrene equivalent and H_2S concentrations were recorded during the Post-October 2011 period during summer and spring months when the air quality monitoring stations are more frequently downwind of the BSL facility. During autumn and winter months (March to June), when airflow from the southwesterly quadrant prevails and the monitoring stations are predominantly upwind of the BSL facility, overall concentrations were lower with mixed results when pre- and post-October 2011 concentrations are compared.

During months when the prevailing wind was towards the monitoring stations, distinctly lower TSP concentrations were recorded during the post-October 2011 period with the exception of February 2012. Elevated TSP concentrations were recorded in February 2012 across all monitoring stations. The reason for the elevated concentrations is not known to the author.

The pre- and post-October 2011 trends evident for PAH, benzo[a]pyrene, benzo[a]pyrene equivalent, H_2S and TSP were not apparent for benzene and PM_{10}. No significant change in benzene levels was recorded. PM_{10} trend analysis was limited due to data availability. PM_{10} data were only available for the March to June 2012 period on which to assess Post-October 2011 trends. During this time of the year, airflow is predominantly from the southwesterly quadrant, with the BSL Old Scouts Hall monitoring station therefore being situated generally upwind of the BSL facility. The comparative analysis will be more effective if applied during summer and spring months during which time there is a higher frequently of northerly and northeasterly airflow.

6.2 Compliance of Predictions with Air Quality Criteria

No exceedances of the OEH air quality are predicted for the following air pollutants for either of the emission scenarios: TSP, SO_2, ammonia, phenol, cyanide, chlorine, benzene, toluene, ethylbenzene, xylene, styrene, benzo[a]pyrene equivalent and PCDD/F. Benzene, toluene, xylene and benzo[a]pyrene concentrations were also predicted to be well below the NEPM air toxics monitoring investigation levels. Cumulative annual average PM_{10} and NO_2 concentrations were predicted to be within OEH air quality impact assessment criteria.

Air quality criteria exceedances were restricted to the following pollutants and averaging periods:

- 24-hour average PM_{10};
- 1-hour average NO_2; and
- Nose-response-time (1-second) H_2S

A summary of the predicted exceedances is given in the following subsections.

6.2.1 PM_{10}

Maximum 24-hour average PM_{10} concentrations are predicted to exceed the OEH criterion of 50µg/m³ at all sensitive receptors for the 5.2 Mtpa scenario, with the greatest number of exceedances being predicted at Cringila Primary School (16 days per year).

Maximum concentrations and numbers of exceedances are projected to have been reduced given the 2.6 Mtpa scenario, with no exceedances predicted at Coniston Primary School and Unanderra Community Centre, and seven fewer exceedance days at Cringila Primary School.

The OEH 24-hour criterion is predicted to be exceeded for distances of over 5 km from the BSL facility boundary for both emission scenarios.

6.2.2 NO_2

Maximum 1-hour average NO_2 concentrations are predicted to exceed the OEH criterion of 246 µg/m³ at the WCC receptor given the 5.2 Mtpa scenario. No exceedances are predicted at the selected sensitive receptors for the 2.6 Mtpa scenario.

The OEH 1-hour NO_2 criterion is predicted to be exceeded to the southeast of the BSL facility boundary. The area projected to be affected by the exceedance is significantly reduced for the 2.6 Mtpa scenario.

6.2.3 H_2S

The OEH odour criterion for urban areas (1.38 µg/m³) was predicted to be exceeded at all selected sensitive receptors for the 5.2 Mtpa scenario. Despite reduced concentrations predicted due to the 2.6 Mtpa scenario, criterion exceedances are still predicted to occur at Residence 2, Coniston Primary School, Cringila Primary School and The Warrawong Community Centre.

Given the 5.2 Mtpa scenario, the OEH odour criterion of 1.38 µg/m³ is predicted to be exceeded over most of the modelling domain (i.e. extending over 5 km from the BSL facility boundary). Although the spatial extent of the exceedance is significantly reduced for the 2.6 Mtpa scenario, the criterion is still predicted to be exceeded for over 1 km from the northern and western boundary of the facility, and for approaching 5 km from the southern boundary of the facility.

Base on the assessment of predicted concentrations due to individual source groups it was determined that the following sources individually resulted in OEH odour criterion exceedances beyond the BSL facility boundary:

- Coke Oven Battery Quench Tower Stacks (5.2 Mtpa and 2.6 Mtpa scenarios)
- No. 5 Blast Furnace Granulation Stacks (5.2 Mtpa and 2.6 Mtpa scenarios)
- No. 6 Blast Furnace Granulation Stacks (5.2 Mtpa scenario only; shut down)
- No. 6 Blast Furnace Slag Pit Fugitives (5.2 Mtpa scenario only; shut down)

The OEH odour criterion is substantially more stringent that air quality criteria applied inter-state (except for Victoria) and internationally. The NSW OEH and Victoria EPA odour criteria appear to be more reflective of odour detection levels rather than demonstrated odour annoyance. Given the stringency of the OEH odour criteria, the applicability of such

criteria to proposed developments, and the fact that compliance with the H_2S criterion is impractical given the scale of BSL's operations and their proximity to sensitive receptors, it has been recommended that an alternative ambient H_2S criterion be established.

Following the review of ambient H_2S criterion inter-state and abroad, it was recommended that the Californian EPA 1-hour average odour (public welfare) criterion of 42 µg/m³ be considered for adoption for the assessment of *cumulative impacts due to all sources* in the region including BSL sources. Given the uncertainty in short-term measured and modelled concentrations, the longer 1-hour averaging period is considered to provide a more robust basis for a criterion. No exceedances of the California Acute REL were predicted to occur due to cumulative H_2S concentrations arising from either the 5.2 Mtpa or 2.6 Mtpa emission scenarios.

6.3 Source Contributions to Ground Level Concentrations

Contributions from individual sources were evaluated to determine which sources impacted ground level concentrations most significantly at the selected sensitive receptors. The contribution analysis was based on maximum annual averages predicted due to each source across three sensitive receptors (Cringila Primary School, Warrawang Community Centre and Residence 2). Sources are listed in order of significance, with the first listed source having the greatest contribution.

6.3.1 5.2 Mtpa Scenario

TSP and PM_{10}

The most significant fugitive sources were:

- Slag cooling pit and slag stockpile
- BOS roof vents
- Coke oven batteries
- Crushing plants

The most significant stack emissions were:

- Coke Screening House Dedusting Stack (EPA23)
- No. 6 Blast Furnace Stock House Dedusting Stack (EPA5)
- BOS No. 2 Dedusting Stack (EPA27)
- No. 2 Walking Beam Furnace Stack (EPA120)
- Slab Handling – Slab Scarfing Machine Stack (EPA34)

NO_2

- Lime Kiln Discharge Building Baghouse Stack (EPA93)
- Furnace Stacks (EPA47, 48, 49, 120)
- Blower Station Boiler Stacks (EPA37, 38, 39, 40)
- Lime Kiln Waste Heat Stack (EPA30)
- Blast Furnace Stove Heating Stacks (EPA3, EPA7)
- Battery Heating Stacks (EPA 13, 14, 15, 16)
- Sinter Plant Exhaust Stack (EPA 107)

SO_2

- Furnace Stacks (EPA 47, 48, 49, 120)
- Coke oven battery fugitives
- Blower Station Boiler Stacks (EPA 37, 38, 39, 40)
- Blast Furnace Stove Heating Stacks (EPA 3, 7)

PCCD/F

- BOS Secondary Dedusting Stacks (EPA27, EPA28)
- Sinter Plant Exhaust Stack (EPA 107)

H_2S

- No. 5 Blast Furnace - Slag granulator stacks (EPA10, EPA11, EPA128)
- No 6 Blast Furnace - Slag Granulator Stack (EPA104)
- Quench Tower Stacks (EPA 18,19,20)
- BF6 Slag pit fugitives

Benzene

- Coke oven battery heating stacks (specifically EPA 13 and EPA 14)
- Springhill stacks (SP13, SP12)
- Coke oven battery fugitives
- Coke oven battery fume suppression plant stacks (EPA21, EPA22).
- No 4/5 Battery Fume Control Stack (EPA76)

Toluene

- Coke oven battery heating stacks (specifically EPA13 and EPA14)
- Springhill Stacks (especially SP13)
- Springhill Building fugitives

Xylene

- Springhill Stacks (SP13)
- Springhill Building fugitives

BaP equivalent

- Coke oven batter fugitives (Leaks and Standpipes)
- Quench Tower Stacks (EPA18, EPA19 and EPA20)
- Coke oven battery fume suppression plant stacks (EPA21, EPA22).

6.3.2 2.6 Mtpa Scenario

TSP and PM_{10}

The most significant fugitive sources were:

- Slag cooling pit and slag stockpile
- BOS roof vents
- Coke oven batteries
- Crushing plants

The most significant stack emissions were:

- Coke Screening House Dedusting Stack (EPA23)

- BOS No. 2 Dedusting Stack (EPA27)
- No. 5 Blast Furnace Cast House Dedusting Stack (EPA8)
- Lime Kiln Storage bins –Bahco Baghouse Stack (EPA32)

NO_2

- Lime Kiln Discharge Building Baghouse Stack (EPA93)
- Furnace Stacks (EPA47, 48, 49, 120)
- Lime Kiln Waste Heat Stack (EPA30)
- Blower Station Boiler Stacks (EPA38, 39, 40)
- Blast Furnace Stove Heating Stacks (EPA7)
- Coke oven batteries
- Battery Heating Stacks (EPA14, 15, 16)

SO_2

- Furnace Stacks (EPA 47, 48, 49, 120)
- Coke oven battery fugitives
- Blower Station Boiler Stacks (EPA 38, 39, 40)
- Blast Furnace Stove Heating Stacks (EPA7)

PCCD/F

- BOS Secondary Dedusting Stacks (EPA27)

H_2S

- No. 5 Blast Furnace - Slag granulator stacks (EPA10, EPA11, EPA128)
- Quench Tower Stacks (EPA 18,19,20)

Benzene

- Coke oven battery heating stacks (EPA 14, 15)
- Springhill stacks (SP13, SP12)
- Coke oven battery fugitives
- Coke oven battery fume suppression plant stacks (EPA21, EPA22).
- No. 2 Blower Station Package Boiler No. 11 (EPA138)
- No 4/5 Battery Fume Control Stack (EPA76)

Toluene

- Coke oven battery heating stacks (EPA14)
- Springhill Stacks (especially SP13)
- Springhill Building fugitives

Xylene

- Springhill Stacks (SP13)
- Springhill Building fugitives

BaP equivalent

- Coke oven batter fugitives (Leaks and Standpipes)
- Quench Tower Stacks (EPA18, EPA19 and EPA20)

6.4 Sinter Plant Annular Cooler Emissions

The sinter plant annular cooler emissions occur as a diffuse release from the building. Quantification of this source can not robustly be done through the application of stack monitoring methods. Given the absence of an emission factor for this source, emissions were provisionally estimated based on particulate concentration monitoring within the building with emission rates assigned a low confidence level. Alternative methods should be considered to quantify sinter plant annular cooler emissions.

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8 Limitations

ENVIRON Australia prepared this report in accordance with the scope of work as outlined in our proposal to BlueScope Steel dated 13 March 2012 and in accordance with our understanding and interpretation of current regulatory standards.

A representative program of sampling and laboratory analyses was undertaken as part of this investigation, based on past and present known uses of the site. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous.

Site conditions may change over time. This report is based on conditions encountered at the site at the time of the report and ENVIRON disclaims responsibility for any changes that may have occurred after this time.

The conclusions presented in this report represent ENVIRON's professional judgment based on information made available during the course of this assignment and are true and correct to the best of ENVIRON's knowledge as at the date of the assessment.

ENVIRON did not independently verify all of the written or oral information provided to ENVIRON during the course of this investigation. While ENVIRON has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to ENVIRON was itself complete and accurate.

This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

8.1 User Reliance

This report has been prepared exclusively for BlueScope Steel and may not be relied upon by any other person or entity without ENVIRON's express written permission.

Appendix A

Air Quality Assessment Criteria for Hydrogen Sulphide

A. Air Quality Criteria for H_2S

Ambient air quality criteria specified for H_2S are most typically designed to protect either amenity from odour impacts or human health. Air quality criteria published in respect of odour are presented in **Section A.1** with toxicity values for human health discussed in **Section A.2**.

A.1 Odour Assessment Criteria

Odour thresholds for individual compounds are defined in several ways including absolute perception thresholds, recognition thresholds and detection thresholds. At the perception threshold one is barely certain that an odour is detected but it is too faint to identify further. The concentration at which 50% of an odour panel can detect the smell is deemed the Odour Detection Threshold (ODT). Recognition thresholds refer to instances where the specific odorous substance is identified by either 50% of the panel (50% Odour Recognition Threshold) or 100% of the panel (100% Odour Recognition Threshold).

H_2S is readily detectable by humans at very low concentrations. Some people may be able to detect the odour of H_2S in air at concentrations as low as 0.5 ppb (0.7 µg/m³) (ATSDR, 1999). In a report to the California Air Resources Board, Amoore (1985) synthesised over twenty individual studies and described a lognormal distribution of odour detection thresholds with a geometric mean of 8 ppb (11 µg/m³) and a geometric standard deviation of 4 (California EPA, 1999). Reasons for this variability include differences in experimental methodologies and in human olfactory responses.

Exposure to objectionable odour may cause headache, nausea, appetite loss, irritability and fatigue may occur with perception of odour.

Whereas ODTs provide information on the concentrations at which specific odorous substances will become detectable, such thresholds do not indicate the level at which they will become unacceptable or objectionable. Air quality criteria are published by governments and organisations to illustrate the concentrations above which odorous substances are likely to have an impact on amenity.

Amoore (1985) further concluded based on the studies reviewed that, as a provisional rule, an unpleasant odour is at or above the threshold of annoyance for half the people when its concentration reaches 5 times the average threshold of detection. Applying this multiplier to the ODT of H_2S (8 ppb, 11 µg/m³), indicates that the odour annoyance threshold for H_2S is about 40 ppb or 56 µg/m³.

The 50% odour recognition threshold for H_2S is in the range of 6 µg/m³ to 11 µg/m³ (Amoore and Hautala, 1983; AIHA, 1989; Woodfield and Hall, 1994).

The OEH *Approved Methods for Modelling* outlines impact assessment criteria for a number of individual odorous air pollutants including H_2S. The criteria for H_2S is specified as a function of population density, as per the summary provided in Table 7.4b of the *Approved Methods for Modelling*, is given in **Table A.1**. Given the urban nature of the study area a criterion of 1.38 µg/m³ has been indicated to be applicable for the assessment of ambient H_2S concentrations in the vicinity of the BSL facility.

Table A.1 OEH Impact Assessment Criteria for Hydrogen Sulphide	
Population of Affected Community	**Impact Assessment Criteria for Hydrogen Sulphide (µg/m³)**
Urban area (≥ 2000)	1.38
500 – 2000	2.07
125 – 500	2.76
30 – 125	3.45
10-30	4.14
Single residence (≤ 2)	4.83

Source: OEH (2005). *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.*

The OEH impact assessment criteria for H_2S are compared to criteria published by other jurisdictions in **Table A.2**. The states of NSW and North Dakota criteria are noted to be specified for the shortest averaging period (1 second; instantaneous) compared to other jurisdictions. Other than the 3-minute averaging period adopted by Victoria, Tasmania and the US state of Delaware, and the 10-minute averaging period specified by Ontario, Canada, most other jurisdictions specify short-term averaging periods of either 30-minutes or 1-hour.

The odour limit values adopted in NSW, Victoria and Tasmania are noted to be substantially lower than those specified in Queensland, New Zealand, and in the Unites States and Canadian states reviewed. The values included in the NSW OEH and Victoria EPA criteria appear to be more reflective of odour detection levels rather than odour annoyance.

California EPA based its H_2S standard on a mean olfactory perception level (average odour detection level) of 30 ppb or 42 µg/m³ for a one-hour average. The standard was designed to protect against symptoms of headache and nausea due to odour. Initially adopted in 1969, the California EPA chose to retain this standard in 1984. At California's ambient standard of 42 µg/m³ it is estimated that 83% of people could detect the odour and that 40% of those exposed are likely to experience odour annoyance (Amoore, 1985).

Table A.2 Assessment Criteria for H_2S given for Odour/Nuisance/Amenity		
Jurisdiction	**Criterion Value (µg/m³)**	**Averaging Period (Notes)**
NSW DECCW (2005) Impact Assessment Criteria	Ranges from 1.38 – 4.83 (see Table A.1)	1-second (nose response time average, 99th percentile)
Victoria EPA (2001) Class 2 Design Criteria (Odour Detection)	0.14	3-minute average
Tasmania Design Criteria (Odour Detection)	0.14	3-minute average
Queensland (2008) Air Quality Objective (Protecting Aesthetic Environment)	7.5	30-minute average
New Zealand Ambient Air Quality Guideline	7	1 hour average
WHO (2000) Guideline for Odour	7	30 minute average
Ontario, Canada (2008)	13	10-minute average (odour)
British Columbia, Canada	7.5 – 14 28 – 45	1-hour average (maximum desirable; long-term protection of all environments) 1-hour average (maximum acceptable; interim objective)

Table A.2 Assessment Criteria for H_2S given for Odour/Nuisance/Amenity		
Jurisdiction	**Criterion Value (µg/m³)**	**Averaging Period (Notes)**
	42 - 45	1-hour average (maximum tolerable; immediate objective)
Alberta, Canada	14	1-hour average
California	42	1-hour average
Colorado	1.42	1-hour average
Delaware	84 42	3-minute average (health and nuisance) 1-hour average (health and nuisance)
Idaho	42 14	30 minute average 24-hour average
Kentucky	14	1-hour average
Maryland	3.8	24-hour average
Massachusetts	3.8	24-hour average
Minnesota / Missouri / Wyoming	42 70	30-minute average (not to be exceeded more than 2 days in a 5-day period) 30-minute average (not to be exceeded more than 2 times per year)
Montana	70	1-hour average
New York	14	1-hour average
North Dakota	70	Instantaneous, two readings 15 minutes apart
Pennsylvania	140 7	1-hour average 24-hour average
Texas	113 170	30-minute average (residential/commercial) Industrial, vacant or range lands

A summary of the assessment criteria across jurisdictions, by averaging period, is given below demonstrating the significant range in the criterion specified by different jurisdictions:

Criterion Value (µg/m³)	Averaging Period (Notes)
1.38 – 4.83	1-second (nose response time average, 99th percentile)
70	Instantaneous (2 readings 15 min apart)
0.14 – 84	3-minute average
13	10-minute average
7 – 113	30-minute average
1.4 – 140	1 hour average
3.8 - 14	24-hour average

A.2 Occupational Health Thresholds

Since the 1970s, the occupational exposure limits for H_2S has been **10 ppm** (8-hour TWA - time weighted average) and **15 ppm** (STEL - short term exposure limit)[2].

In 2010, the American Conference of Industrial Hygienists (ACGIH) revised the exposure limits for H_2S to **1 ppm** (TWA) and **5 ppm** (STEL). The basis and rationale for the changes can be found in the 2010 ACGIH Documentation for H_2S[3].

A.3 Public Health Assessment Criteria and Toxicity Values

Air quality criteria defined for the protection of public exposures are lower than those defined for occupational exposures.

Toxicological research suggests that the concentration of H_2S needed to cause an adverse response in the respiratory system is higher than the concentrations at which the odour can be detected and odour responses are apparent. An exposure guideline to protect against headache, nausea and other effects that might be related to odour would be lower than a guideline based on respiratory effects.

Air quality criteria specified by various jurisdictions for the protection of human health are summarised in **Table A.3**. Toxicity values specified by widely-referenced health agencies are documented in **Table A.4**.

In Australia, such criteria are specified in Victoria, Queensland and Western Australia (WA). The recent WA criteria are based on the health data published in WHO (2003). The criterion specified in Queensland is similar to the air quality guideline published by the WHO (2000) for H_2S. The criteria promulgated by the states of California and Delaware reflect the reference exposure limits published by the California Office of Human Health Hazard Assessment (OEHHA). The basis for the stringent 24-hour criterion specified by the state of Ontario is not known.

Table A.3: Air Quality Criteria for Hydrogen Sulphide (Health)

Criterion	Criterion Value (µg/m³)	Averaging Period (Notes)
Victoria EPA (2001) Class 2 Design Criteria (Toxicity)	470	3-minute average
Queensland (2008) Air Quality Objective (Health and Wellbeing)	160	24-hour average
WA Dept. of Health (2009)	2800	30 minutes(associated with bronchial effects in some sensitive asthmatics and so should not be exceeded)
	140	24 hours (safety margins built into them and so an exceedance does not necessarily mean a health consequence)
	20	90 days (safety margins built into them and so an exceedance does not necessarily mean a health consequence)

[2] Worksafe Australia, Exposure Standards for Atmospheric Contaminants in the Occupational Environment, National Exposure Standards, NOHSC:1003(1995), AGPS, Canberra, May 1995.
[3] www.acgih.org/store/ProductDetail.cfm?id=1017.

Table A.3: Air Quality Criteria for Hydrogen Sulphide (Health)		
Criterion	**Criterion Value (µg/m³)**	**Averaging Period (Notes)**
Ontario, Canada (2008)	7	24-hour average (health)
Delaware, USA (1981 to current)	84 42	3-minute average (health and nuisance) 1-hour average (health and nuisance)
California, USA (1969 to current)	42	1-hour average

Table A.4: Toxicity Values for Hydrogen Sulphide (Human Health)		
Agency	**Toxicity Value (µg/m³)**	**Exposure Duration / Averaging Period**
WHO (2000)	150	24-hour average
California OEHHA (accessed 2010) Reference Exposure Levels	42	Acute, 1-hour (respiratory)
	10	Chronic (respiratory)
US IRIS (accessed 2010)	2	Chronic inhalation reference concentration
US ATSDR (2009) Maximum Risk Levels	98	Acute (respiratory)
	28	Intermediate (respiratory)

WHO – World Health Organisation

OEHHA – California Office of Environmental Health Hazard Assessment

IRIS – Integrated Risk Information System

ATSDR – US Agency for Toxic Substances and Disease Registry

A.4 Summary

Whereas the OEH odour assessment criteria are specified for a nose-response-time (1-second average), most other jurisdictions reviewed express odour criterion for 3-minute, 30-minute, 1-hour or 24-hour averaging periods. The OEH criteria are however typically applied to the assessment of proposed developments.

Odour criteria adopted in NSW, Victoria and Tasmania are substantially lower than those specified in Queensland, New Zealand, and in the Unites States and Canadian states reviewed. The values included in the NSW OEH and Victoria EPA criteria appear to be more reflective of odour detection levels rather than demonstrated odour annoyance.

Toxicity values for H_2S based on respiratory effects are notably higher than criteria set for odour due to adverse response in the respiratory system occurring at higher concentrations than are associated with odour detection and annoyance.

Criteria adopted by some jurisdictions are based on the protection of headache, nausea and other effects that might be related to odour rather than on odour detection levels (e.g. California EPA 1-hour criteria).

Appendix B

Validation Test Results

B. Validation Testing Results

Temporary air quality monitoring stations were set up by BSL at the five locations to monitor particulate concentrations and at two locations to monitor H_2S downwind of predominant low level sources. Monitoring was conducted downwind of the following sources:

- No. 6 Blast Furnace Slag Pit (PM_{10}, H_2S);
- BOS Slag Pit (PM_{10}, H_2S);
- Crushing and Screening Plant (PM_{10});
- Hot Metal Pit (PM_{10}); and
- Metal Recovery Plant (PM_{10}).

The locations of the monitoring stations are illustrated in **Figure B.1**. The stations recorded 3-minute average PM_{10} and H_2S concentrations over a period of thirty days. Results are discussed in subsequent sub-sections.

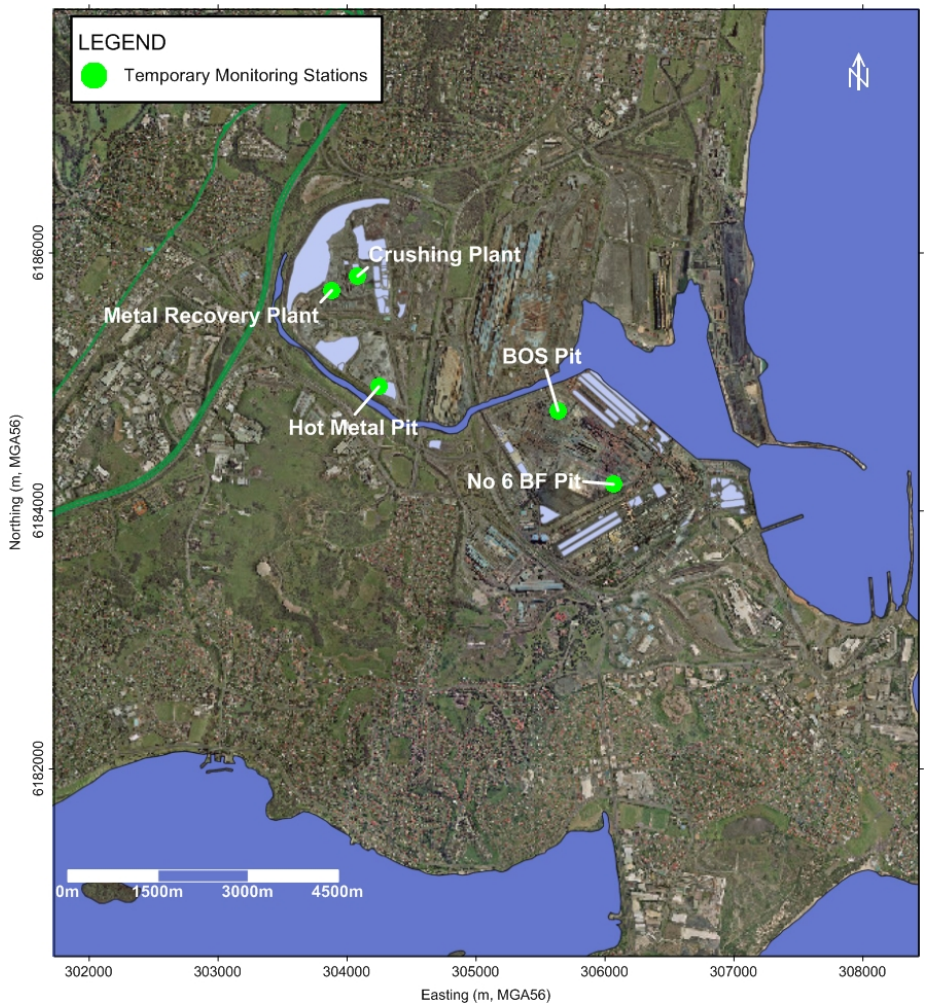
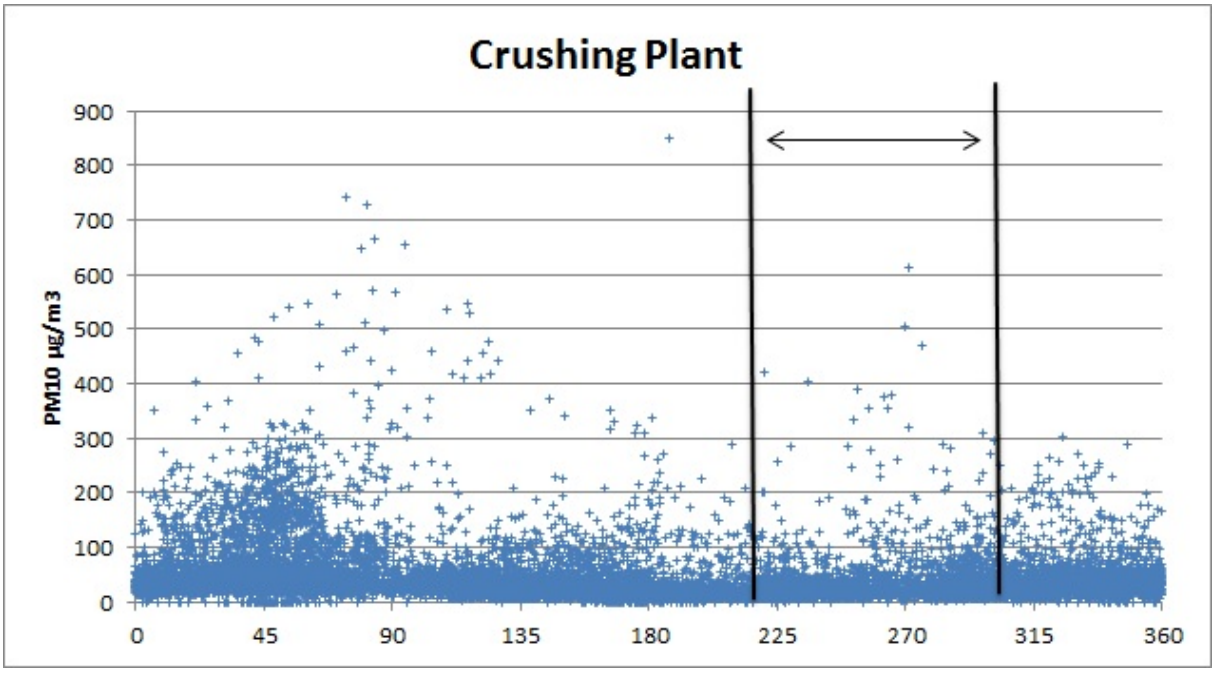


Figure B.1 Location of Temporary Air Quality Monitoring Stations

B.1 PM_{10} Monitoring within the Recycling Area

B.1.1 Crushing and Screening Plant

Monitoring was undertaken for 30 days between 20th October 2011 and 18th November 2011. The PM_{10} monitoring station was directly downwind of the crushing plant when the wind direction is between 215º and 305º (SSW and NW). Peaks in PM_{10} concentrations did not necessary coincide with airflow from this sector indicating the significance of contributions from other sources (**Figure B.2, Figure B.3**).



Note: Arrows indicate when crushing plant is downwind of monitoring station.

Figure B.2. Crushing Plant Station - PM_{10} Concentration by Wind Direction

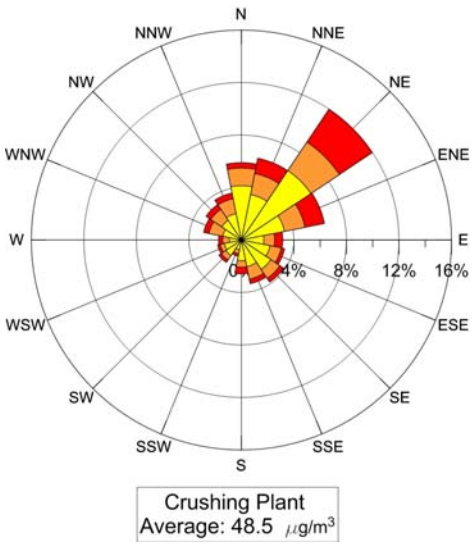
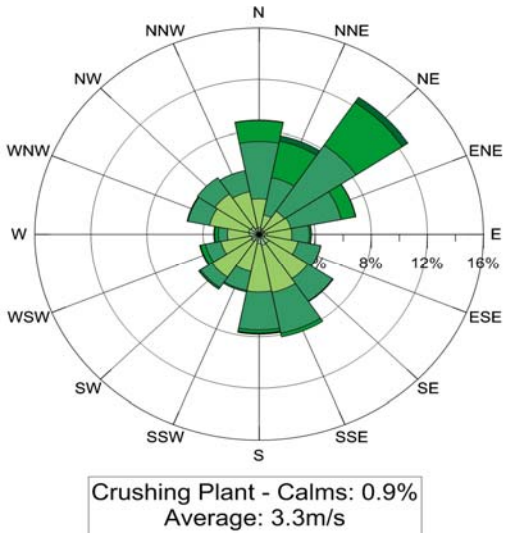
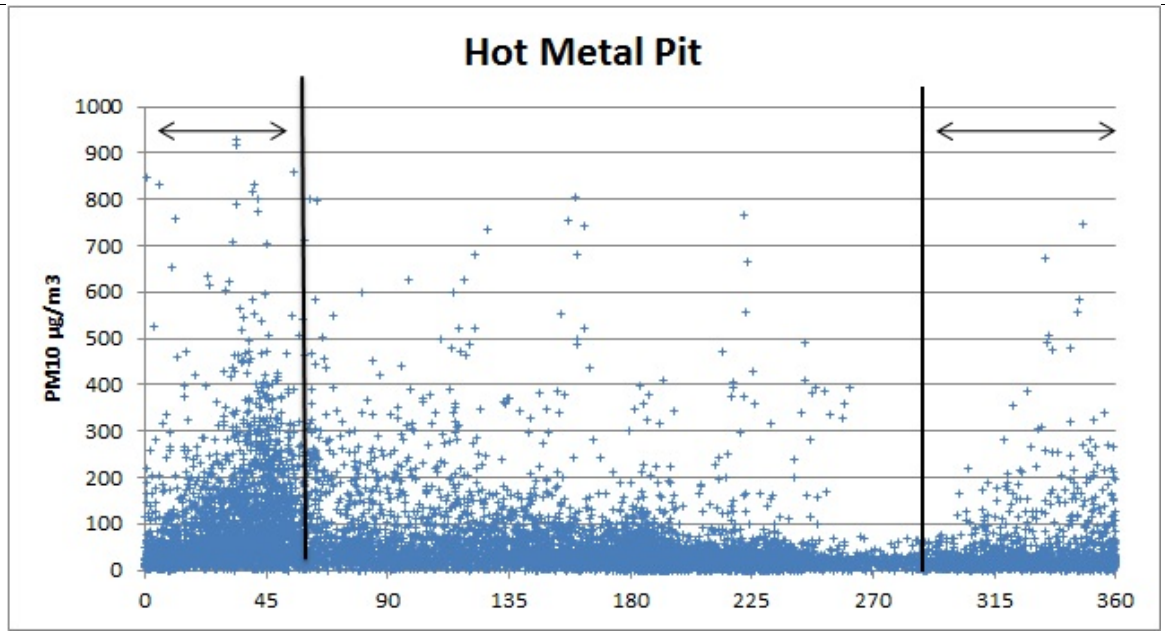
PM_{10} Pollution Rose	Wind Rose
	

Figure B.3 Crushing Plant Monitoring Station - Wind and PM_{10} Concentration Roses

B.1.2 Hot Metal Pit

Monitoring was undertaken for 35 days during between 25th January 2012 and 28th February 2012. The PM_{10} monitoring station was sited downwind of the Hot Metal Pit when the wind direction was recorded to be between 285º and 55º. Although peaks in PM_{10} concentrations did not necessary coincide with airflow from this sector indicating the significance of contributions from other sources, generally higher PM_{10} concentrations were recorded when the station was downwind of the hot metal pit area (**Figure B.4, Figure B.5**).



Note: Arrows indicate when crushing plant is upwind from monitoring station.

Figure B.4. Hot Metal Pit Monitoring Station - PM_{10} Concentration by Wind Direction

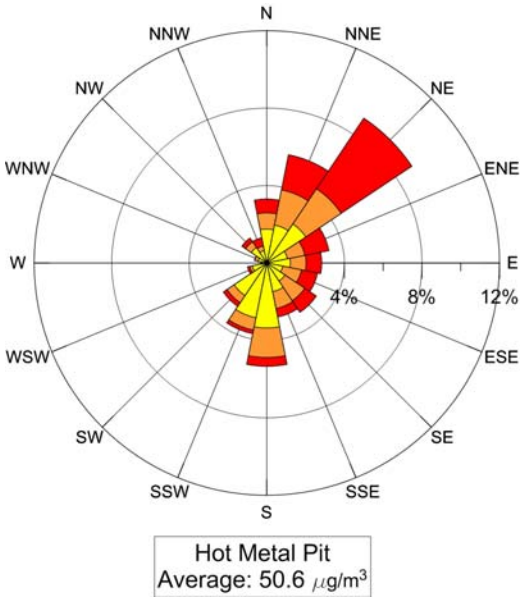
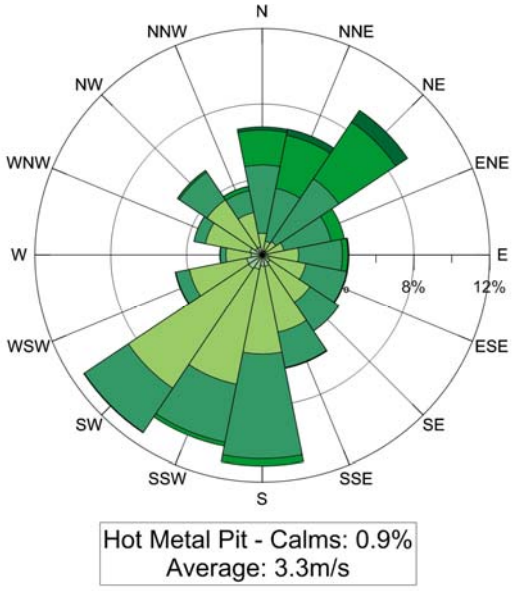
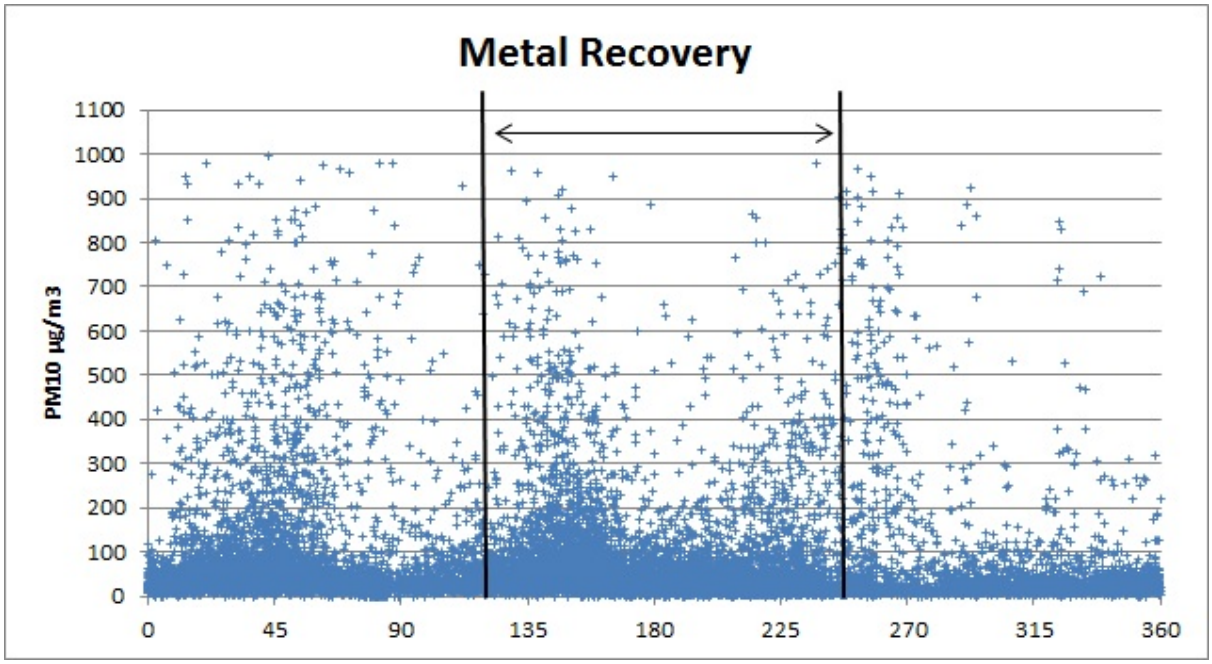
PM_{10} Pollution Rose	Wind Rose
	

Figure B.5 Crushing Plant Monitoring Station - Wind and PM_{10} Concentration Roses

B.1.3 Metal Recovery Plant

Monitoring was undertaken for 45 days from 29th November 2011 to 12th January 2012. The PM_{10} monitoring station was sited downwind of the Metal Recover Plant when the wind direction was recorded to be between 120º and 250º (**Figure B.6, Figure B.7**).



Note: Arrows indicate when crushing plant is downwind of monitoring station.

Figure B.6. Metal Recovery Plant - PM_{10} Concentration by Wind Direction

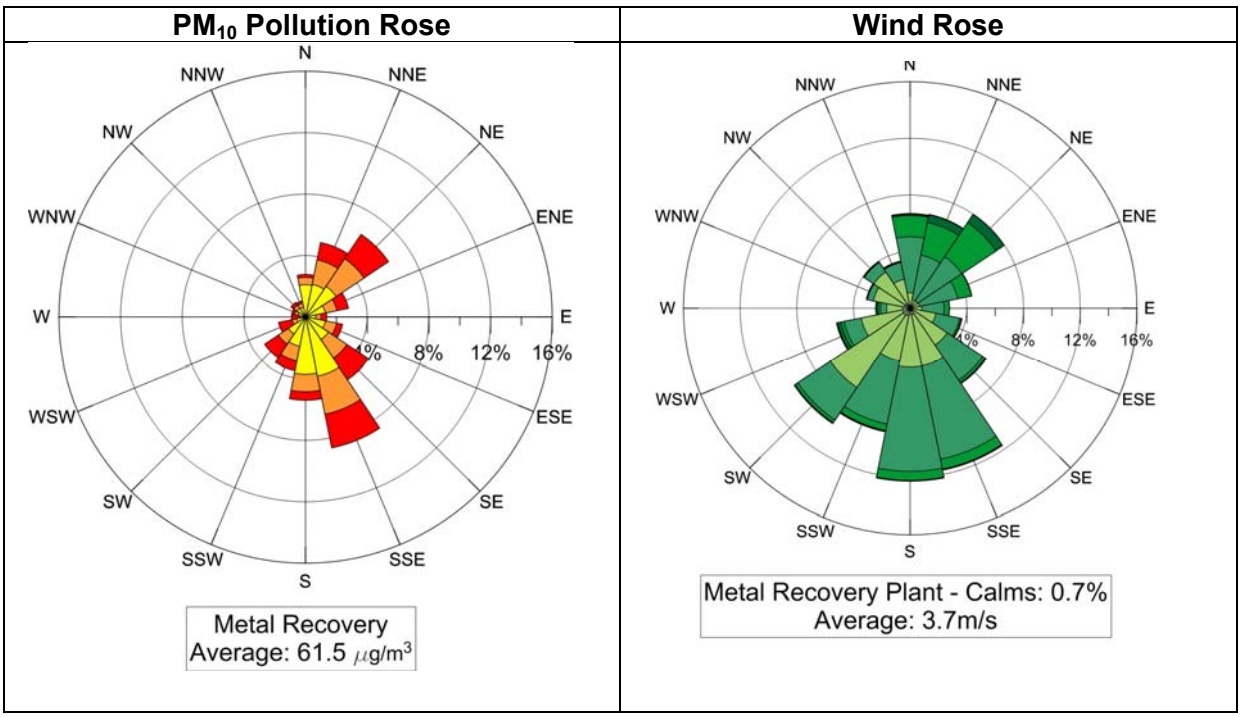
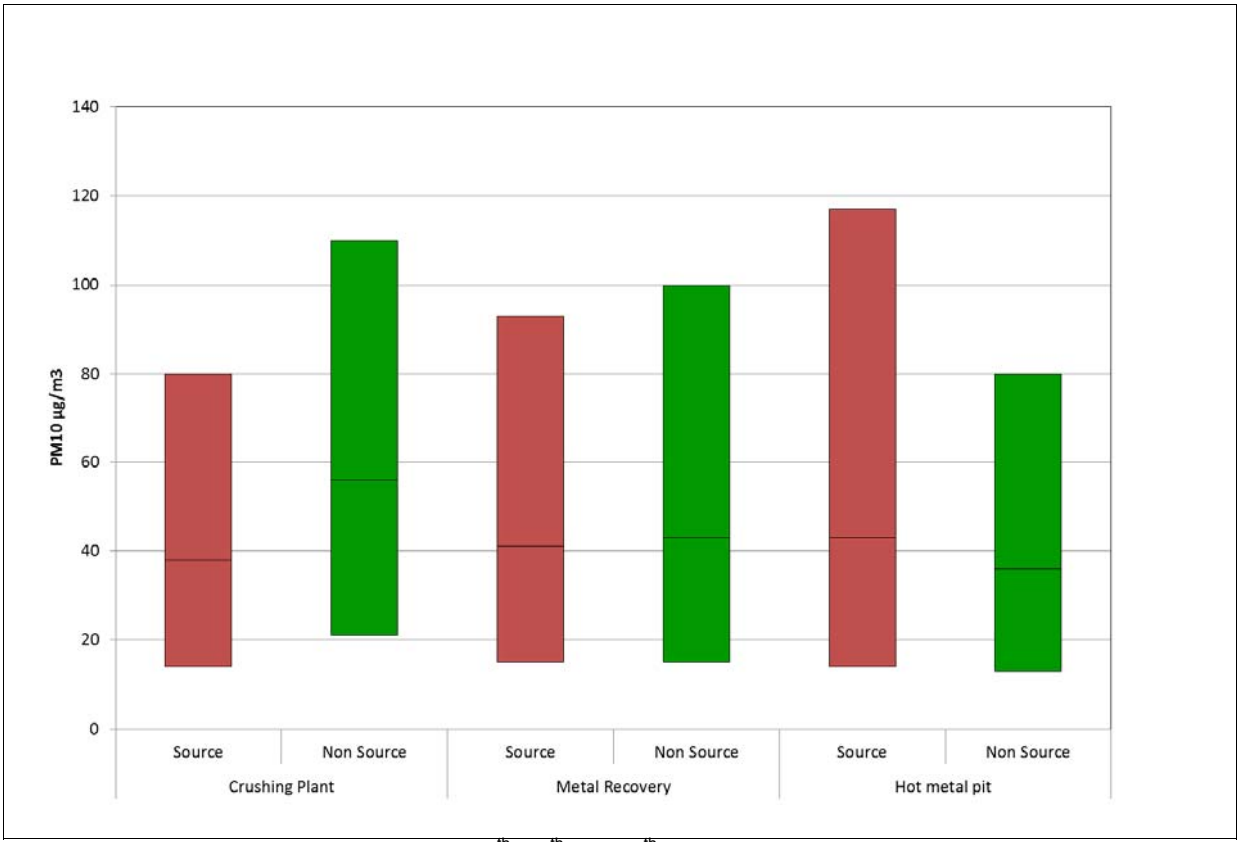


Figure B.7 Metal Recovery Plant Monitoring Station - Wind and PM_{10} Roses

B.1.4 Synopsis of PM_{10} Concentrations Recorded in the Recycling Area

'Downwind' monitoring of particulate matter concentrations is complicated due to fluctuations in the wind field and the occurrence of a wide variety of other sources (within the BSL facility and external sources) likely to contribute to airborne particle concentrations.
This is partially illustrated within Figure B.8 where summary statistics are given for PM_{10} concentrations measured during periods when the station was downwind of the source being assessed ("Source") compared to concentrations measured at other times ("Non-source").



Note: Lower, middle and top lines indicate 25th, 50th and 75th percentile of PM_{10} levels recorded

Figure B.8 PM_{10} Concentrations Recorded at Validation Testing Stations

The PM_{10} concentrations measured within the Recycling Area could not be used for model validation since the period over which the site model is run (1 calendar year) is different from the period over which the measurements were conducted (typically a month). Furthermore, the modelling was undertaken based on 2007 meteorological data, whereas the monitoring data are generally available for the August to November 2011 period. However to provide an indication of how measured PM_{10} concentrations recorded within the Recycling Area compare to projected PM_{10} concentrations due to all BSL facility sources and estimated background levels, data in this respect are presented in **Table B.1**.

Table B.1 Comparison of Predicted and Measured PM_{10} Concentrations			
	Predicted Incremental Concentrations due to BSL Sources		
Monitoring Station	**Maximum 24-hour PM_{10} (µg/m³)**	**Average PM_{10} (µg/m³)**	**Average TSP (µg/m³)**
Hot Metal Pit	244	29	47
Crushing Plant	348	47	79
Metal Recovery Plant	279	23	36
	816	270	489
No 6 BF Pit	385	41	84
Background Levels	**13**	**13**	**27**
Monitoring Station	**Predicted Cumulative Concentrations**		
	Maximum 24-hour PM_{10} (µg/m³)	**Average PM_{10} (µg/m³)**	**Average TSP (µg/m³)**
Hot Metal Pit	257	42	60
Crushing Plant	348	47	79
Metal Recovery Plant	535	279	292
BOS Pit	1,164	619	837
No 6 BF Pit	733	389	432
Monitoring Station	**Measured Concentrations during Validation Testing**		
	Maximum 24-hour PM_{10} (µg/m³)	**Average PM_{10} (µg/m³)**	**Average TSP (µg/m³)**
Hot Metal	95	47	139
Crushing Plant	108	53	187
Metal Recovery	153	66	208
BOS Pit	346	145	694
No6BF Slag Pit	137	62	249
Monitoring Station	**Ratio of Projected Cumulative Concentrations to Measured Concentrations**		
	Maximum 24-hour PM_{10} (µg/m³)	**Average PM_{10} (µg/m³)**	**Average TSP (µg/m³)**
Hot Metal	2.7	0.9	0.4
Crushing Plant	3.2	0.9	0.4
Metal Recovery	3.5	4.3	1.4
BOS Pit	3.4	4.3	1.2
No6BF Slag Pit	5.3	6.3	1.7

B.2 H_2S Concentrations Recorded at Slag Pits

H_2S concentration roses are depicted in **Figure B.8**. The BOS slag pit monitoring station was located to capture H_2S emissions from the BOS slag pit with peaks coinciding with wind directions in the range of 150º and 290º being potentially indicative of emissions from the slag pit. Concentrations were recorded for 28 days between 19th September 2011 and 16th October 2011.

The No. 6 Blast Furnace pit monitoring station was located to capture H_2S emissions from the No.6 Blast furnace pit with peaks coinciding with wind directions in the range of 280º to 360º being indicative of emissions from the pit. Emissions were recorded for 27 days between 15th August 2011 and 10th September 2011.

H_2S concentration roses are depicted in **Figure B.9**, with diurnal variations in concentrations illustrated in **Figure B.10**. Significantly higher concentrations were recorded in the vicinity of the No. 6 BF Slag Pits. Although peaks coincided with periods when the monitoring station was downwind from source, peaks were are also recorded when the monitoring station was upwind indicating the contribution from other sources in the vicinity (and/or the influence of atmospheric recirculation/stagnation). Higher H_2S levels were recorded between 5pm and 8pm indicative of emissions from the pit during slag watering (**Figure B.10**). The daytime peak in H_2S concentrations evident is likely to be due to downmixing of elevated plumes due to convective mixing.

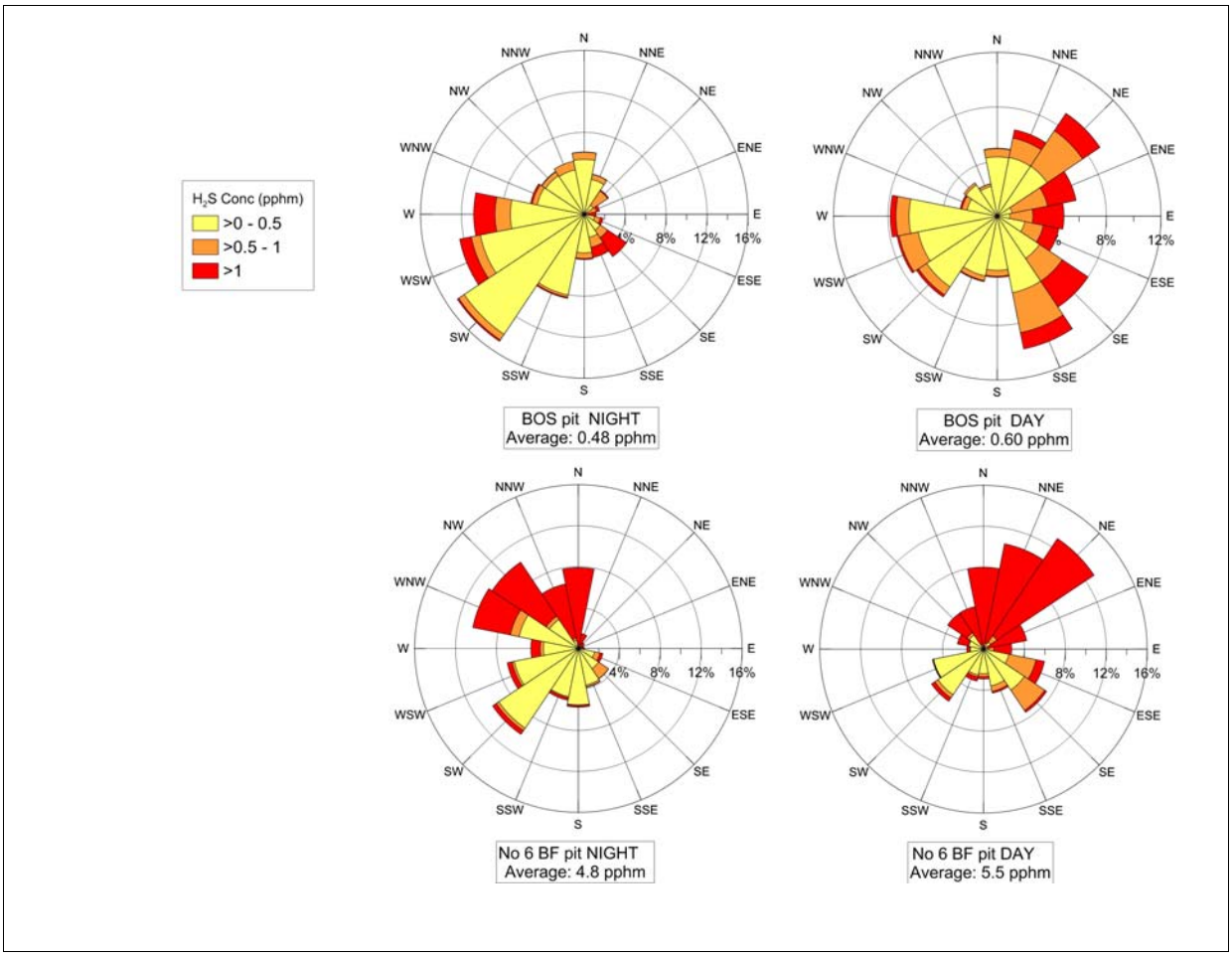


Figure B.9 H_2S Pollution Roses

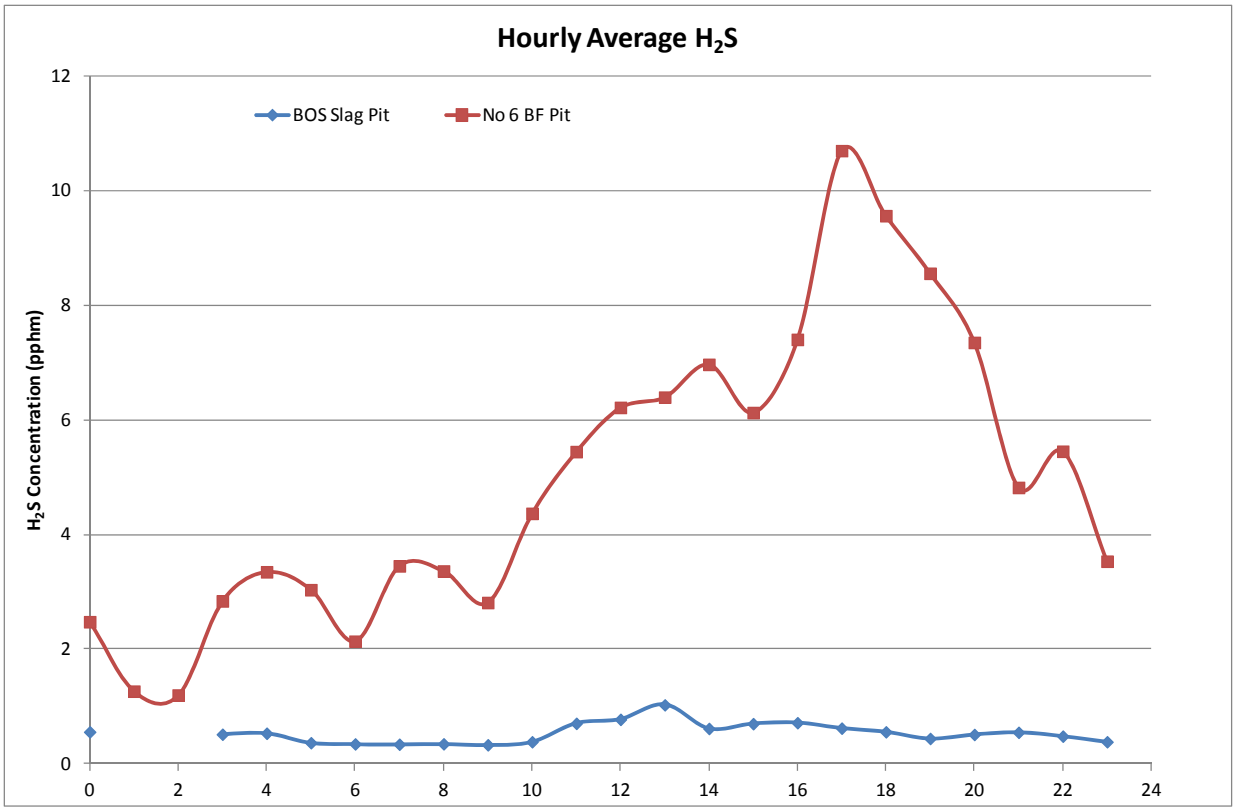


Figure B.10 Diurnal Variations in H_2S Concentrations

Peak and average H_2S concentrations recorded were as follows:

Monitoring Station	Maximum 3-minute Peak H_2S Concentration (µg/m³)	Maximum 1-hour Average H_2S Concentration (µg/m³)	Period Average H_2S Concentration (µg/m³)
No. 6 BF Slag Pit	1426.3	1076.5	72.1
BOS Slag Pit	511.4	84.4	7.5

Emission rates associated with the spraying of water were back-calculated by dispersion modelling based on the peak measured 3-minute H_2S concentrations from the BSL monitoring campaign, as measured when the stations were downwind of the slag pits. The emission rates were calculated to be 0.042 g/s for the No. 6 BF Slag Pit and 0.006 g/s for the BOS Slag Pit.

.

Appendix C

Source Configuration Data

5.2 Mtpa Scenario - Source Parameters

Source Type	ID	Description	Height	Diam	Exit Velocity	Exit Temp	Release Type	SigmaY	SigmaZ	X1	Y1	X2	Y2	X3	Y3	X4	Y4
			[m]	[m]	[m/s]	[K]		[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
POINT	EPA_002	Sinter Machine Room Dedusting Stack	45.00	5.00	14.01	318.00	VERTICAL			306690	6184247						
POINT	EPA_003	No 6 Blast Furnace Stove Heating Stack	70.00	4.00	7.60	399.50	VERTICAL			305975	6184445						
POINT	EPA_004	No 6 Blast Furnace Cast House Dedusting Stack	36.00	3.70	25.22	337.27	VERTICAL			305926	6184334						
POINT	EPA_005	No 6 Blast Furnace Stock House Dedusting Stack	26.00	3.00	28.33	303.90	VERTICAL			306339	6184260						
POINT	EPA_006	No 6 Blast Furnace Highline Dedusting Stack	30.00	1.80	26.82	302.75	VERTICAL			306409	6184426						
POINT	EPA_007	No 5 Blast Furnace Stove Heating Stack	61.00	5.90	3.49	399.50	VERTICAL			305892	6184645						
POINT	EPA_008	No 5 Blast Furnace Cast House Dedusting Stack	23.00	3.25	12.96	336.54	VERTICAL			305767	6184718						
POINT	EPA_009	No 5 Blast Furnace Stock House Dedusting Stack	25.00	2.40	13.88	300.24	VERTICAL			306197	6184569						
POINT	EPA_010	No 5 Blast Furnace - No 2 Slag Granulator Stack	70.00	4.00	2.81	312.20	VERTICAL			305832	6184716						
POINT	EPA_013	No 4 Coke Oven Battery Heating Stack	81.00	3.96	5.88	459.91	VERTICAL			306356	6183873						
POINT	EPA_014	No 5 Coke Oven Battery Heating Stack	89.00	3.96	6.09	450.21	VERTICAL			306454	6183941						
POINT	EPA_015	No 6 Coke Oven Battery Heating Stack	90.00	4.72	5.80	461.52	VERTICAL			306583	6184023						
POINT	EPA_016	No 7a Coke Oven Battery Heating Stack	140.00	7.70	2.12	442.31	VERTICAL			306653	6184128						
POINT	EPA_018	No 4/5 Coke Oven Battery Quench Tower Stack	52.00	5.50	9.81	335.60	VERTICAL			306321	6183786						
POINT	EPA_019	No 6 Coke Oven Battery Quench Tower Stack	52.00	5.10	11.41	335.60	VERTICAL			306693	6184003						
POINT	EPA_020	No 7a Coke Oven Battery Quench Tower Stack	35.00	14.04	1.51	335.60	VERTICAL			306655	6184139						
POINT	EPA_021	No 7a Battery Fume Suppression Plant No 1 Stack	26.00	3.00	9.94	315.33	VERTICAL			306601	6184147						
POINT	EPA_022	No 7a Battery Fume Suppression Plant No 2 Stack	26.00	3.00	11.36	312.33	VERTICAL			306585	6184162						
POINT	EPA_023	Coke Screen House Dedusting Stack	17.00	1.80	17.06	301.24	VERTICAL			306833	6184047						
POINT	EPA_024	BOS No 1 Vessel Flare Stack	85.00	2.00	22.44	342.15	VERTICAL			305620	6184746						
POINT	EPA_025	BOS No 2 Vessel Flare Stack	85.00	2.00	22.44	342.15	VERTICAL			305591	6184759						
POINT	EPA_026	BOS No 3 Vessel Flare Stack	85.00	2.00	22.44	342.15	VERTICAL			305564	6184771						
POINT	EPA_027	BOS No 2 Secondary Dedusting Stack	30.00	4.50	23.66	327.34	VERTICAL			305342	6184766						
POINT	EPA_028	BOS No 3 Secondary Dedusting Stack	19.00	2.90	11.28	334.46	VERTICAL			305523	6184878						
POINT	EPA_030	Lime Kiln Waste Heat Stack	28.00	2.40	18.94	434.16	VERTICAL			305326	6184519						
POINT	EPA_031	Lime Kiln Storage bins - Enacon Baghouse Stack	11.00	0.60	10.88	302.75	VERTICAL			305554	6184370						
POINT	EPA_032	Lime Kiln Storage bins - Bahco Baghouse Stack	3.00	0.66	11.51	296.71	VERTICAL			305568	6184365						
POINT	EPA_033	Lime Kiln Transfer House Stack	55.78	0.39	7.64	294.53	VERTICAL			305704	6184631						
POINT	EPA_034	Slab Handling - Slab Scarfing Machine Stack	37.00	2.60	5.57	300.89	VERTICAL			305348	6184602						

Source Type	ID	Description	Height	Diam	Exit Velocity	Exit Temp	Release Type	SigmaY	SigmaZ	X1	Y1	X2	Y2	X3	Y3	X4	Y4
			[m]	[m]	[m/s]	[K]		[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
POINT	EPA_035	Raw Material Road Rail Dump Station Stack	52.00	1.65	14.50	299.25	VERTICAL			305784	6185046						
POINT	EPA_037	No 2 Blower Station 21/22 Boiler Stack	60.00	4.30	6.58	399.50	VERTICAL			306115	6184528						
POINT	EPA_038	No 2 Blower Station 23 Boiler Stack	60.00	3.70	8.88	399.50	VERTICAL			306097	6184544						
POINT	EPA_039	No 2 Blower Station 24 Boiler Stack	60.00	3.70	8.88	399.50	VERTICAL			306079	6184559						
POINT	EPA_040	No 2 Blower Station 25 Boiler Stack	61.00	3.70	8.88	399.50	VERTICAL			306042	6184569						
POINT	EPA_046	Hydrogen Reformer Furnace Stack	32.00	0.49	20.68	979.00	VERTICAL			305540	6185070						
POINT	EPA_047	No 1 Walking Beam Furnace Stack	97.32	4.70	5.51	399.50	VERTICAL			305153	6185471						
POINT	EPA_048	3500mm Furnace No 1 Stack	25.00	2.50	1.89	488.48	VERTICAL			305033	6185503						
POINT	EPA_049	3500mm Furnace No 2 Stack	19.00	3.20	1.16	488.48	VERTICAL			305040	6185534						
POINT	EPA_052	GEGA M/C Cut to Length Stack	15.30	1.23	16.89	303.50	VERTICAL			305002	6185364						
POINT	EPA_076	No 4/5 Battery Fume Control Stack	24.10	2.75	10.72	318.40	VERTICAL			306489	6183855						
POINT	EPA_077	No 6 Battery Fume Control Stack	24.10	2.75	9.65	317.47	VERTICAL			306513	6183872						
POINT	EPA_090	No 5 & 6 Hammer Mills Dedusting Stack	11.50	0.60	12.01	294.38	VERTICAL			306326	6184033						
POINT	EPA_092	CAS Baghouse Stack	30.00	0.70	10.55	329.50	VERTICAL			305544	6184645						
POINT	EPA_093	Lime Kiln Discharge Building Baghouse Stack	5.00	0.65	17.06	313.12	VERTICAL			305415	6184402						
POINT	EPA_100	Gas Processing Sulphate Plant Stack	18.00	0.90	8.59	344.00	VERTICAL			305946	6183659						
POINT	EPA_104	No 6 Blast Furnace - Slag Granulator Stack	39.00	3.20	8.99	351.00	VERTICAL			305849	6184157						
POINT	EPA_105	PCI Hot Gas Exhaust Stack	62.00	1.25	8.36	434.50	VERTICAL			306522	6184172						
POINT	EPA_106	PCI Facility - Stacks Serving Depressurising Bag Filters	54.74	0.48	8.11	403.50	VERTICAL			306479	6184180						
POINT	EPA_107	Sinter Plant Waste Gas Cleaning	100.00	6.50	16.66	414.13	VERTICAL			306678	6184361						
POINT	EPA_108	Scrap Cutting Dust Collector Baghouse	15.00	1.01	10.54	337.06	VERTICAL			305238	6184349						
POINT	EPA_112	Roll Service Technology Stack - Round	30.00	0.60	11.67	305.50	VERTICAL			305479	6185646						
POINT	EPA_113	Ecocem Slag Dryer Dust Collector	10.30	0.84	14.50	374.50	VERTICAL			305813	6185928						
POINT	EPA_115	Metserv Iron Dumping/Cutting Shed Baghouse Stack	20.00	1.60	12.27	315.38	VERTICAL			303749	6185549						
POINT	EPA_117	No 1, 2 & 3 Slab Caster Stacks	40.00	0.39	50.00	329.75	VERTICAL			305545	6184614						
POINT	EPA_117A	No 1, 2 & 3 Slab Caster Stacks	40.00	0.39	50.00	329.75	VERTICAL			305608	6184577						
POINT	EPA_117B	No 1, 2 & 3 Slab Caster Stacks	40.00	0.39	50.00	329.75	VERTICAL			305580	6184588						
POINT	EPA_117C	No 1, 2 & 3 Slab Caster Stacks	40.00	0.39	50.00	329.75	VERTICAL			305573	6184591						
POINT	EPA_117D	No 1, 2 & 3 Slab Caster Stacks	40.00	0.39	50.00	329.75	VERTICAL			305534	6184608						
POINT	EPA_117E	No 1, 2 & 3 Slab Caster Stacks	40.00	0.39	50.00	329.75	VERTICAL			305509	6184623						
POINT	EPA_118	No 5 Blast Furnace Casthouse Dedusting Stack	22.00	2.82	17.00	334.53	VERTICAL			305737	6184700						
POINT	EPA_120	No 2 Walking Beam Furnace Stack	45.00	3.10	10.11	548.48	VERTICAL			305158	6185464						

Source Type	ID	Description	Height	Diam	Exit Velocity	Exit Temp	Release Type	SigmaY	SigmaZ	X1	Y1	X2	Y2	X3	Y3	X4	Y4
			[m]	[m]	[m/s]	[K]		[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
POINT	EPA_121	Briquetting Southern Scrubber	25.00	1.16	6.77	422.50	VERTICAL			305241	6184219						
POINT	EPA_122	Briquetting Northern Scrubber	25.00	1.16	1.94	422.50	VERTICAL			305294	6184238						
POINT	EPA_123	Briquetting Blast Furnace Screening Baghouse	24.00	0.64	11.81	415.50	VERTICAL			305221	6184316						
POINT	B4APT	Battery 4 Fugitive A (Doors & Leaks)	15.00	11.99	1.00	923.00	VERTICAL			306350	6183817						
POINT	B4BPT	Battery 4 Fugitive B (Doors & Leaks)	15.00	11.99	1.00	923.00	VERTICAL			306361	6183823						
POINT	B4CPT	Battery 4 Fugitive C (Doors & Leaks)	15.00	11.99	1.00	923.00	VERTICAL			306371	6183829						
POINT	B4DPT	Battery 4 Fugitive D (Doors & Leaks)	15.00	11.99	1.00	923.00	VERTICAL			306381	6183835						
POINT	B4EPT	Battery 4 Fugitive E (Doors & Leaks)	15.00	11.99	1.00	923.00	VERTICAL			306392	6183841						
POINT	B4FPT	Battery 4 Fugitive F (Doors & Leaks)	15.00	11.99	1.00	923.00	VERTICAL			306402	6183847						
POINT	B4GPT	Battery 4 Fugitive G (Doors & Leaks)	15.00	11.99	1.00	923.00	VERTICAL			306413	6183853						
POINT	B4HPT	Battery 4 Fugitive H (Doors & Leaks)	15.00	11.99	1.00	923.00	VERTICAL			306423	6183859						
POINT	B5APT	Battery 5 Fugitive A (Doors & Leaks)	15.00	11.83	1.00	923.00	VERTICAL			306455	6183877						
POINT	B5BPT	Battery 5 Fugitive B (Doors & Leaks)	15.00	11.83	1.00	923.00	VERTICAL			306465	6183883						
POINT	B5CPT	Battery 5 Fugitive C (Doors & Leaks)	15.00	11.83	1.00	923.00	VERTICAL			306476	6183890						
POINT	B5DPT	Battery 5 Fugitive D (Doors & Leaks)	15.00	11.83	1.00	923.00	VERTICAL			306486	6183896						
POINT	B5EPT	Battery 5 Fugitive E (Doors & Leaks)	15.00	11.83	1.00	923.00	VERTICAL			306495	6183901						
POINT	B5FPT	Battery 5 Fugitive F (Doors & Leaks)	15.00	11.83	1.00	923.00	VERTICAL			306506	6183907						
POINT	B5GPT	Battery 5 Fugitive G (Doors & Leaks)	15.00	11.83	1.00	923.00	VERTICAL			306517	6183913						
POINT	B5HPT	Battery 5 Fugitive H (Doors & Leaks)	15.00	11.83	1.00	923.00	VERTICAL			306527	6183920						
POINT	B6APT	Battery 6 Fugitive A (Doors & Leaks)	15.00	11.94	1.00	923.00	VERTICAL			306572	6183947						
POINT	B6BPT	Battery 6 Fugitive B (Doors & Leaks)	15.00	11.94	1.00	923.00	VERTICAL			306582	6183953						
POINT	B6CPT	Battery 6 Fugitive C (Doors & Leaks)	15.00	11.94	1.00	923.00	VERTICAL			306593	6183960						
POINT	B6DPT	Battery 6 Fugitive D (Doors & Leaks)	15.00	11.94	1.00	923.00	VERTICAL			306603	6183966						
POINT	B6EPT	Battery 6 Fugitive E (Doors & Leaks)	15.00	11.94	1.00	923.00	VERTICAL			306613	6183972						
POINT	B6FPT	Battery 6 Fugitive F (Doors & Leaks)	15.00	11.94	1.00	923.00	VERTICAL			306623	6183978						
POINT	B6GPT	Battery 6 Fugitive G (Doors & Leaks)	15.00	11.94	1.00	923.00	VERTICAL			306634	6183985						
POINT	B6HPT	Battery 6 Fugitive H (Doors & Leaks)	15.00	11.94	1.00	923.00	VERTICAL			306644	6183991						
POINT	B6IPT	Battery 6 Fugitive I (Doors & Leaks)	15.00	11.94	1.00	923.00	VERTICAL			306654	6183997						
POINT	B6JPT	Battery 6 Fugitive J (Doors & Leaks)	15.00	11.94	1.00	923.00	VERTICAL			306664	6184002						
POINT	B7APT	Battery 7A Fugitive A (Doors & Leaks)	16.00	20.00	1.00	923.00	VERTICAL			306626	6184097						
POINT	B7BPT	Battery 7A Fugitive B (Doors & Leaks)	16.00	20.00	1.00	923.00	VERTICAL			306572	6184070						
POINT	B7CPT	Battery 7A Fugitive C (Doors & Leaks)	16.00	20.00	1.00	923.00	VERTICAL			306591	6184079						
POINT	B7DPT	Battery 7A Fugitive D (Doors & Leaks)	16.00	20.00	1.00	923.00	VERTICAL			306608	6184090						

Source Type	ID	Description	Height	Diam	Exit Velocity	Exit Temp	Release Type	SigmaY	SigmaZ	X1	Y1	X2	Y2	X3	Y3	X4	Y4
			[m]	[m]	[m/s]	[K]		[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
VOLUME	B4P	Battery 4 Pushing	6.00					1.16	2.33	306385	6183822						
VOLUME	B5P	Battery 5 Pushing	6.00					1.16	2.33	306492	6183885						
VOLUME	B6P	Battery 6 Pushing	6.00					1.16	2.33	306636	6183974						
VOLUME	B7AP	Battery 7A Pushing	8.00					1.16	2.33	306602	6184071						
VOLUME	B4C	Battery 4 Charging	14.00					2.79	1.86	306385	6183830						
VOLUME	B5C	Battery 5 Charging	14.00					2.79	1.86	306490	6183893						
VOLUME	B6C	Battery 6 Charging	14.00					2.79	1.86	306636	6183981						
POINT	SINTC_01	Sinter Cooler Fugitive Emissions 01	10.00	6.61	3.47	599.22	VERTICAL			306522	6184365						
POINT	SINTC_02	Sinter Cooler Fugitive Emissions 02	10.00	6.61	3.47	599.22	VERTICAL			306518	6184368						
POINT	SINTC_03	Sinter Cooler Fugitive Emissions 03	10.00	6.61	3.47	599.22	VERTICAL			306515	6184372						
POINT	SINTC_04	Sinter Cooler Fugitive Emissions 04	10.00	6.61	3.47	599.22	VERTICAL			306513	6184377						
POINT	SINTC_05	Sinter Cooler Fugitive Emissions 05	10.00	6.61	3.47	599.22	VERTICAL			306513	6184383						
POINT	SINTC_06	Sinter Cooler Fugitive Emissions 06	10.00	6.61	3.47	599.22	VERTICAL			306515	6184388						
POINT	SINTC_07	Sinter Cooler Fugitive Emissions 07	10.00	6.61	3.47	599.22	VERTICAL			306518	6184392						
POINT	SINTC_08	Sinter Cooler Fugitive Emissions 08	10.00	6.61	3.47	599.22	VERTICAL			306523	6184396						
POINT	SINTC_09	Sinter Cooler Fugitive Emissions 09	10.00	6.61	3.47	599.22	VERTICAL			306528	6184397						
POINT	SINTC_10	Sinter Cooler Fugitive Emissions 10	10.00	6.61	3.47	599.22	VERTICAL			306533	6184397						
POINT	SINTC_11	Sinter Cooler Fugitive Emissions 11	10.00	6.61	3.47	599.22	VERTICAL			306538	6184396						
POINT	SINTC_12	Sinter Cooler Fugitive Emissions 12	10.00	6.61	3.47	599.22	VERTICAL			306543	6184392						
POINT	SINTC_13	Sinter Cooler Fugitive Emissions 13	10.00	6.61	3.47	599.22	VERTICAL			306546	6184388						
POINT	SINTC_14	Sinter Cooler Fugitive Emissions 14	10.00	6.61	3.47	599.22	VERTICAL			306528	6184363						
VOLUME	BOS_01	BOS01 Roof Vent Fugitive Emissions	41.20					3.67	1.16	305566	6184702						
VOLUME	BOS_02	BOS02 Roof Vent Fugitive Emissions	41.20					3.67	1.16	305543	6184713						
VOLUME	BOS_03	BOS03 Roof Vent Fugitive Emissions	41.20					3.67	1.16	305511	6184728						
VOLUME	SCP	Slag Cooling Pot	2.50					7.7	2.33	305661	6184730						
VOLUME	CRSH	Crusher	2.50					1.16	2.33	306870	6184188						
VOLUME	SSP_01	Slag Stockpile 01	2.50					4.67	2.33	305596	6184814						
VOLUME	SSP_02	Slag Stockpile 02	2.50					4.67	2.33	305616	6184804						
VOLUME	SSP_03	Slag Stockpile 03	2.50					4.67	2.33	305637	6184792						
VOLUME	SSP_04	Slag Stockpile 04	2.50					4.67	2.33	305658	6184781						
VOLUME	HMP_01	Hot Metal Pit 01	2.50					12	2.33	303856	6185603						
VOLUME	HMP_02	Hot Metal Pit 02	2.50					12	2.33	303914	6185602						
VOLUME	HMP_03	Hot Metal Pit 03	2.50					12	2.33	303980	6185603						

Source Type	ID	Description	Height	Diam	Exit Velocity	Exit Temp	Release Type	SigmaY	SigmaZ	X1	Y1	X2	Y2	X3	Y3	X4	Y4
			[m]	[m]	[m/s]	[K]		[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
VOLUME	HMP_04	Hot Metal Pit 04	2.50					12	2.33	304033	6185603						
VOLUME	HMP_05	Hot Metal Pit 05	2.50					12	2.33	304099	6185603						
VOLUME	MHND	Materials Handling - VE	5.00					2.33	4.65	306856	6184063						
VOLUME	MRP	Recycling Area - Metal Recovery Plant - VE	2.50					25.4	2.33	303998	6185792						
VOLUME	CSP1	Recycling Area - Crushing/Screening Plant 01 - VE	2.50					27.7	2.33	304217	6185047						
VOLUME	CSP2	Recycling Area - Crushing/Screening Plant 02 - VE	2.50					27.7	2.33	304164	6185136						
POINT	SP05	Springhill 5 (MCL1 Selas Stack)	39.00	1.60	5.60	478.50	VERTICAL			304730	6184908						
POINT	SP06	Springhill 6 (MCL2 Selas Stack)'	39.00	1.65	13.00	813.20	VERTICAL			304740	6184906						
POINT	SP07	Springhill 7 (MCL2 Selas Stack)	28.00	1.53	9.90	1440.20	VERTICAL			304759	6184912						
POINT	SP09	Springhill 9 (MCL2 Passivation Stack)	10.00	0.39	6.30	306.90	VERTICAL			304741	6184789						
POINT	SP10	Springhill 10 (MCL1 Passivation Exhaust)	10.00	0.39	9.90	295.50	VERTICAL			304712	6184810						
POINT	SP12	Springhill 12 (CPL3 Prime Oven Incinerator)	35.00	1.20	11.30	650.40	VERTICAL			304682	6184902						
POINT	SP13	Springhill 13 (CPL3 Finish Oven Incinerator)	35.00	1.20	14.83	640.90	VERTICAL			304682	6184899						
VOLUME	SPBLG	Springhill Building Fugitives	8.85					26.5	46.2	304773	6185005						
AREA_POLY	BF5SLAG	BF No. 5 Slag Pits	0.00							305813	6184799	305858	6184757	305846	6184742	305797	6184784
AREA_POLY	BF6SLAG	BF No. 6 Slag Pits	0.00							305828	6184322	306007	6184241	305989	6184199	305802	6184272
POINT	B4STD	Battery 4 (standpipe emissions)	15.00	0.50	6.00	923.00	VERTICAL			306350	6183817						
POINT	B5STD	Battery 5 (standpipe emissions)	15.00	0.50	6.00	923.00	VERTICAL			306455	6183877						
POINT	B6STD	Battery 6 (standpipe emissions)	15.00	0.50	6.00	923.00	VERTICAL			306572	6183947						
POINT	B7STD	Battery 7A (standpipe emissions)	16.00	0.50	6.00	923.00	VERTICAL			306626	6184097						

2.6 Mtpa Scenario - Source Parameters

Source Type	ID	Description	Height	Diam	Exit Velocity	Exit Temp	Release Type	SigmaY	SigmaZ	X1	Y1	X2	Y2	X3	Y3	X4	Y4
			[m]	[m]	[m/s]	[K]		[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
POINT	EPA_002	Sinter Machine Room Dedusting Stack	45.0	5.0	14.3	318.0	VERTICAL			306690	6184247						
POINT	EPA_006	No 6 Blast Furnace Highline Dedusting Stack	30.0	1.8	26.8	302.8	VERTICAL			306409	6184426						
POINT	EPA_007	No 5 Blast Furnace Stove Heating Stack	61.0	5.9	3.5	399.5	VERTICAL			305892	6184645						
POINT	EPA_008	No 5 Blast Furnace Cast House Dedusting Stack	23.0	3.3	13.0	336.5	VERTICAL			305767	6184718						
POINT	EPA_009	No 5 Blast Furnace Stock House Dedusting Stack	25.0	2.4	13.9	300.2	VERTICAL			306197	6184569						
POINT	EPA_010	No 5 Blast Furnace - No 2 Slag Granulator Stack	70.0	4.0	2.4	307.9	VERTICAL			305832	6184716						
POINT	EPA_014	No 5 Coke Oven Battery Heating Stack	89.0	4.0	5.8	440.7	VERTICAL			306454	6183941						
POINT	EPA_015	No 6 Coke Oven Battery Heating Stack	90.0	4.7	5.8	461.5	VERTICAL			306583	6184023						
POINT	EPA_016	No 7a Coke Oven Battery Heating Stack	140.0	7.7	2.1	442.3	VERTICAL			306653	6184128						
POINT	EPA_018	No 4/5 Coke Oven Battery Quench Tower Stack	52.0	5.5	10.1	331.2	VERTICAL			306321	6183786						
POINT	EPA_019	No 6 Coke Oven Battery Quench Tower Stack	52.0	5.1	11.4	335.6	VERTICAL			306693	6184003						
POINT	EPA_020	No 7a Coke Oven Battery Quench Tower Stack	35.0	14.0	1.5	335.6	VERTICAL			306655	6184139						
POINT	EPA_021	No 7a Battery Fume Suppression Plant No 1 Stack	26.0	3.0	9.9	315.3	VERTICAL			306601	6184147						
POINT	EPA_022	No 7a Battery Fume Suppression Plant No 2 Stack	26.0	3.0	11.4	312.3	VERTICAL			306585	6184162						
POINT	EPA_023	Coke Screen House Dedusting Stack	17.0	1.8	16.5	305.7	VERTICAL			306833	6184047						
POINT	EPA_024	BOS No 1 Vessel Flare Stack	85.0	2.0	22.4	342.2	VERTICAL			305620	6184746						
POINT	EPA_027	BOS No 2 Secondary Dedusting Stack	30.0	4.5	23.7	327.3	VERTICAL			305342	6184766						
POINT	EPA_030	Lime Kiln Waste Heat Stack	28.0	2.4	18.9	434.2	VERTICAL			305326	6184519						
POINT	EPA_031	Lime Kiln Storage bins - Enacon Baghouse Stack	11.0	0.6	10.9	302.8	VERTICAL			305554	6184370						
POINT	EPA_032	Lime Kiln Storage bins - Bahco Baghouse Stack	3.0	0.7	11.5	296.7	VERTICAL			305568	6184365						
POINT	EPA_033	Lime Kiln Transfer House Stack	55.8	0.4	7.6	294.5	VERTICAL			305704	6184631						
POINT	EPA_034	Slab Handling - Slab Scarfing Machine Stack	37.0	2.6	5.6	300.9	VERTICAL			305348	6184602						
POINT	EPA_035	Raw Material Road Rail Dump Station Stack	52.0	1.7	14.5	299.3	VERTICAL			305784	6185046						
POINT	EPA_038	No 2 Blower Station 23 Boiler Stack	60.0	3.7	8.9	399.5	VERTICAL			306097	6184544						
POINT	EPA_039	No 2 Blower Station 24 Boiler Stack	60.0	3.7	8.9	399.5	VERTICAL			306079	6184559						
POINT	EPA_040	No 2 Blower Station 25 Boiler Stack	61.0	3.7	8.9	399.5	VERTICAL			306042	6184569						
POINT	EPA_046	Hydrogen Reformer Furnace Stack	32.0	0.5	20.7	979.0	VERTICAL			305540	6185070						
POINT	EPA_047	No 1 Walking Beam Furnace Stack	97.3	4.7	5.5	399.5	VERTICAL			305153	6185471						
POINT	EPA_048	3500mm Furnace No 1 Stack	25.0	2.5	1.9	488.5	VERTICAL			305033	6185503						

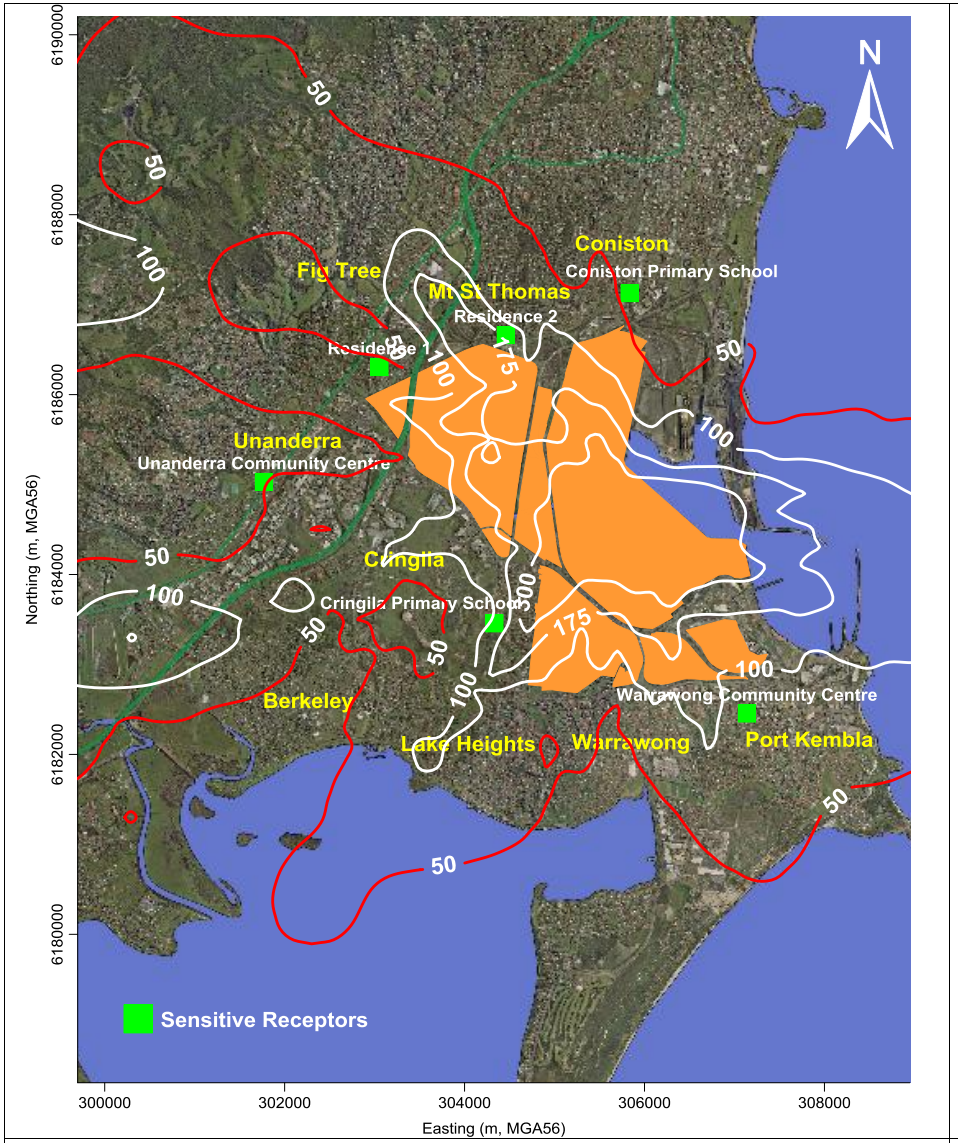
Source Type	ID	Description	Height	Diam	Exit Velocity	Exit Temp	Release Type	SigmaY	SigmaZ	X1	Y1	X2	Y2	X3	Y3	X4	Y4
			[m]	[m]	[m/s]	[K]		[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
POINT	EPA_049	3500mm Furnace No 2 Stack	19.0	3.2	1.2	488.5	VERTICAL			305040	6185534						
POINT	EPA_052	GEGA M/C Cut to Length Stack	15.3	1.2	16.9	303.5	VERTICAL			305002	6185364						
POINT	EPA_076	No 4/5 Battery Fume Control Stack	24.1	2.8	10.7	318.4	VERTICAL			306489	6183855						
POINT	EPA_077	No 6 Battery Fume Control Stack	24.1	2.8	9.7	317.5	VERTICAL			306513	6183872						
POINT	EPA_090	No 5 & 6 Hammer Mills Dedusting Stack	11.5	0.6	10.6	298.2	VERTICAL			306326	6184033						
POINT	EPA_092	CAS Baghouse Stack	30.0	0.7	10.6	329.5	VERTICAL			305544	6184645						
POINT	EPA_093	Lime Kiln Discharge Building Baghouse Stack	5.0	0.7	17.1	313.1	VERTICAL			305415	6184402						
POINT	EPA_100	Gas Processing Sulphate Plant Stack	18.0	0.9	8.6	344.0	VERTICAL			305946	6183659						
POINT	EPA_105	PCI Hot Gas Exhaust Stack	62.0	1.3	8.4	434.5	VERTICAL			306522	6184172						
POINT	EPA_106	PCI Facility - Stacks Serving Depressurising Bag Filters	54.7	0.5	8.1	403.5	VERTICAL			306479	6184180						
POINT	EPA_107	Sinter Plant Waste Gas Cleaning	100.0	6.5	12.2	415.4	VERTICAL			306678	6184361						
POINT	EPA_108	Scrap Cutting Dust Collector Baghouse	15.0	1.0	10.5	337.1	VERTICAL			305238	6184349						
POINT	EPA_113	Ecocem Slag Dryer Dust Collector	10.3	0.8	14.5	374.5	VERTICAL			305813	6185928						
POINT	EPA_115	Metserv Iron Dumping/Cutting Shed Baghouse Stack	20.0	1.6	12.3	315.4	VERTICAL			303749	6185549						
POINT	EPA_117	No 1, 2 & 3 Slab Caster Stacks	40.0	0.4	50.0	329.8	VERTICAL			305545	6184614						
POINT	EPA_117A	No 1, 2 & 3 Slab Caster Stacks	40.0	0.4	50.0	329.8	VERTICAL			305608	6184577						
POINT	EPA_117B	No 1, 2 & 3 Slab Caster Stacks	40.0	0.4	50.0	329.8	VERTICAL			305580	6184588						
POINT	EPA_117C	No 1, 2 & 3 Slab Caster Stacks	40.0	0.4	50.0	329.8	VERTICAL			305573	6184591						
POINT	EPA_118	No 5 Blast Furnace Casthouse Dedusting Stack	22.0	2.8	17.0	334.5	VERTICAL			305737	6184700						
POINT	EPA_120	No 2 Walking Beam Furnace Stack	45.0	3.1	10.1	548.5	VERTICAL			305158	6185464						
POINT	B5APT	Battery 5 Fugitive A (Doors & Leaks)	15.0	11.8	1.0	923.0	VERTICAL			306455	6183877						
POINT	B5BPT	Battery 5 Fugitive B (Doors & Leaks)	15.0	11.8	1.0	923.0	VERTICAL			306465	6183883						
POINT	B5CPT	Battery 5 Fugitive C (Doors & Leaks)	15.0	11.8	1.0	923.0	VERTICAL			306476	6183890						
POINT	B5DPT	Battery 5 Fugitive D (Doors & Leaks)	15.0	11.8	1.0	923.0	VERTICAL			306486	6183896						
POINT	B5EPT	Battery 5 Fugitive E (Doors & Leaks)	15.0	11.8	1.0	923.0	VERTICAL			306495	6183901						
POINT	B5FPT	Battery 5 Fugitive F (Doors & Leaks)	15.0	11.8	1.0	923.0	VERTICAL			306506	6183907						
POINT	B5GPT	Battery 5 Fugitive G (Doors & Leaks)	15.0	11.8	1.0	923.0	VERTICAL			306517	6183913						
POINT	B5HPT	Battery 5 Fugitive H (Doors & Leaks)	15.0	11.8	1.0	923.0	VERTICAL			306527	6183920						
POINT	B6APT	Battery 6 Fugitive A (Doors & Leaks)	15.0	11.9	1.0	923.0	VERTICAL			306572	6183947						
POINT	B6BPT	Battery 6 Fugitive B (Doors & Leaks)	15.0	11.9	1.0	923.0	VERTICAL			306582	6183953						
POINT	B6CPT	Battery 6 Fugitive C (Doors & Leaks)	15.0	11.9	1.0	923.0	VERTICAL			306593	6183960						
POINT	B6DPT	Battery 6 Fugitive D (Doors & Leaks)	15.0	11.9	1.0	923.0	VERTICAL			306603	6183966						

Source Type	ID	Description	Height	Diam	Exit Velocity	Exit Temp	Release Type	SigmaY	SigmaZ	X1	Y1	X2	Y2	X3	Y3	X4	Y4
			[m]	[m]	[m/s]	[K]		[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
POINT	B6EPT	Battery 6 Fugitive E (Doors & Leaks)	15.0	11.9	1.0	923.0	VERTICAL			306613	6183972						
POINT	B6FPT	Battery 6 Fugitive F (Doors & Leaks)	15.0	11.9	1.0	923.0	VERTICAL			306623	6183978						
POINT	B6GPT	Battery 6 Fugitive G (Doors & Leaks)	15.0	11.9	1.0	923.0	VERTICAL			306634	6183985						
POINT	B6HPT	Battery 6 Fugitive H (Doors & Leaks)	15.0	11.9	1.0	923.0	VERTICAL			306644	6183991						
POINT	B6IPT	Battery 6 Fugitive I (Doors & Leaks)	15.0	11.9	1.0	923.0	VERTICAL			306654	6183997						
POINT	B6JPT	Battery 6 Fugitive J (Doors & Leaks)	15.0	11.9	1.0	923.0	VERTICAL			306664	6184002						
POINT	B7APT	Battery 7A Fugitive A (Doors & Leaks)	16.0	20.0	1.0	923.0	VERTICAL			306626	6184097						
POINT	B7BPT	Battery 7A Fugitive B (Doors & Leaks)	16.0	20.0	1.0	923.0	VERTICAL			306572	6184070						
POINT	B7CPT	Battery 7A Fugitive C (Doors & Leaks)	16.0	20.0	1.0	923.0	VERTICAL			306591	6184079						
POINT	B7DPT	Battery 7A Fugitive D (Doors & Leaks)	16.0	20.0	1.0	923.0	VERTICAL			306608	6184090						
VOLUME	B5P	Battery 5 Pushing	6.0					1.16	2.33	306492	6183885						
VOLUME	B6P	Battery 6 Pushing	6.0					1.16	2.33	306636	6183974						
VOLUME	B7AP	Battery 7A Pushing	8.0					1.16	2.33	306602	6184071						
VOLUME	B5C	Battery 5 Charging	14.0					2.79	1.86	306490	6183893						
VOLUME	B6C	Battery 6 Charging	14.0					2.79	1.86	306636	6183981						
POINT	SINTC_01	Sinter Cooler Fugitive Emissions 01	10.0	6.6	1.7	599.2	VERTICAL			306522	6184365						
POINT	SINTC_02	Sinter Cooler Fugitive Emissions 02	10.0	6.6	1.7	599.2	VERTICAL			306518	6184368						
POINT	SINTC_03	Sinter Cooler Fugitive Emissions 03	10.0	6.6	1.7	599.2	VERTICAL			306515	6184372						
POINT	SINTC_04	Sinter Cooler Fugitive Emissions 04	10.0	6.6	1.7	599.2	VERTICAL			306513	6184377						
POINT	SINTC_05	Sinter Cooler Fugitive Emissions 05	10.0	6.6	1.7	599.2	VERTICAL			306513	6184383						
POINT	SINTC_06	Sinter Cooler Fugitive Emissions 06	10.0	6.6	1.7	599.2	VERTICAL			306515	6184388						
POINT	SINTC_07	Sinter Cooler Fugitive Emissions 07	10.0	6.6	1.7	599.2	VERTICAL			306518	6184392						
POINT	SINTC_08	Sinter Cooler Fugitive Emissions 08	10.0	6.6	1.7	599.2	VERTICAL			306523	6184396						
POINT	SINTC_09	Sinter Cooler Fugitive Emissions 09	10.0	6.6	1.7	599.2	VERTICAL			306528	6184397						
POINT	SINTC_10	Sinter Cooler Fugitive Emissions 10	10.0	6.6	1.7	599.2	VERTICAL			306533	6184397						
POINT	SINTC_11	Sinter Cooler Fugitive Emissions 11	10.0	6.6	1.7	599.2	VERTICAL			306538	6184396						
POINT	SINTC_12	Sinter Cooler Fugitive Emissions 12	10.0	6.6	1.7	599.2	VERTICAL			306543	6184392						
POINT	SINTC_13	Sinter Cooler Fugitive Emissions 13	10.0	6.6	1.7	599.2	VERTICAL			306546	6184388						
POINT	SINTC_14	Sinter Cooler Fugitive Emissions 14	10.0	6.6	1.7	599.2	VERTICAL			306528	6184363						
VOLUME	BOS_01	BOS01 Roof Vent Fugitive Emissions (EPA91)	41.2					3.67	1.16	305566	6184702						
VOLUME	BOS_02	BOS02 Roof Vent Fugitive Emissions (EPA91)	41.2					3.67	1.16	305543	6184713						
VOLUME	BOS_03	BOS03 Roof Vent Fugitive Emissions (EPA91)	41.2					3.67	1.16	305511	6184728						
VOLUME	SCP	Slag Cooling Pot	2.5					7.7	2.33	305661	6184730						

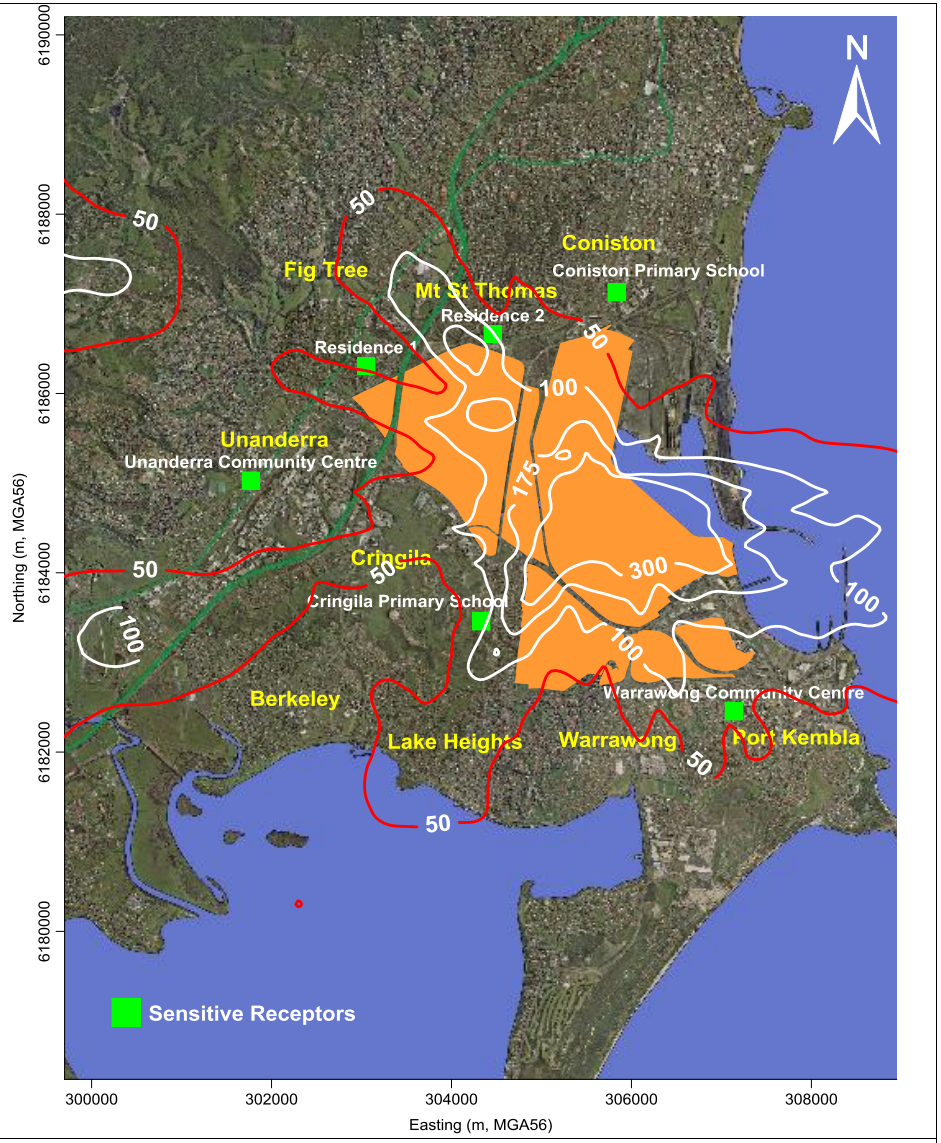
Source Type	ID	Description	Height	Diam	Exit Velocity	Exit Temp	Release Type	SigmaY	SigmaZ	X1	Y1	X2	Y2	X3	Y3	X4	Y4
			[m]	[m]	[m/s]	[K]		[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]	[m]
VOLUME	CRSH	Crusher	2.5					1.16	2.33	306870	6184188						
VOLUME	SSP_01	Slag Stockpile 01	2.5					4.67	2.33	305596	6184814						
VOLUME	SSP_02	Slag Stockpile 02	2.5					4.67	2.33	305616	6184804						
VOLUME	SSP_03	Slag Stockpile 03	2.5					4.67	2.33	305637	6184792						
VOLUME	SSP_04	Slag Stockpile 04	2.5					4.67	2.33	305658	6184781						
VOLUME	HMP_01	Hot Metal Pit 01	2.5					12	2.33	303856	6185603						
VOLUME	HMP_02	Hot Metal Pit 02	2.5					12	2.33	303914	6185602						
VOLUME	HMP_03	Hot Metal Pit 03	2.5					12	2.33	303980	6185603						
VOLUME	HMP_04	Hot Metal Pit 04	2.5					12	2.33	304033	6185603						
VOLUME	HMP_05	Hot Metal Pit 05	2.5					12	2.33	304099	6185603						
VOLUME	MHND	Materials Handling - VE	5.0					2.33	4.65	306856	6184063						
VOLUME	MRP	Recycling Area - Metal Recovery Plant - VE	2.5					25.4	2.33	303998	6185792						
VOLUME	CSP1	Recycling Area - Crushing/Screening Plant 01 - VE	2.5					27.7	2.33	304217	6185047						
VOLUME	CSP2	Recycling Area - Crushing/Screening Plant 02 - VE	2.5					27.7	2.33	304164	6185136						
POINT	SP05	Springhill 5 (MCL1 Selas Stack)	39.0	1.6	5.6	478.5	VERTICAL			304730	6184908						
POINT	SP06	Springhill 6 (MCL2 Selas Stack)'	39.0	1.7	13.0	813.2	VERTICAL			304740	6184906						
POINT	SP07	Springhill 7 (MCL2 Selas Stack)	28.0	1.5	9.9	1440.2	VERTICAL			304759	6184912						
POINT	SP09	Springhill 9 (MCL2 Passivation Stack)	10.0	0.4	6.3	306.9	VERTICAL			304741	6184789						
POINT	SP10	Springhill 10 (MCL1 Passivation Exhaust)	10.0	0.4	9.9	295.5	VERTICAL			304712	6184810						
POINT	SP12	Springhill 12 (CPL3 Prime Oven Incinerator)	35.0	1.2	11.3	650.4	VERTICAL			304682	6184902						
POINT	SP13	Springhill 13 (CPL3 Finish Oven Incinerator)	35.0	1.2	14.8	640.9	VERTICAL			304682	6184899						
VOLUME	SPBLG	Springhill Building Fugitives	8.8					26.5	46.2	304773	6185005						
AREA_POLY	BF5SLAG	BF No. 5 Slag Pits	0.0						0	305813	6184799	305858	6184757	305846	6184742	305797	6184784
POINT	B5STD	Battery 5 (standpipe emissions)	15.0	0.5	6.0	923.0	VERTICAL			306455	6183877						
POINT	B6STD	Battery 6 (standpipe emissions)	15.0	0.5	6.0	923.0	VERTICAL			306572	6183947						
POINT	B7STD	Battery 7A (standpipe emissions)	16.0	0.5	6.0	923.0	VERTICAL			306626	6184097						
POINT	EPA_138	No2 Blower Station Package Boiler No. 11	30.0	1.9	16.0	398.2	VERTICAL			306148	6184402						
POINT	EPA_139	No2 Blower Station Package Boiler No. 12	30.0	1.9	5.3	388.2	VERTICAL			306139	6184390						

Appendix D

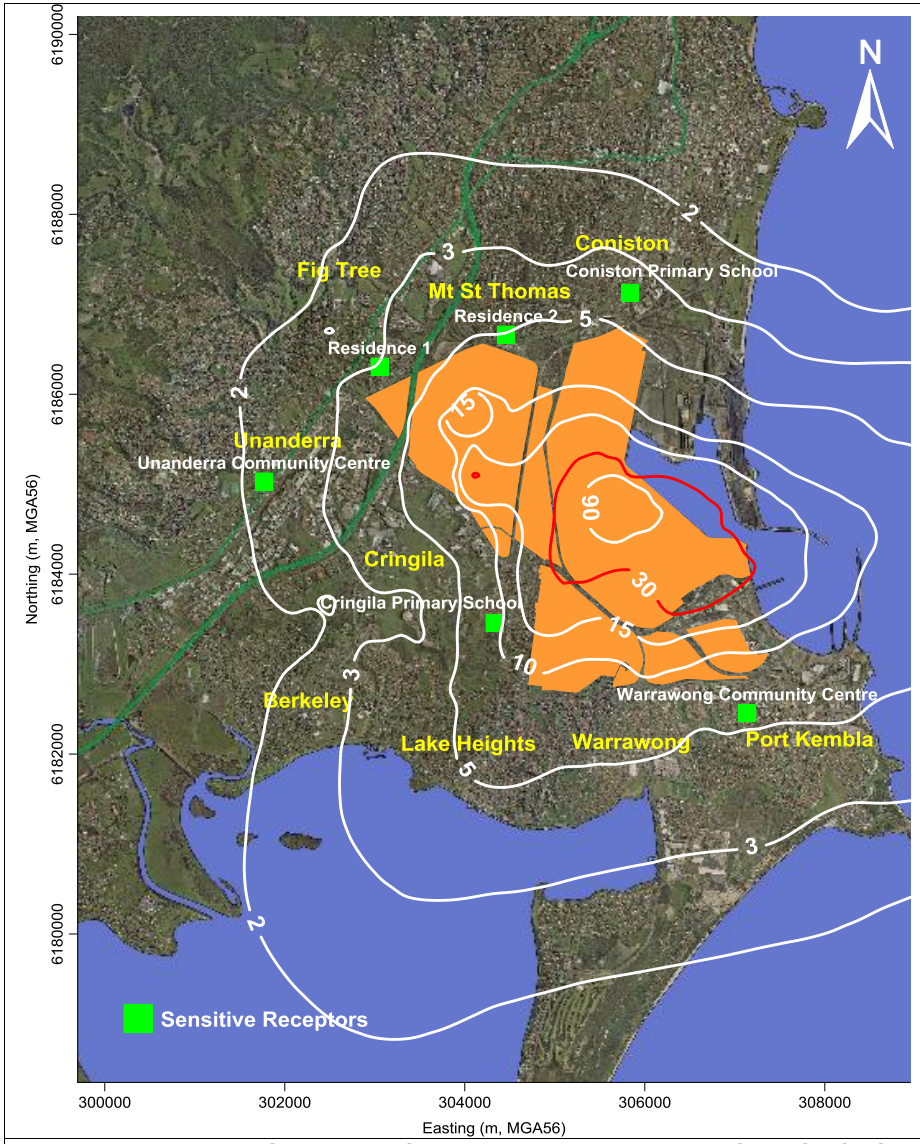
Isopleth Plots



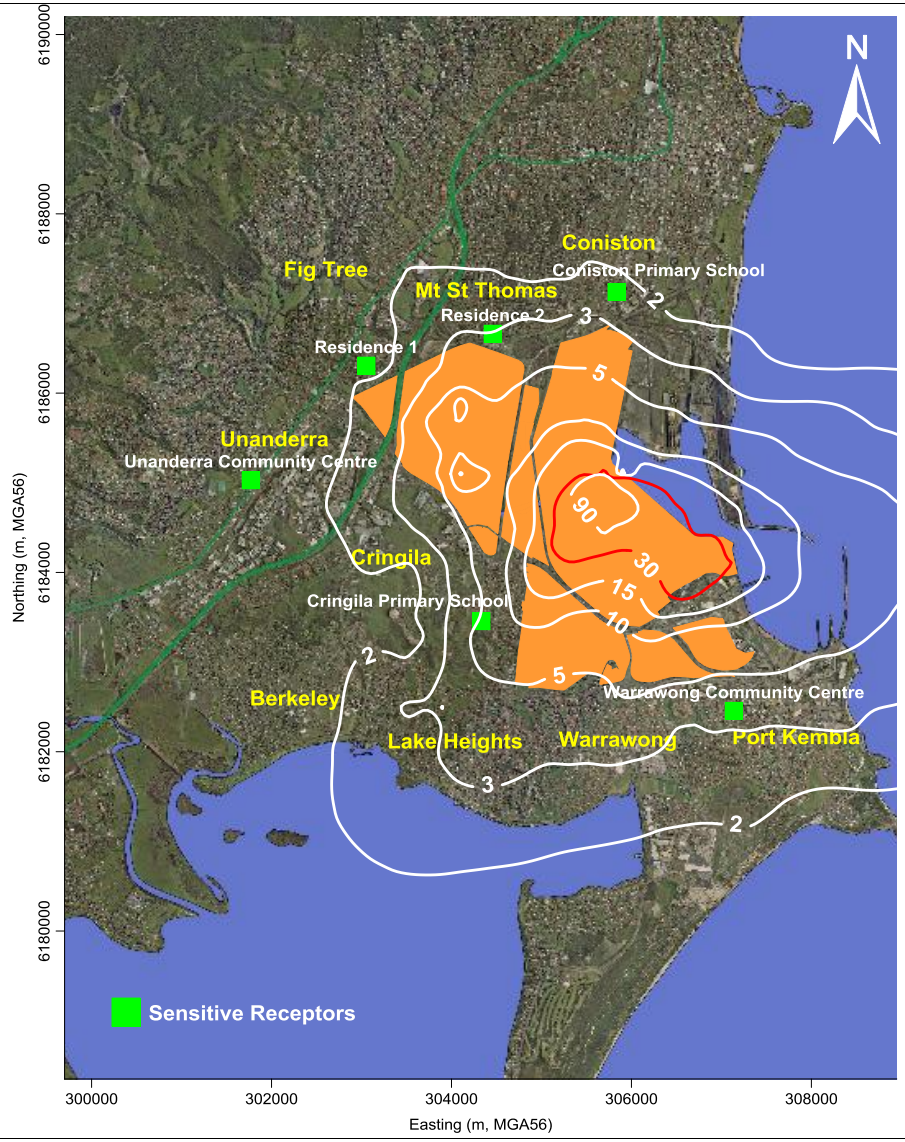
5.2 Mtpa Scenario - Maximum 24-hour PM_{10} concentrations (µg/m³)



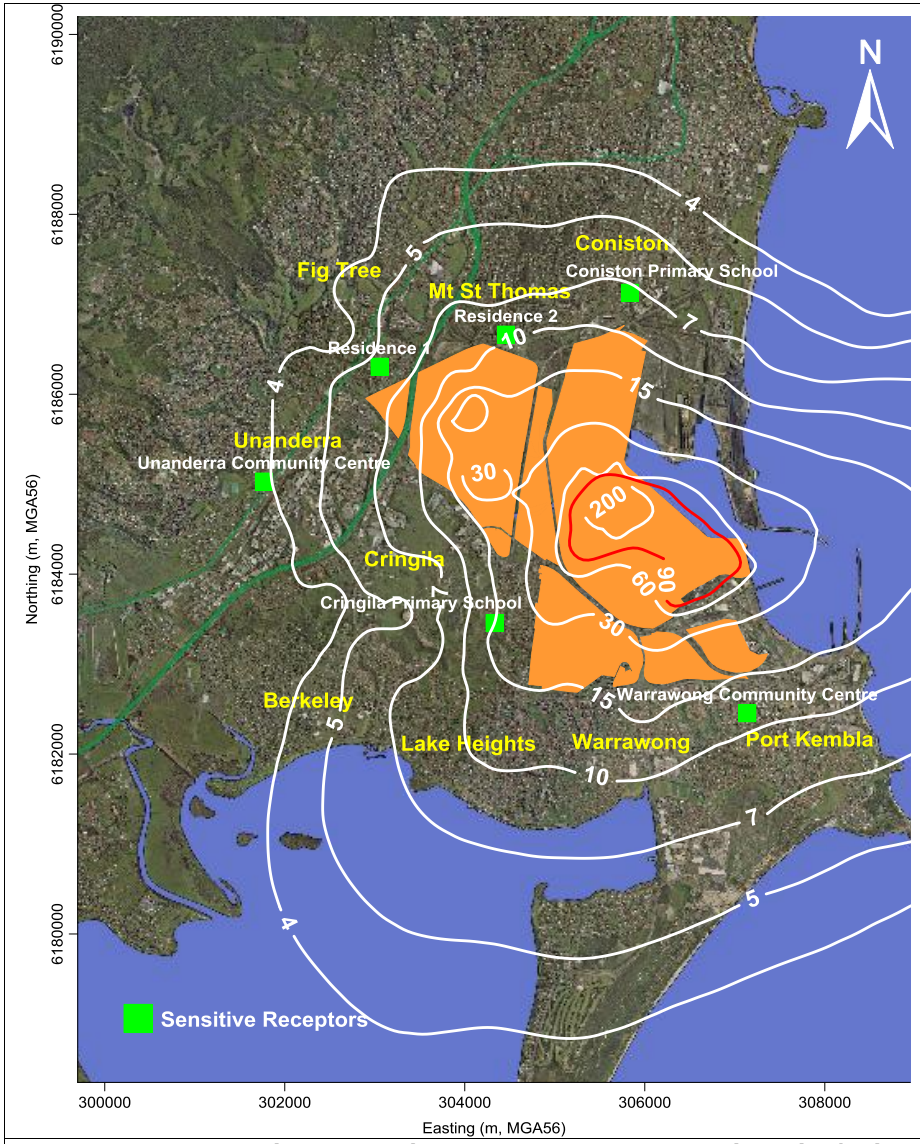
2.6 Mtpa Scenario - Maximum 24-hour PM_{10} concentrations (µg/m³)



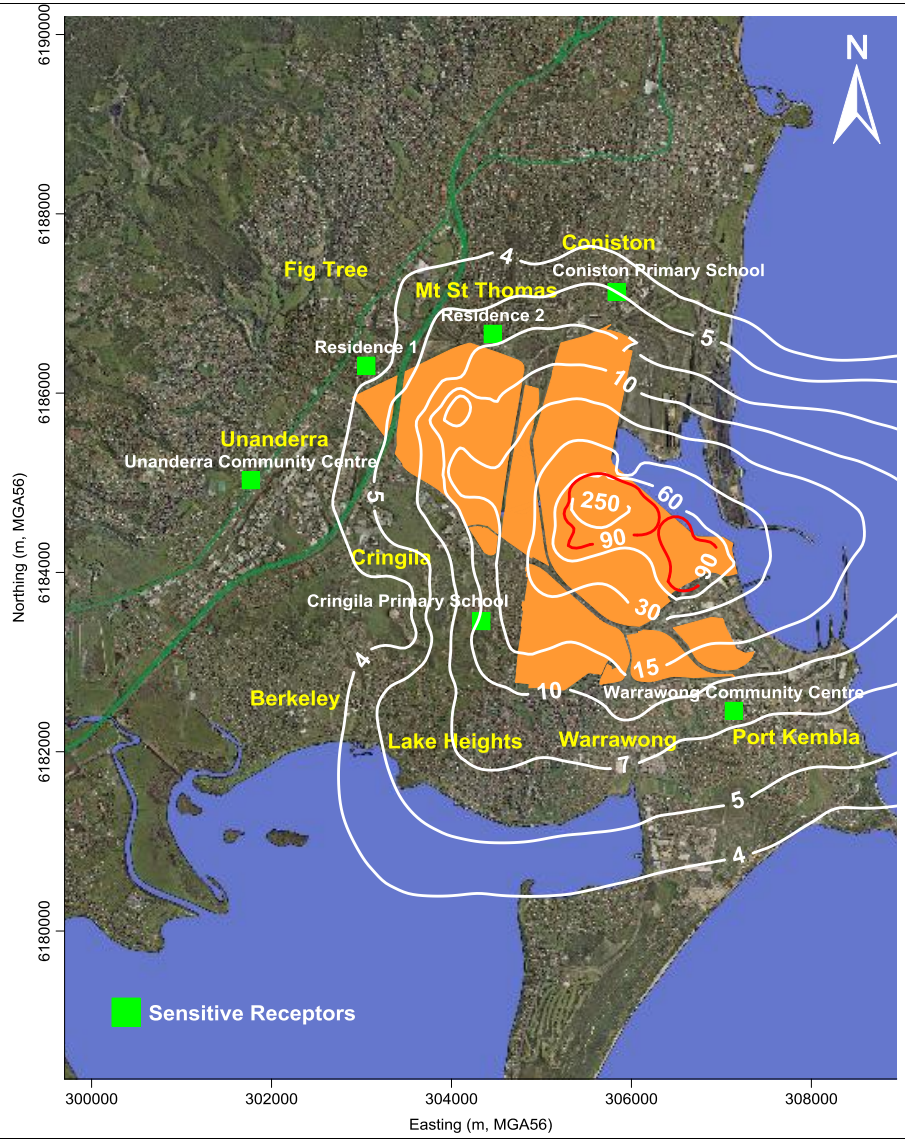
5.2 Mtpa Scenario – Annual Average PM_{10} concentrations (µg/m³)



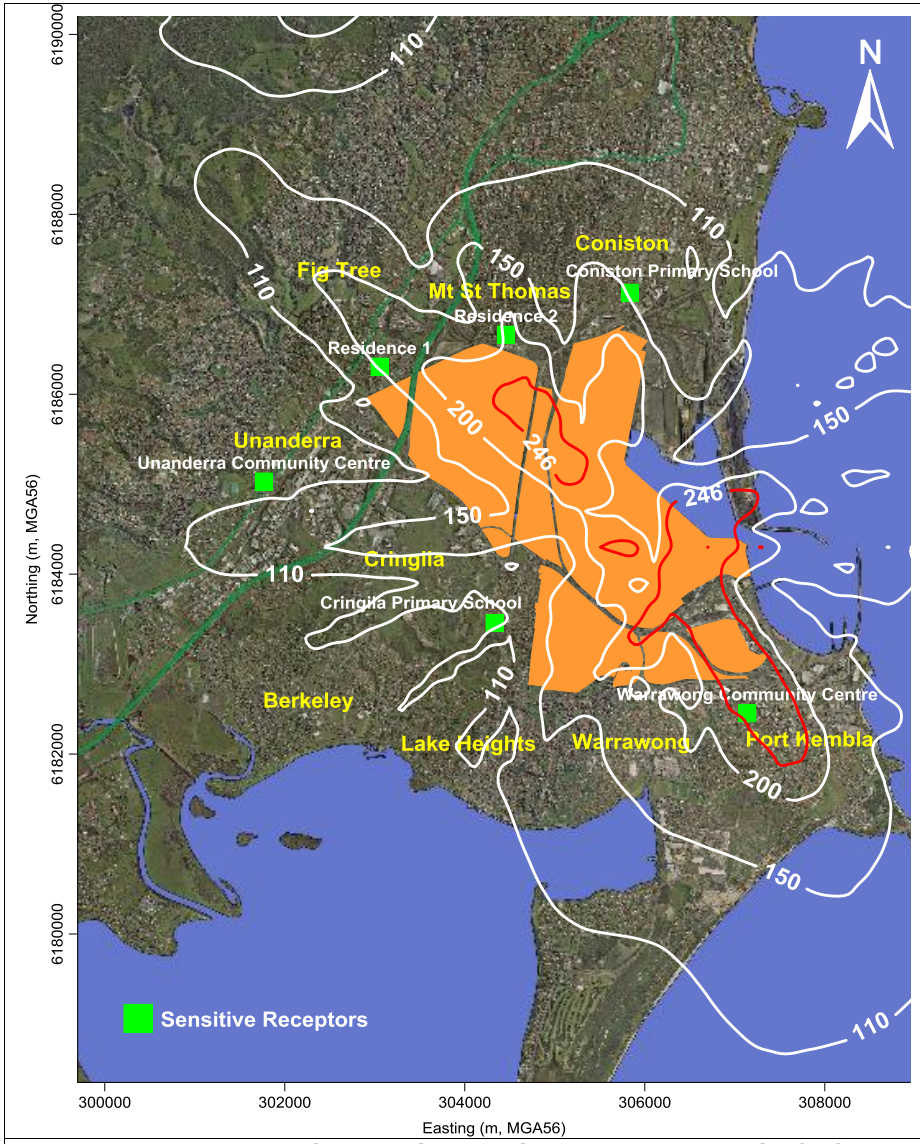
2.6 Mtpa Scenario - Annual Average PM_{10} concentrations (µg/m³)



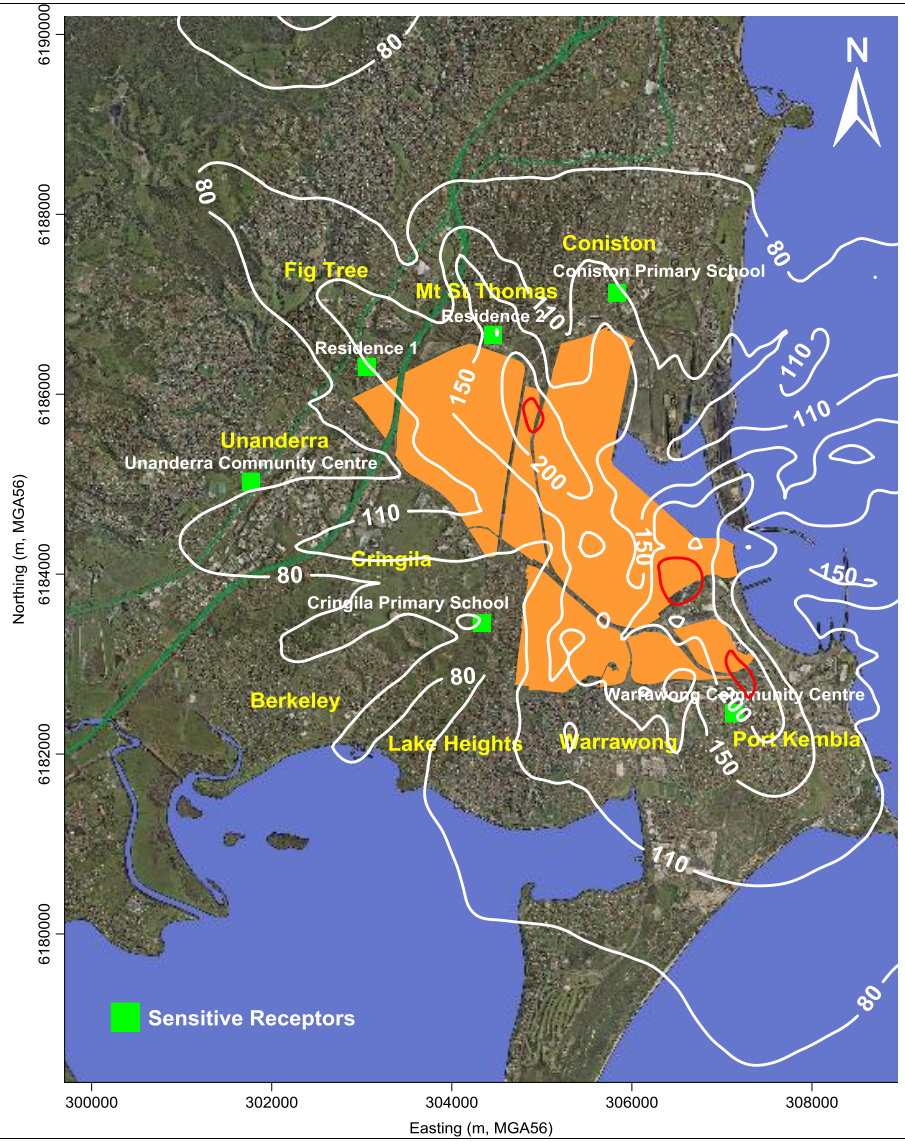
5.2 Mtpa Scenario – Annual Average TSP concentrations (µg/m³)



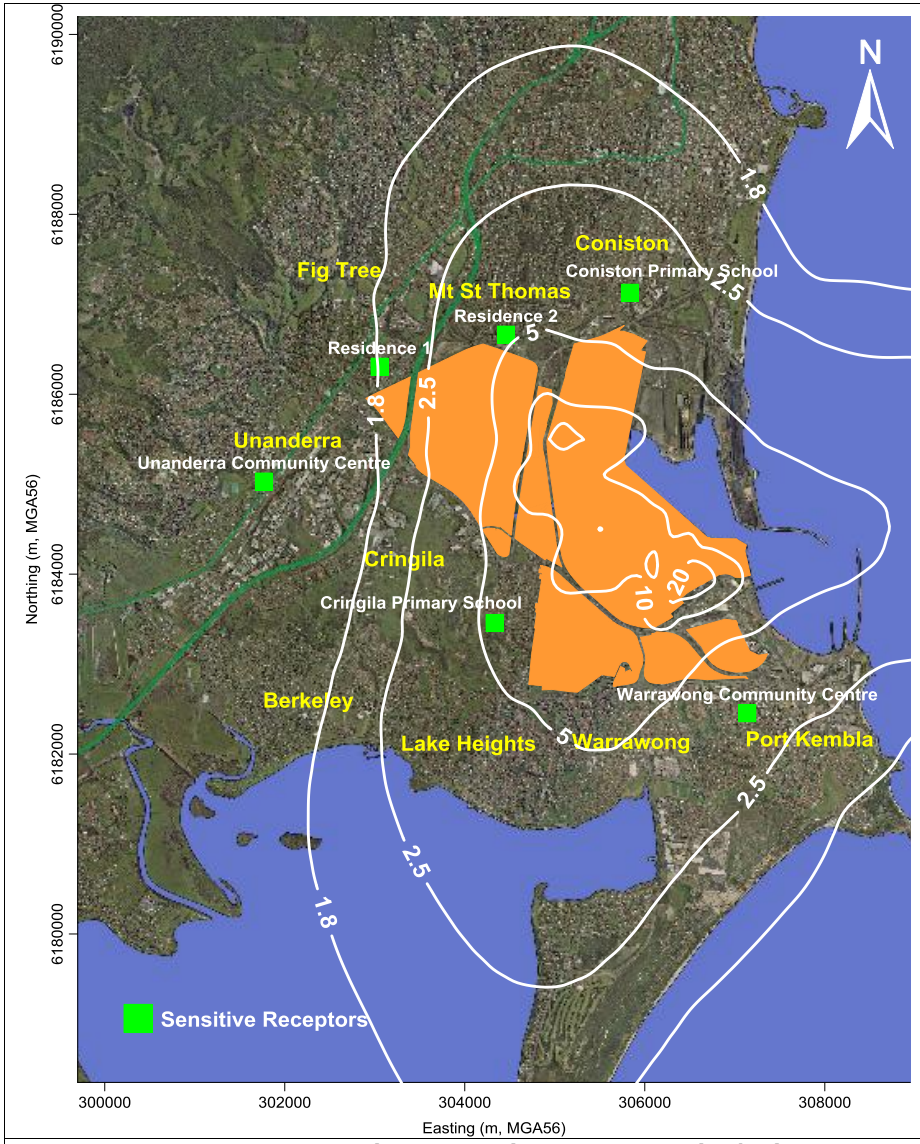
2.6 Mtpa Scenario - Annual Average TSP concentrations (µg/m³)



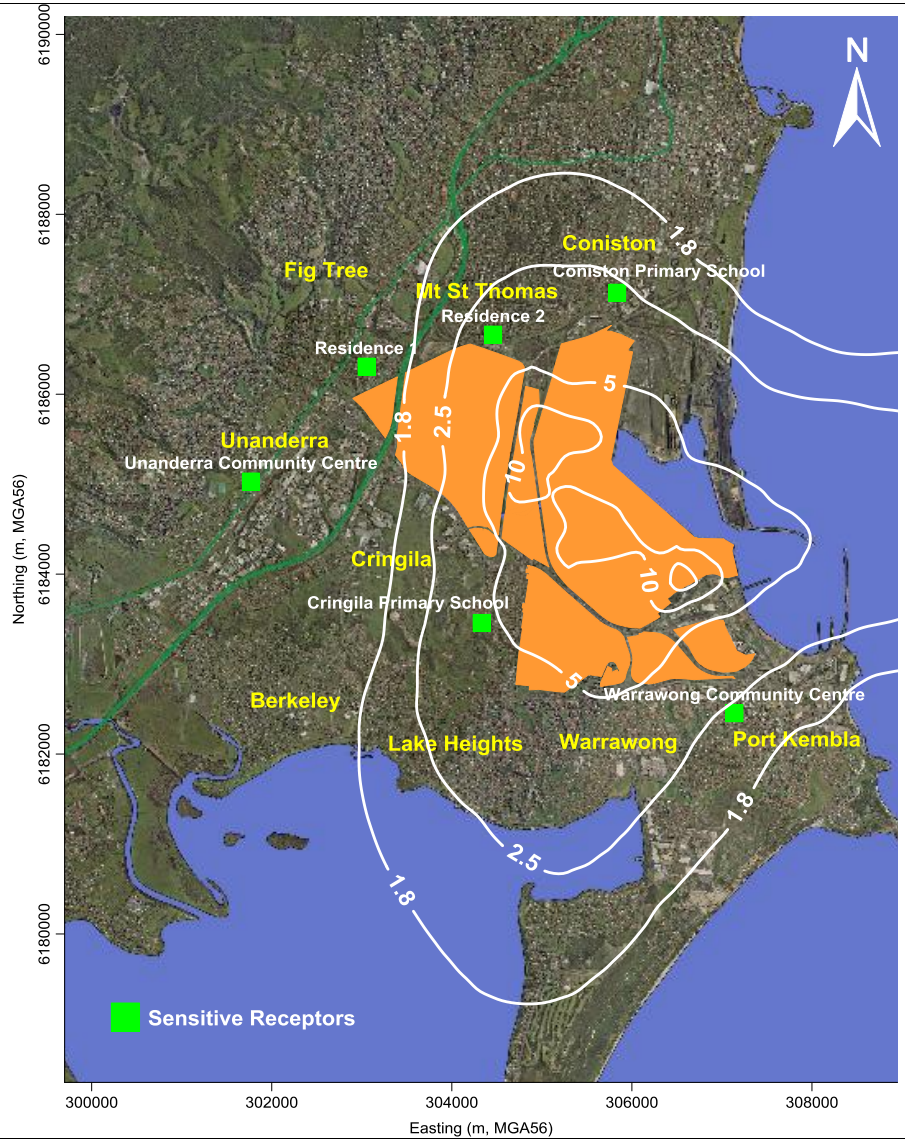
5.2 Mtpa Scenario – Maximum 1-hour Average NO_2 (µg/m³)



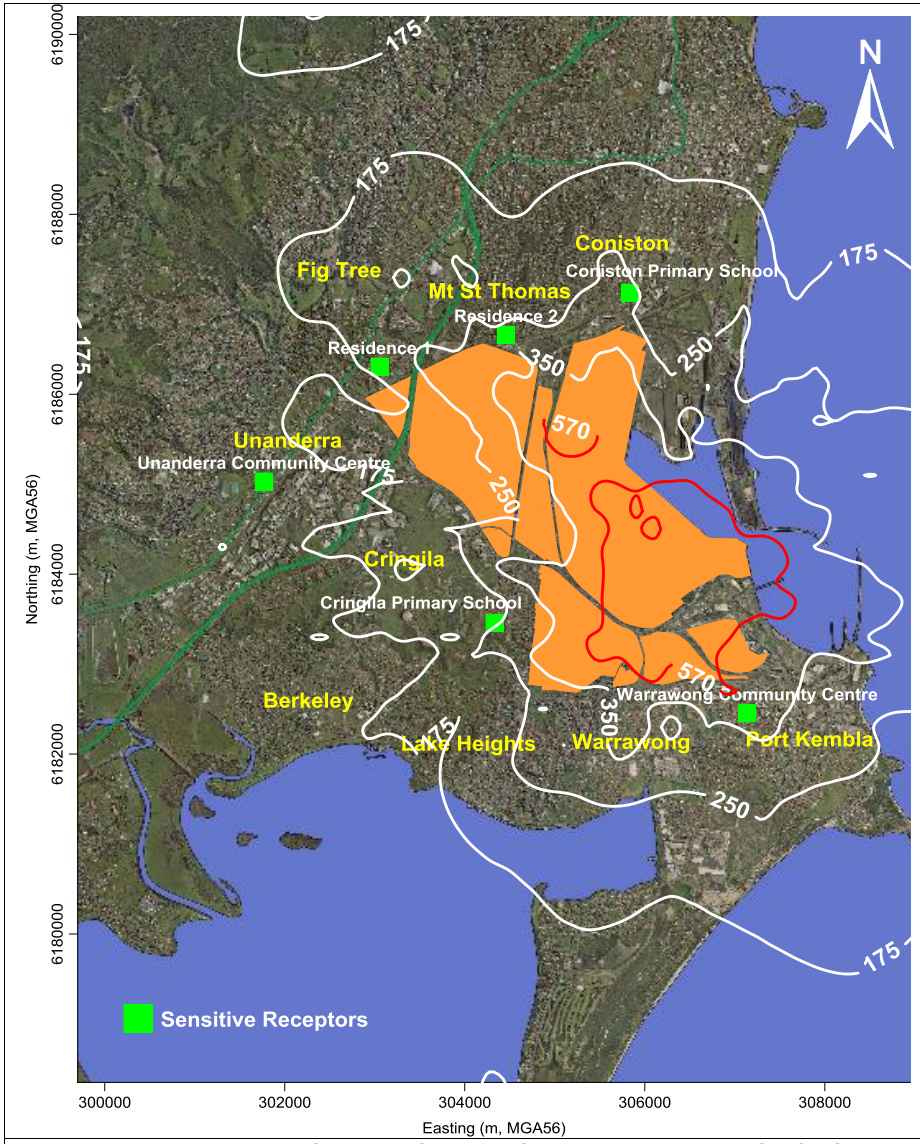
2.6 Mtpa Scenario – Maximum 1-hour Average NO_2 (µg/m³)



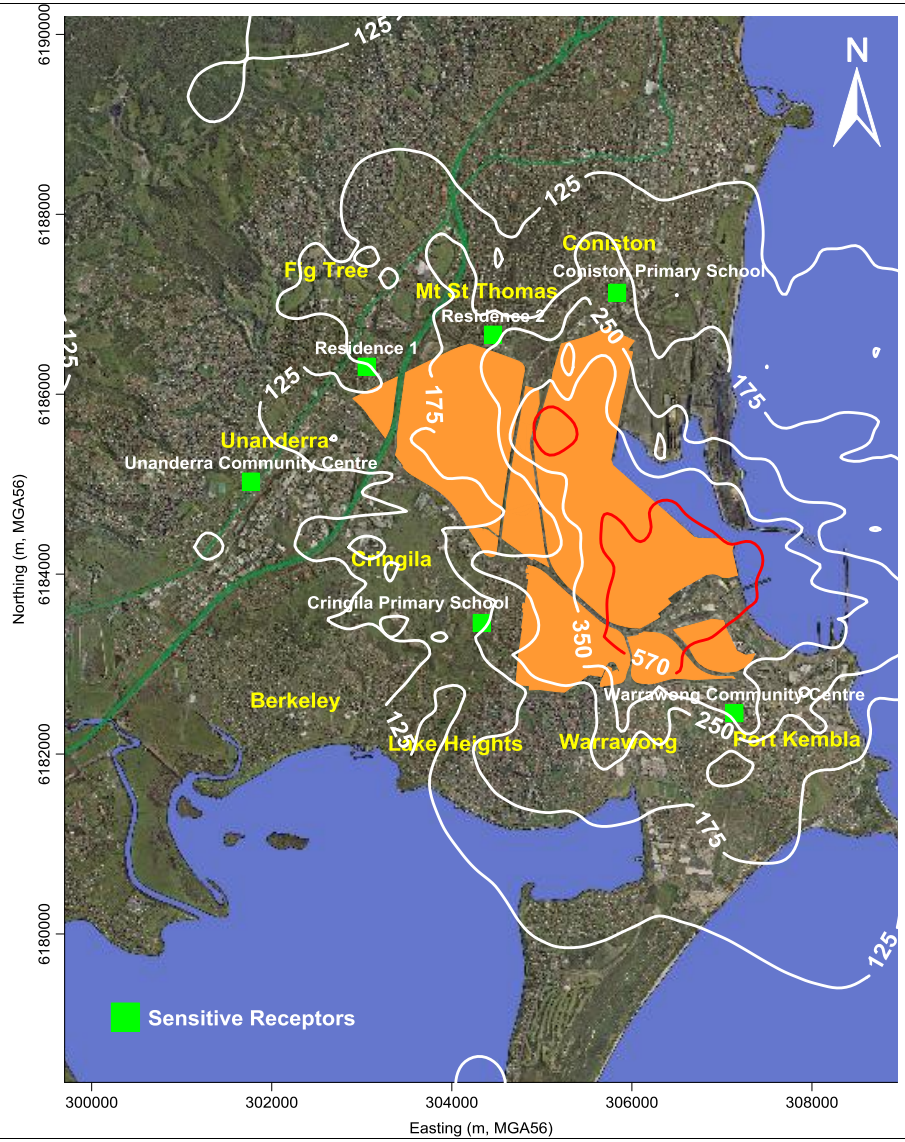
5.2 Mtpa Scenario – Annual Average NO_2 (µg/m³)



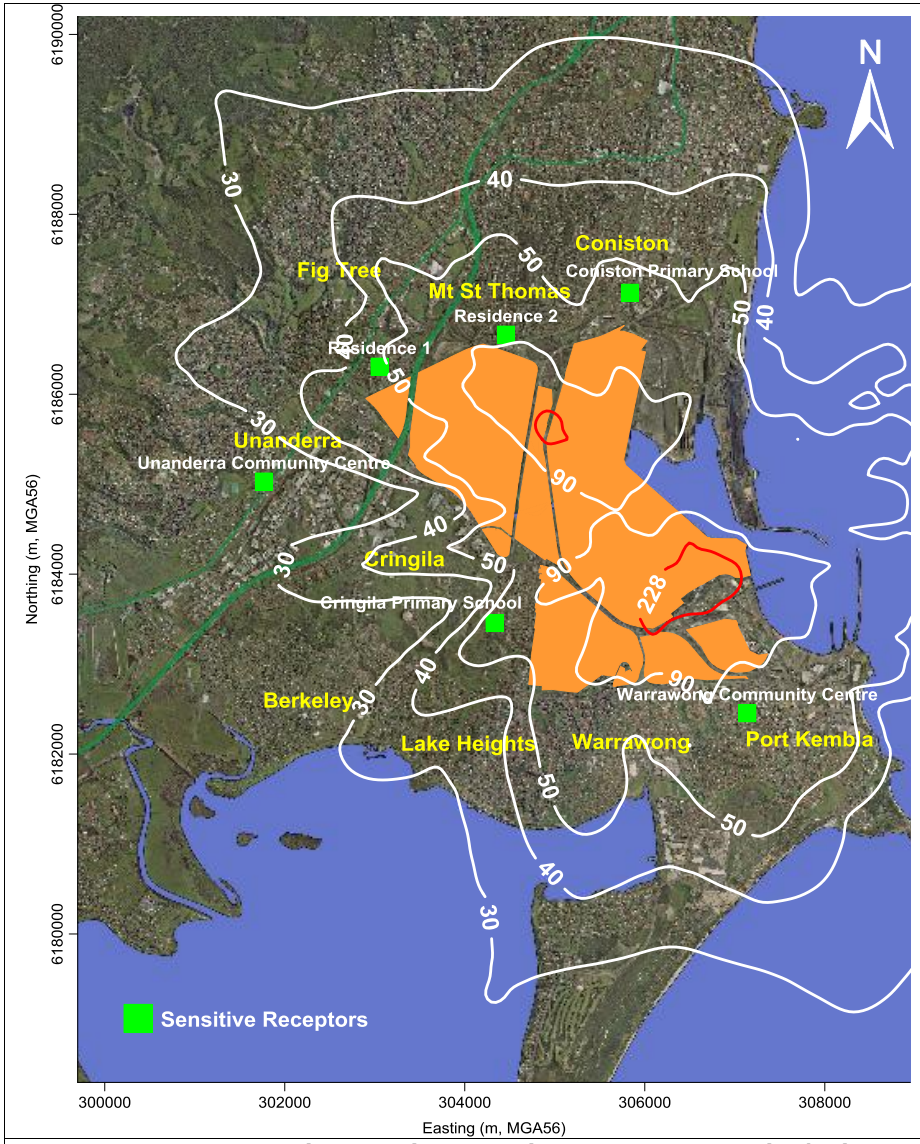
2.6 Mtpa Scenario – Annual Average NO_2 (µg/m³)



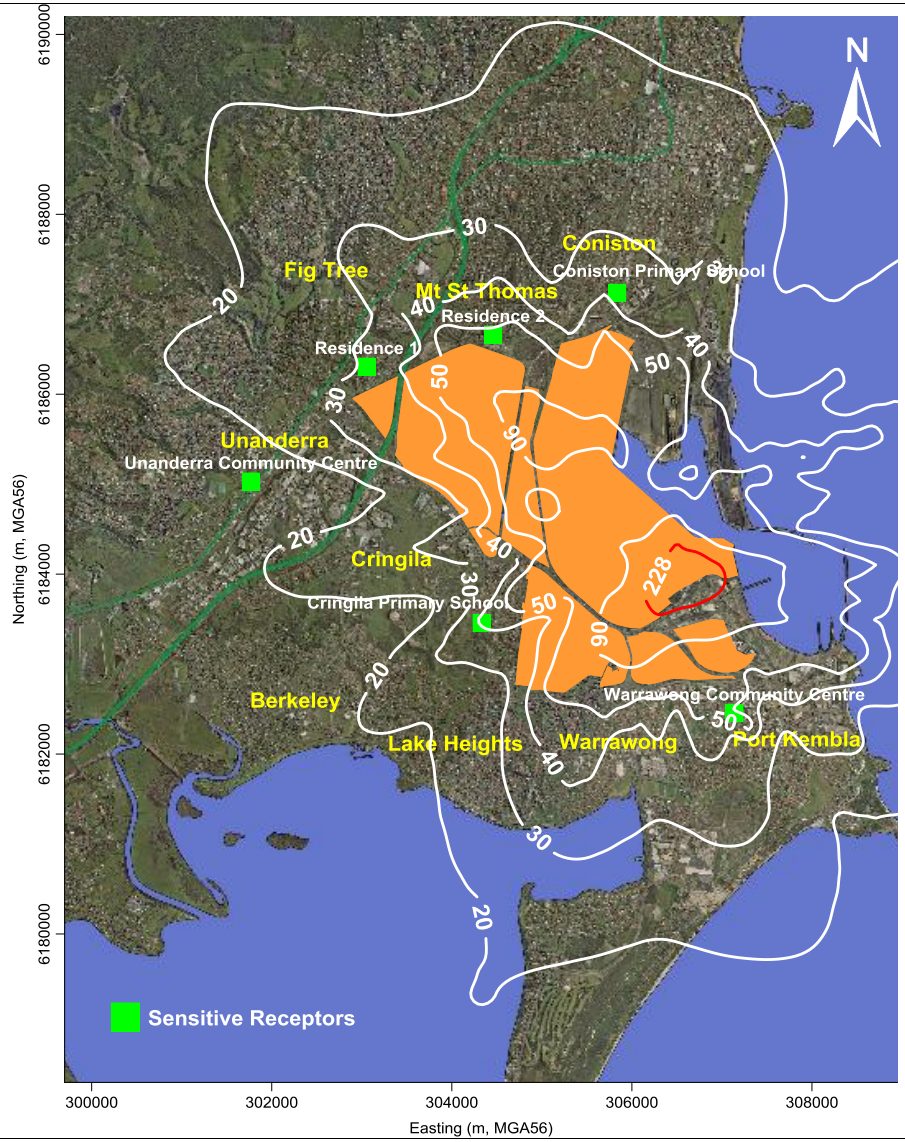
5.2 Mtpa Scenario – Maximum 1-hour Average SO_2 (µg/m³)



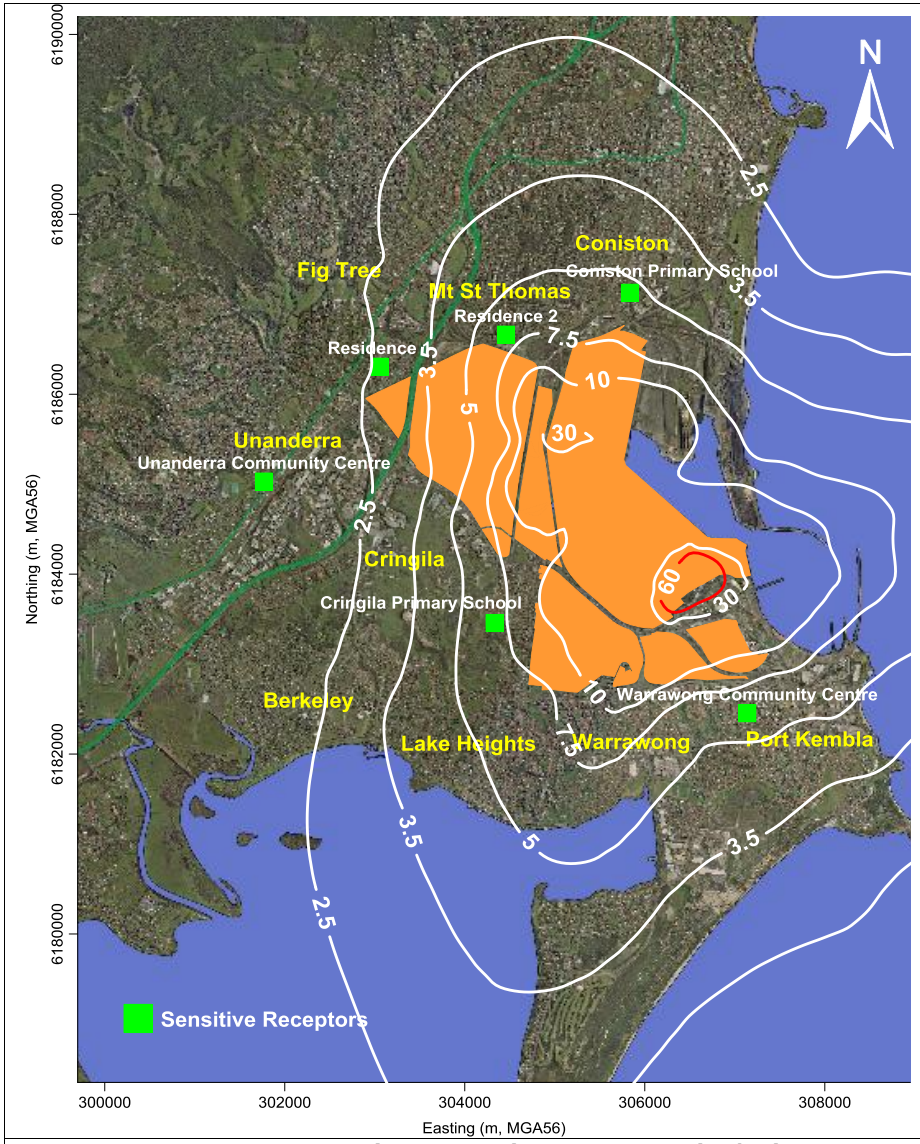
2.6 Mtpa Scenario – Maximum 1-hour Average SO_2 (µg/m³)



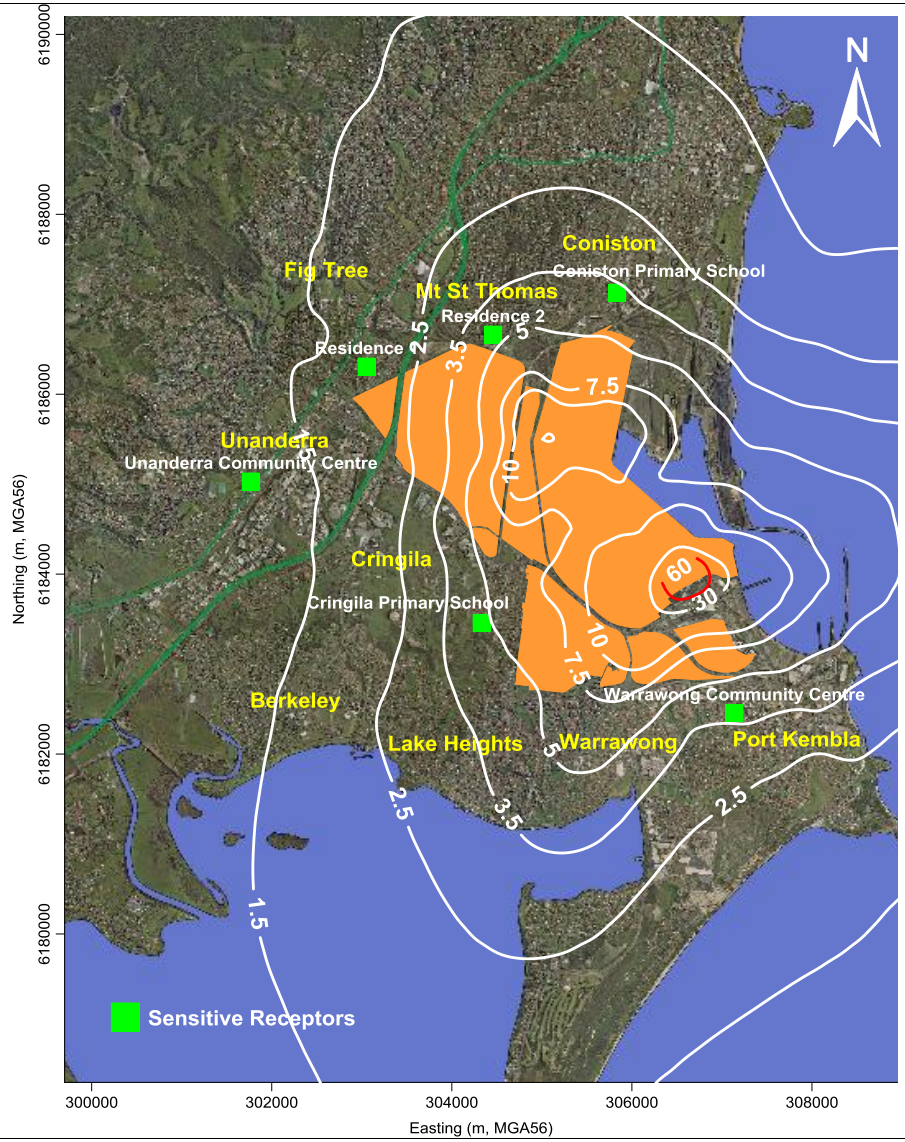
5.2 Mtpa Scenario – Maximum 24-hour Average SO_2 (µg/m³)



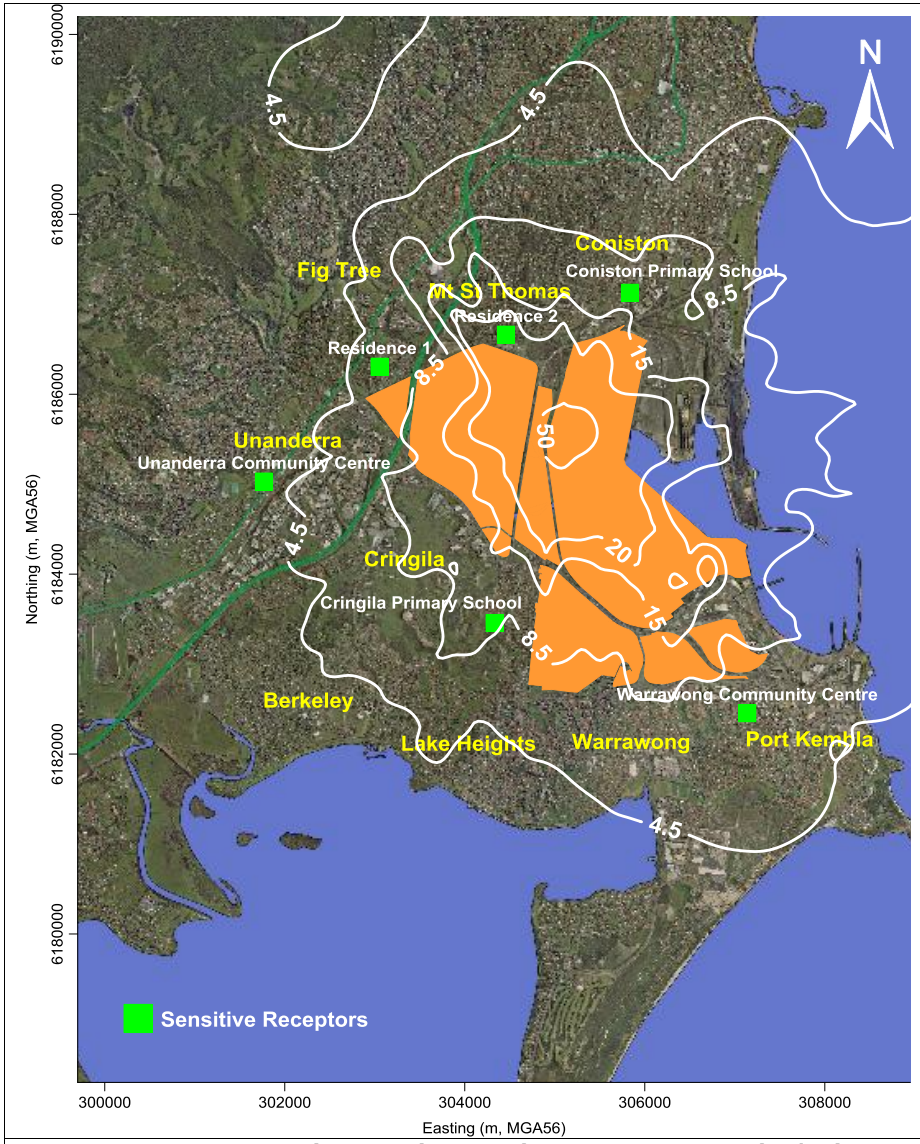
2.6 Mtpa Scenario – Maximum 24-hour Average SO_2 (µg/m³)



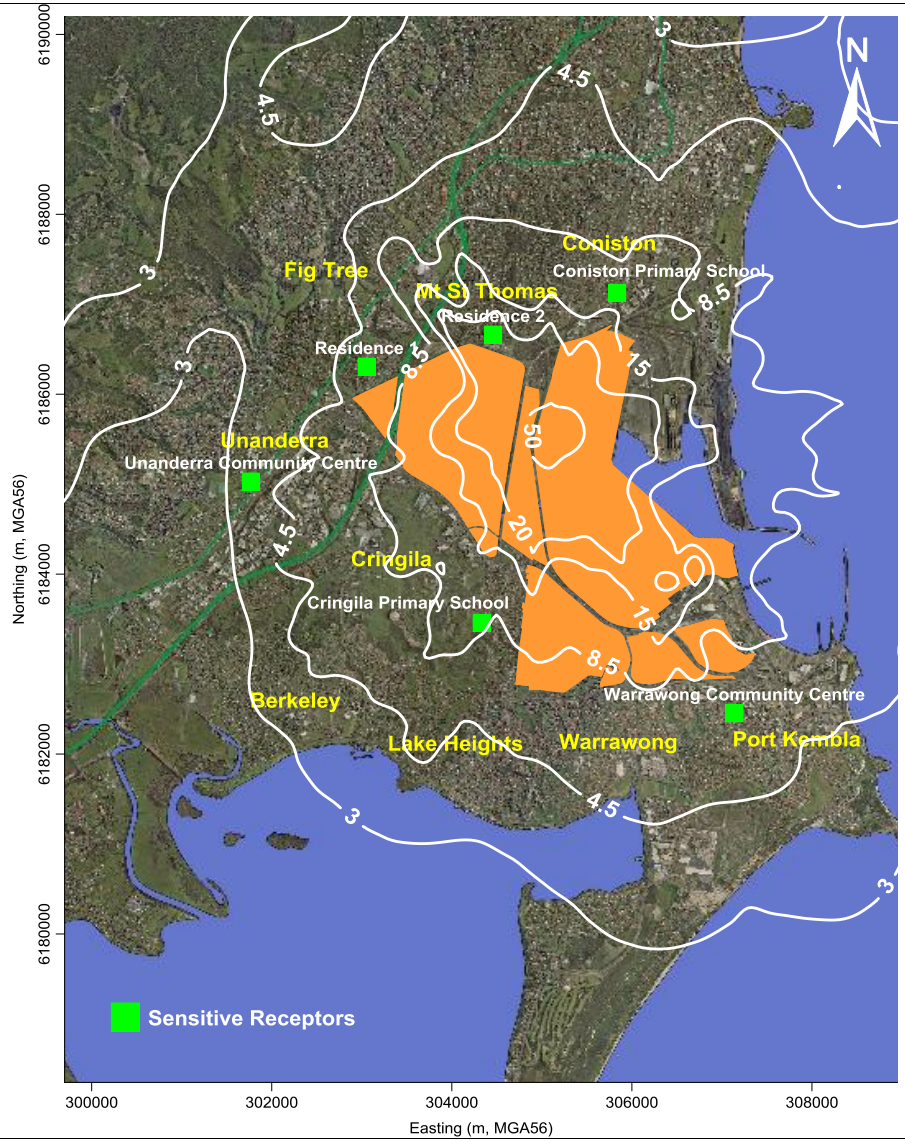
5.2 Mtpa Scenario – Annual Average SO_2 (µg/m³)



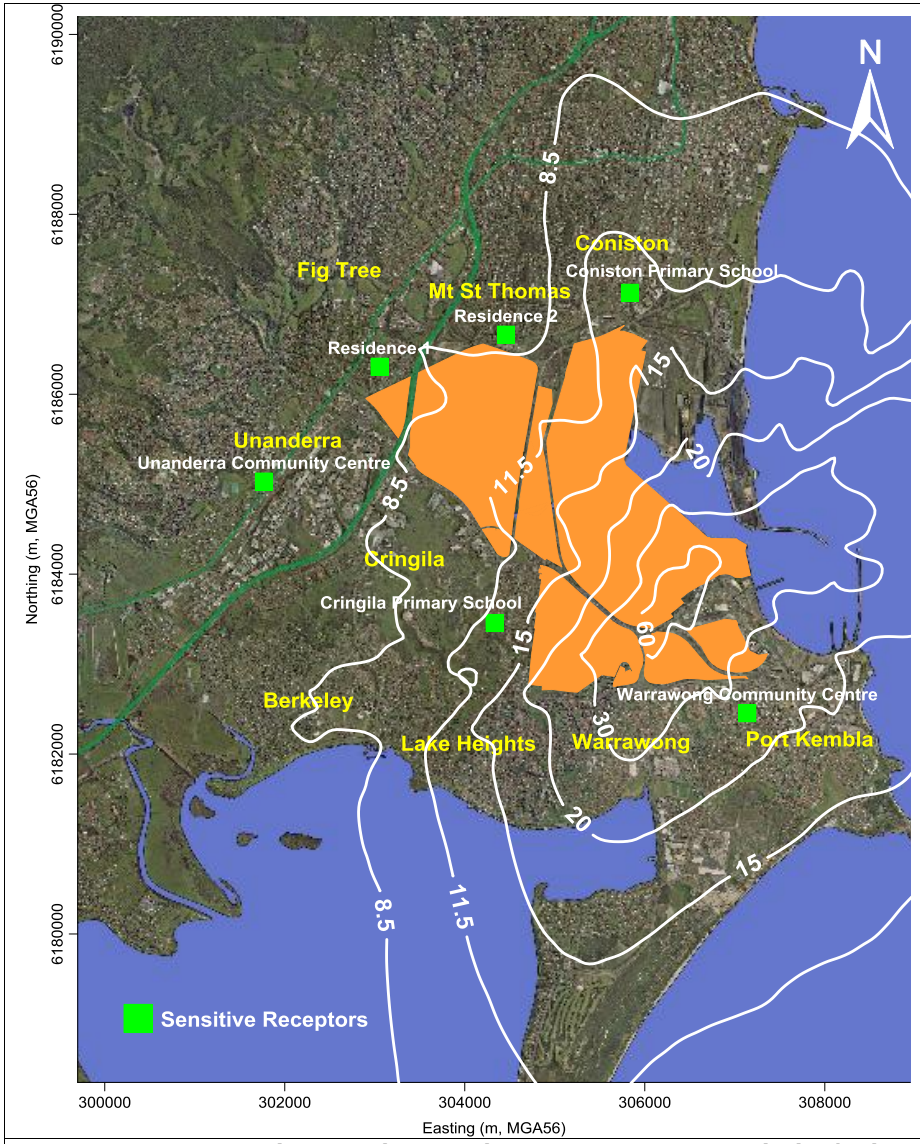
2.6 Mtpa Scenario – Annual Average SO_2 (µg/m³)



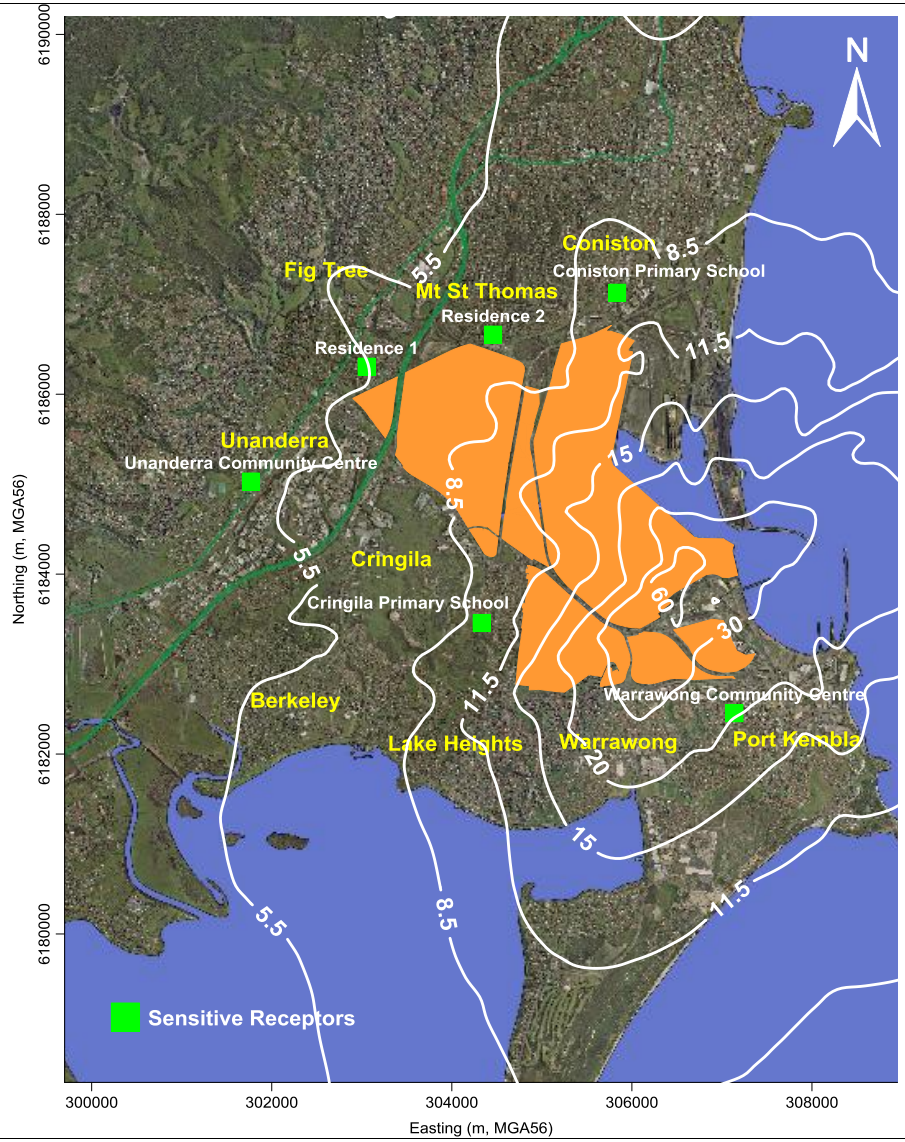
5.2 Mtpa Scenario – Maximum 1-hour Average SO_3 (µg/m³)



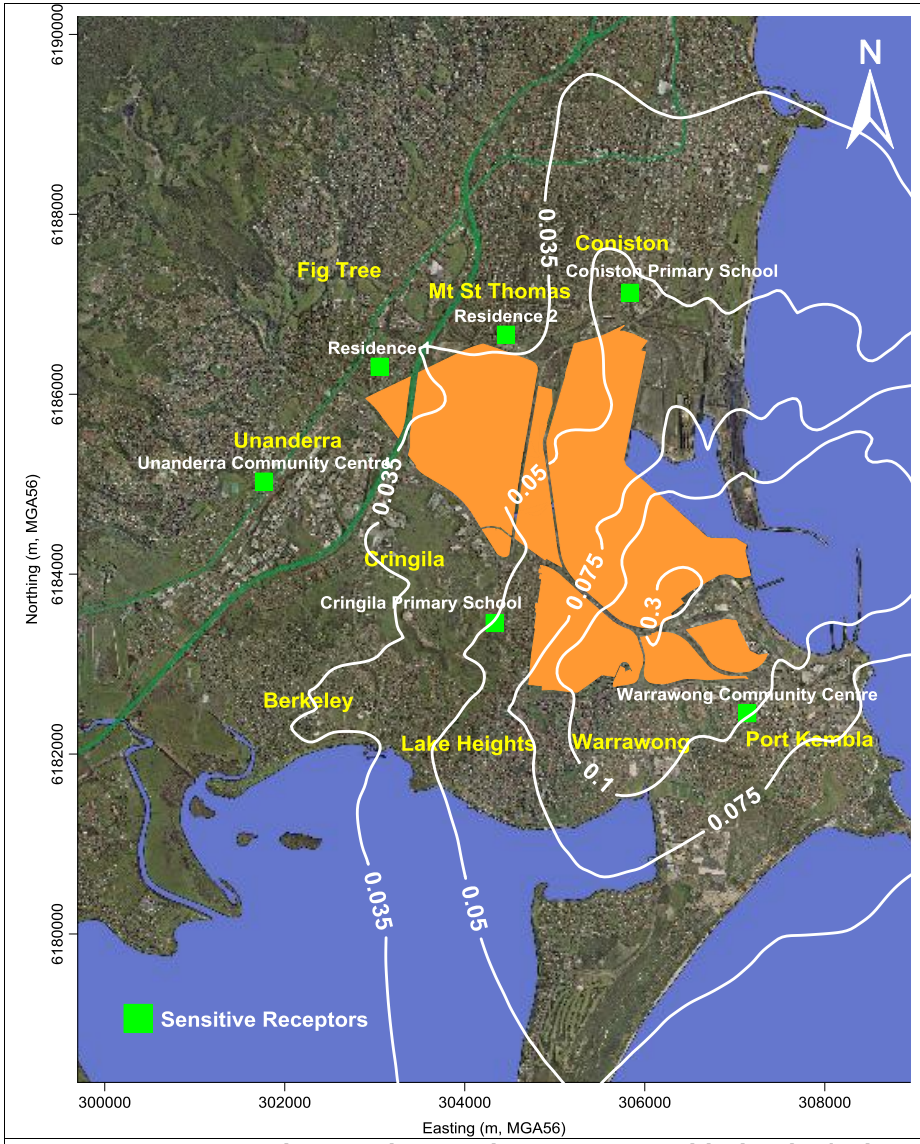
2.6 Mtpa Scenario – Maximum 1-hour Average SO_3 (µg/m³)



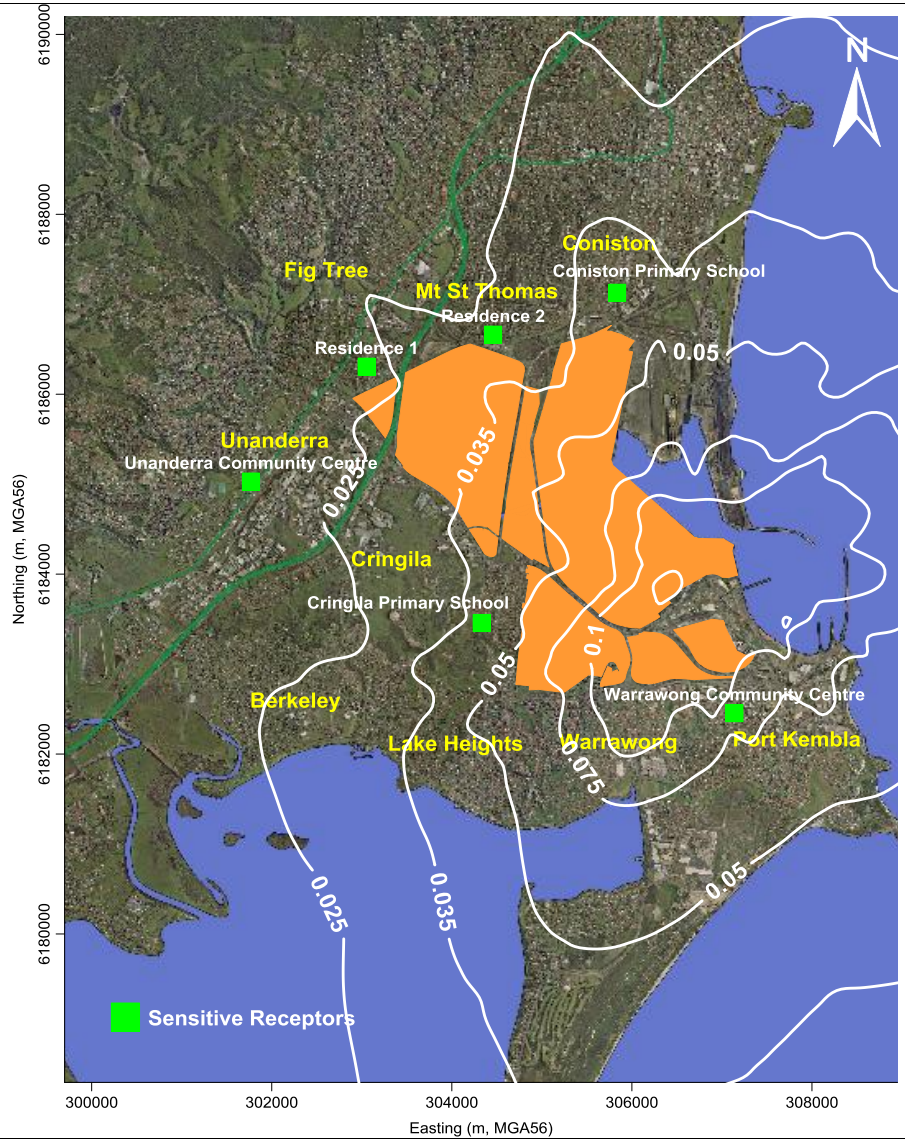
5.2 Mtpa Scenario – Maximum 1-hour Average Ammonia (µg/m³)



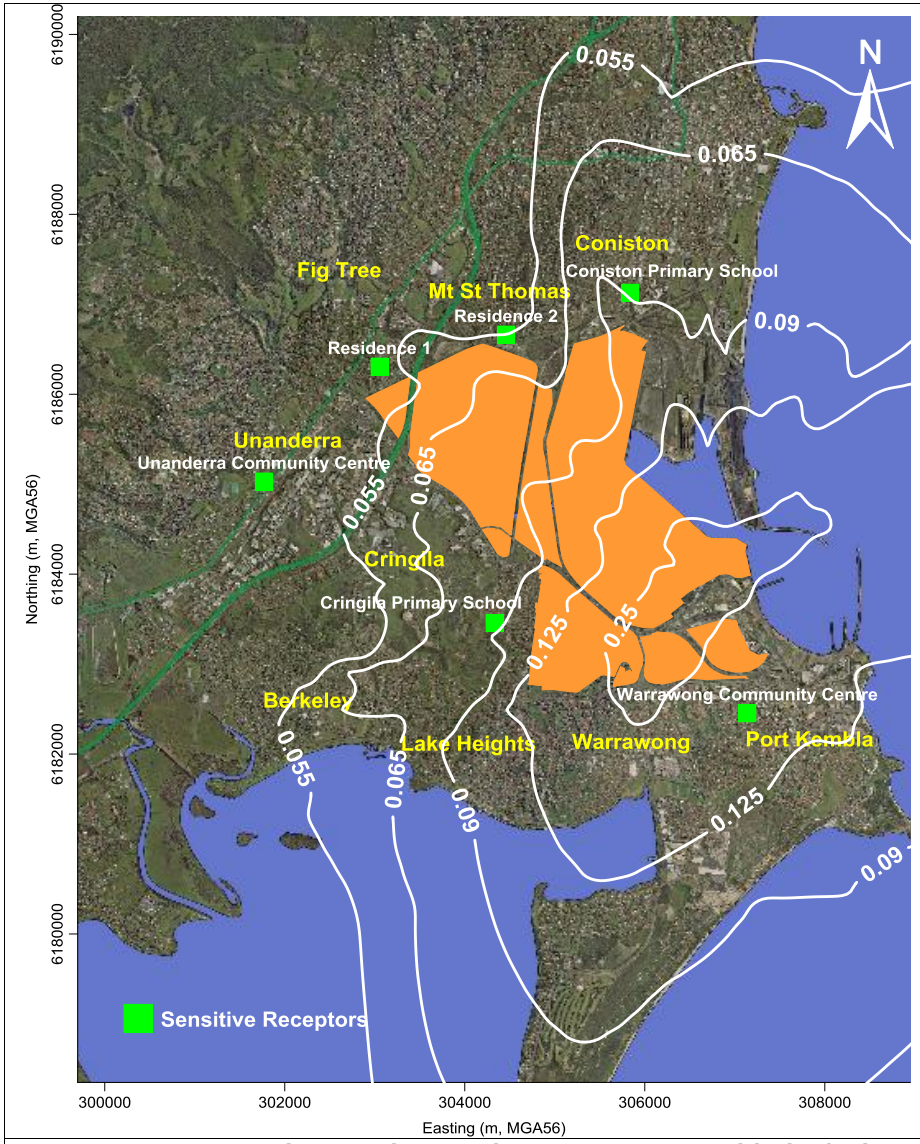
2.6 Mtpa Scenario – Maximum 1-hour Average Ammonia (µg/m³)



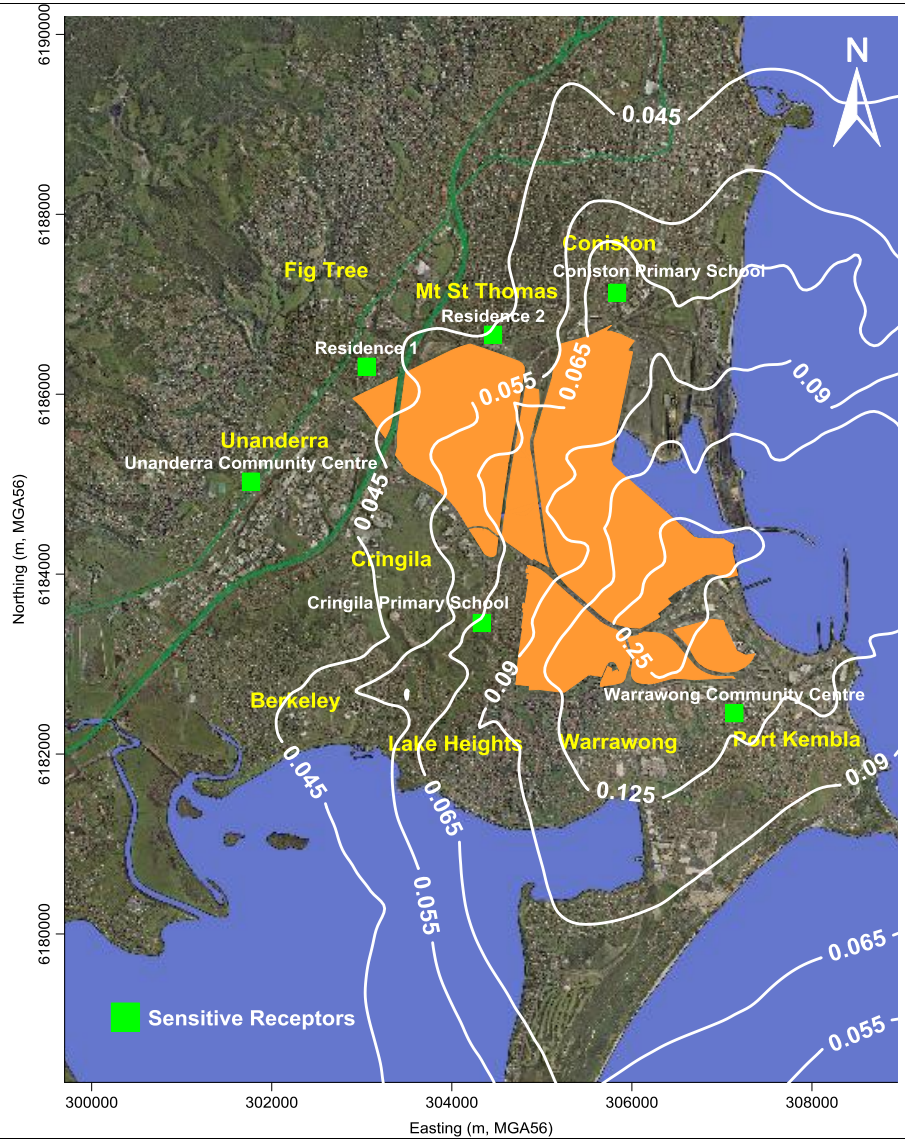
5.2 Mtpa Scenario – Maximum 1-hour Average Chlorine (µg/m³)



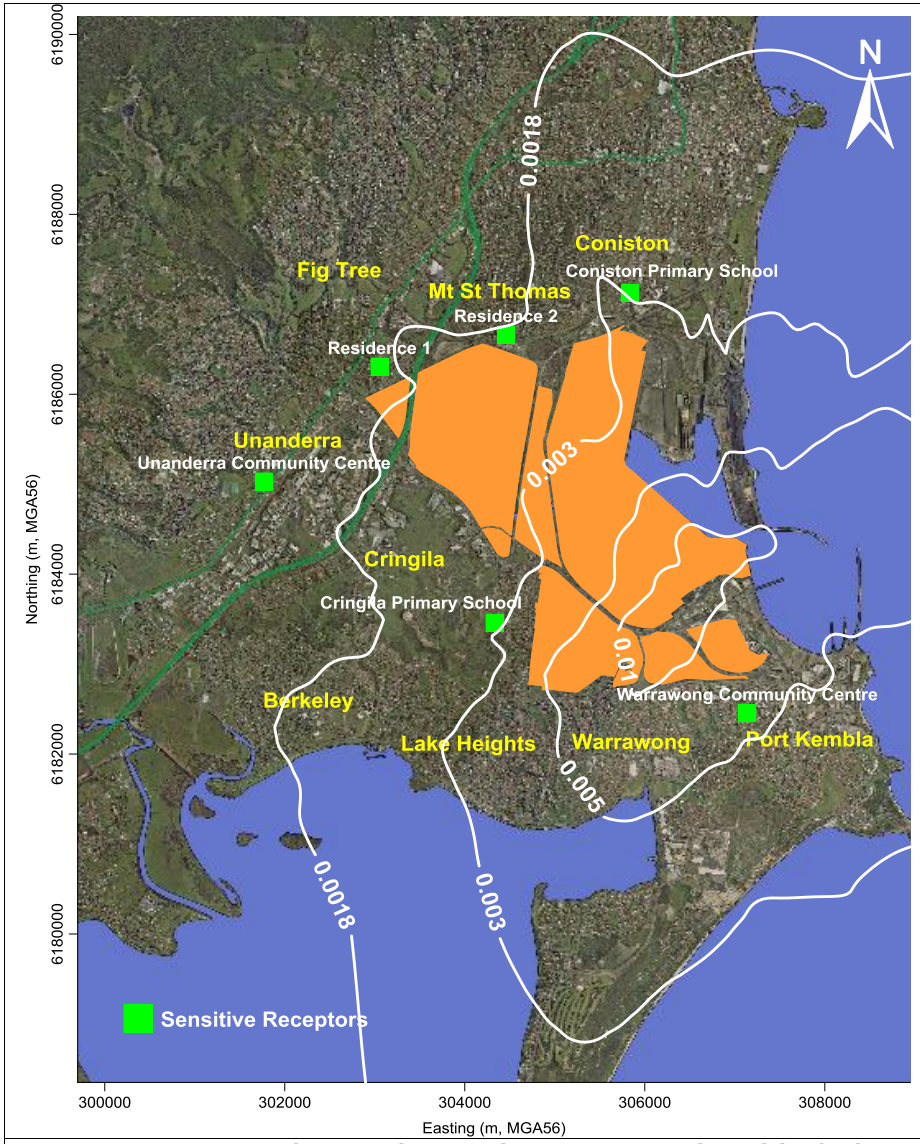
2.6 Mtpa Scenario – Maximum 1-hour Average Chlorine (µg/m³)



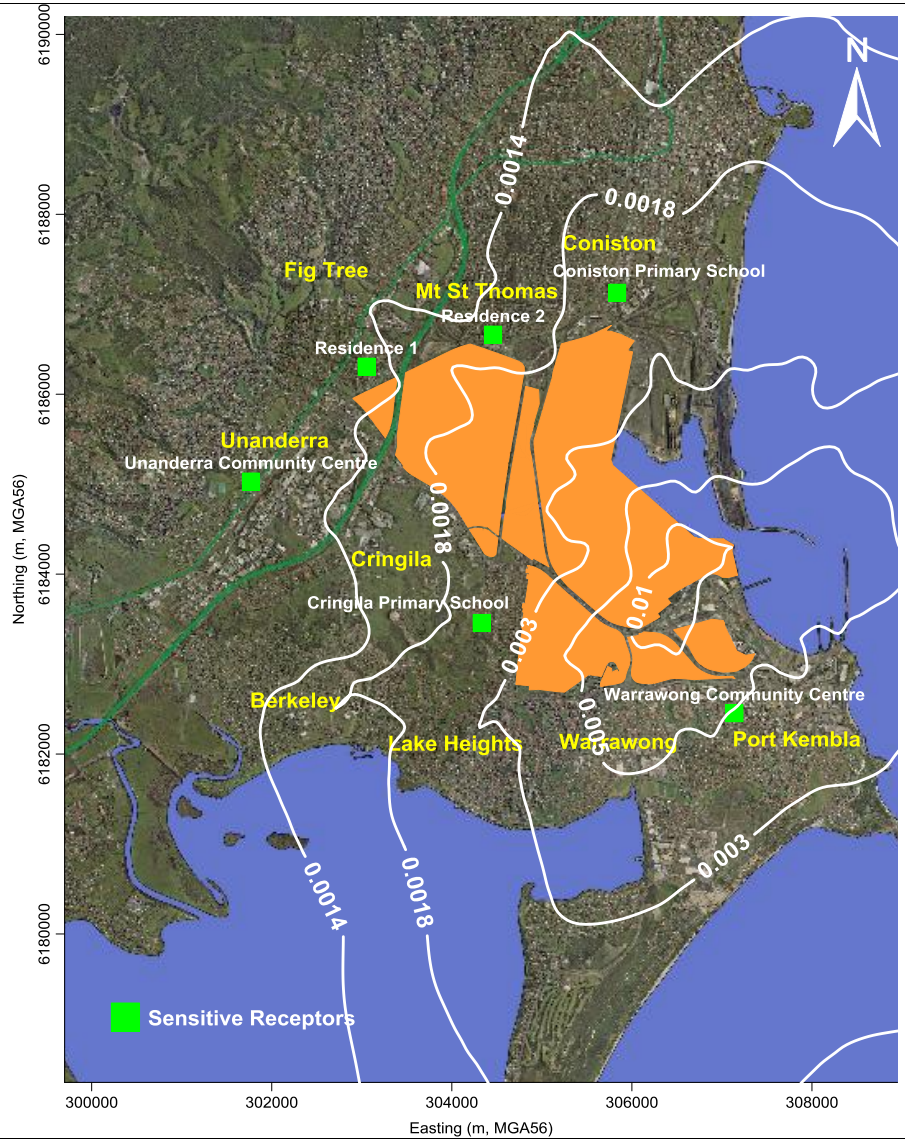
5.2 Mtpa Scenario – Maximum 1-hour Average Cyanide (µg/m³)



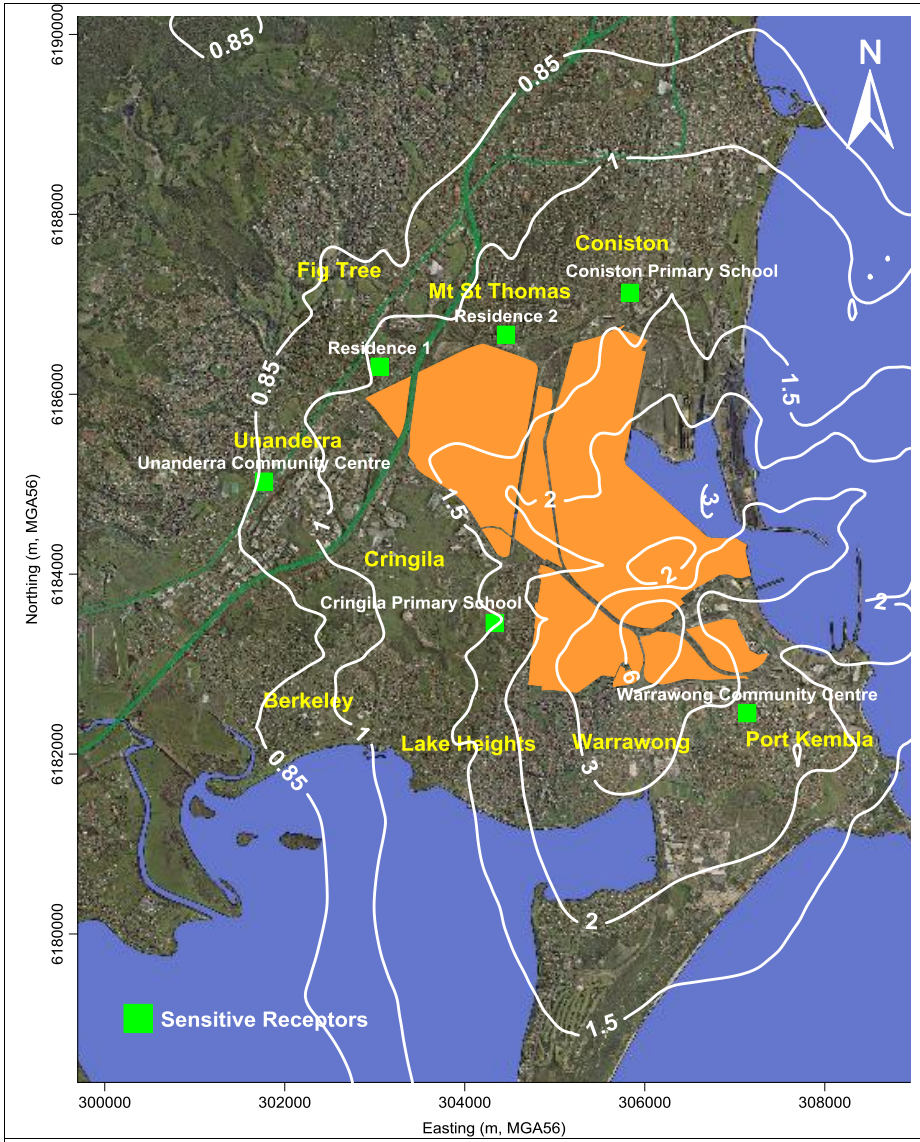
2.6 Mtpa Scenario – Maximum 1-hour Average Cyanide (µg/m³)



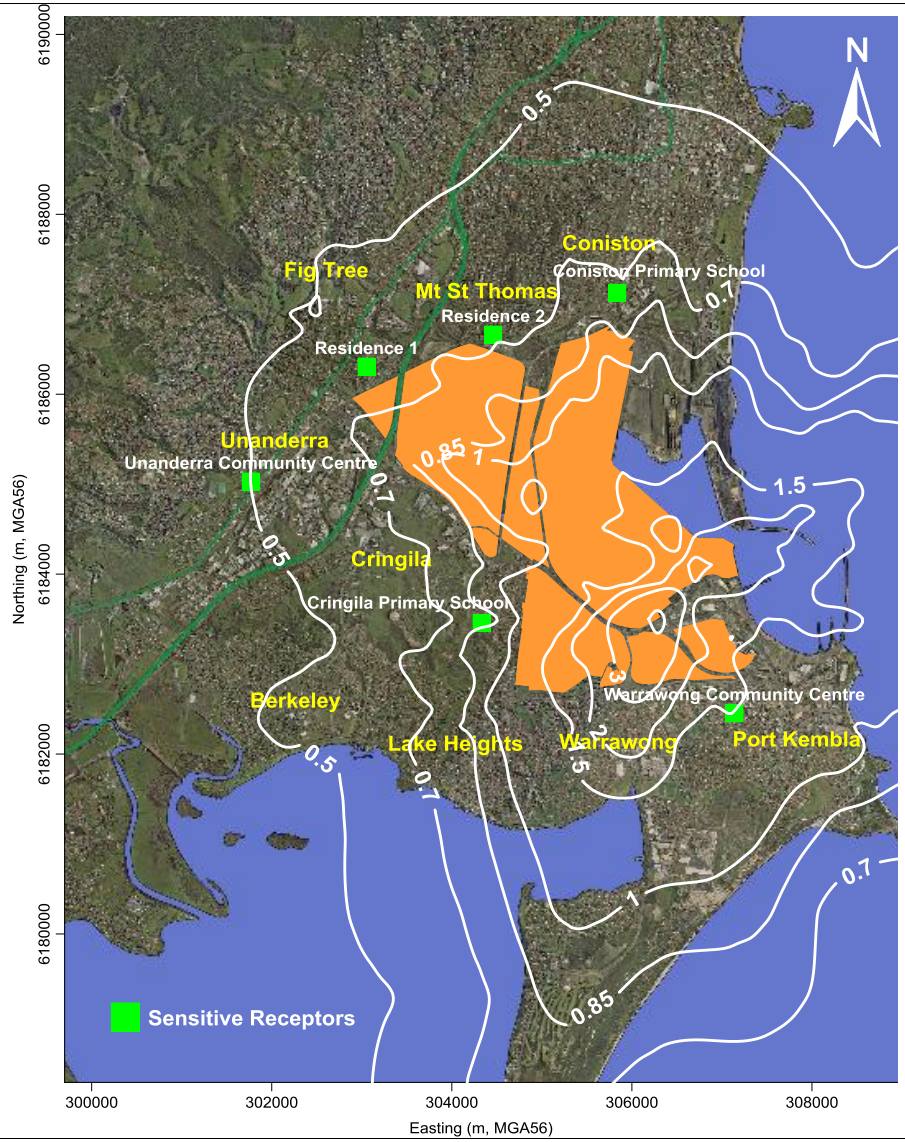
5.2 Mtpa Scenario – Maximum 1-hour Average Phenol (µg/m³)



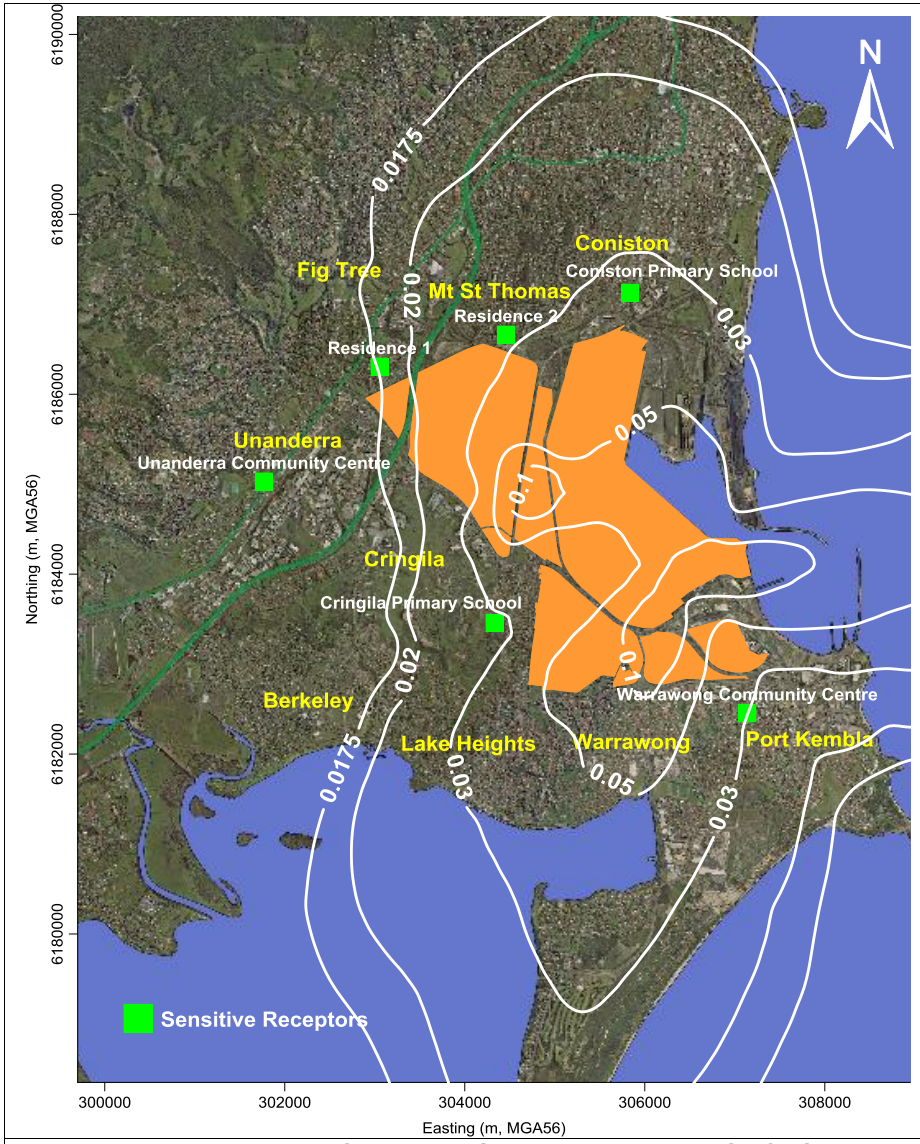
2.6 Mtpa Scenario – Maximum 1-hour Average Phenol (µg/m³)



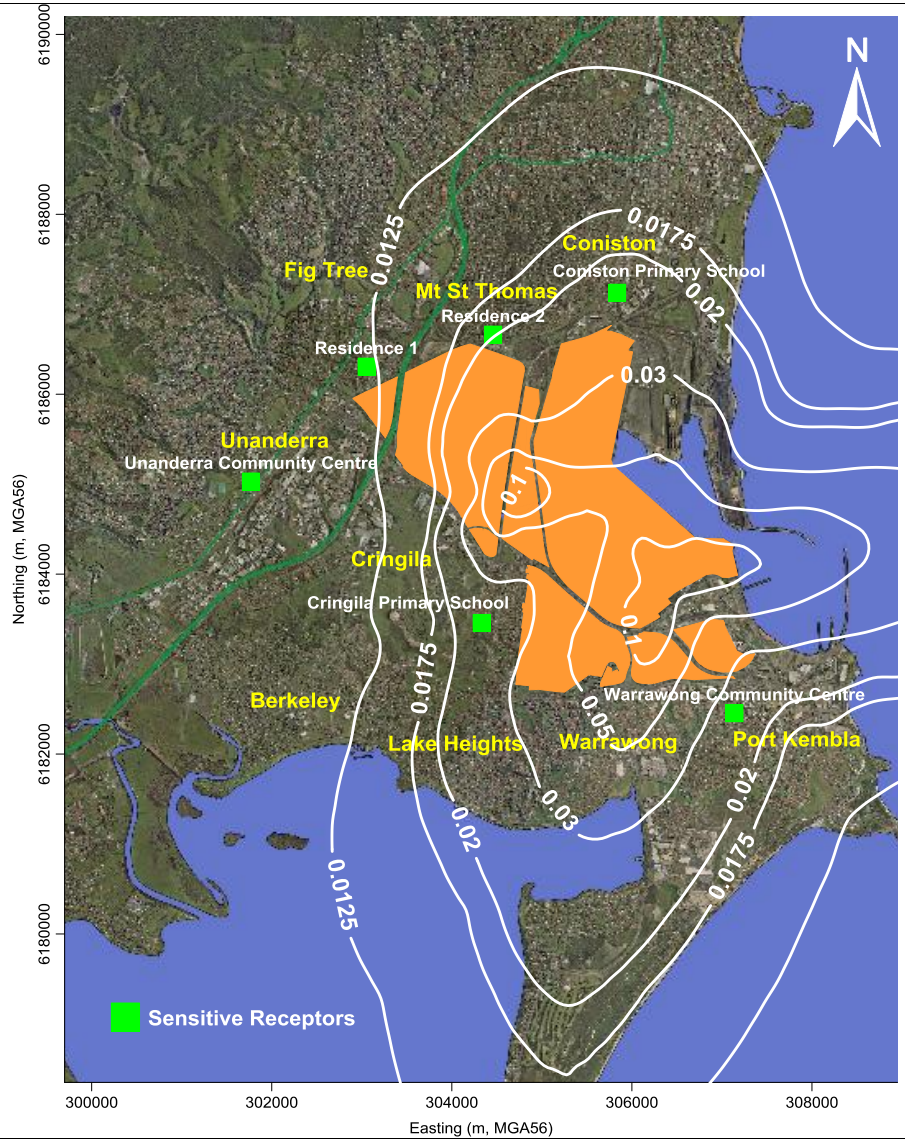
5.2 Mtpa Scenario – Maximum 1-hour Average Benzene (µg/m³)



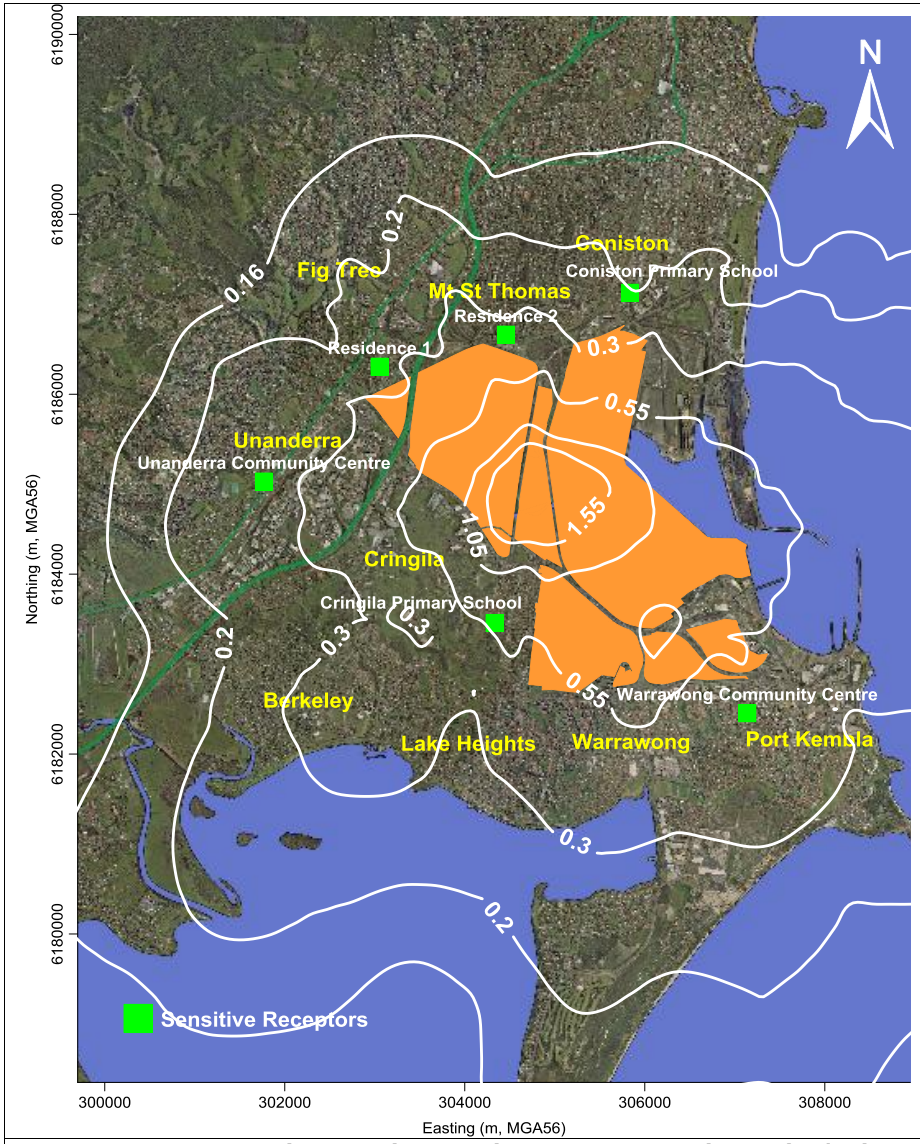
2.6 Mtpa Scenario – Maximum 1-hour Average Benzene (µg/m³)



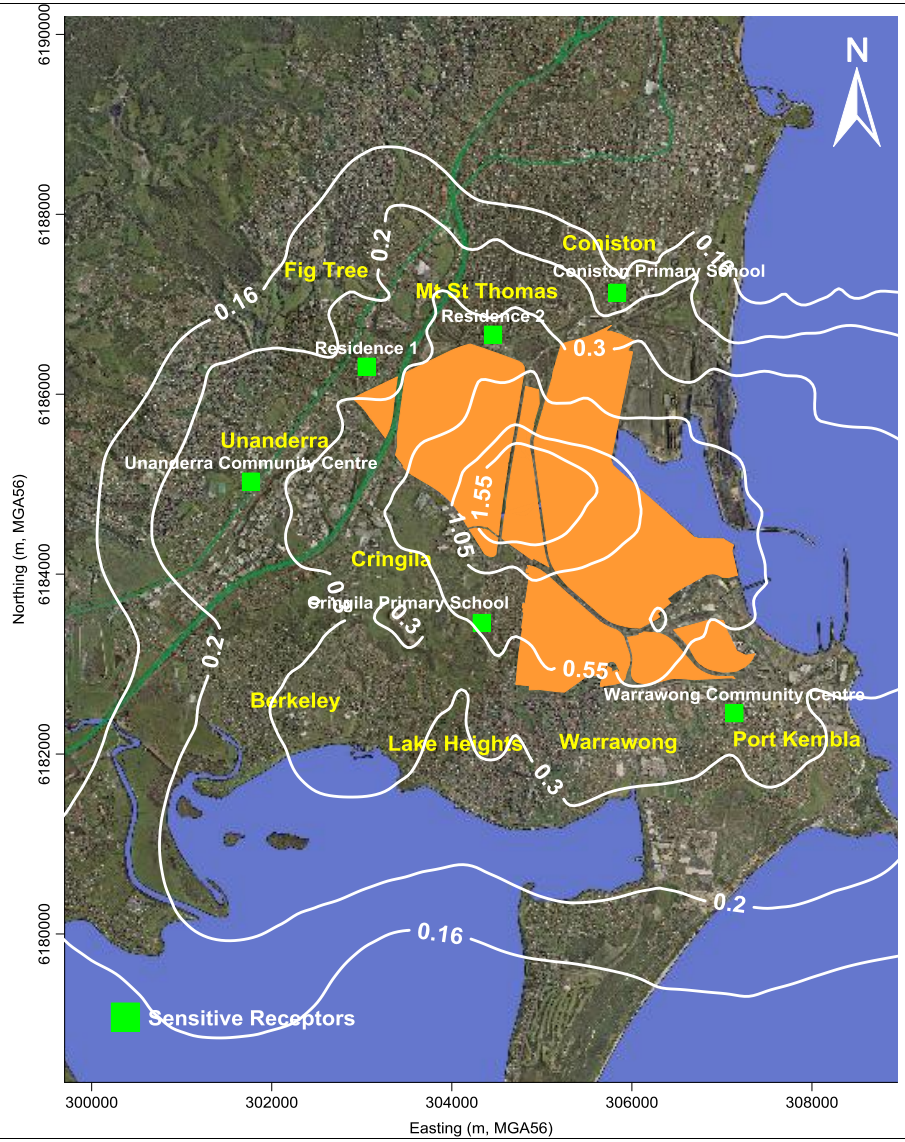
5.2 Mtpa Scenario – Annual Average Benzene (µg/m³)



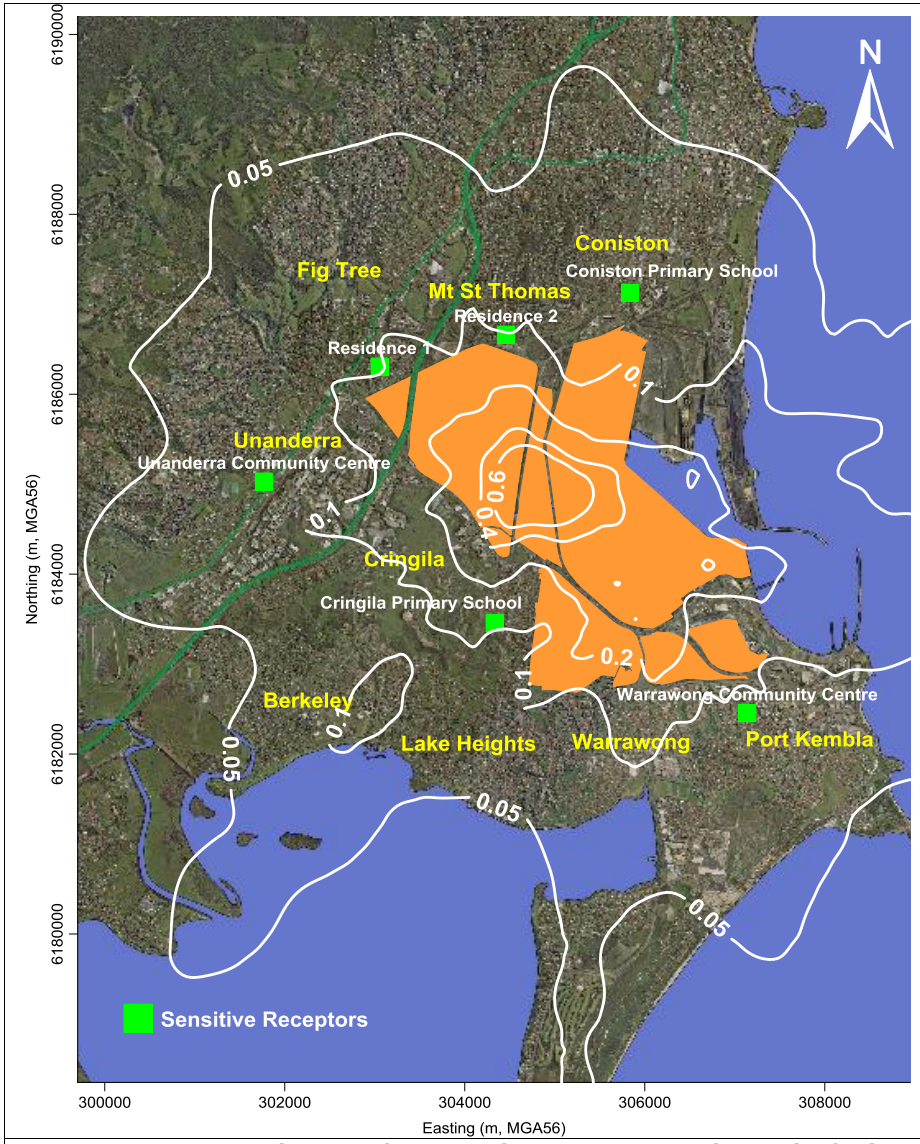
2.6 Mtpa Scenario – Annual Average Benzene (µg/m³)



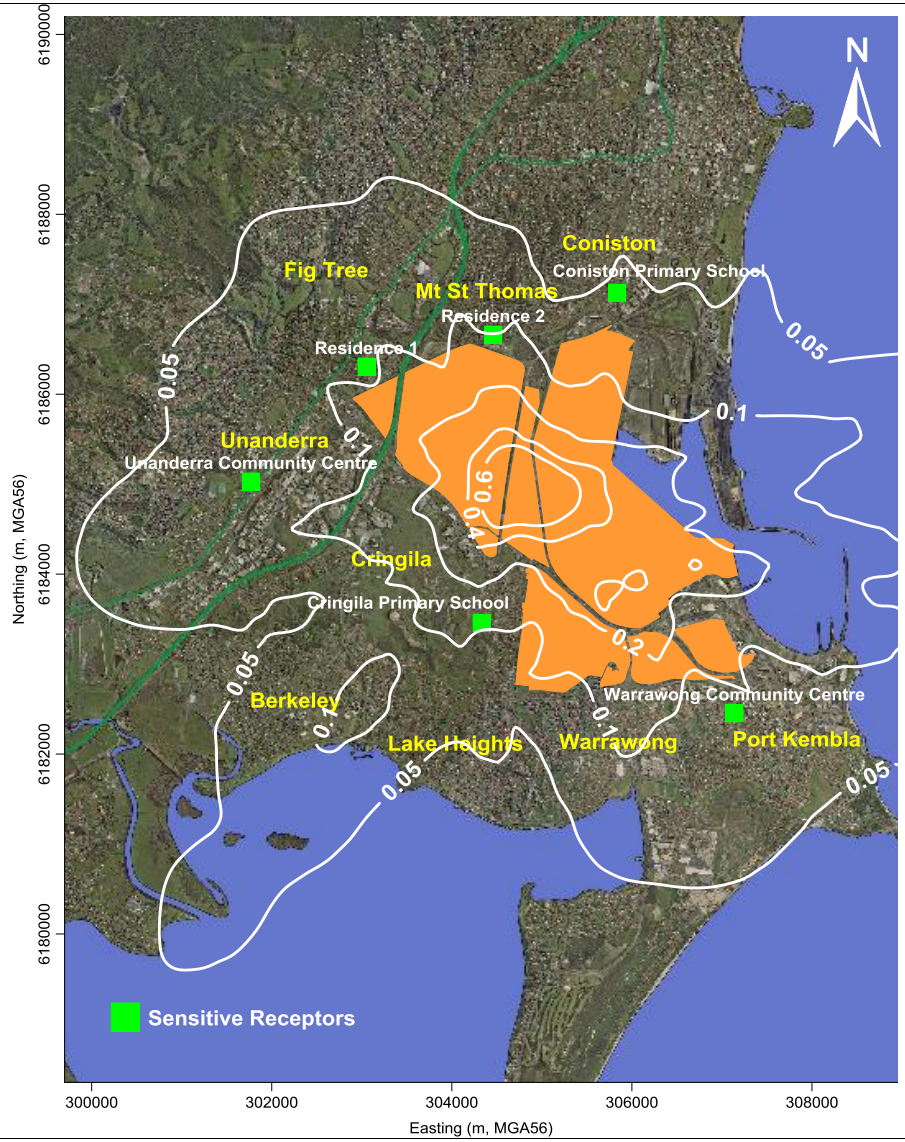
5.2 Mtpa Scenario – Maximum 1-hour Average Toluene (µg/m³)



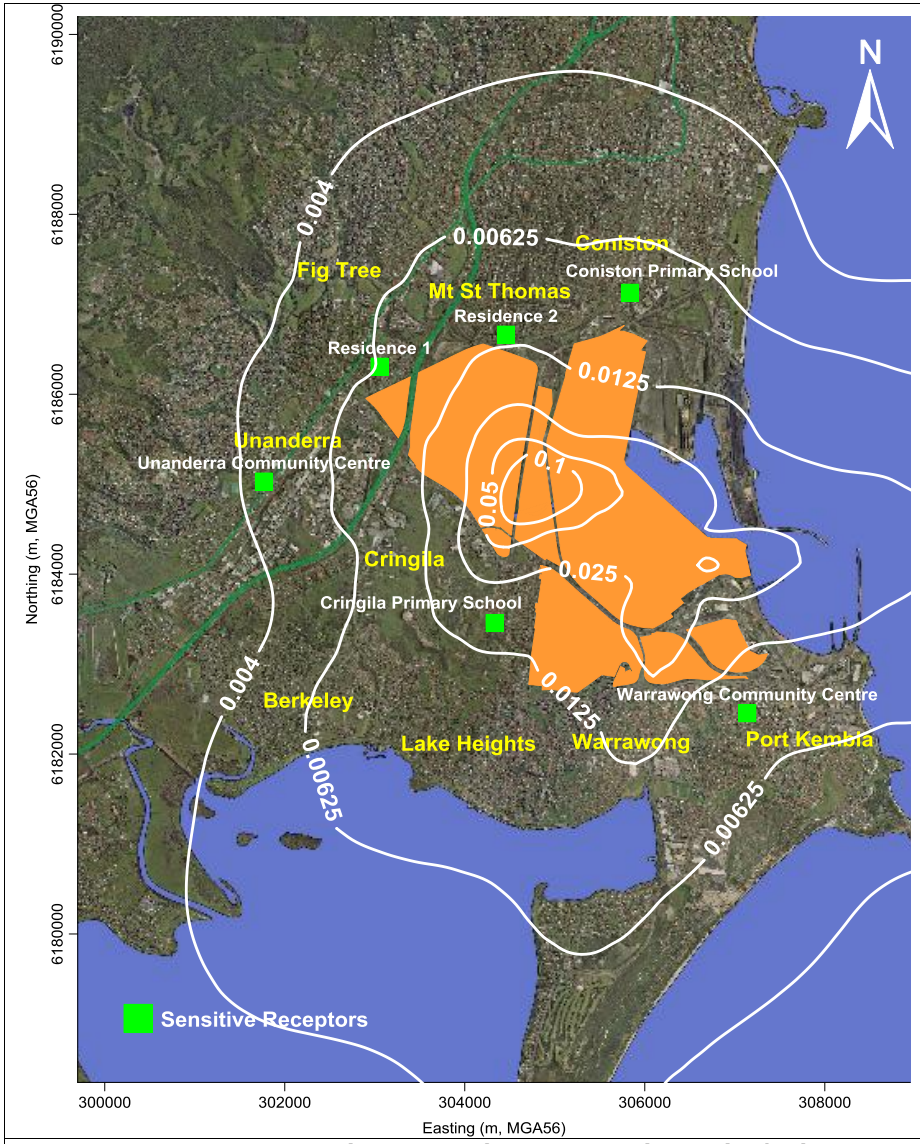
2.6 Mtpa Scenario – Maximum 1-hour Average Toluene (µg/m³)



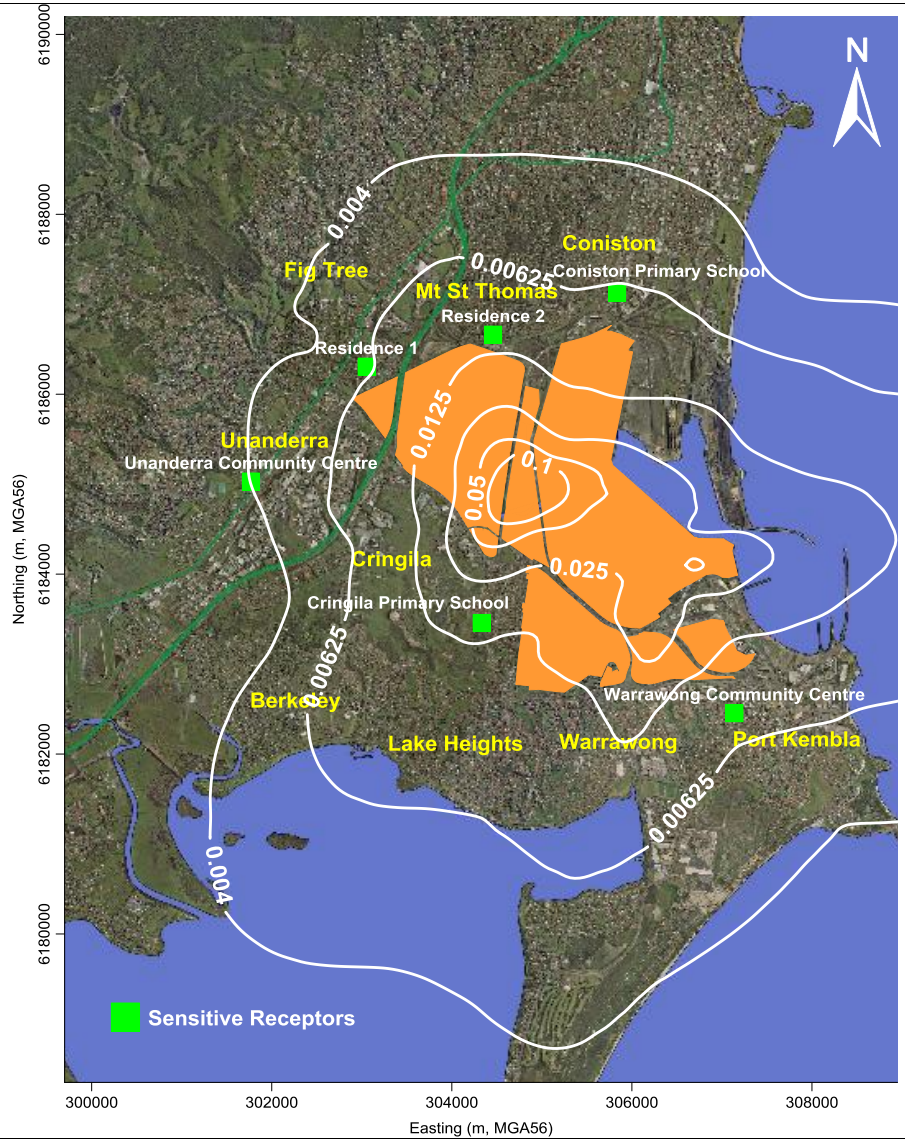
5.2 Mtpa Scenario – Maximum 24-hour Average Toluene (µg/m³)



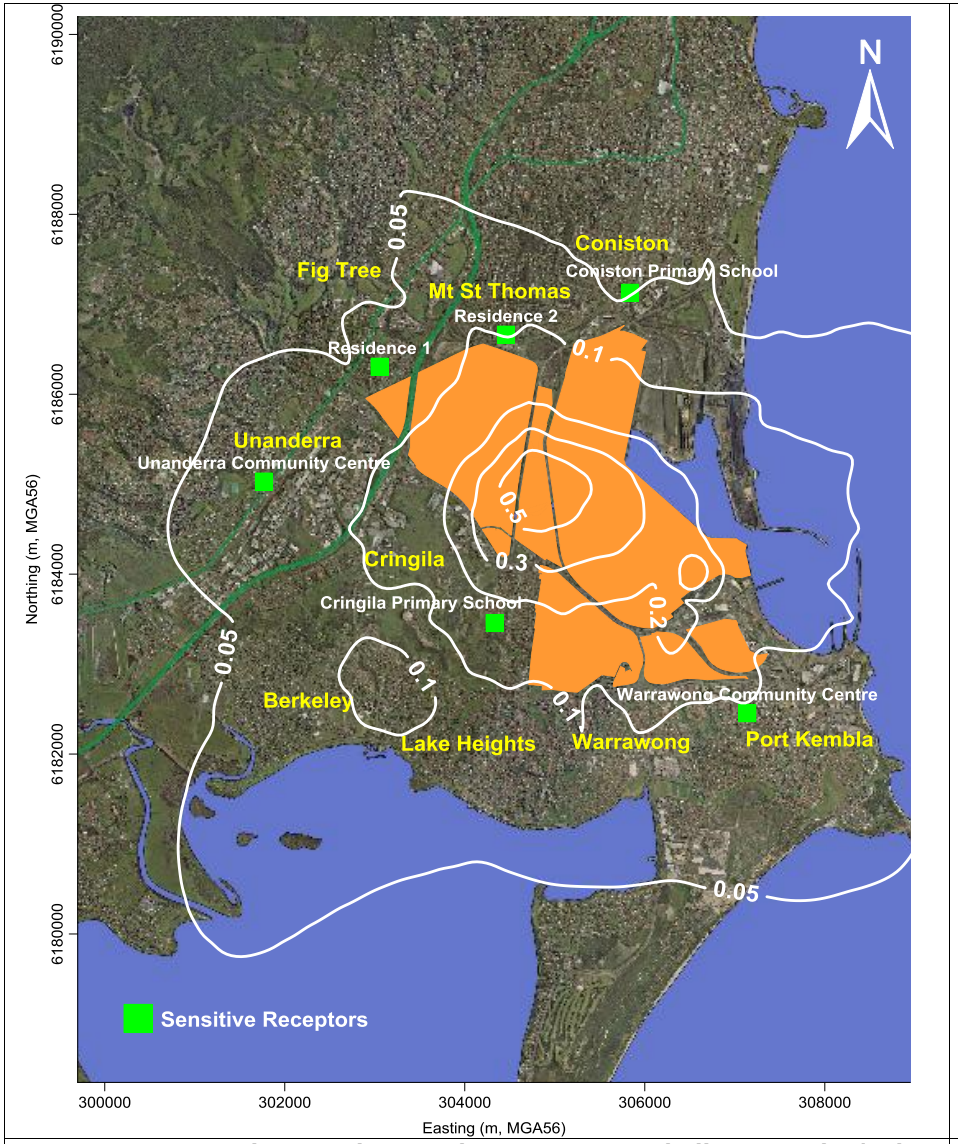
2.6 Mtpa Scenario – Maximum 24-hour Average Toluene (µg/m³)



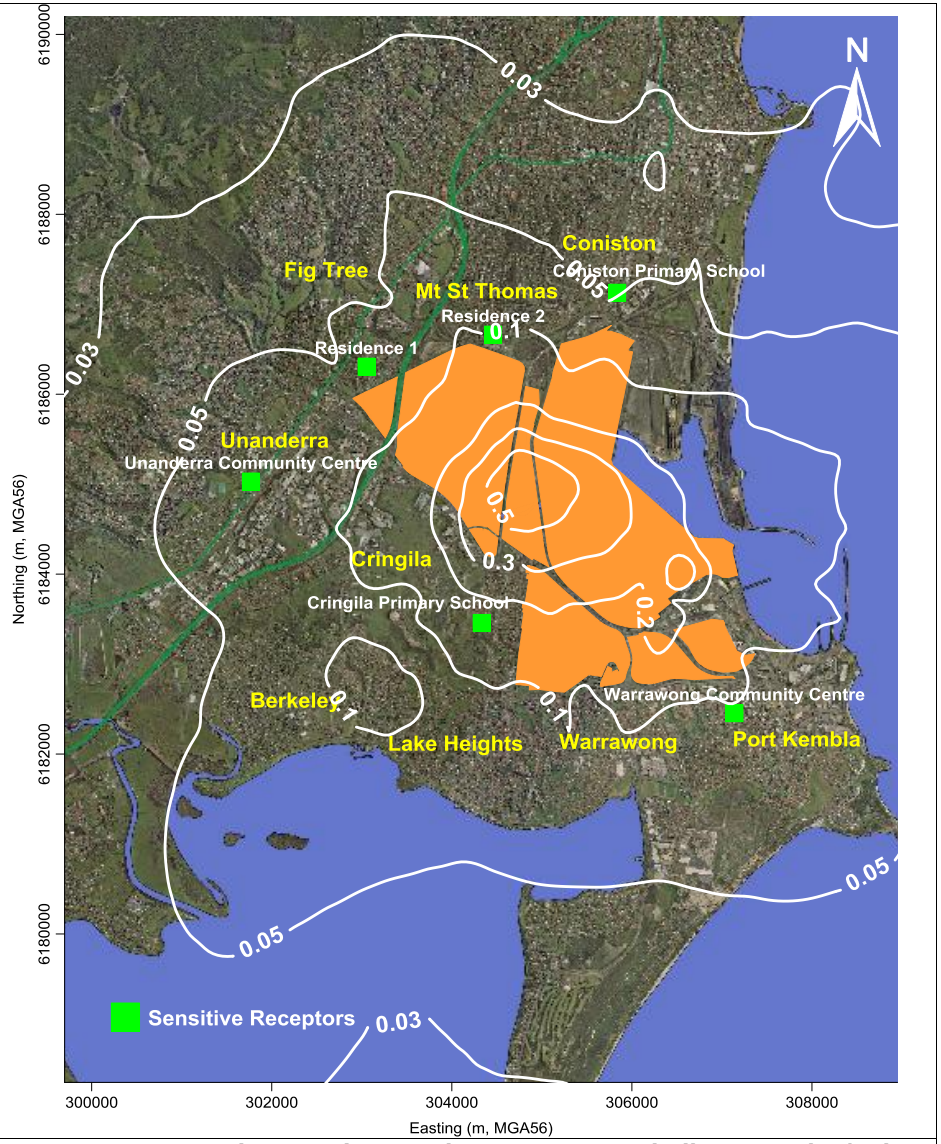
5.2 Mtpa Scenario – Annual Average Toluene (µg/m³)



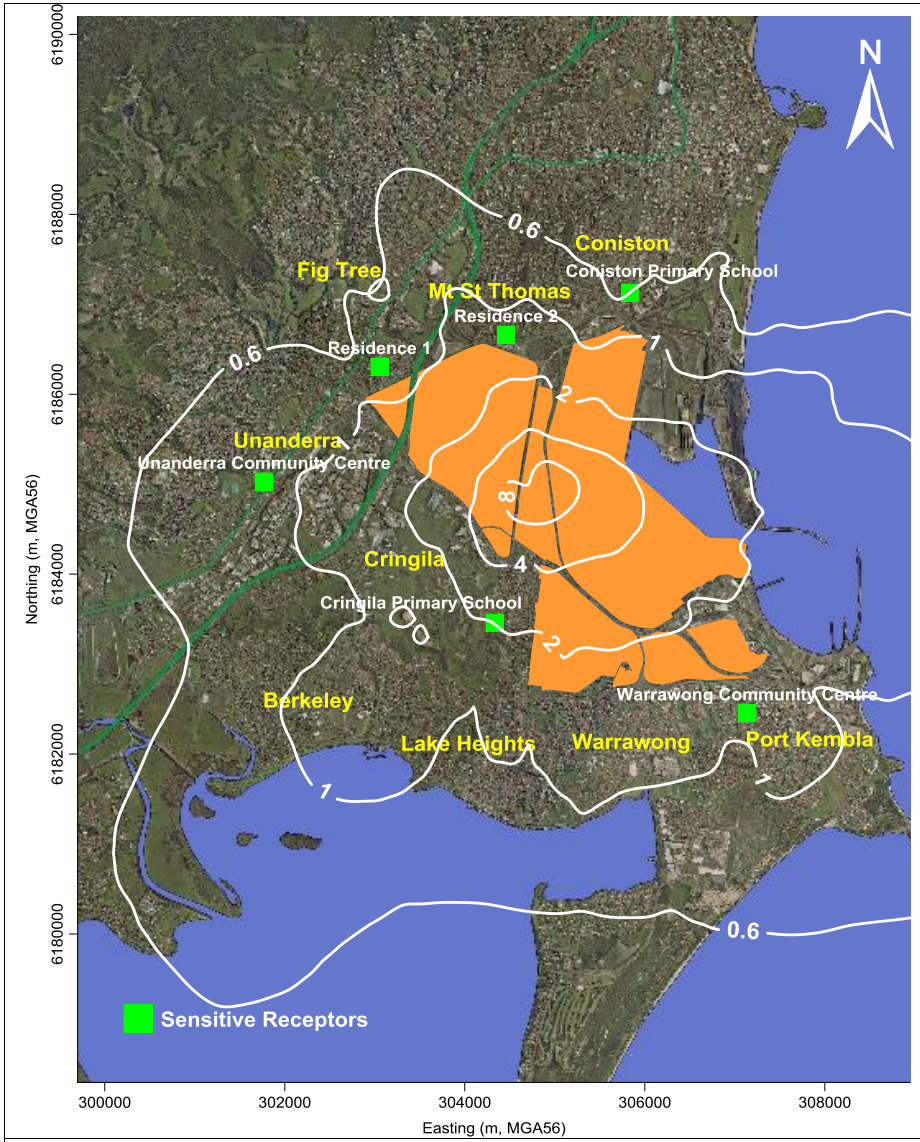
2.6 Mtpa Scenario – Annual Average Toluene (µg/m³)



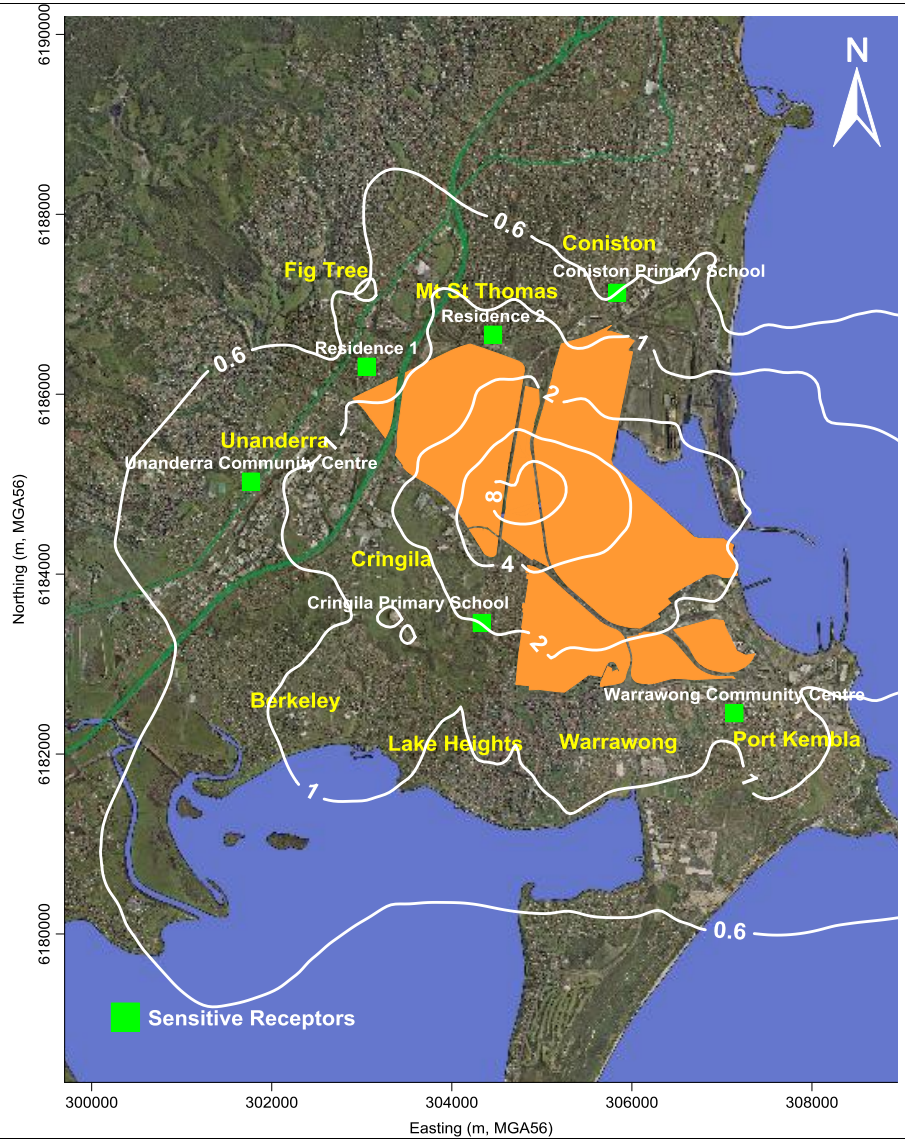
5.2 Mtpa Scenario – Maximum 1-hour Average Ethylbenzene (µg/m³)



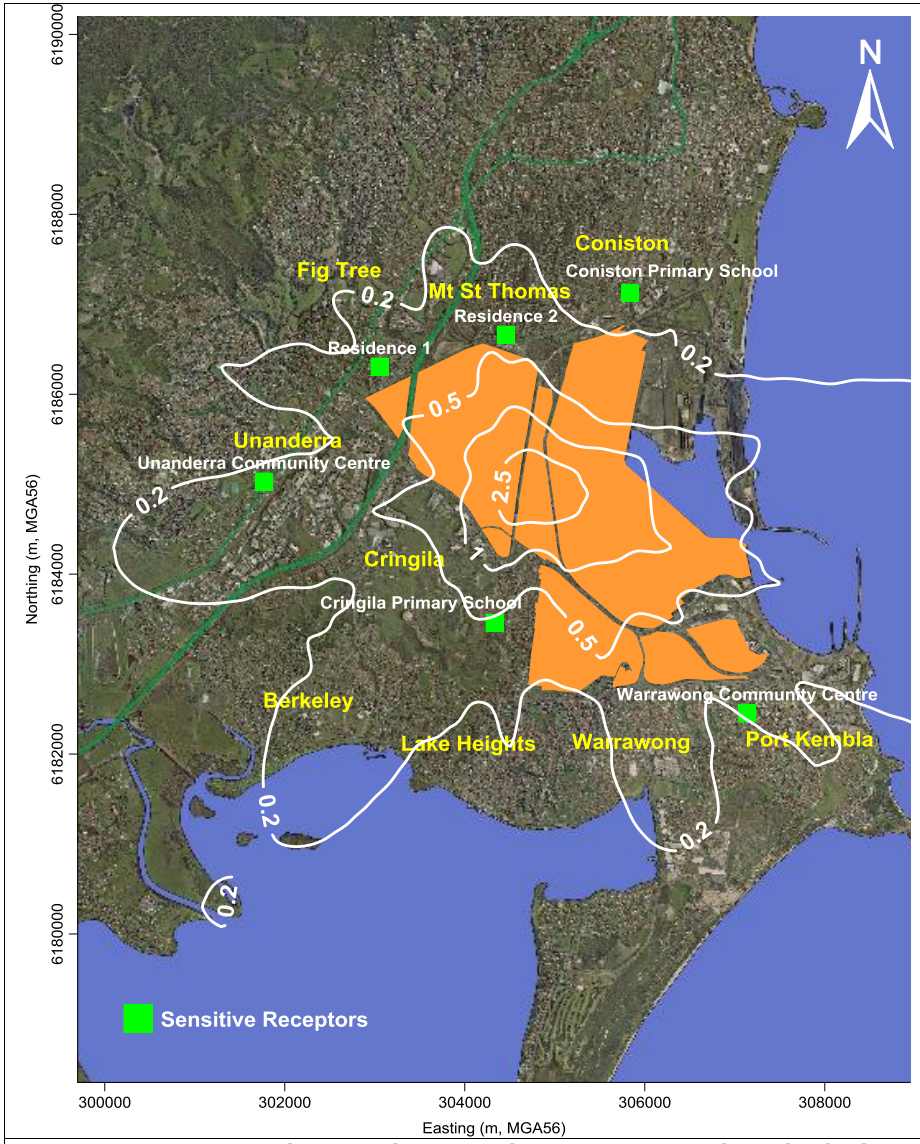
2.6 Mtpa Scenario – Maximum 1-hour Average Ethylbenzene (µg/m³)



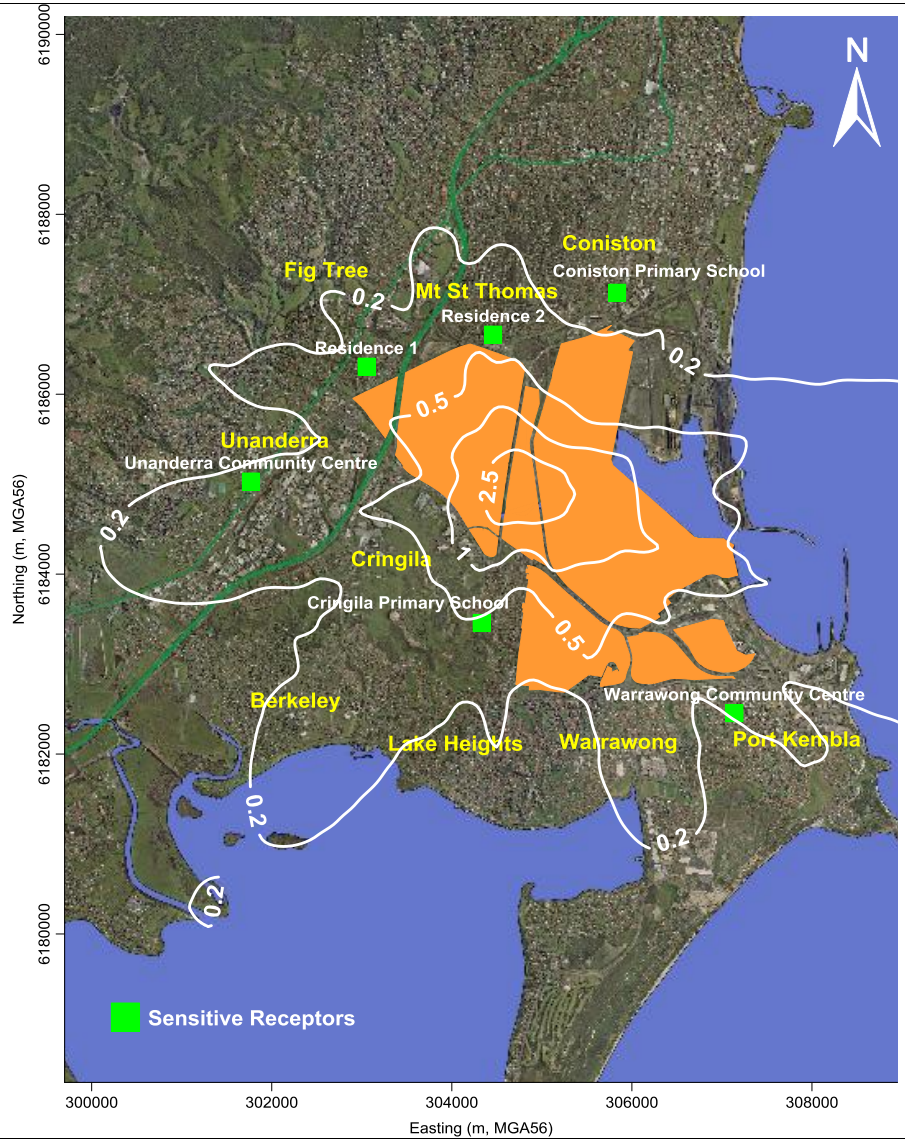
5.2 Mtpa Scenario – Maximum 1-hour Average Xylene (µg/m³)



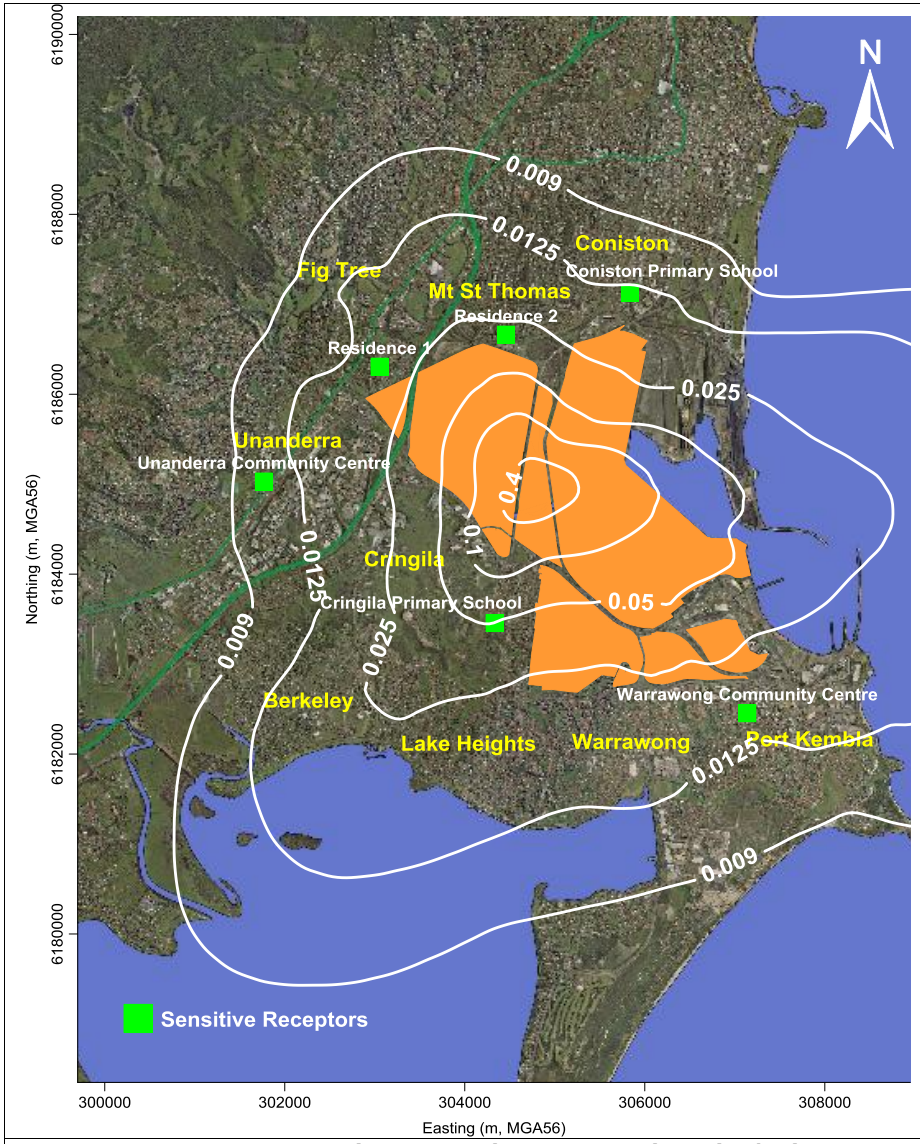
2.6 Mtpa Scenario – Maximum 1-hour Average Xylene (µg/m³)



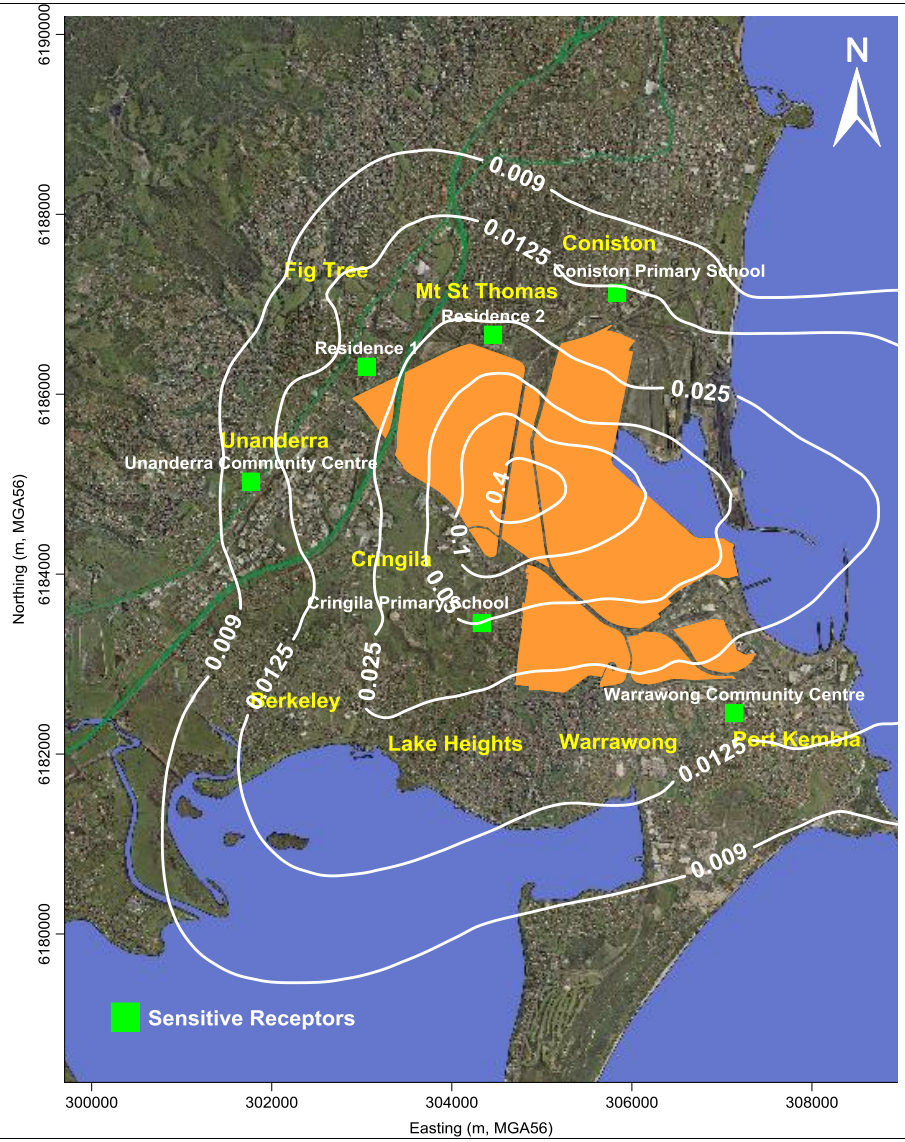
5.2 Mtpa Scenario – Maximum 24-hour Average Xylene (µg/m³)



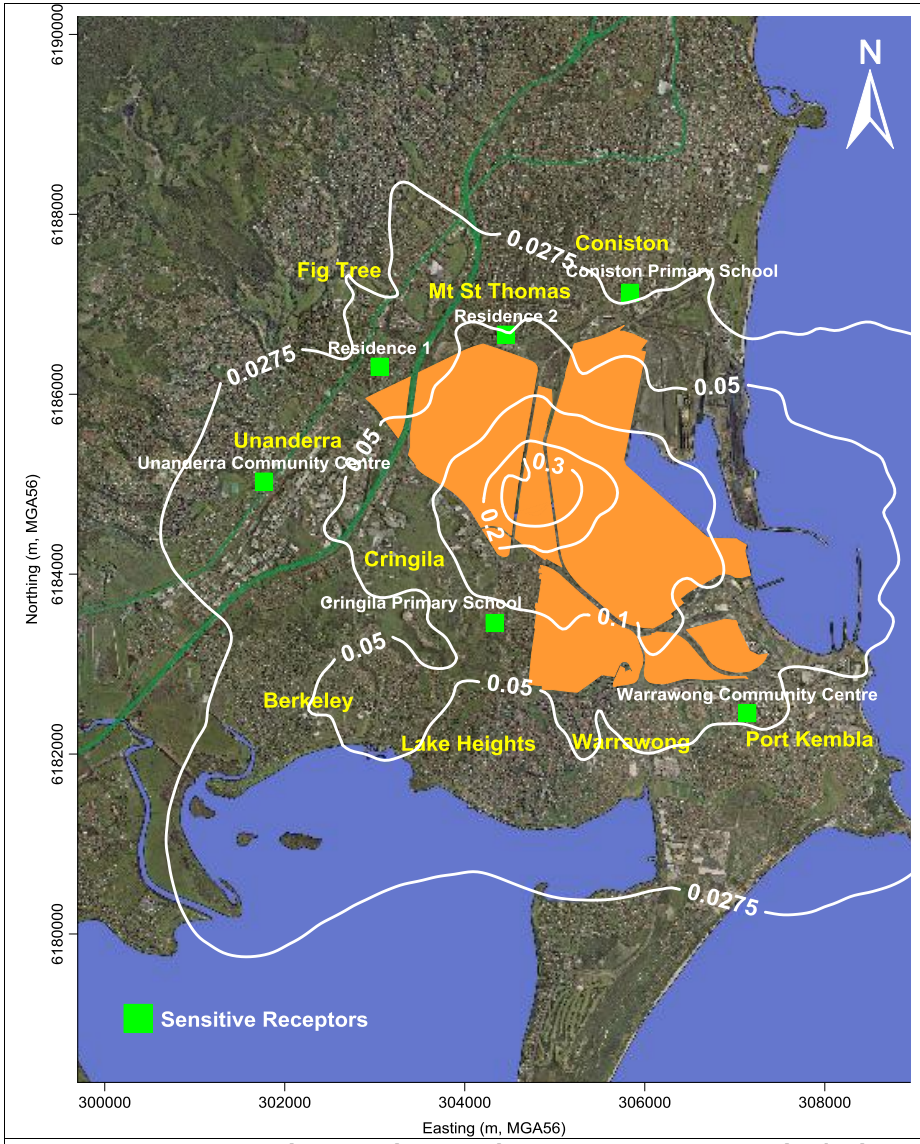
2.6 Mtpa Scenario – Maximum 24-hour Average Xylene (µg/m³)



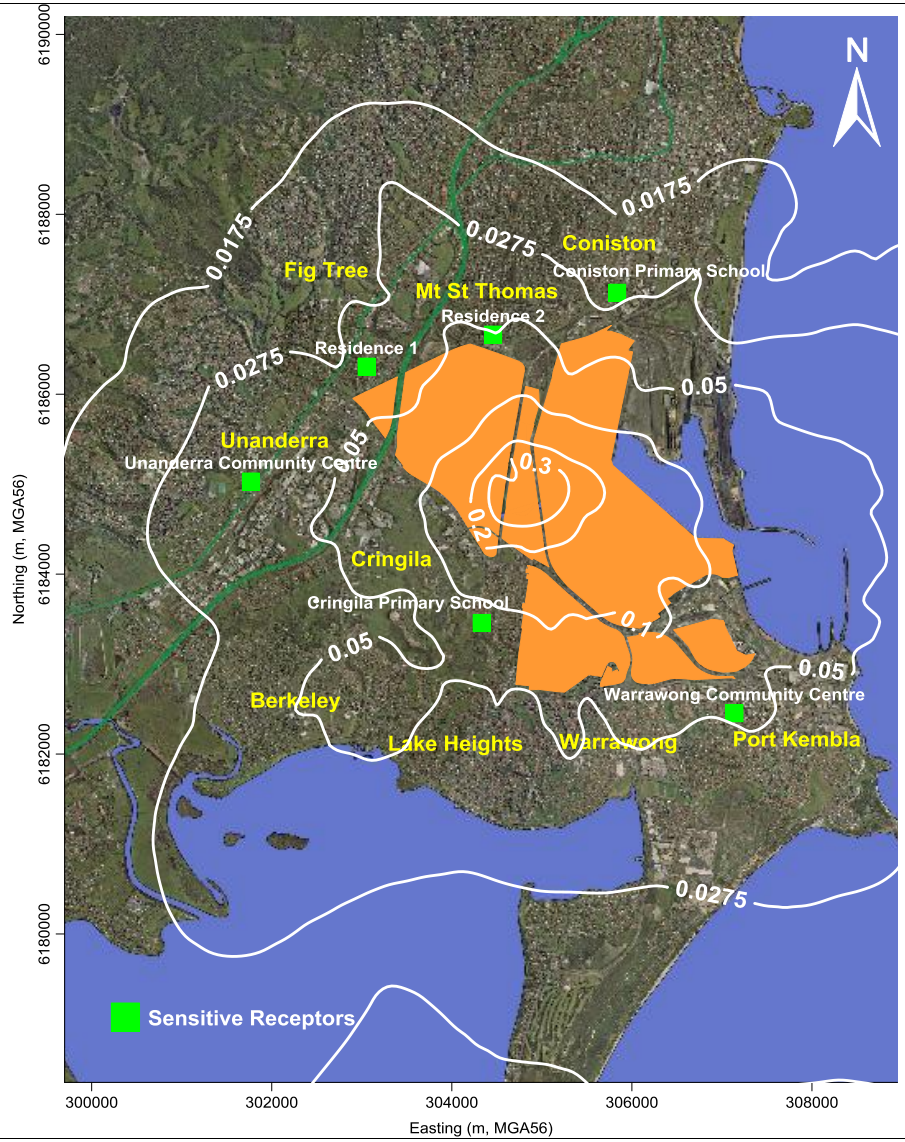
5.2 Mtpa Scenario – Annual Average Xylene (µg/m³)



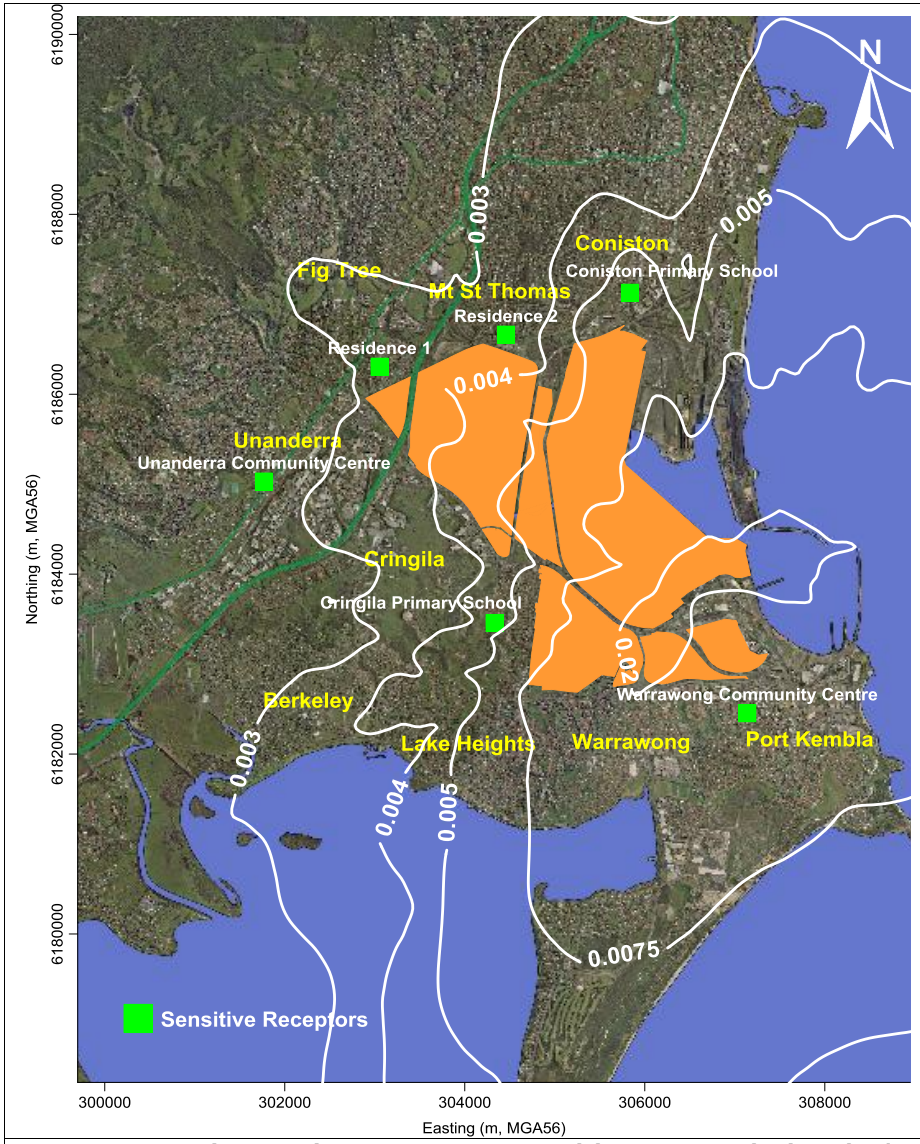
2.6 Mtpa Scenario – Annual Average Xylene (µg/m³)



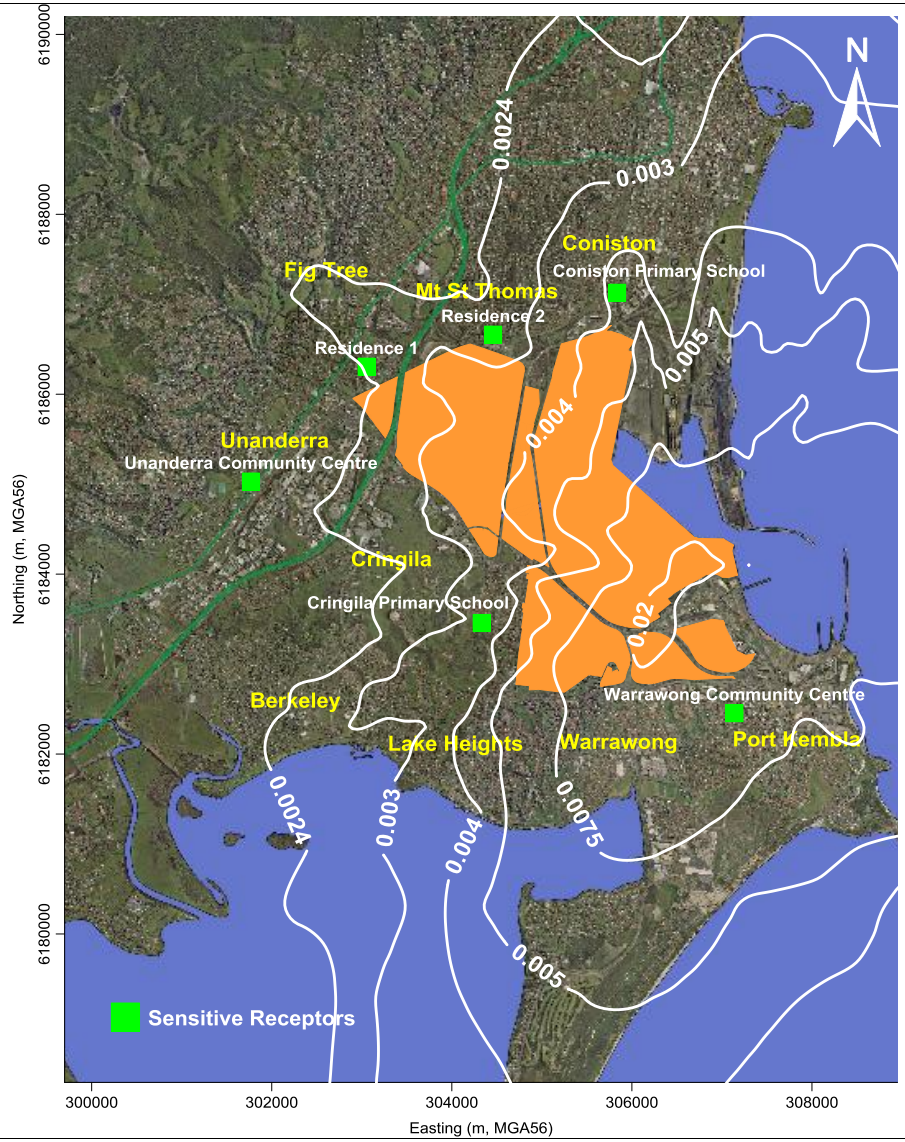
5.2 Mtpa Scenario – Maximum 1-hour Average Styrene (µg/m³)



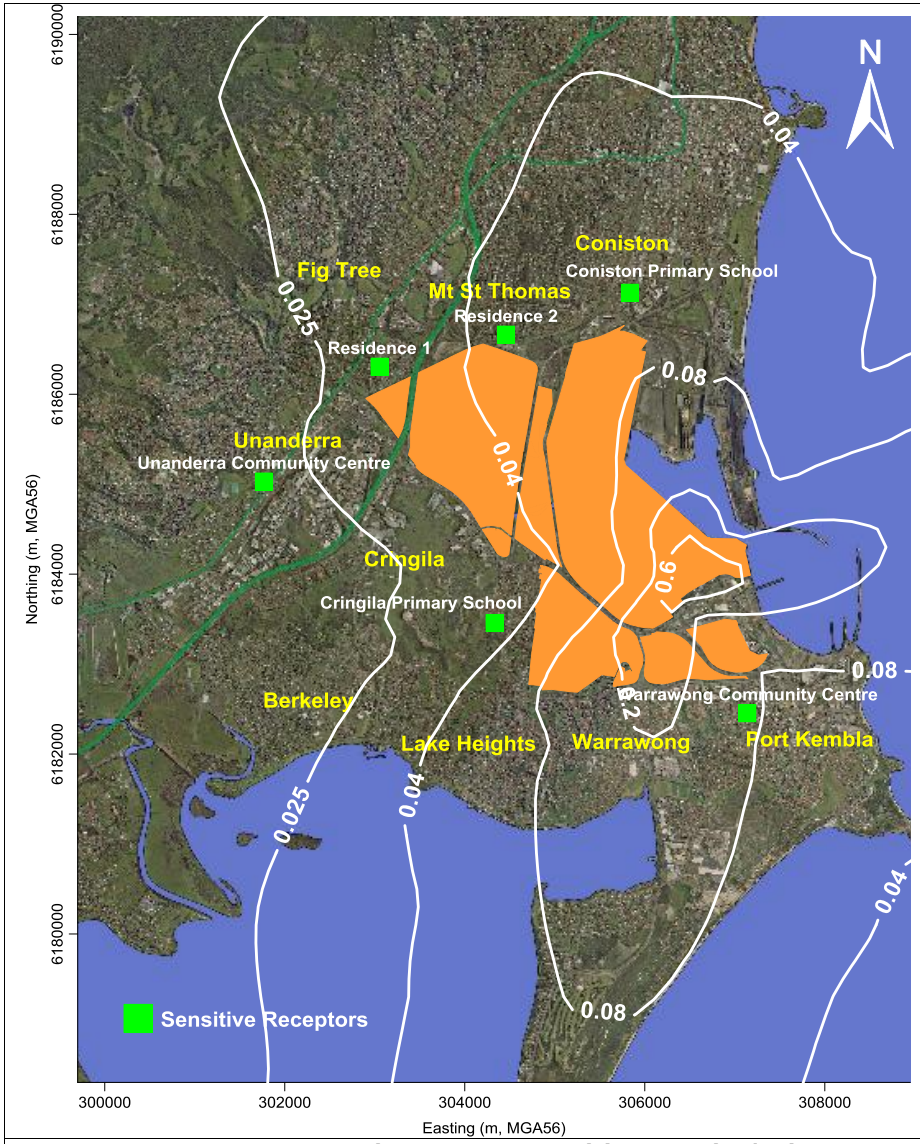
2.6 Mtpa Scenario – Maximum 1-hour Average Styrene (µg/m³)



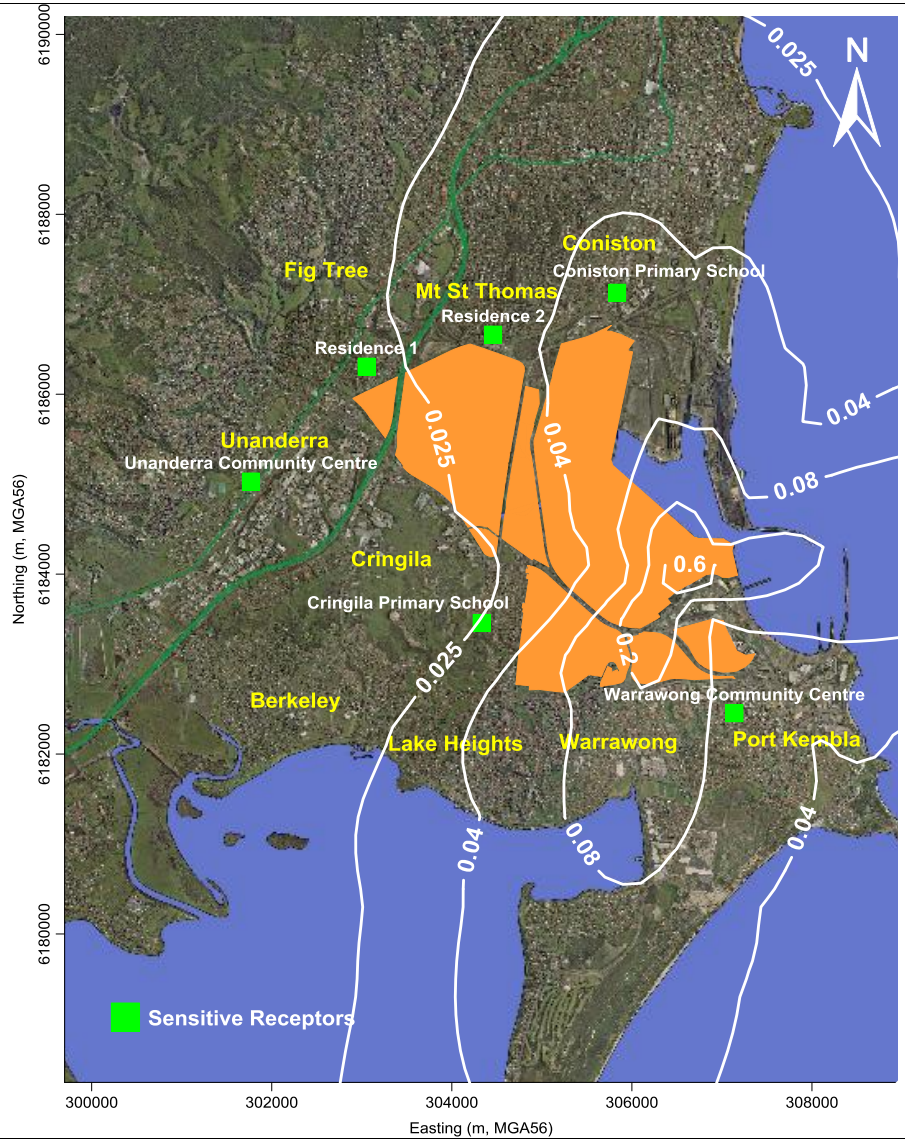
5.2 Mtpa – Maximum 1-hour Average Benzo(a)pyrene Equivalent (µg/m³)



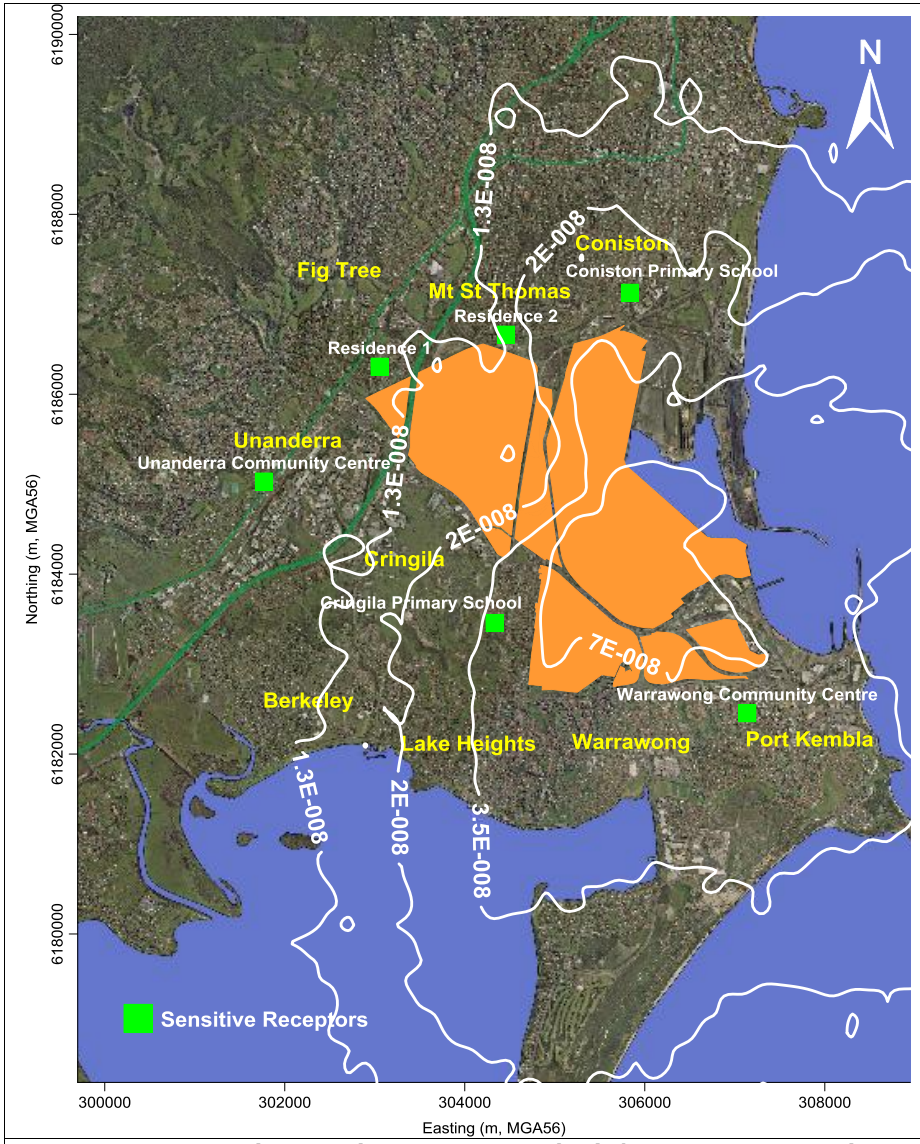
2.6 Mtpa – Maximum 1-hour Average Benzo(a)pyrene Equivalent (µg/m³)



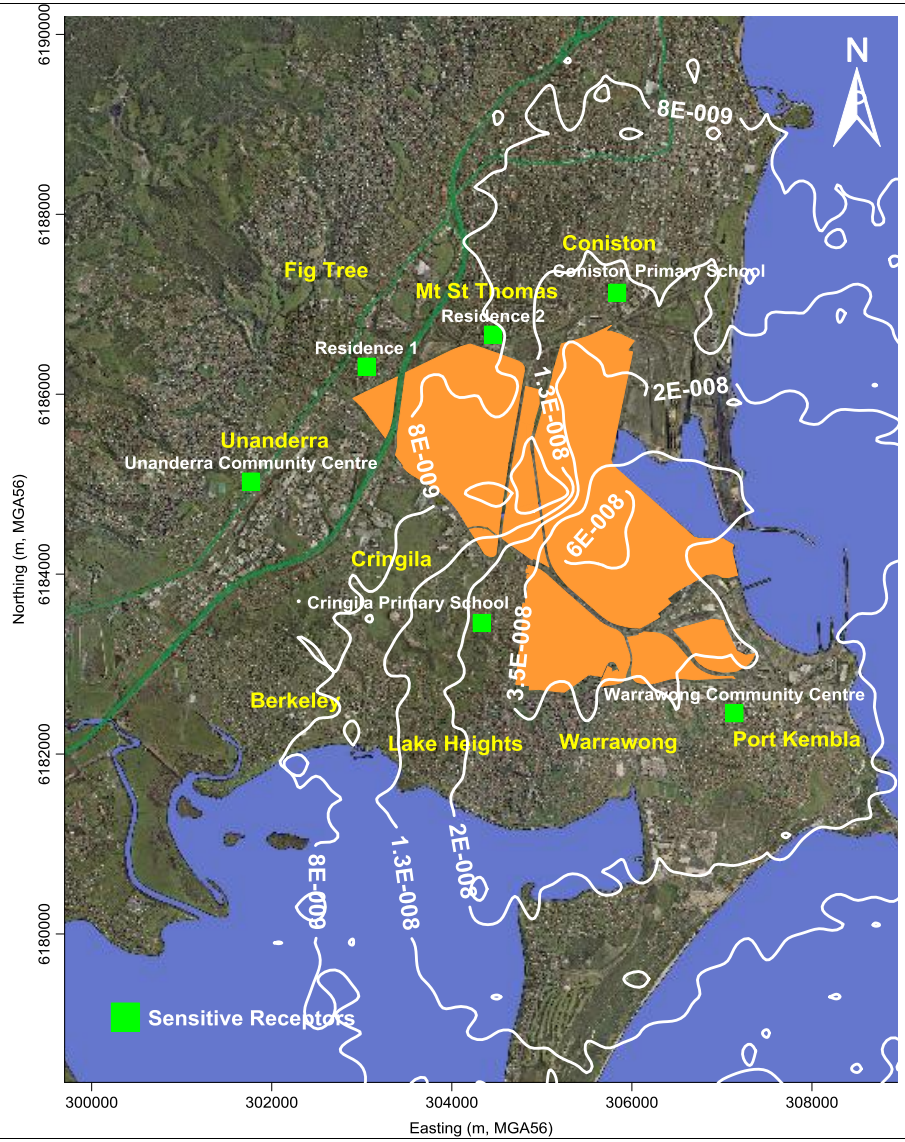
5.2 Mtpa – Annual Average Benzo(a)pyrene (µg/m³)



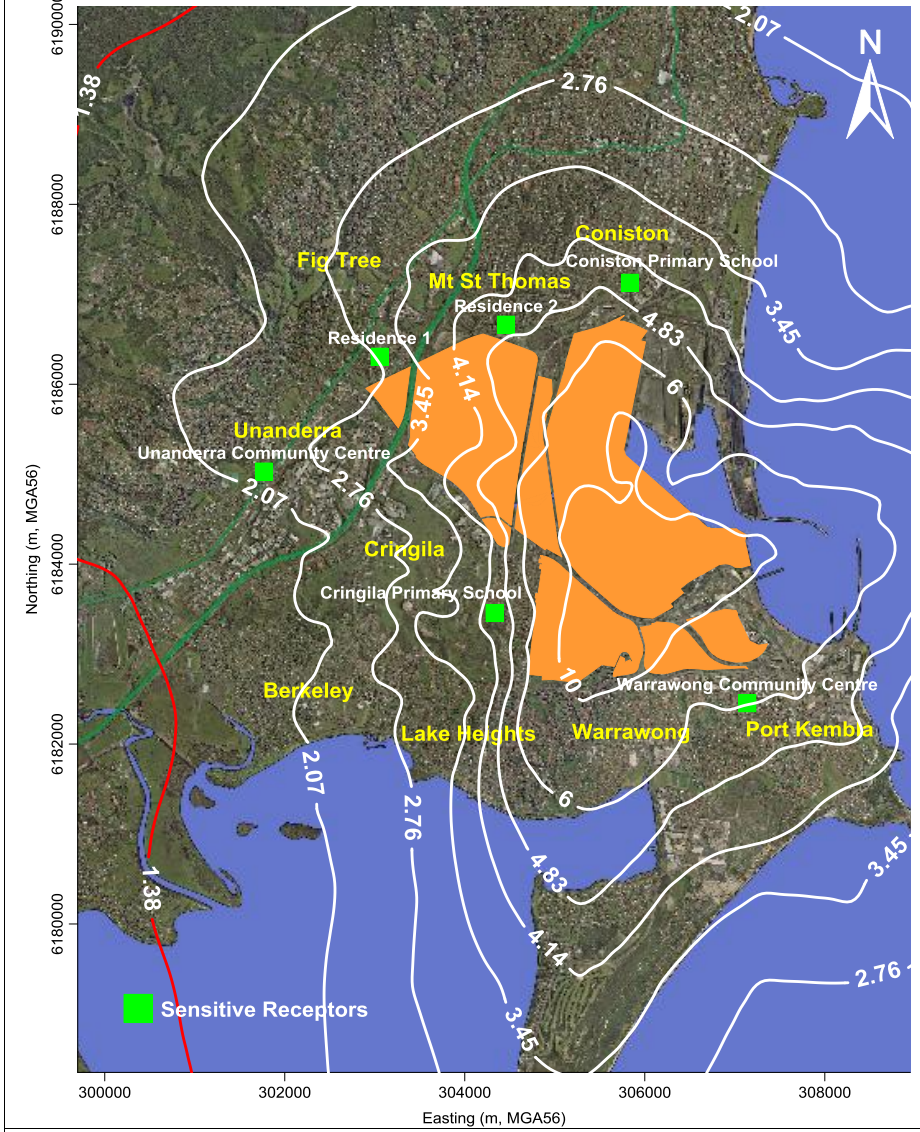
2.6 Mtpa – Annual Average Benzo(a)pyrene (µg/m³)



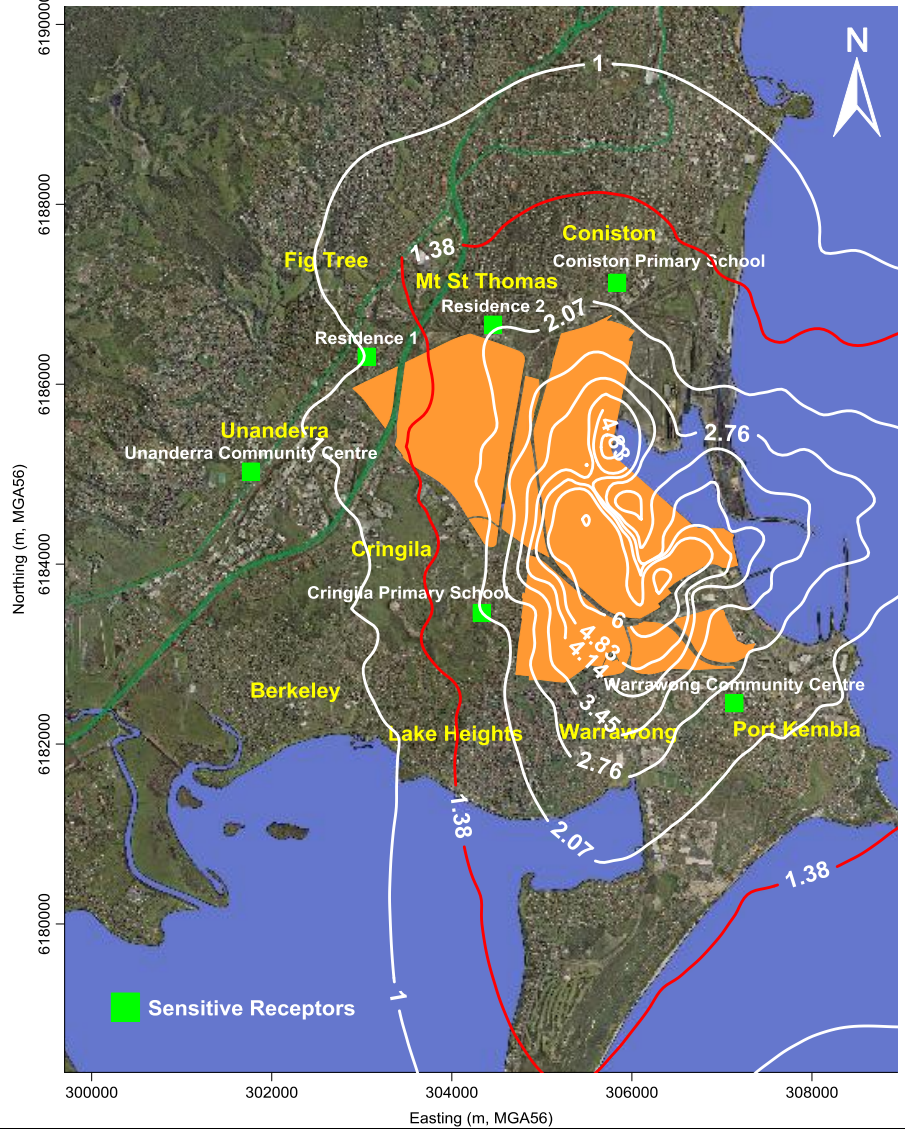
5.2 Mtpa – Maximum 1-hour Average Dioxin/Furan Concentration (µg/m³)



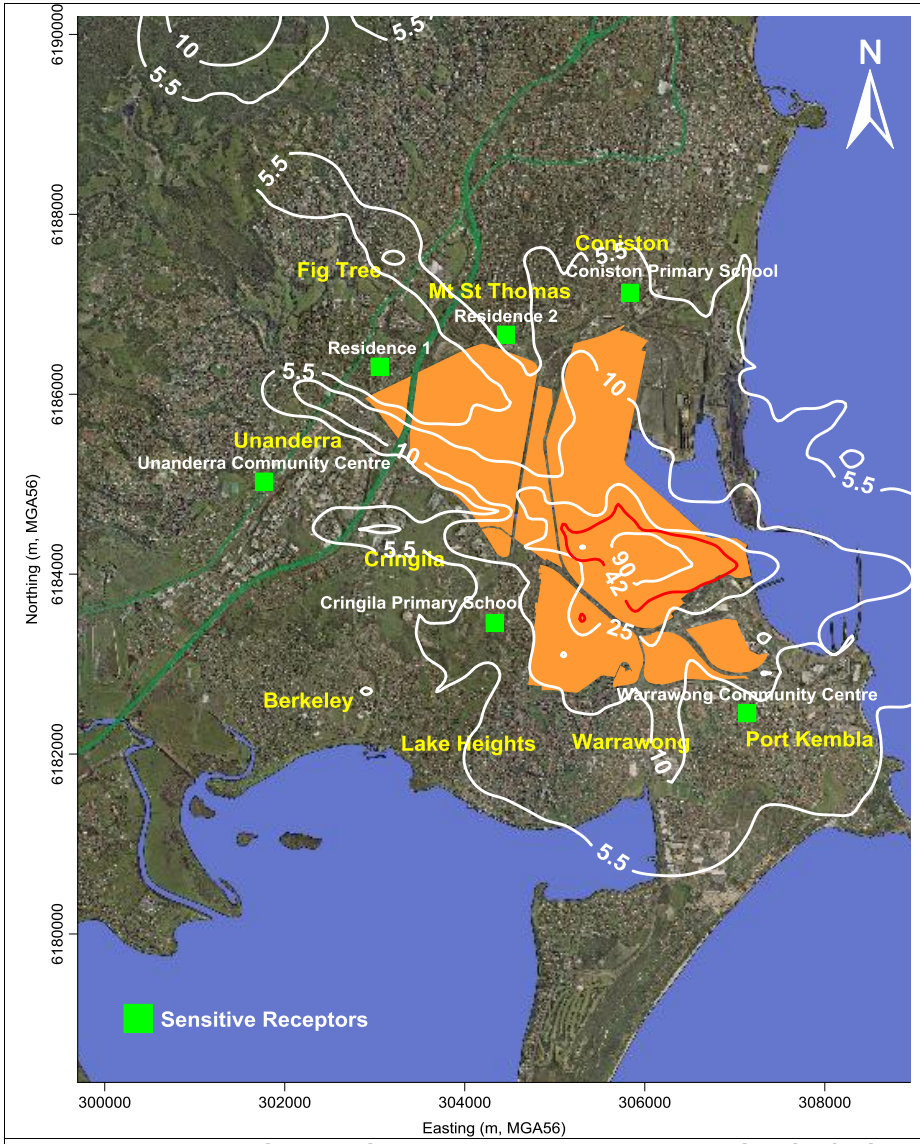
2.6 Mtpa – Maximum 1-hour Average Dioxin/Furan Concentration (µg/m³)



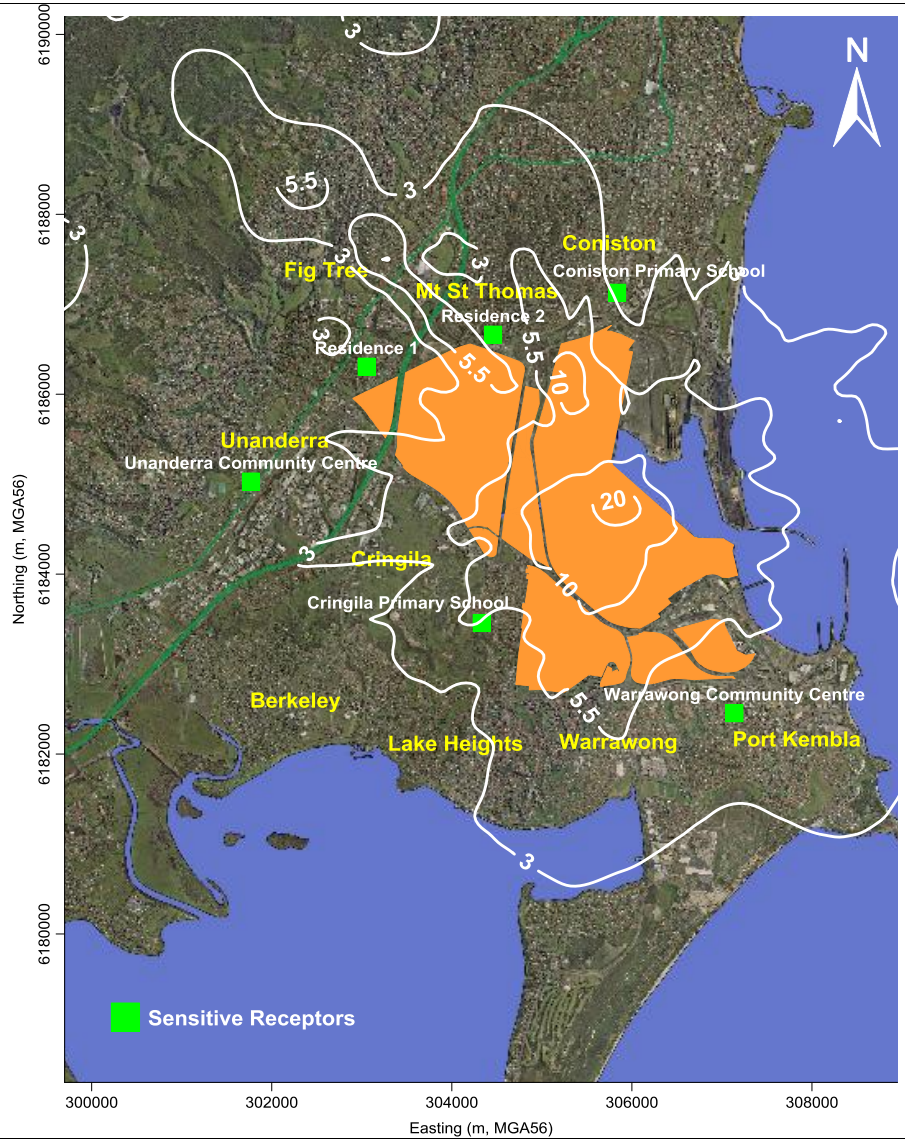
5.2 Mtpa – Maximum Nose-Response H_2S Concentration (µg/m³)



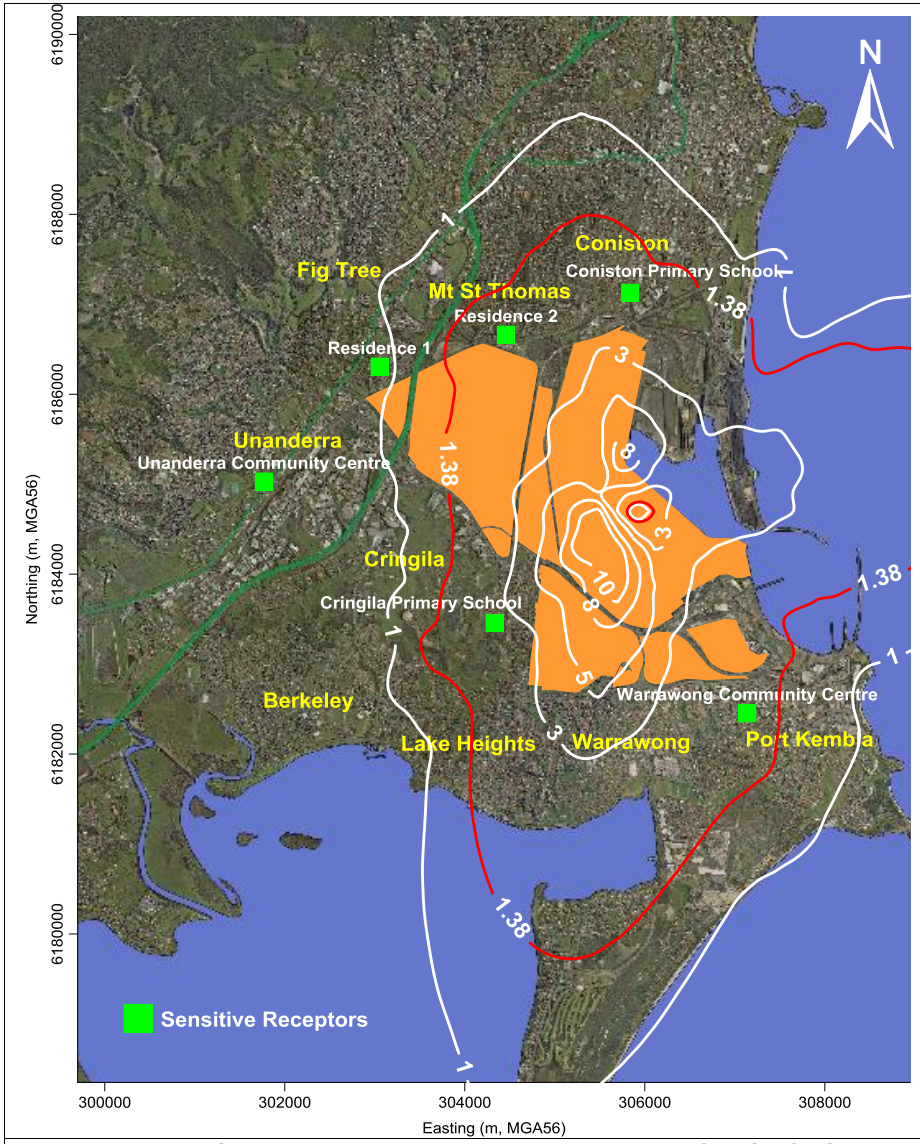
2.6 Mtpa – Maximum Nose-Response H_2S Concentration (µg/m³)



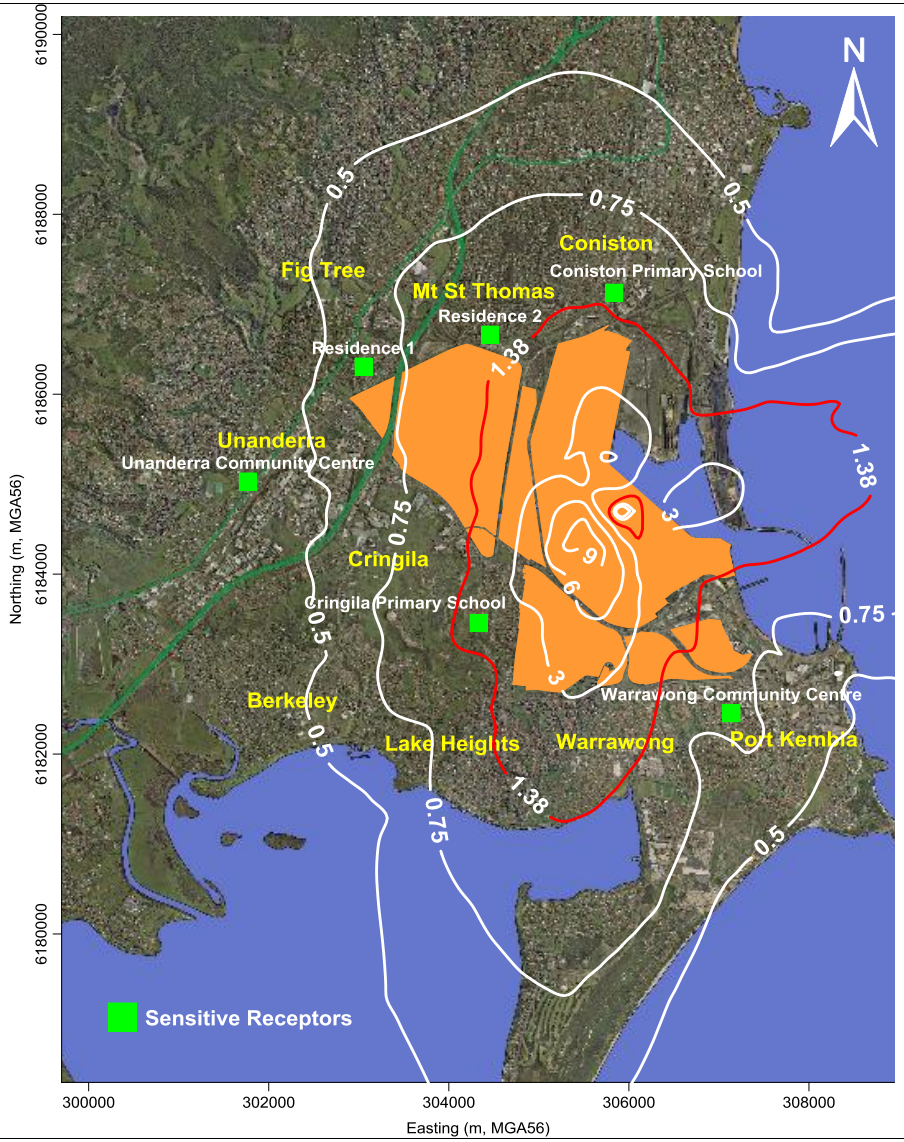
5.2 Mtpa – Maximum 1-hour Average H_2S Concentration (µg/m³)



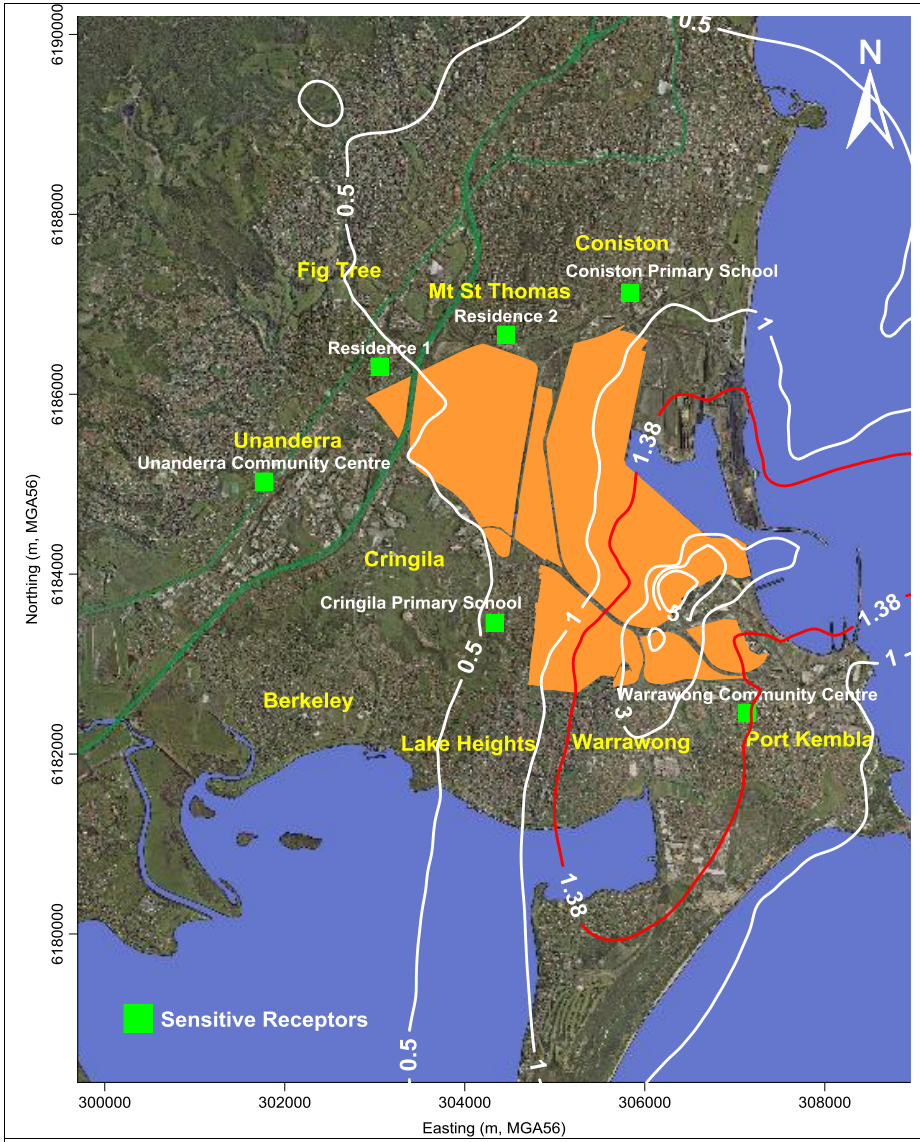
2.6 Mtpa – Maximum 1-hour Average H_2S Concentration (µg/m³)



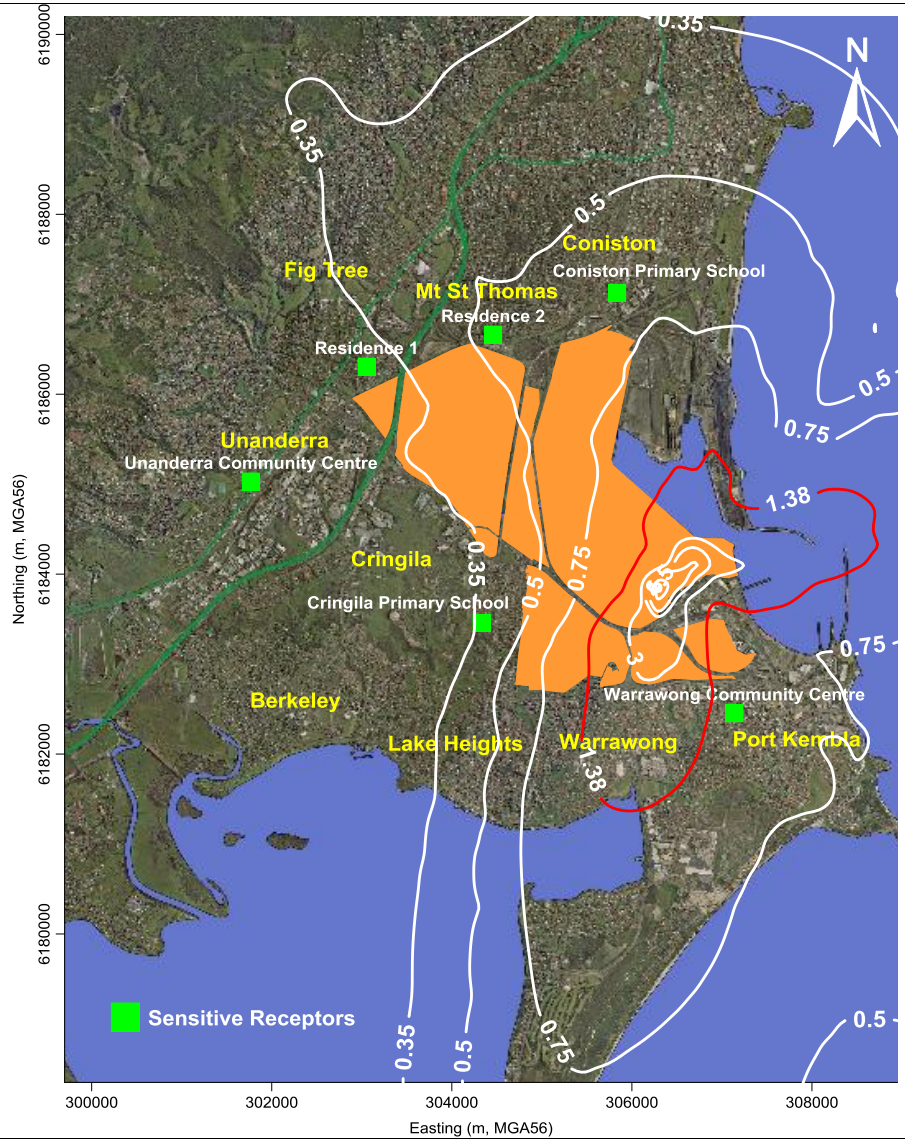
5.2 Mtpa – Maximum Nose-Response H_2S Concentration (µg/m³) – No.5 Blast Furnace Granulation Stacks Only



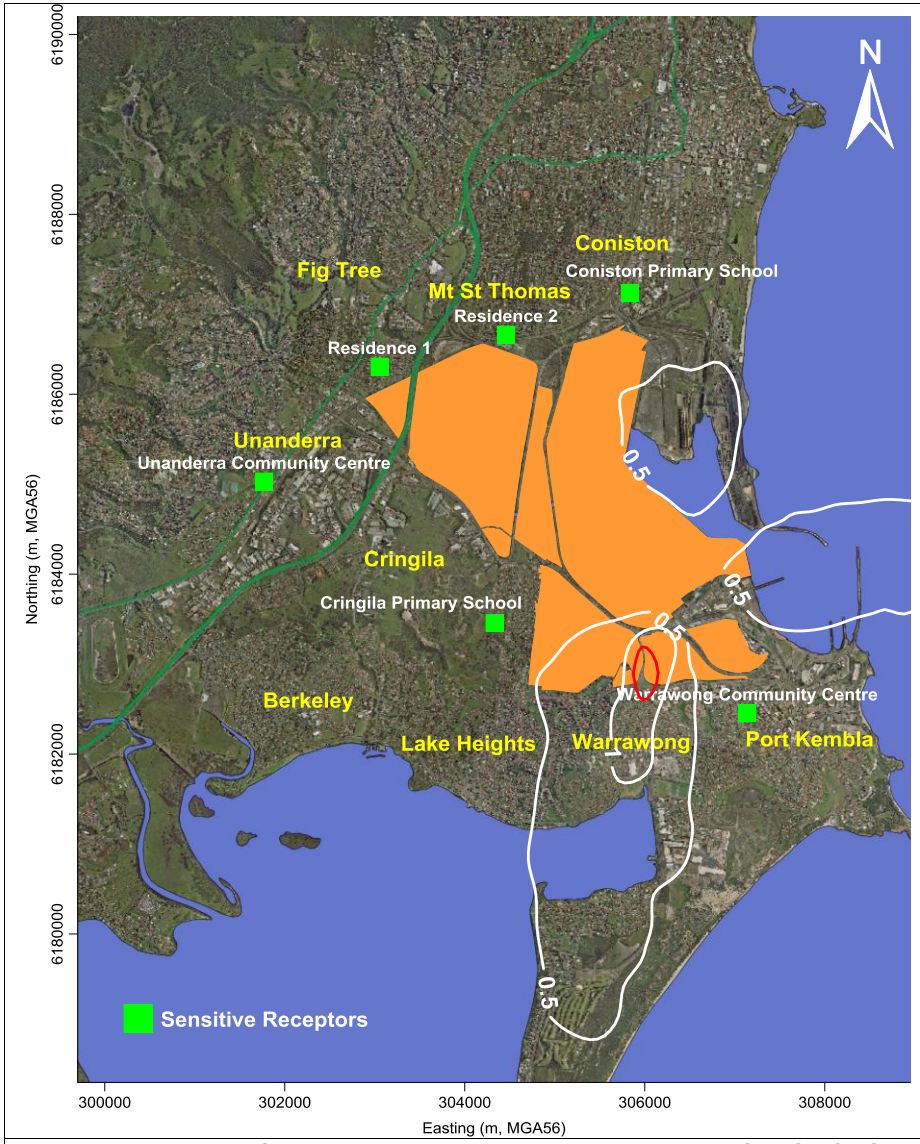
2.6 Mtpa – Maximum Nose-Response H_2S Concentration (µg/m³) – No.5 Blast Furnace Granulation Stacks Only



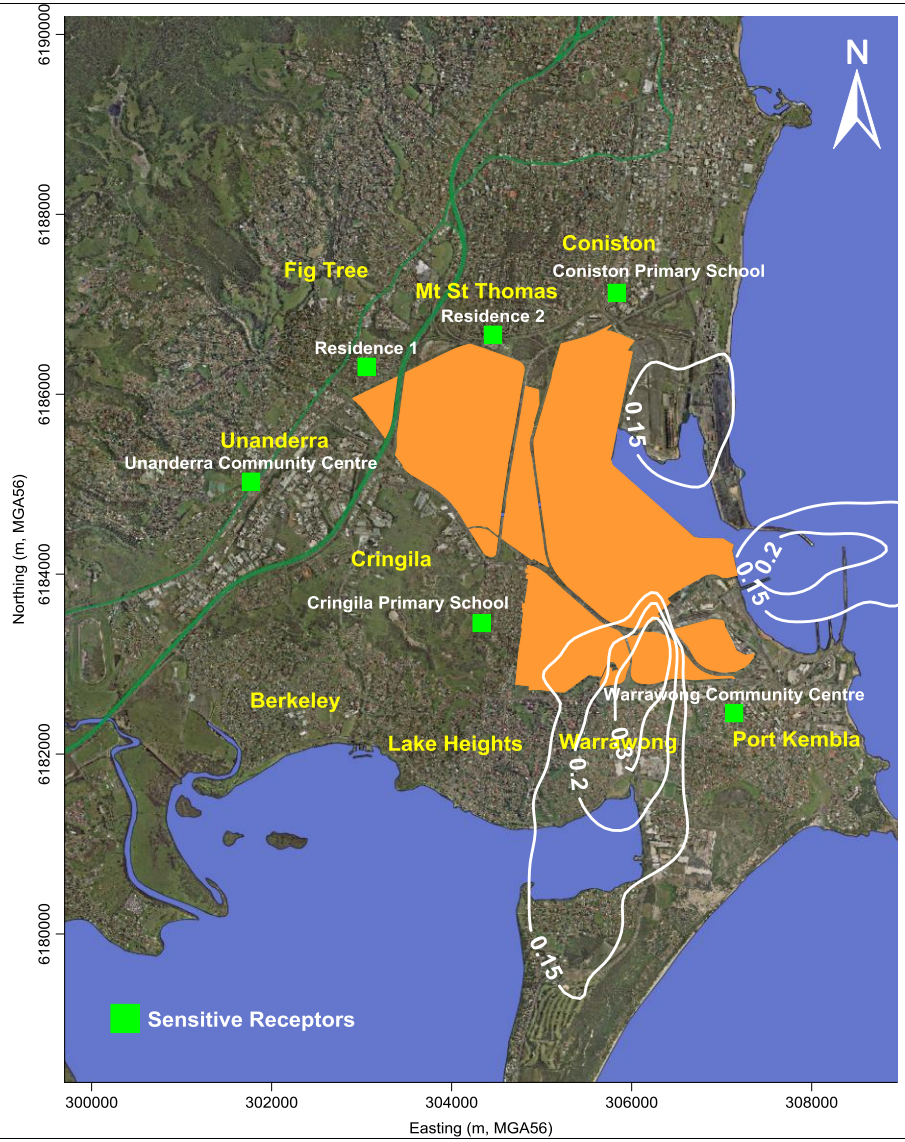
5.2 Mtpa – Maximum Nose-Response H_2S Concentration (µg/m³) – Coke Oven Battery Quench Tower Stacks Only



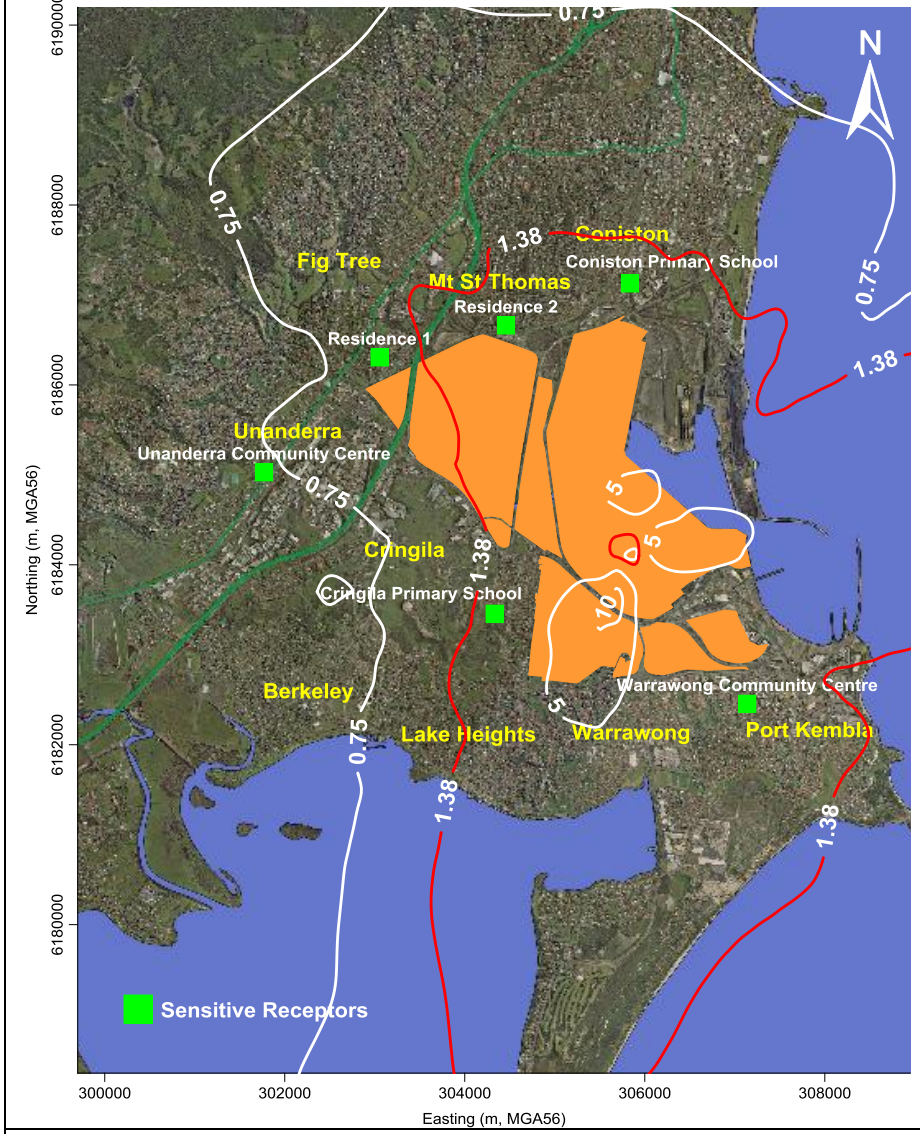
2.6 Mtpa – Maximum Nose-Response H_2S Concentration (µg/m³) – Coke Oven Battery Quench Tower Stacks Only



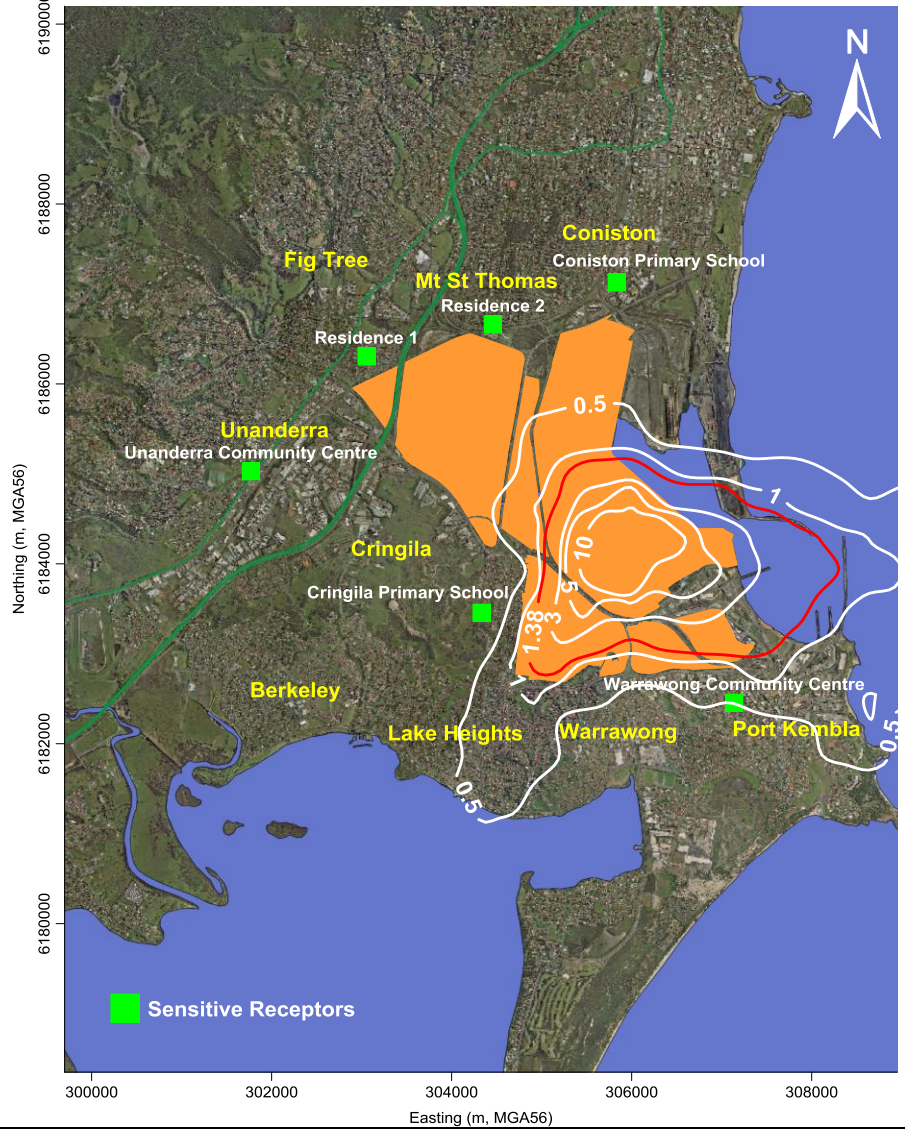
5.2 Mtpa – Maximum Nose-Response H_2S Concentration (µg/m³) – Coke Oven Battery Heating Stacks Only (EPA13,14,15,16)



2.6 Mtpa – Maximum Nose-Response H_2S Concentration (µg/m³) – Coke Oven Battery Heating Stacks Only (EPA14,15,16)



5.2 Mtpa – Maximum Nose-Response H_2S Concentration (µg/m³) – No.6 Blast Furnace Granulation Stacks Only



5.2 Mtpa – Maximum Nose-Response H_2S Concentration (µg/m³) – Slag Pit Fugitives Only