Air Quality Assessment

Remediation of Former Macdonaldtown Gasworks

Incoll Management Pty Ltd

On behalf of
Rail Corporation NSW

Former Macdonaldtown Gasworks
Burren St
Erskineville, NSW

August 2011
JBS40913-15136 Revision H

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List of Abbreviations

A list of the common abbreviations used throughout this report is provided below.

- As Arsenic
- Cd Cadmium
- Cr Chromium
- Cu Copper
- BTEX Benzene, Toluene, Ethylbenzene and Xylenes
- B(a)P Benzo (a) pyrene
- DCE Cis-1,2-dichloroethene
- DECC NSW Department of Environment and Climate Change
- DoP NSW Department of Planning
- DP Deposited Plan
- DQO Data Quality Objectives
- DWE NSW Department of Water and Energy
- EPA NSW Environment Protection Authority
- Hg Mercury
- HIL Health Based Investigation Level
- LOR Limit of Reporting
- MAH Monocyclic Aromatic Hydrocarbon
- Ni Nickel
- OCP Organochlorine Pesticide
- PCE Tetrachloroethene
- SAR Site Audit Report
- SAS Site Audit Statement
- PAH Polycyclic Aromatic Hydrocarbons
- Pb Lead
- PIL Phytotoxicity Based Investigation Level
- PCB Polychlorinated Biphenyls
- PQL Practical Quantitation Limit
- QA/QC Quality Assurance/Quality Control
- RPD Relative Percentage Difference
- TCE Trichloroethene
- TPH Total Petroleum Hydrocarbons (C_6-C_9 and C_{10}-C_{36})
- VC Vinyl Chloride
- VOC Volatile Organic Compound
- Zn Zinc

Executive Summary

JBS Environmental Pty Ltd (JBS) was engaged by Incoll Management Pty Ltd (Incoll) on behalf of the Rail Corporation NSW Environmental Projects Unit (RailCorp) to prepare an air quality study to accompany an Environmental Assessment for the proposed remediation of the former Macdonaldtown Gasworks located at Burren St Erskineville NSW.

The objectives of this air quality assessment are to:

- Estimate potential air emissions including particulates, potential chemical constituents and odours from the proposed remediation works;
- Identify the requirement and type of air emission controls required;
- Undertake dispersion modelling of air emissions to determine potential impacts to nearby receptors and adjoining properties to assess the effectiveness of proposed air emission controls;
- Undertake a health risk assessment to determine potential health impacts of speciated chemical constituents identified as occurring from the works to nearby receptors and adjoining properties;
- Based on results of air modelling, assess compliance with relevant NSW Office of Environment and Heritage (OEH) and National Environmental Protection Council (NEPC) published criteria; and
- Estimate the greenhouse contribution of the proposed works.

A range of activities that may be undertaken with the gasworks remediation has been considered in the air quality assessment including:

- Excavation, handling and stockpiling of low level contaminated soils;
- Excavation , handling and stockpiling of coal tar contaminated soils;
- Movement of site vehicles over non-paved site haulage roads;
- Treatment of coal tar contaminated soils on-site by bioremediation;
- Dewatering of coal tar impacted groundwater from excavations and operation of a water treatment plant;
- Potential pooling and evaporation of coal tar impacted groundwater within site excavations; and
- Backfilling of excavations and compaction.

The assessment has been completed by undertaking air modelling to determine the impacts at a range of representative receptor locations in close proximity of the site. A number of conservative assumptions have been assumed in the air modelling to determine of the nature air quality controls required. Modelling results have been compared to OEH published and endorsed air quality criteria. On the basis of the assessment, a number of air quality controls have been designed to reduce the air emissions from the proposed works to an acceptable level. These include:

The assessment has been initially completed by undertaking air modelling to determine worst case impacts for a range of representative receptor locations in close proximity of the site. A number of conservative assumptions, including the complete absence of any air quality controls, has been assumed in the air modelling to allow the identification of all site activities that will require air quality controls. Modelling results have been compared to OEH published and endorsed air quality criteria.

A number of air quality controls have been designed to reduce the air emissions from the proposed works. These include:

- Excavation Works: Water will be applied to disturbed areas at least hourly within the remediation site. Areas of coal tar impacted soil excavation will require addition of an odour suppression agent to the water sprays. Notwithstanding this recommendation, any works involving the excavation or handling of potential asbestos contaminated soils shall be undertaken subject to constant water application;
- Enclosure of Remediation Works: The excavation of soils impacted with high levels of coal tar anticipated in proximity of the northern gasholder and the former tar wells to the north of the gasholder shall require encapsulation within a ventilation controlled enclosure. Air discharges from the enclosure shall be through a controlled air filtering system designed to remove malodorous emissions and particulates;
- Soils Treatment on Site: Where treatment of coal tar impacted soils (as defined by the soil criteria summarised in **Table ES.1**) is proposed to occur on site this shall also be required to occur within a ventilation controlled enclosure. The enclosure shall be sufficiently sized to accommodate both the soil treatment works and the associated stockpiling;
- Odour Control: The presence of the coal tar impacted soils and groundwater on the site causes them to be highly malodorous on exposure during excavation and when stockpiled. A number of measures require implementation to minimise the impacts of odours including, in some sections of the site, enclosure of any excavation and soil handling works with treatment of air emissions to remove odours. In areas unsuited to the enclosure of soil handling activities, control measures shall include the minimisation of areas of exposed soils by works staging and covering of stockpiles, covering of tippers used to transport materials on the site, enclosure and controlled ventilation of any areas of splash filling the water treatment plant, installation and operation of an odour suppression system on the site boundary, application of odour suppression agents with dust control sprays during excavation and soil handling works and prevention of the exposure of contaminated groundwater saturated soils by control of water levels in open excavations. Materials with chemical concentrations exceeding those stipulated in **Table ES.1** shall not be stockpiled outside of enclosure without odour controls;
- Air Treatment System Monitoring: daily monitoring of volatile constituents will be required in emissions from the carbon filter forming part of the treatment system for the enclosure. When the measured concentrations exceed the nominated screening level the filter requires replacement and work within the enclosure shall be halted until a new filter has been installed;
- Site Monitoring: Site monitoring will be required, including assessment for particles less than 10 micron in diameter (PM_{10}), malodorous emissions, levels of volatile organic compounds, respirable fibres and dust deposition. Where site monitoring identifies potential exceedances of acceptable levels of dust or odour, site practices shall be reviewed, or the particular dust / odour

generating activity ceased until more favourable meteorological conditions occur or revised mitigation practices are adopted;

- Deep Excavations: Infiltrating coal tar impacted groundwater is to be prevented from accumulating within excavations by removing any ponded groundwater generated during the remediation works; and
- Monitoring: An atmospheric monitoring program requires to be implemented at the site boundary and adjoining residential areas to continually assess levels of airborne pollutants and offensive odours being generated by the works. Monitoring shall include dust and particulate, odour, asbestos and volatile constituents.

Table ES.1: Summary of Maximum Allowable Levels of Malodorous Constituents

Constituent	Criteria (mg/kg)	Comments
Benzene	2.5	-
Ethylbenzene	5	-
Toluene	10	-
Xylene (total)	10	-
Cresols	_	Non volatile, no limits requiring covering from odour potential
Acenaphthene	35	-
Naphthalene	25	-
Phenol	40	-

Notwithstanding the implementation of these air quality controls, it is considered likely that localised detections of coal tar odours will occur in close proximity of the site for the duration of the works. However the level of impact has been demonstrated by the air quality impact assessment not to be offensive, and is unavoidable in achieving the environmental rehabilitation of the site.

An Air Quality Management Plan (AQMP) detailing the requirements for the aforementioned controls and monitoring requirements has been prepared for the remediation program. The proposed controls are considered to be best practice for the proposed remediation works. The recommended controls above are identified as having a 'High' relative effectiveness (USEPA, 1991). Enclosure of soil handling works, with collection and treatment of air emissions, has been demonstrated as effective in protecting the surrounding community on other sites heavily impacted with tar (USEPA 1992).

1 Introduction

1.1 Introduction and Background

JBS Environmental Pty Ltd (JBS) was engaged by Incoll Management Pty Ltd (Incoll) on behalf of the Rail Corporation NSW Environmental Projects Unit (RailCorp) to prepare an air quality assessment to accompany an Environmental Assessment for the proposed remediation of the former Macdonaldtown Gasworks located at Burren St Erskineville NSW. The air quality assessment was required to determine the management procedures necessary to control potential air emissions from the remediation works proposed for the site.

In August 2000 the Site was found by the (former) NSW Environment Protection Authority (EPA) to pose a Significant Risk of Harm (SRoH) to human health and the environment. The finding was made in consideration of the concentrations of contaminants in the soil and groundwater reported in previous site investigations.

It is understood that RailCorp wish to remediate the site to a condition that:

- Results in the removal of the SRoH finding;
- Reduces health risks to future commercial / industrial site users to an acceptable level;
- Reduces the potential risks to the surrounding environment to an acceptable level; and
- Facilitates the beneficial use of the site for a future commercial / industrial use as consistent with rail activities.

The air quality assessment has been undertaken in accordance with the guidelines made or endorsed by the OEH, NEPC and enHealth including:

- NSW DEC (August 2005) 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales';
- NSW DEC (November 2006) 'Technical Framework Assessment and management of odour from stationary sources in NSW';
- NEPC (1999) 'National Environment Protection (Assessment of Site Contamination) Measure'; and
- enHealth (2004) 'Environmental Health Risk Assessment Guidelines for assessing human health risks from environmental hazards'.

1.2 Objectives

In developing an approach for the assessment it has been acknowledged that two types of air emissions will potentially occur from the site;

- Particulate/dust emission as associated with the handling of soils; and
- Odour/chemical emissions as associated with environmentally impacted materials which have driven the need for remediation works.

The chemical constituents impacting soils on the site are considered to be highly malodourous. Malodourous impacts are commonly found to precede potential toxicological impacts.

Dust controls for excavation / soil handling works are relatively widely used and easily identifiable for the proposed works on the site. Notwithstanding this, controls put in place to controls the potential chemical/malodourous emissions will also reduce potential dust emissions from the site. The controls developed discussed and modelled within this report are considered effective and feasible and have been included in the Air Quality Management Plan (AQMP) and Environmental Management Plan (EMP) prepared for the site.

On this basis, the assessment has been undertaken by the following approach:

- Describing the site, environmental condition of materials to be handled and assessment of existing air quality (**Section 2**);
- Description of the nature and scope of the proposed works and identification of the potential sources of air emissions and identification of best practice air quality controls (**Section 3**);
- Identification of air quality criteria to be protective of potential receptors in proximity of the site works (**Section 4**);
- Detailed descriptions of sources of odour emissions and quantification of anticipated rates of release of particulates, odours and associated chemical emissions (**Section 5**);
- Derivation of levels of potentially volatile constituents in soils where malodourous impacts are not anticipated to occur. The derivation of these criteria are used to facilitate the definition of malodourous soils throughout the remainder of the assessment (**Section 6**);
- Estimation of air quality impacts of the proposed remediation works on the basis of the air emission rates identified for each activity and the best practice air quality control as nominated (**Section 7**);
- Detailed description of the extent and proposed application of the range of air quality controls, and associated monitoring requirements to inform the preparation of the Air Quality management Plan (AQMP) (**Section 8**);
- An estimate of the greenhouse gas contribution of the proposed works (**Section 9**); and
- An estimate of the potential chronic health risk associated with the potential exposure of adjoining and nearby properties to chemical emissions from the works (**Section 10**).

2 Site Condition & Surrounding Environment

2.1 Site Identification

The site is located between Erskineville and Macdonaldtown railway stations. The site is roughly triangular in shape, being part of the area referred to as the Macdonaldtown Triangle. The site location is shown in **Figure 1**. The site details are summarised in **Table 2.1** and described in more detail in the following sections.

Table 2.1 Summary Site Details

Lot/DP	Part Lot 50 in DP1004167
Address	Burren Street, Erskineville NSW
Geographical Coordinates	624700N; 343200E
Local Government Authority	City of Sydney
Site Zoning	Railways as per SREP 26
Current Use	Vacant
Site Area	7,732m^2

A site plan showing the site is shown on **Figure 2**.

2.1.1 Proposed Future Use

RailCorp has advised that the site is to be remediated to a condition that facilitates commercial / industrial use of the site.

2.2 Current Site Condition

A site inspection was completed on the 25th March 2010 by JBS. The site was found to be overgrown with vegetation. Several stockpiles of predominantly soil and ballast based materials were located over the eastern portion of the site, which were being removed during the site inspection. It was reported by RailCorp representatives that the observed works were being undertaken to remove all stockpiled materials. The northern most former gasholder was observed as a circular area of exposed brickwork. The southern most gasholder was observed to be substantially intact. Some brick and metallic debris, presumably associated with the former operation of the site as a gasworks, was distributed throughout the remainder of the property.

The site has been previously delineated into eight areas by CH2M Hill (March 2007) 'Delineation & Characterisation Sampling and review of Remedial Options' (CH2M Hill 2007a). These areas are shown on **Figure 3** and include:

- Gasholders: encompasses both Gasholder structures adjoining the western boundary. The Southern Gasholder remains intact with the superstructure standing approximately 12 metres above the ground surface. The above ground structure of the Northern Gasholder has been demolished, however the brick annulus structure remains intact beneath the ground;
- Retort: encompasses the footprint of the former Retort House, Tar Wells, Condensers, Coal and Shale Storage areas and other building structures associated with the gasworks operations (office, amenities, etc). These buildings and structures have been demolished and associated structures are no longer visible above the ground surface. However some underground

structures remain in place, including the two Tar Wells, pipework, brick flooring and foundations and concrete slabs;

- Gas Purifier: encompasses the footprint of the former Purifier Beds, Scrubbers and Gas Meters. Similar to the Retort Area, structures only remain buried below the ground surface, with no above ground structures remaining;
- Northeast: includes the majority of the northeast section of the Site;
- South Central: includes the portion along the central southeast boundary;
- Southwest: includes the majority of the southern area of the Site;
- Retaining Wall: includes the filled area embankment along the northern site boundary; and
- Western Lot: includes the small rectangular section of land that extends west to Burren Street.

2.3 Surrounding Landuse

Surrounding land-uses include:

- North – Covered rail sidings are present adjoining the northern boundary of the former gasworks. Further north is located Macdonaldtown station and associated rail corridor;
- South-east – A noise barrier and access roadway is located adjoining the south-eastern boundary of the site. Further south is the rail corridor associated with the Illawarra and south-west rail corridor; and
- West – Residences fronting Burren St Erskineville are located adjoining the eastern boundary of the site. Residences consist of detached and semi attached low and medium density dwellings and small yard areas. Further west is located the residential area of Erskineville.

2.4 Topography

The site topography has been defined in CH2M Hill (December 2007) 'Remedial Action Plan Former Macdonaldtown Gasworks – Burren Street, Erskineville, NSW' (CH2M Hill 2007b). The Site is generally flat with a gentle grade that falls toward the south east. Along the western boundary that adjoins residential properties, the ground level falls off sharply to the backyards of the residential homes forming an embankment. This is considerable in the southern corner where there is a surface level difference of approximately four metres.

The ground surface of the adjoining northern property (Stabling Yards) is approximately 2m higher than the gasworks site, and this surface elevation extends into the gasworks site up to five metres in some places, where an old retaining wall was constructed (CH2M Hill 2007b).

2.5 Geology

The Sydney Geological Series Sheet 9130 (C. Herbert, 1999) indicates that the geological formation underlying the Site is the Wianamatta Group Ashfield Shale comprising black to dark-grey shale and laminite.

The Sydney Soil Landscape Series Sheet 9130 (G. A. Chapman et. Al, 1999) indicates that the Site soils are of the Residual Blacktown Grouping, consisting of:

- Landscape – gently undulating rises on Wianamatta Group shales and Hawkesbury shale. Local relief to 30m, slopes are usually <5%. Broad rounded crests and ridges with gently inclined slopes. Cleared woodland and tall open-forest;
- Soils – shallow to moderately deep (<100cm) Red and Brown Podzolic Soils (Dr3.21, Dr3.11, Db2.11) on crests, upper slopes and well-drained areas; deep (150-300cm) Yellow Podzolic soils and Soloths (Dy2.11, Dy3.11) on lower slopes and areas of poor drainage; and
- Limitations – moderately reactive highly plastic subsoil, low soil fertility, poor soil drainage.

Previous investigations on the site as reported in CH2M Hill (2007b) have identified three general soil types on the site including fill materials, natural soils and tar impacted fill and natural soils. Each is described in more detail in **Section 2.8**.

2.6 Meteorology

The Sydney area has a humid to temperate climate with a seasonal rainfall maximum during the summer and autumn months. The average rainfall for Sydney Airport Station is 1107mm. Rainfall ranges from 522-2025mm for Sydney Airport (DLWC, 2000).

The area has a history of droughts, which are broken by periods of heavy rainfall resulting in significant recharges to groundwater resources. The 1940's and 1980's and the current decade are observed to be dry periods, while the early 1970's and 1990's were wet periods.

Summer winds are northeasterly with southerly thunderstorms common. Winter winds are westerly. An assessment of the site specific meteorology is detailed with the preparation of meteorological data for the site in **Appendix A**.

2.7 Air Quality

Air quality in the Sydney region is impacted by a range of air pollution emissions sources including major industry, motor vehicles, commercial operations and leaking pipes and tanks as well as from domestic activities such as solid fuel heaters. A description of each of the major pollutants that may potentially be emitted by the proposed remediation works is provided in the following sections.

2.7.1 Fine particles

Particles (or particulate matter) in the atmosphere come from a wide variety of sources, including soil (dust), vegetation (pollens and fungi), sea salt, fossil fuel combustion, biomass burning and industrial activities. Particles in the atmosphere typically exhibit a bi-modal size distribution with a peak in the range of 0.1-2.5μm and a second peak in the range 2.5-50μm. As a result, particles with a diameter of up to 2.5μm ($PM_{2.5}$) are commonly referred to as fine particles. There is also a distinction in the health effects of different sized particles. Particles up to about 10µm (PM_{10}) diameter are inhaled, whereas larger particles are not. On this basis, the term 'fine particles' is often used to refer to PM_{10}.

Air monitoring results have been reviewed for each of the OEH air monitoring stations in proximity of the site to determine a typical background level of fine particulates. Air monitoring stations include:

- Randwick monitoring station located approximately 4km south-east of the site;
- Earlwood monitoring station located approximately 8km south-west of the site; and
- Rozelle monitoring station located in closest proximity to the site, being approximately 4.5km to the north-west of the site.

Levels of fine particulates, reported as PM_{10}, as recorded at each of the three stations are summarised in **Table 2.2** following for the most recent published monitoring available. Particulate levels are reported to be based on measurements using an oscillating microbalance and corrected to 0°C.

Table 2.2: Summary of PM_{10} Background Concentrations (µg/m^3)

Monitoring Station	24h Maximum	Monthly average	Source / Comments
Rozelle	37	17-22	January – March 2007[1]
	53	13-21	April – June 2007[2]
	31	13-18	July – September 2007[3]
	40	16-25	October – November – December 2007[4]
Randwick	45	18-24	January – March 2007[1]
	70	14-20	April – June 2007[2]
	31	13-18	July – September 2007[3]
	36	16-24	October – November – December 2007[4]
Earlwood	42	18-24	January – March 2007[1]
	67	15-26	April – June 2007[2]
	33	16-20	July – September 2007[3]
	49	16-29	October – November – December 2007[4]

Notes: 1. DECC (2007) 'Air Quality Monitoring Report 2007 Part A DEC Data January – February – March 2007'
2. DECC (2007) 'Air Quality Monitoring Report 2007 Part A DEC Data April – May – June 2007'
3. DECC (2007) 'Air Quality Monitoring Report 2007 Part A DEC Data July – August – September 2007'
4. DECC (2007) 'Air Quality Monitoring Report 2007 Part A DEC Data October – November – December 2007'

Based on **Table 2.2**, the maximum 24h level of PM_{10} recorded in proximity of the site using the most recent available monitoring data was 70µg/m^3, and monthly averages, approximately equivalent to the anticipated level of an annual average have been reported at 13 to 29µg/m^3.

2.7.2 Coarse Particles

Coarse particles remain in the air for relatively short periods of time and are therefore generally not carried long distances. As a result coarse particles tend to be a local rather than a regional problem, occurring close to industrial sources such as metal processing plants and mining operations. The level of particles in the atmosphere is determined by measurement of their mass. In the greater metropolitan area two methods of measurement are commonly used, total suspended particulates (TSP) and dust deposition rates (DDR). While the mass determined by these measures will include fine particles, these will generally only make a small contribution. Therefore measurements of TSP and DDR are used to provide an indication of the level of coarse particulates in the atmosphere.

Concerns about coarse particles are generally more in terms of nuisance such as damage to or soiling of materials, or adverse effects on sensitive vegetation through surface coating.

As per the discussion provided to **Section 2.7.1** the most recent data for the closest air quality monitoring stations has been reviewed to determine levels of total particulates as may be present in background air. It has been assumed that coarse particulates are present at 50% of the level of total particulates. This is a common assumption in several guidelines. Total particulates data has been summarised in **Table 2.3** following.

Table 2.3: Summary of Estimated TSP Background Concentrations (µg/m^3)

Monitoring Station	24h Maximum	Monthly average	Source / Comments
Rozelle	74	34-44	January – March 2007
	106	26-42	April – June 2007
	62	26-36	July – September 2007
	80	32-50	October – November – December 2007
Randwick	90	36-48	January – March 2007
	140	28-40	April – June 2007
	62	26-36	July – September 2007
	72	32-48	October – November – December 2007
Earlwood	64	36-48	January – March 2007
	134	30-52	April – June 2007
	66	32-40	July – September 2007
	98	32-58	October – November – December 2007

2.7.3 Air Toxins

Another group of air pollutants which can be hazardous to human health, even at low levels, are toxic compounds known as air toxins. This group includes chemicals such as benzene, formaldehyde, chlorinated hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and dioxins. Trace amounts of many of these chemicals have been detected in air in urban environments in a number of areas around the world.

In recent years there has been increasing community concern about air toxins in ambient air and the associated health effects. These compounds may cause cancer, gene mutation, reproductive malfunction, affect foetal development, or have neurotoxic effects. While the levels that endanger public health have not been established, it is believed that even very low levels, particularly under long term exposure, could have adverse effects. Many air toxins are highly volatile and evaporate readily into the air following inhalation.

Background levels of a range of air toxins that may be present in emissions from the Macdonaldtown remediation works have been assessed and reported in:

- NSW DEC (December 2004) 'Ambient Air Quality Research Project (1996-2001) Internal working paper no. 2 Ambient concentrations of toxic organic compounds in NSW';
- NSW DEC (December 2004) 'Ambient Air Quality Research Project (1996-2001) Internal; working paper no. 3 Ambient Concentrations of Polycyclic Aromatic Hydrocarbon Species in NSW'; and
- NSW DEC (December 2004) 'Ambient Air Quality Research Project (1996-2001) Internal working paper no. 4 Ambient concentrations of heavy metals in NSW'.

Airborne levels have generally been reported for the Sydney CBD, or the wider Sydney area. These levels are reported in **Table 2.4** following for each constituent that will be anticipated to be present in emissions from the site.

Table 2.4: Background Levels of Air Toxins in Sydney

Constituent	Background Concentration
Arsenic	0.51 ng/m^3 (1)
Cadmium	0.28 ng/m^3 (1)
Chromium	No data
Lead	48 ng/m^3
Nickel	No data
Cyanide	No data
Total petroleum hydrocarbons	No data
Benzene	2.3 ppb[1] (7.7$\mu g/m^3$)
Toluene	4.2 ppb[1] (15.4$\mu g/m^3$)
Ethylbenzene	0.5 ppb[1] (2.2$\mu g/m^3$)
Xylene	3.0 ppb[1] (13.1$\mu g/m^3$)
PAHs (total)	3.90 ng/m^3 (2)
Benzo(a)pyrene	0.40 ng/m^3 (2)
Phenols	No data
Asbestos	Nil

Note: 1. DECC (December 2004) overall average for Sydney CBD
2. DECC average of mean summer (Sydney) and winter (Sydney CBD) concentrations

2.7.4 Odour

Odour is measured using panels of people who are presented with samples of odorous gas diluted with decreasing quantities of clean odour-free air. The panellists report when the smell becomes detectable. Odour in air is quantified in terms of "odour units" which is the number of dilutions required to bring the odour to a level at which 50% of the panellists can just detect the odour. This process is known as olfactometry.

Background levels of odour in the environment can vary enormously based on a range of factors.

2.8 Previous Environmental Site Assessments

A range of previous environmental assessments have been completed for the site. These include:

- Rail Services Australia (November 1999) '*Eveleigh Gasworks – Site History*';
- CH2M Hill (June 2000) '*Phase I & II Environmental Site Assessments*';
- CH2M Hill (November 2000) '*Vegetable, Soil and Sediment Sampling – Letter Report*';
- CH2M Hill (December 2001) '*Soil and Groundwater Investigations of the former Gasworks Area and Offsite*';
- Australian Railway Historical Society (June 2003) '*A Brief History of NSW Railway Gasworks*';
- Banksia Heritage & Archaeology '*Macdonaldtown Station Works – Archaeological Assessment*';
- GHD (September 2005) '*Macdonaldtown Triangle (Former Cleaning Sheds) – Delineation and Classification Sampling*';
- Sinclair Knight Merz (April 2006) '*Macdonaldtown Triangle (Former Gasworks Site) – Human Health and Ecological Risk Assessment*';
- Heritage Concepts (November 2006) '*Archaeological Assessment and Remediation Management Strategy*';
- CH2M Hill (March 2007) '*Delineation & Characterisation Sampling and review of Remedial Options*'; and

- CH2M Hill (December 2007) '*Remedial Action Plan*'.

On the basis of a review of these assessments, CH2M Hill (December 2007) characterised the contamination status of the site. The characterisation is detailed in the following sections for each of the media of soils, groundwater, surface water and vapours.

2.9 Contamination Status - Soils

Previous investigations on the site as reported in CH2M Hill (2007b) have identified three general soil types on the site including fill materials, natural soils and tar impacted fill and natural soils. The findings of contamination assessments are summarised following. Reference should be made to **Figure 4** which shows the former operational areas of the gasworks.

2.9.1 Fill Material

Based on the findings of previous investigations as reported in CH2M Hill (2007b), the fill materials identified at the Site can be grouped as follows:

- Ash and Coke Gravels – observed across the majority of the Site in surface and near surface layers from ground level to approximately 0.5m depth;
- Reworked Clays – observed in subsurface layers in some site areas between 0.5m depth to approximately 1.5m depth. This material was observed in the majority of areas as general filling;
- Sands and Gravels – observed in subsurface layers in some site areas between 0.5m depth to approximately 1.5m depth. This material was observed in the North East, South Central and Gas Purifier areas;
- Gravelly Sand and Clay with Minor Ash – observed in surface and subsurface layers in some site areas from ground level to approximately 3.5m depth. This material was predominantly observed in the South West area of the Site as general filling; and
- Gravel, Sand and Demolition Wastes – observed in the fill embankment of the Retaining Wall and inside the annulus of the Northern Gasholder. This material was observed to mainly consist of sandy gravels and some ash gravels. It also consisted of demolition wastes and rubble including bricks, metal pipes, tiles, fibro-cement sheeting and Asbestos Containing Material (ACM) and other building rubble in a gravely sand matrix.

Organic Compounds

CH2M Hill (December 2007) reported that contaminants including polycyclic aromatic hydrocarbons (PAHs) including benzo(a)pyrene (B(a)P), semi- and non-volatile total petroleum hydrocarbons (TPH C_{10}-C_{36}), benzene and xylenes were reported as being present in a high number of samples at levels that exceeded the relevant commercial/industrial land use criteria.

PAH and B(a)P impacts were reported to be governed by the presence of tar in fill material proximal to source areas including underground tar pipes, the Retort area, Tar Wells and the Gas Purifier. The other major source of PAH and B(a)P impacts is a layer of ash/coke material covering the majority of the Site surface to a depth of approximately 0.5m.

TPH impacts were reported to be attributed to the presence of PAH, considering analytical results indicate that the main constituents of the TPH impacts comprise aromatic compounds.

Benzene and xylene impacts were reported to be related to the presence of tar in fill material proximal to source areas and also to the surface ash/coke fill layer.

The remainder of the organic contaminants were present in relatively low concentrations that meet the relevant land use criteria.

Inorganic Compounds

The majority of metal contaminants were reported in CH2M Hill (December 2007) to be at concentrations that meet the adopted land use criteria, with the exception of three samples that exceed the criterion for lead (Pb). This included samples collected from the fill present inside the annulus of the Northern Gasholder and the surface fill material in an area south of the Southern Gasholder.

Asbestos

All fibrous cement fragment samples collected from the surface and subsurface layers were reported in CH2M Hill (December 2007) to indicate the presence of asbestos. Fill samples collected from inside the Northern Gasholder and from the Retaining Wall indicated the presence of asbestos in this material.

The asbestos was reported to be present in these samples within a bonded matrix.

2.9.2 Natural Soils

Based on the findings of previous investigations as reported in CH2M Hill (2007b), the natural soil materials identified at the Site can be grouped as follows:

- Silty Clay – observed generally from between 1.5m depth to approximately 2.5m depth. This material exists across the majority of Site areas. This horizon was predominantly a saturated zone, which sustained the perched groundwater system;
- Red/Grey Mottled Clay – observed generally from between 2.5m depth to approximately 4.0-6.0m depth. The soil profile is consistent with a Red Podzolic soil, being moderately to highly plastic, stiff to very stiff, moist and mottled red/grey; and
- Weathered Shale – observed underlying the natural clay. This material grades from extremely weathered to moderately weathered at depths of up to 10m depth. At depths beyond 6m, fracturing of the material is common.

Organic Compounds

CH2M Hill (December 2007) reported that the results of the analysis of the natural soils indicated similar high numbers of samples that exceeded the relevant land use criteria for the same organic compounds as reported to be present in fill materials.

In particular, the volatile compounds benzene, xylenes and TPH (C_6-C_9) were reported to have higher ratio of samples exceeding the adopted assessment criteria as compared to the fill material. The reasons for this occurrence were considered by CH2M Hill (December 2007) to most likely to be a combination of:

- Higher solubility rates of shorter chained hydrocarbons that become mobile with infiltrating water or migrating groundwater;

- Volatilisation of these compounds from shallower fill materials;
- Higher impacts from leakage of tarry wastes from deep subsurface storage areas, especially from the Tar Wells and the Gasholders; and
- Vertical fracturing of natural clays and weathered shales, which provide a preferential pathway into deeper soils.

The remainder of the organic contaminants were reported to be at relatively low concentrations that met the relevant land use assessment criteria.

<u>Inorganic Compounds</u>

Metal and cyanide contaminants were reported at relatively low concentrations that meet the relevant adopted land use assessment criteria.

2.9.3 Tar Impacted Fill Material and Soils

A number of areas of fill/natural soil materials were observed to be impacted by tar and were summarized in CH2M Hill (2007b). The tar impacts have been categorised as follows:

- <u>Soil/fill impacted by free tar</u> – consisting of soil and fill materials impacted to a high degree with black ooze, highly odorous, liquor type material;
- <u>Tarry soils</u> – consisting of soil and fill materials with minor tar impacts and moderate odours; and
- <u>Dark Stained Impacts</u> – this material was observed as dark brown to black staining in the deep soils and Weathered Shale within the soil pores and shale fractures zones underneath the Southern Gasholder. This material was also moderately odorous.

Soil/fill impacted by free tar is material was reported by CH2M Hill (2007b) to be predominately associated with former gasworks infrastructure, which include the:

- <u>Tar Wells</u> – shallow subsurface and deep natural soils immediately adjacent to these two structures;
- <u>Northern Gasholder</u> – deep natural soils immediately adjacent to the brick base annulus; and
- <u>Old gasworks pipework</u> – inside pipes and immediately adjacent fill/natural soils.

Tarry soils are present at similar locations, however there is spatial separation between former gasworks infrastructure and tarry soils given tars have not migrated significant distances from gasworks infrastructure. Therefore there is a layer of highly impacted soils (free tar impacts) surrounding these structures followed by less impacted tarry soils. Tarry soils are located in the following areas:

- <u>Tar Wells, Northern Gasholder and Gas Purifier</u> – soil and fill surrounding these source areas in surface/subsurface fill and deeper natural soils;
- <u>Retort</u> – fill and deep soil across the majority of this area;
- <u>Gas Purifier</u> – Sandy fill and deeper soils; and
- <u>Localised impacted fill</u> – observed in one localised pocket in the Northeast Area.

Dark stained impacts were also reported in CH2M Hill (2007b) to be associated with deep soils below the base of the annulus of the southern gasholder. The dark stained impacts were considered likely to be secondary sources within the strata in localised areas associated with the Southern Gasholder.

Soil/fill impacted by free tar

Tar source material was reported to have been able to be collected from a former tar well and two buried pipes. Results of analysis have reported high levels of PAHs, TPH and BTEX.

Tarry Soils

Tar material was reported in CH2M Hill (December 2007) to be present within the fill/natural soil matrix and prevalent in areas proximal to the former gasworks structures and specific site areas including:

- The Tar Wells (Retort area);
- The network of underground pipes;
- The base annulus of the Northern Gasholder (Gasholder area); and
- The Retort and Gas Purifier areas – where tar exists in soil pores and soil fractures.

Contaminants including PAHs, TPH, benzene, toluene, ethylbenzene and xylene (collectively referred to as BTEX) were reported to be present in the tar impacted areas.

Tar impacts were reported to be limited to the former gasworks footprint area (i.e. Gasholders, Retort, Gas Purifier) and were considered unlikely to persist in areas away from the former gasworks footprint, such as in the Northeast, South Central, Southwest, Retaining Wall or the Western Lot site areas.

CH2M Hill (December 2007) further reported that the presence of a localised tar impact in the Northeast Area of the Site, at sample location TP16, indicates the potential for other areas of localised impact where tarry material may have been dumped or buried on site. It was further reported that the network of gasworks related pipework has only been partially delineated in the previous investigations. On this basis it was noted that in areas that pipework has not been delineated have the potential for additional tar impacts.

Dark Stained Soils and Fill Material

Dark stained material was reported by CH2M Hill (December 2007) to be observed as dark brown to black staining in the deep soils and Weathered Shale within the soil pores and shale fractures zones underneath the Southern Gasholder. This material appears different in nature to the tars observed at the base of the annulus of the Northern Gasholder. Dark stained materials were only observed underneath the Southern Gasholder.

Minimal contamination impacts were reported to be present beneath the Southern Gasholder including benzene impacts at 10m depth at a concentration of 1.6mg/kg.

Leaching Potential

Neutral water leaching tests were reported in CH2M Hill (December 2007) to have been conducted on three deeper natural soil samples collected from between 7.0m and 8.5m depth from areas below the Southern Gasholder, below the Northern Gasholder, and below the Gas Purifier area.

The results indicate that contaminants will leach under neutral conditions from the Northern Gasholder and Retort (deep tar impacted soil) source areas. The results show the contaminants that are likely to leach include benzene, xylene, naphthalene and C_{10}-C_{14} fraction TPH (from aromatic compounds).

2.10 Contamination Status - Groundwater

Previous investigations on the site as summarized in CH2M Hill (December 2007) have included the installation of groundwater monitoring wells on the Site and off site on RailCorp owned land down gradient of the Site.

Groundwater has been reported to occur as a shallow perched aquifer and deeper groundwater. Elevated concentrations of inorganic and organic contaminants have been reported in both groundwater systems. Concentrations of PAH, TPH (predominantly C_{10}-C_{36}), metals, phenols and BTEX exceed the adopted assessment criteria. The concentration of TPH in the C_6-C_9 range was also considered by CH2M Hill (December 2007) to exceed the solubility limit in water, in the deep groundwater system in the vicinity of the Gasholders. However no light-nonaqueous-phase-liquids (LNAPL) have been encountered in any groundwater monitoring wells on the site. It was further reported that there has been no identification of dense-nonaqueous-phase-liquid (DNAPL) in any groundwater monitoring wells.

Concentrations of contaminants have been reported to be lower in the shallow groundwater compared to the deeper groundwater.

The shallow groundwater contamination plume has been reported to extend 75m to the south and 50m to the east of the Site, while the deep groundwater contamination plume has been reported to extend 160m to the south and 50m to the east. Off site monitoring of groundwater has determined that the plumes are limited to RailCorp owned land.

The background water quality at the site is also reported to be impacted by some heavy metals, including cadmium, copper, nickel and zinc.

2.11 Contamination Status - Surface Water

Previous sample results reported by CH2M Hill (2007b) indicated that water accumulated in the site structures are impacted to varying degrees with both organic and inorganic contaminants.

These structures constitute the main sources of surface water at the Site and include the Tar Wells, the Northern and Southern Gasholders, and shallow fill material. Generally the organic contaminants were found to include the more soluble compounds including naphthalene and BTEX. The waters also showed moderate to high concentrations of TPH. Metal impacts were reported to include cadmium, copper, lead nickel and zinc.

2.12 Contamination Status - Vapours

The measured levels and results of modelling of soil vapour were reported in CH2M Hill (2007b). The results of soil vapour analysis were reported to indicate:

- Concentrations of benzene, ethylbenzene and xylenes below the LORs;
- Concentrations of toluene ranging from below the LOR to 28mg/m^3;
- Concentrations of PAH below the LORs; and
- Concentrations of naphthalene ranging from below the LOR to 0.00541mg/m^3.

It is reported to have been concluded in the SKM (2006) assessment that "*All test results measured concentrations of BTEX and PAHs well below the WorkCover Exposure Guidelines.*"……and……"*These results suggest there may be a low risk that soil-gas vapours at the former gasworks site are an environmental media of concern*."

Soil vapour levels as predicted by modelling were found to be substantially higher than measured levels.

2.13 Constituents of Potential Concern

On the basis of the review of the previous site assessments, CH2M Hill (December 2007) identified constituents of potential concern (COPCs) for each of the media as assessed on the site. This included:

<u>Soils</u>

- Monocyclic aromatic hydrocarbons (MAH), being benzene, toluene, ethylbenzene & xylenes (BTEX));
- Polycyclic aromatic hydrocarbons (PAH);
- Phenolic compounds (phenol and cresol isomers);
- Heavy metals (localised fill materials); and
- Asbestos.

<u>Surface Water and Groundwater</u>

- Monocyclic aromatic hydrocarbons (MAH), being benzene, toluene, ethylbenzene & xylenes (BTEX));
- Polycyclic aromatic hydrocarbons (PAH);
- Phenolic compounds (phenol and cresol isomers);
- Heavy metals including arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), lead (Pb), nickel (Ni) and zinc (Zn); and
- Cyanides

<u>Soil Gas</u>

- BTEX compounds and naphthalene as based on outcomes of computer simulation only.

TPH was excluded from the list of COPCs proposed by CH2M Hill (2007b) on the basis that the main components of TPH are aromatic compounds, as based on the consideration of the total concentrations of BTEX, PAH and phenolic compounds compared to total TPH concentrations. This is consistent with the enHealth (2001) '*Health-based Soil Investigation Levels*' approach to assessing TPH.

2.14 Areas of Environmental Concern

Areas of environmental concern were identified by CH2M Hill (2007b) and included:

- Tar in the Tar Wells;
- Tar residues in the network of underground pipework;
- Tar residues in the base annulus of the Northern Gasholder;
- Tar in soil pores and soil fractures in former gasworks areas;

- Potential tar residues in the base annulus of the Southern Gasholder as based on the historical use of this gasholder and the marginally elevated levels of contaminants in proximity;
- Demolition wastes including asbestos containing materials; and
- Ash and Coke fill materials across the majority of the Site in the surface and shallow subsurface layers

Each of these areas requires remediation.

3 Summary of Proposed Works

The information provided in the following sections has been summarised from the RAP (CH2M Hill 2007) prepared for the site. Further details on the proposed scope of works are also provided in the Remedial Strategy (JBS 2011) document prepared for the site. **Table 3.1** summarises the proposed scope of works and should be viewed in conjunction with **Figures 3** and **5** to **8**, which nominate the anticipated remediation areas/depths and likely locations for the associated infrastructure.

Table 3.1: Summary of Remediation Works

Stage	Task	Comments
Preliminary	Project planning and licensing	-
Site Establishment I	Setup of site offices, sediment and erosion controls	-
Remediation Stage I	1A – assessment/soil sampling of northern boundary retaining wall 1B- construction of internal turning circle, vegetation removal	1A - Blue area as shown on **Figure 5** 1B – Orange turning circle as shown on **Figure 5**
	1C – excavation/validation of the top 0.5m of fill material of the entire site surface. Transfer of excavated soil to Chullora for treatment prior to disposal to landfill	Purple shaded areas on **Figure 5** (ash & coke gravel fill) do not have a malodorous potential. These soils will be excavated by standard excavation practice to typical depth of 0.5m
	1D – excavation/validation of four hotspots to depths of 1-2m	Hot-spot at north-east of the site (**Figure 5)** in proximity of former sample location BH14. Benzene impact. Hot-spot at eastern of the site (**Figure 5)** in proximity of former sample location TP16. Free tar impact. Hot-spot at central southern boundary of the site (**Figure 5)** in proximity of former sample location MW04 (**Figure 3** Benzene impact. Hot-spot at south-western of the site (**Figure 5)** in proximity of former sample location MW13. Ash and coke impacts
Site Establishment II	Installation of temporary enclosure, associated air extraction/treatment system and water treatment system	Proposed locations shown on **Figure 6**.
Remediation Stage II	2A- commission air and water treatment system	-
	2B – excavate/validate areas within enclosure. Transfer of excavated soil to Chullora for treatment prior to disposal to landfill	Blue areas on **Figure 6** as present within the boundaries of the enclosure
	2C – reinstate enclosure excavation with imported Virgin Excavated Natural Material (VENM) or Excavated Natural material (ENM)	-
Remediation Stage III	3A – excavate/validate areas external the enclosure. Excavated material unsuitable for onsite bioremediation within enclosure to be transferred to Chullora for treatment prior to disposal to landfill	Orange areas on **Figure 8** as present external to the boundaries of the enclosure
	3B –Material assessed as suitable for remediation by bioremediation to be stockpiled for treatment within enclosure	-

Stage	Task	Comments
	3C – reinstatement of site using VENM or ENM, landscaping as required	-
Disestablishment	Decommissioning of air and water treatment plants, disestablishment of enclosure and site offices	-

The approximate quantities of materials associated with the above program of remediation, based on CH2M Hill (March 2007) are summarised in **Table 3.2** following. The handling / storage options associated with each of these material types is based on its waste classification, as per DECC (2009) '*Waste Classification Guidelines*'. The anticipated waste classification of material sourced from each excavation is also provided in **Table 3.2**.

Table 3.2: Summary of Remediation Volumes

Area	Volume	Description	Indicative Waste Classification
Surface soils	2,950m^3	Ash and coke fill. Excluding surface fill materials impacted with tar	General Solid
Contamination hot-spot at BH14	100m^3	Soils impacted with benzene	General Solid
Contamination hot-spot at TP16	115m^3	Soils impacted with coal tar. Potentially malodorous.	Restricted Solid / Hazardous
Contamination hot-spot at MW04	100m^3	Soils impacted with PAHs and TPH $C_{>10}$	General Solid
Contamination hot-spot at MW13	140m^3	Soils impacted with benzene	General Solid
Fill Behind Retaining Wall	1,765m^3	Soils impacted with PAHs, TPH $C_{>10}$, heavy metals and demolition wastes	General Solid
Fill Within Northern Gasholder to 4m bgl	1,900m^3	Soils impacted with PAHs, TPH $C_{>10}$, heavy metals, asbestos containing materials and demolition wastes	Restricted Solid
Fill and materials within Northern Gasholder >4m bgl	3,060m^3 (2,100m^3 tar impacted materials) (640m^3 tar impacted water) (320m^3 tar)	Tar impacted soils, free tar, tar impacted water. Potentially malodorous.	Hazardous
Former gasworks area	12,700m^3 (9,225m^3 shallow soils, i.e. <4m bgl) (2,375m^3 deeper soils, >4m bgl) (1,000m^3 tar impacted soils in tar wells) (100m^3 tar in tar wells)	Tar impacted soils, free tar, tar impacted water. Potentially malodorous.	Restricted solid / hazardous

3.1 Proposed Hours of Operation

Given the presence of commercial and residential properties in the vicinity of the site, personnel will only be on site during normal working hours. The expected hours for site works are therefore:

Monday to Friday: 7:00 am - 6:00 pm

Saturdays: 8:00 am – 1:00 pm

Sundays: No work permitted.

It is noted that some items of machinery, such as dewatering pumps, shall be required to operate continually. For modelling of air emissions it has been assumed that a standard ten hour day occurs on site, based on the standard allowable construction site hours, commencing at 7:00am. Meteorological data for air modelling is provided as hourly records. On this basis, and to maintain conservatism, it is assumed that the 10 hour period occurs between 7am and 5pm, to correlate to the hourly meteorological records within the meteorological data used for modelling, meteorological conditions conducive to poor dispersion of air pollutants occur in early morning periods (i.e. 7am records), are included in the modelling.

The use of a 10 hour day for the modelling period is considered appropriate given that the bulk of potential air emissions will occur during the standard working hours. Air emissions that will occur outside these standard hours will be related to fugitive emissions from static sources. The values of these fugitive emissions are likely to be a small percentage of the normal daytime emissions and are considered not to significantly impact air quality.

3.2 Identification of Sources of Air Emissions

The proposed scope of remediation works has been reviewed to identify potential sources of air emissions. Based on the site conditions described in **Section 2** and remediation scope of works described in **Section 3**, it is considered that the following works will require air emission controls:

- Excavation and handling of tar impacted soils wherever they should be encountered on the site to control potentially offensive odour emissions at receptor locations;
- Excavation and handling of tar impacted soils wherever they should be encountered on the site to control potential particulate emissions to receptor locations;
- Excavation and handling of tar impacted soils wherever they should be encountered on the site to control potential emissions of air toxins at receptor locations;
- Excavation and handling of all other soils excavated to control potential particulate emissions to receptor locations;
- Excavation and handling of all other soils excavated to control potential emissions of air toxins at receptor locations;
- On site treatment of tar impacted soils to control potentially offensive odour emissions, particulate and air toxin emissions at receptor locations; and

- Management of perched water seeping into excavations and the operation of the groundwater treatment system to prevent the release of unacceptable concentrations of air toxins.

The above works generally relate to control of odours during handling of tar impacted soils. In order to optimise the management of air emissions from the site, **Section 4** has been included to define 'tar impact' in soils in terms of odour potential. As such soils compliant with the criteria provided in **Section 4** will not require specific odour control measures, while those materials not compliant will be subject to the controls for reduction in duration of odour as described below.

3.3 Proposed Air Emissions Controls

The proposed air quality controls for each of the above works are summarised in the following sections. It is noted that air dispersion modelling is required for the detailed design of some of the air quality controls. Further to the outcomes of this modelling, the detailed design of the controls is summarised in **Section 7**. All the air quality controls have been documented in an Air Quality Management Plan (**Appendix B**).

3.3.1 Particulate Emission Controls

Water will need to be regularly applied to disturbed areas within the remediation site. It is reported by Midwest Research Institute that watering of surfaces at 2 hourly intervals reduces dust emissions by 61%, and watering at hourly intervals reduces dust emissions by 74%. It is recommended that all disturbed surfaces are watered by water cart at hourly intervals throughout the remediation works. This shall include:

- Areas of excavation;
- Areas of stockpiling;
- Areas of exposed soils where fugitive dusts may occur; and
- Haulage roads.

3.3.2 Controls for Reduction in Duration of Odour

The following measures are proposed to minimise the potential impact of tar impacted materials:

- Enclosure of excavation works in areas of significant coal tar impact where it may be practically implemented; and
- Enclosure of any soil treatment works to be conducted on the site.

Where lower levels of widespread coal tar impact are present enclosure of works is not required, however excavation and stockpiling in these areas should be managed excavation such that:

- No more than $400m^2$ of *in-situ* materials are exposed in surface soil excavations;
- No more than $25m^2$ of *in-situ* materials are exposed in retaining wall fill excavations; and
- Stockpiled materials to be left uncovered for an extended period outside of the enclosure must be demonstrated to comply with the site specific odour based criteria provided in **Section 8**.

- For works required outside of the enclosure, infiltrating groundwater should be prevented from accumulating within excavations present on the site; and
- Any areas of splash filling associated with the water treatment plant require to be enclosed to control emissions. Emissions within the enclosed area require to be filtered through GAC filters.

The maximum areas of 400 m^2 and 25 m^2 described above for exposed surface soil and retaining wall excavations were derived from dispersion modelling of worst case and controlled conditions. Details regarding this modelling scenario are provided in **Section 5**.

3.3.3 Enclosure of Odour Generating Works

The enclosure shall be constructed and operated in such a way that it is maintained under negative pressure. Air emissions from the enclosure will require treatment through bag filters to remove particulates and granular activated carbon (GAC) filters to remove potential malodorous emissions.

3.3.4 Soil Treatment on Site

For soils assessed to be suitable for treatment on site by bioremediation, treatment and associated soil stockpiling and handling activities shall occur within the enclosure. The enclosure shall be constructed and operated as described in **Section 7** and **Appendix B**.

Alternately, treatment of malodorous materials may potentially be undertaken at the RailCorp nominated off-site facility at Chullora.

3.3.5 Deep Excavations

Infiltrating groundwater should be prevented from accumulating within excavations present on the site. This will be achieved by continual extraction as required to prevent ponding of water within the excavations.

4 Air Quality Criteria

Air quality criteria are provided and endorsed by the OEH and are provided in DEC (2005) 'Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW'. This document specifies a range of impact assessment criteria for toxic and malodorous air pollutants. The impact assessment criteria for these pollutants associated with the proposed remediation works are summarised in **Table 4.1**.

In addition to assessment of results to the OEH endorsed air quality criteria for each of the principal contaminants recorded on the Macdonaldtown Site, estimation of incremental risk and hazard index of the proposed air quality impacts from the site works has been undertaken. This is detailed in the Health Impact Assessment as detailed in **Section 10**.

Table 4.1: OEH Air Quality Impact Assessment Criteria

Pollutant	Concentration		Averaging Period
	ppm	µg/m3	
PM10	-	50	24 hour
	-	30	Annual
Total Suspended Particulates	-	90	Annual
Benzene	0.009	29	1 hour
Benzo(a)pyrene	-	0.4	1 hour

The air quality impact assessment criteria require to be assessed at each of the nearest potentially affected off-site properties.

Dust deposition criteria are also provided by DEC (2005). A maximum increase of dust deposition of 2 g/m^2/month requires to be adopted for the proposed works at Macdonaldtown, based on the strong likelihood that existing levels of dust deposition currently exceed 2 g/m^2/month.

4.1 Ambient Air Quality Criteria

The relevant ambient air standards and goals are provided in NEPC (1998) 'National Environment Protection (Ambient Air Quality) Measure' and DEC (2006) 'Action for Air – the NSW Government's 25-year Air Quality Management Plan'. The air quality goals contained within these guidelines are designed for use in assessing regional air quality and are generally not intended for use as boundary or atmospheric dispersion modelling criteria. Although the proposed remediation works have not been assessed directly against these guidelines it should be noted that the maximum concentrations in these guidelines for PM_{10} are identical to the OEH criteria in **Table 4.1**.

4.2 Odour Impact Assessment Criteria

Odour performance criteria are provided in DEC (2006) 'Assessment and management of odour from stationary sources in NSW'. The detection of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. The point at which an odour is detected is called the 'odour threshold' and defined as 1 odour unit (1 OU).

In practice the character of a particular odour can be judged by the receiver's reaction to it. DEC (2006) advises the level at which an odour is perceived to be of nuisance can range from 2OU to 10OU depending on a combination of a number of factors including: odour quality; odour intensity; odour frequency, timing and duration; population sensitivity; background level; public expectation; source characteristics; and health effects. DEC (2006) provides a range of odour assessment criteria for various population densities. The lowest of the available criteria of 2 odour units (2 OU) has been adopted for this study. The peak concentration of odour, calculated as a 1 second average using the guidance provided in DEC (2005), requires to be complied with at each of the nearest potentially affected off-site properties.

DEC (2006) advises the use of peak to mean ratios to convert modelled odour levels at one hour averaging to times to maximum 1 second concentrations, consistent with olfactory detection times. Peak to mean ratios are summarised following for each source of odour emissions included in the modelling:

- Area source – 2.3 (E and F stability classes where maximum levels occur)

5 Sources of Air Emissions

Table 5.1 summarises the following potential air emissions arising from the proposed remediation program.

Table 5.1: Summary of Air Emissions

Works	Air Emissions
Excavation and handling of soils	Particulates, Air toxins, Odours, Greenhouse gases
Haulage of soils across site roads	Particulates, Greenhouse gases
Stockpiling of soils	Particulates, Air toxins, Odours, Greenhouse gases
Treatment of soils	Particulates, Air toxins, Odours, Greenhouse gases
Fugitive dust emissions from exposed surfaces	Particulates, Air toxins (where contaminated soil exposed), Odours
Volatilisation of impact in groundwater	Potentially Volatile Groundwater Contaminants, Odours
Dewatering and transfer of groundwater	Potentially Volatile Groundwater Contaminants, Odours
Infiltration and pooling of contaminated groundwater within deep open excavations	Potentially Volatile Groundwater Contaminants, Odours

Details of the methods used to estimate the emissions from each of the above sources is discussed in the following sections, including, where appropriate, the value used to incorporate the effect of the relevant control measures described in **Section 3**.

Due to the nature of the emissions, greenhouse gas emissions are considered separately in **Section 9.**

5.1 Excavation of Soils

Soil excavation is required to remove contaminated soils. **Table 5.1** includes the quantities of soils that are anticipated to require removal. Anticipated excavation rates are required to allow air emission rates to be estimated. The following excavation rates are anticipated to occur during remediation works:

- Surface soils and contamination hot-spots – 500m^3/day;
- Fill materials behind the northern retaining wall – 300m^3/day;
- Fill materials from within northern gasholder – 100m^3/day; and
- Impacted soils across former gasworks area (tar impacted soils) – 200m^3/day.

In applying these rates it has been assumed that only one area will be subject to excavation at any given time.

A reduced excavation rate is proposed for the tar impacted materials as significant treatment / handling works will be required on excavation. The handling requirements will control the rate at which the soils can be excavated.

An emission factor for excavation and loading of soils is provided in NEPC (2001).

$EF = k * 0.0016 * (U / 2.2)^{1.3} * (M/2)^{-1.4}$

where: EF – Emission factor (kg/t)

U – Wind speed (m/s)

M – Moisture content

k – 0.74 for TSP, 0.35 for PM_{10}

It is noted that groundwater is present at a shallow depth in many of the impacted areas requiring excavation. Materials excavated from below the depth of groundwater will be in a saturated condition and are not anticipated to generate dust. However it has been assumed in modelling that all materials will be equally likely to generate dust (saturated in addition to non-saturated).

The soils on the site are found to be typically clay based. Based on a brief review of the laboratory analysis of soil samples from the site a moisture content of 0.1 has been adopted.

It is noted that volatile and semi-volatile constituents present in soils may be rapidly volatilised during soil excavation works. The potential release of chemical vapours during soil handling and stockpiling works has been assessed in **Appendix C**.

Additionally the effect of the proposed hourly watering of disturbed areas on mitigating emissions from excavation of soil has been included by reducing the emission factor by 74% consistent with the literature review described in **Section 3.3.1**.

5.2 Haulage Across Site Roads

In the time between remediating and reinstating the site, soils will be transported across site roads and more than likely be removed from the site. Departure from site will be via the site access/egress located at the south-west of the site. A paved access road moves from this point into Swanson Rd, Erskineville. Environmental controls (i.e. wheel wash / vehicle decontamination) will be present at the south-west of the Macdonaldtown site, prior to vehicle movement onto the paved road. These will restrict dust emissions associated with vehicle movement over roads to the dimensions of the Macdonaldtown site as shown on **Figure 6**. An emission factor for paved roads is provided in NEPC (1999a).

$EF = k_{iu} * (s/12)^{A} * (AW/3)^{B} / (M/0.2)^{C}$

where: EF_{iu} – Emission factor for particle size category 'i' and unpaved roads (kg/km)

K_{iu} – Empirical factor for particle size category 'i' and unpaved roads (0.35 for PM_{10} and 0.74 for TSP)

s – Surface material silt content (%)

AW – Average weight of vehicles, tonnes

M – Surface material moisture content (%)

A, B and C are empirical constants (A = 0.8, B=0.5 and C=0.4 for TSP and A=0.8, B=0.4 and C=0.3 for PM_{10})

It is noted that gravelly sands that have been identified as surface soils over the majority of the site have relatively low silt contents. It has been assumed that surface soils on the site, as may be present on site roadways, will have a silt content of 5%. This would be anticipated to decrease in the most likely scenario where imported materials (i.e. crushed stone) are used to pave roadways on the site.

Movement over unpaved roads would typically be by 10T tippers transporting soils. Excavator movement would be anticipated to be insignificant in comparison.

Additionally the effect of the proposed hourly watering of disturbed areas on mitigating emissions from excavation of soil has been included by reducing the emission factor by 74% consistent with the literature review described in **Section 3.3.1**.

5.3 Fugitive Dust

Exposed surfaces will be anticipated to generate dust by wind movement and erosion of surface particles. The excavated areas of the site and the proposed area of stockpiling have been considered as having an unlimited wind erosion potential subsequent to the completion of excavation works. This is characterised as being a smooth field, lacking any vegetation and covered with loose sandy soil. The site immediately subsequent to excavation works may be characterised as this. A general emission factor of 0.85 tonnes/ha.year is provided in NEPC (1999b) for this scenario.

This worst case emission factor, reduced by a factor of 74% to account for hourly watering, has been used to predict emission rates from stockpiled soils as will be present on the site.

5.4 Stockpiling and Handling of Soils

Stockpiling and handling of soils will principally be undertaken in each of the areas of proposed excavation works. Localised stockpiling will generally occur adjoining the area of excavation prior to loading of materials onto road tippers for off-site disposal, on-site treatment or off-site treatment.

The greatest potential for the release of air pollutants from the stockpiles will be during handling of soils. The emission factor provided for excavation is considered to be sufficient to allow estimation during this activity.

The emission factor for fugitive dust is considered suitably conservative to estimate the fugitive emissions at other times from the stockpiled soils. The worst case emission factor has been used to predict emission rates from stockpiled soils as will be present on the site within the enclosure. The worst case emission factor has been reduced by a factor of 74% for stockpiles external to the site enclosure to account for the impact of hourly watering on reducing proposed emissions.

5.5 On-Site Treatment of Soils - Bioremediation

Bioremediation of soils will typically be undertaken by stockpiling of soils. This will occur on the site as uncovered stockpiles within the controlled ventilation conditions of the enclosure. Modelling has assumed the uncovered spreading and stockpiling of soils only. Covered bioremediation areas would not be anticipated to release particulates. Emissions of chemical and malodorous constituents would be anticipated to be the same for each scenario. Emissions for the bioremediation areas would be anticipated to be similar to those predicted for soil stockpiling in **Section 4.4**. The same emission factors will be adopted for bioremediation.

5.6 Sorbed Impact to Soils

Elevated levels of several contaminants have been identified in soils underlying the site. Particulates generated by these soils will be anticipated to be similarly subject to contamination. Consequently, levels of contaminants in generated dusts must also be considered. It has been assumed for this calculation that soil contaminants are present at the same concentrations within particles as present in soils.

5.7 Groundwater Exposure

Groundwater will be anticipated to enter deeper excavations as placed across the site, more than likely necessitating dewatering works. This groundwater is proposed to be dewatered and transferred to holding tanks. Volatile and semi-volatile constituents present in groundwater will volatilise out of groundwater. This will most likely be most significant where groundwater is discharged into the holding tanks. It has been assumed that the area of water transfer is open to the atmosphere.

Volatilisation of impact present in this transferred water is able to be estimated using the shower model as provided in NZ Ministry for the Environment (1999). Details of calculations using this model are provided in **Appendix C**.

Groundwater is also anticipated to potentially pool in each of the deeper excavations on the site. It is likely that groundwater will be impacted with dissolved contamination as recorded in groundwater monitoring wells and by tar in highly impacted areas of the site. The pooled water would be anticipated to evaporate, causing releases of dissolved impact present within the water. The following equation is presented in US EPA (2004) 'Methods for Estimating Fugitive Air Emissions of Radionuclides from Diffuse Sources at DoE Facilities' to estimate releases by evapo-transpiration.

$R = (20.73 * P_S * A^{0.9} * U^{0.8} * a * 3600) / T^{1.47}$

where: R – emission rate (g/hr);

P_S – vapour pressure of water at ambient temperature (assumed to be 20°C, 293 K, equal to 17.5 mm Hg)

A – surface area of pooled water

U – wind speed at pooled water surface (m/s)

T – Ambient temperature (K)

a – concentration of constituent in water (g/g)

5.8 Constituents Present in Soils and Groundwater

Soil and groundwater data has been analysed in CH2M Hill (March 2007). Statistical analysis of the levels of principal constituents of potential concern (COPCs) identified by CH2M Hill as benzo(a)pyrene and benzene, have been detailed for a range of material types on the site. Of the constituents identified at significant levels, benzene and benzo(a)pyrene are found to be most potentially toxic. Benzene is also found to have a significant volatilisation potential. This is detailed in **Table 5.2** following.

Total PAHs have also been detailed for materials that have been identified as potentially malodorous. These are used in **Section 5.9** to estimate potential odour emissions from tar impacted soils.

Table 5.2: Summary of Levels of Principal COPCs in Site Soils

Site Area	Constituent	Mean Concentration	Maximum Concentration
Surface soils, ash and coke gravels	Benzo(a)pyrene	31.2	339
	Benzene	0.24	4.2
Reworked clays / fill materials (including hot-spots and areas of free tar)	Benzo(a)pyrene	21	444
	Benzene	0.25	4.6
	PAHs (total)	674	15,238
Silty clays (near surface depths, including hot-spots and areas of free tar)	Benzo(a)pyrene	19.0	178
	Benzene	0.73	4
	PAHs (total)	589	5,302
Gravel, Sand & Demolition Wastes (behind retaining wall and within northern gasholder)	Benzo(a)pyrene	18.26	150
	Benzene	1.2	15
Red / Grey Clays (deeper soils, including hot-spots and areas of free tars)	Benzo(a)pyrene	2.2	13.9
	Benzene	1.4	20
	PAHs (total)	85.4	516
Weathered Shales (deeper depths at vertical extent of excavation, including free tars)	Benzo(a)pyrene	0.6	17.6
	Benzene	1.3	7.5
	PAHs (total)	96	1,906

Tar impacted water as present in a tar well on the site has also been characterised by previous sampling and analysis in CH2M Hill (March 2007). Levels of impact in the water are summarised in **Table 5.3**. These levels would also be indicative of the highest levels of impact that would be anticipated in infiltrating seepage water that will occur in excavation of highly impacted soils.

Table 5.3: Summary of Maximum Concentrations of Impact in Tar Impacted Water on Site (mg/l)

Constituent	Maximum Concentration
Acenaphthene	0.215
Acenaphthylene	1.45
Anthracene	0.482
Benz(a)anthracene	0.357
Benzo(a)pyrene	0.277
Benzo(b)fluoranthene	0.259
Benzo(g,h,i)perylene	0.124
Benzo(k)fluoranthene	0.0771
Chrysene	0.288
Dibenz(a,h)anthracene	0.0336
Fluoranthene	0.622
Fluorene	0.75

Constituent	Maximum Concentration
Indeno(1,2,3-c,d)pyrene	0.0979
Naphthalene	20.9
Phenanthrene	1.52
Pyrene	0.651
Benzene	1.36
Ethylbenzene	0.16
Toluene	1.26
Xylenes	1.903

From review of **Table 5.3**, it can be observed that benzene is present at significant concentrations within the water, as compared to the other constituents, and benzo(a)pyrene, a known animal carcinogen is also present, despite being detected at a lower concentrations. Consequently, assessment of potential impacts of chemical constituents will be appropriately undertaken by assessment to these two constituents, as adopted for the assessment of soil impact.

Specific sampling and analysis of coal tar has also been undertaken. This represents the maximum concentrations of constituents that may occur in materials as excavated from the site. Maximum levels of constituents are summarised in **Table 5.4** following.

Table 5.4: Summary of Maximum Concentrations of Impact in Coal Tar (mg/kg)

Constituent	Maximum Concentration
Acenaphthene	355
Acenaphthylene	2,260
Anthracene	1,380
Benz(a)anthracene	921
Benzo(a)pyrene	595
Benzo(b)fluoranthene	364
Benzo(g,h,i)perylene	250
Benzo(k)fluoranthene	545
Chrysene	765
Dibenz(a,h)anthracene	99.3
Fluoranthene	1,770
Fluorene	1,720
Indeno(1,2,3-c,d)pyrene	241
Naphthalene	9,750
Phenanthrene	3,920
Pyrene	1,870
Total PAHs	26,805
Benzene	576

Constituent	Maximum Concentration
Ethylbenzene	156
Toluene	1,210
Xylenes	1,506
Phenol	2,060
2-methylphenol	1,730
3- and 4-methylphenol	3,590
2,4-dimethylphenol	2,490
2,6-dichlorophenol	2.4

Benzene and benzo(a)pyrene can be observed from review of **Table 5.4** to constitute a significant proportion of the constituents of coal tar. As with impacted soil and water, potential chemical impacts will be assessed by consideration of benzene and benzo(a)pyrene only.

5.9 Odour Emissions

Some of the hydrocarbon constituents identified in soils and groundwater underlying the site, and which will be potentially released from the site during the remediation works, are observed to be potentially malodorous. As discussed within the previous CH2M Hill assessments and the characterisation of contamination on the site, the source of hydrocarbon contamination is found to be coal tar. Previous odour analysis of coal tar has been undertaken in Egis Consulting (August 2001) '*Thiess Services Notice of Intention for Demolition and Earthworks Former Platypus Site Neutral Bay, North Sydney*'. Coal tar has been found to have an odour strength of 290 OU/m^2.s. This odour strength has been used in modelling of potential worse case odour impacts of the excavation and soil handling works.

The majority of excavation works will not comprise the excavation and handling of 'pure' coal tar. Instead coal tar impacted soils will be stored and handled for the majority of the works. The odour generating potential of these materials is considered to be reduced as a function of the decreasing coal tar content. The extent of coal tar impact in these soils has been estimated by the comparison of total PAH levels in the sample of coal tar from the site and total PAHs in the site soils. On this basis, the following odour emission rates have been determined as summarised in **Table 5.5**.

Table 5.5: Summary of Odour Emission Rates

Site Activity / Source	Odour Emission Rate	Basis of Estimation
Excavation / handling of free tar	290 OU/m^2.s	Maximum odour emission rate for coal tar
Pooled tar impacted water	0.3 OU/m^2.s	Comparison of weight % of PAHs in tar impacted water and free tar
Stockpiled / homogenised soils Open Excavations on Site	7.3 OU/m^2	Comparison of highest mean total PAH concentration in site soil type and PAH concentration in free tar. Applicable to areas of Figure 4 shown shaded in orange and pink.

5.10 Deposition

Dust deposition has also been calculated for the site. The particle size distribution as recommended for mechanically generated aggregate in US EPA (1986) 'Generalised Particle Size Distributions for Use in Preparing Site Specific Particulate Emission Inventories' has been used to characterise particulates as may be emitted from the site activities. To remain conservative, it has assumed that wet depletion of particulates does not occur. The adopted mass fractions include:

- Particles <2.5µm – 15%;
- Particles 2.5-6µm – 34%; and
- Particles 6-10µm – 51%.

5.11 Treatment Plant Emissions and Works within the Temporary Enclosure

Separate air and water treatment systems will be run on the site, and emissions from both systems will require treatment through a granular activated carbon (GAC) filter. The USEPA (1991) review of air emission mitigation technologies reported that enclosures were successfully used in '*preventing the escape of any air emissions*'. While this may be interpreted as meaning the enclosure was 100% effective, the modelling has assumed the enclosure and associated extraction/treatment system will be capable of reducing emissions from all internal activities by 99% (US EPA 1997[1]).

For simulation of the emissions from the air treatment system GAC filter the modelling has assumed 99% effectiveness in reducing of all of the air emissions generated within the enclosure.

For simulation of the emissions from the water treatment system GAC filter the modelling has assumed 99% effectiveness in reducing of all of the air emissions generated by the pooled water for treatment.

The adopted 99% efficiency is considered to be sufficient to be protective of both the emissions from the filters during treatment the intermittent releases from the enclosure that may occur over the course of a work day when doors are briefly opened to allow for plant /personnel entry and exit.

5.12 Summary of Air Emission Rates

Air emission rates have been calculated for each of the air emission sources in the preceding sections. These are summarised in **Table 5.6** following. Chemical constituent emission rates can be observed to be related to rates of particulate emissions and as vapour emissions by volatilisation from the soil matrix. Detailed discussion of the derivation of the emission estimates for the chemical constituents is summarised in **Appendix C**.

[1] U.S. Environmental Protection Agency (1997) *Capsule Report; Sources and Air Emission Control Technologies at Waste Management Facilities*, US EPA / 625/R-97/002. Performance of activated carbon filters/adsorbers reported as '*Carbon adsorbers can achieve control efficiencies of at least 95 percent, and control levels of 99 percent have been demonstrated in many applications*'.

Table 5.6: Summary of Emission Rates

Source / control to be adopted	Constituent	Emission Factor under worst case conditions (i.e. no controls)	Comments
Excavation and Stockpiling – Surface Soils / hourly watering	TSP	$2.81*10^{-2}*U^{1.3}$ kg/t	An excavation rate of 500m^3/day has been adopted in the modelling and the worst case emission factor has been reduced by 74% to account for control measures.
	PM_{10}	$1.33*10^{-2}*U^{1.3}$ kg/t	An excavation rate of 500m^3/day has been adopted in the modelling and the worst case emission factor has been reduced by 74% to account for control measures.
	Benzene	$1.18*10^{-8}*U^{1.3}$ kg/t (max) $6.74*10^{-9}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for surface soils, ash, coke and gravels and the worst case emission factors have been reduced by 74% to account for control measures.
	Benzo(a)pyrene	$9.53*10^{-6}*U^{1.3}$ kg/t (max) $8.77*10^{-7}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for surface soils, ash, coke and gravels and the worst case emission factors have been reduced by 74% to account for control measures.
Excavation and Stockpiling – Fill Materials behind Northern Retaining Wall / hourly watering	TSP	$2.81*10^{-2}*U^{1.3}$ kg/t	An excavation rate of 300m^3/day has been adopted in the modelling and the worst case emission factor has been reduced by 74% to account for control measures.
	PM_{10}	$1.33*10^{-2}*U^{1.3}$ kg/t	An excavation rate of 300m^3/day has been adopted in the modelling and the worst case emission factor has been reduced by 74% to account for control measures.
	Benzene	$4.22*10^{-7}*U^{1.3}$ kg/t (max) $3.37*10^{-8}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for gravels, sand and demolition wastes and the worst case emission factors have been reduced by 74% to account for control measures.
	Benzo(a)pyrene	$4.22*10^{-6}*U^{1.3}$ kg/t (max) $5.14*10^{-7}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for gravels, sand and demolition wastes and the worst case emission factors have been reduced by 74% to account for control measures.
	Odour	7.3 OU/m^2.s	Based on comparison of impacted soils to coal tar in **Section 5.9**

Source / control to be adopted	Constituent	Emission Factor under worst case conditions (i.e. no controls)	Comments
Excavation and Stockpiling – Northern Gasholder / works within temporary enclosure with capture of and GAC filter treatment of emissions	TSP	$2.81*10^{-2}*U^{1.3}$ kg/t	An excavation rate of $100m^3$/day has been adopted in the modelling and the worst case emission factor has been reduced by 99% to account for control measures.
	PM_{10}	$1.33*10^{-2}*U^{1.3}$ kg/t	An excavation rate of $100m^3$/day has been adopted in the modelling and the worst case emission factor has been reduced by 99% to account for control measures.
	Benzene	$4.22*10^{-7}*U^{1.3}$ kg/t (max) $3.37*10^{-8}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for gravels, sand and demolition wastes and the worst case emission factor has been reduced by 99% to account for control measures.
	Benzo(a)pyrene	$4.22*10^{-6}*U^{1.3}$ kg/t (max) $5.14*10^{-7}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for gravels, sand and demolition wastes and the worst case emission factors have been reduced by 99% to account for control measures.
	Odour	7.3 $OU/m^2.s$	Based on comparison of impacted soils to coal tar in **Section 5.9** and the worst case emission factors have been reduced by 99% to account for control measures.
Excavation and Stockpiling – Former Gasworks Area / works within temporary enclosure with capture of and GAC filter treatment of emissions	TSP	$2.81*10^{-2}*U^{1.3}$ kg/t	An excavation rate of $200m^3$/day has been adopted in the modelling and the worst case emission factor has been reduced by 99% to account for control measures.
	PM_{10}	$1.33*10^{-2}*U^{1.3}$ kg/t	An excavation rate of $200m^3$/day has been adopted in the modelling and the worst case emission factor has been reduced by 99% to account for control measures.
	Benzene	$5.62*10^{-7}*U^{1.3}$ kg/t (max) $3.93*10^{-8}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzene concentration recorded for each of the soil types assessed for the site and the worst case emission factors have been reduced by 99% to account for control measures.
	Benzo(a)pyrene	$1.25*10^{-5}*U^{1.3}$ kg/t (max) $5.90*10^{-7}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzo(a)pyrene concentration recorded for each of the soil types assessed for the site and the worst case emission factors have been reduced by 99% to account for control measures.
	Odour	7.3 $OU/m^2.s$	Based on comparison of impacted soils to coal tar in **Section 5.9**

Source / control to be adopted	Constituent	Emission Factor under worst case conditions (i.e. no controls)	Comments
Haulage Site Roads/ hourly watering	TSP	0.177 kg/km (loaded trucks) 0.109 kg/km (unloaded trucks)	Maximum excavation rate will result in 65 return trips over longest length of roadway during a 10 hour day. A roadway length of 65m has been adopted for the modelling, with roadway use distributed over the duration of the modelling and the worst case emission factors have been reduced by 74% to account for control measures.
	PM_{10}	0.105 kg/km (loaded trucks) $7.09*10^{-2}$ kg/km (unloaded trucks)	Maximum excavation rate will result in 65 return trips over longest length of roadway during a 10 hour day. A roadway length of 65m has been adopted for the modelling, with roadway use distributed over the duration of the modelling and the worst case emission factors have been reduced by 74% to account for control measures.
Stockpiles (Fugitive Emissions) Surface Soil and Hotspots Remediation / hourly watering	TSP	0.85 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling and the worst case emission factor has been reduced by 74% to account for control measures. Surplus soils would generally be rapidly removed from the site.
	PM_{10}	0.43 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling and the worst case emission factor has been reduced by 74% to account for control measures. Surplus soils would generally be rapidly removed from the site.
	Benzene	$3.57*10^{-6}$ tonnes/ha.year (max) $2.04*10^{-7}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for surface soils, ash, coke and gravels and the worst case emission factors have been reduced by 74% to account for control measures.
	Benzo(a)pyrene	$2.88*10^{-4}$ tonnes/ha.year (max) $2.65*10^{-5}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for surface soils, ash, coke and gravels and the worst case emission factors have been reduced by 74% to account for control measures.
Stockpiles (fugitive emissions) – Fill Materials behind Northern Retaining Wall / hourly watering	TSP	0.85 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling and the worst case emission factor has been reduced by 74% to account for control measures. Surplus soils would generally be rapidly removed from the site.
	PM_{10}	0.43 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling and the worst case emission factor has been reduced by 74% to account for control measures.

Source / control to be adopted	Constituent	Emission Factor under worst case conditions (i.e. no controls)	Comments
			Surplus soils would generally be rapidly removed from the site.
	Benzene	$1.26*10^{-5}$ tonnes/ha.year (max) $1.02*10^{-6}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for gravels, sand and demolition wastes. Worst case emission factors have been reduced by 74% to account for control measures.
	Benzo(a)pyrene	$1.28*10^{-4}$ tonnes/ha.year (max) $1.55*10^{-5}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for gravels, sand and demolition wastes. Worst case emission factors have been reduced by 74% to account for control measures.
	Odour	7.3 $OU/m^2.s$	Requires to be based on likely extent of stockpiling with this stage. This can be assumed to be 10m * 10m. Based on comparison of impacted soils to coal tar in **Section 5.9**.
Stockpiles (fugitive emissions) – Northern Gasholder / works within temporary enclosure with capture of and GAC filter treatment of emissions	TSP	0.85 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling and the worst case emission factor has been reduced by 99% to account for control measures. Surplus soils would generally be rapidly removed from the site.
	PM_{10}	0.43 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling and the worst case emission factor has been reduced by 99% to account for control measures. Surplus soils would generally be rapidly removed from the site.
	Benzene	$1.26*10^{-5}$ tonnes/ha.year (max) $1.02*10^{-6}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for gravels, sand and demolition wastes. Worst case emission factors have been reduced by 99% to account for control measures.
	Benzo(a)pyrene	$1.28*10^{-4}$ tonnes/ha.year (max) $1.55*10^{-5}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for gravels, sand and demolition wastes. Worst case emission factors have been reduced by 99% to account for control measures.
	Odour	7.3 $OU/m^2.s$	Requires to be based on likely extent of stockpiling with this stage. This can be assumed to be 10m * 10m. Based on comparison of impacted soils to coal tar in

Source / control to be adopted	Constituent	Emission Factor under worst case conditions (i.e. no controls)	Comments
			Section 5.9 and the worst case emission factors have been reduced by 99% to account for control measures.
Stockpiles (fugitive emissions) – Former Gasworks Area / works within temporary enclosure with capture of and GAC filter treatment of emissions	TSP	0.85 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling and the worst case emission factor has been reduced by 99% to account for control measures. Surplus soils would generally be rapidly removed from the site.
	PM_{10}	0.43 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling and the worst case emission factor has been reduced by 99% to account for control measures. Surplus soils would generally be rapidly removed from the site.
	Benzene	$1.70*10^{-5}$ tonnes/ha.year (max) $1.19*10^{-6}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzene concentration recorded for each of the soil types assessed for the site. Worst case emission factors have been reduced by 99% to account for control measures.
	Benzo(a)pyrene	$3.77*10^{-4}$ tonnes/ha.year (max) $1.79*10^{-5}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzo(a)pyrene concentration recorded for each of the soil types assessed for the site. Worst case emission factors have been reduced by 99% to account for control measures.
	Odour	7.3 $OU/m^2.s$	Requires to be based on likely extent of stockpiling with this stage. This can be assumed to be 10m * 10m. Based on comparison of impacted soils to coal tar in **Section 5.9** and the worst case emission factors have been reduced by 99% to account for control measures.
Bioremediation of Soils / works within temporary enclosure with capture of and GAC filter treatment of emissions	TSP	0.85 tonnes/ha.year	Requires to be based on likely extent of stockpiling within the temporary enclosure. This has been assumed to be an area of $1,000m^2$ in the western portion of the site for the purposes of modelling. Worst case emission factors have been reduced by 99% to account for control measures.
	PM_{10}	0.43 tonnes/ha.year	Requires to be based on likely extent of stockpiling within the temporary enclosure. This has been assumed to be an area of $1,000m^2$ in the western portion of the site for the purposes of modelling. Worst case emission factors have been reduced by 99% to account for control measures.
	Benzene	$1.70*10^{-5}$ tonnes/ha.year (max) $1.19*10^{-6}$ tonnes/ha.year (mean)	Using the highest of the maximum and mean benzene concentration recorded for each of the soil types assessed for the site. Worst case emission factors have been

Source / control to be adopted	Constituent	Emission Factor under worst case conditions (i.e. no controls)	Comments
		Vapour emission rate as per **Appendix C**	reduced by 99% to account for control measures.
	Benzo(a)pyrene	$3.77*10^{-4}$ tonnes/ha.year (max) $1.79*10^{-5}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzo(a)pyrene concentration recorded for each of the soil types assessed for the site. Worst case emission factors have been reduced by 99% to account for control measures.
	Odour	7.3 OU/m^2.s	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 1,000m^2 in the western portion of the site for the purposes of modelling. Based on comparison of impacted soils to coal tar in **Section 5.9**.
Groundwater Treatment and Transfer / capture of and GAC filter treatment of emissions	Odour	0.3 OU/m^2.s	As per estimate rate for pooled water. Area of water column exposed to air needs to be considered. Conservative assumption is 1m^2. Worst case emission factor has been reduced by 99% to account for control measures.
	Benzene	Vapour emission rate as per **Appendix C**	Calculated in **Appendix C**.
	Benzo(a)pyrene	Vapour emission rate as per **Appendix C**	Calculated in **Appendix C**.
Pooled Groundwater / works within temporary enclosure with capture of and GAC filter treatment of emissions	Odour	0.3 OU/m^2.s	As per estimated rate for pooled water. Pooled water assumed to be present across area of the northern gasholder (20m * 20m) for the purposes of modelling. Worst case emission factor has been reduced by 99% to account for control measures.
	Benzene	Vapour emission rate as per **Appendix C**	Calculated in **Appendix C**.
	Benzo(a)pyrene	Vapour emission rate as per **Appendix C**	Calculated in **Appendix C**.

6 Derivation of Soil Criteria Protective of Potential Malodorous Effects

As part of the Air Quality Management Plan (**Appendix B**) to be adopted at the site, a set of odour based criteria have been derived for materials to be stockpiled external to the storage area without cover. These criteria, for use only during remediation works, provide an objective system for assessing whether temporarily stockpiled materials have the potential to generate offensive odours at the boundary. Put simply, these criteria are used to define malodourous materials on the site, for the purposes of identifying the requirement for odour controls. The criteria are only specific to activities associated with the above ground stockpiling/storage of soils. All subsurface areas that are potentially tar impacted require specific air quality controls during all excavation works, as described in **Section 5**.

As such soils compliant with the criteria derived within this section will not require specific odour control measures, while those materials not compliant will be subject to the controls for reduction in duration of odour.

6.1 Characterisation of Constituents of Coal Tar

With respect to the subsurface materials present on the site, the malodourous constituents of soil are consequent of the occurrence of coal/tar based impact. Analysis of free coal tar was reported in CH2M Hill (March 2007) 'Delineation & Characterisation Sampling and Review of Remedial Options Former Macdonaldtown Gasworks – Burren Street, Erskineville NSW' (CH2M Hill 2007). The coal tar was sampled from coal identified within a pipe on the former Macdonaldtown gasworks being assessed.

The results of analysis are summarised following for each substance reported above laboratory detection limits at a significant concentration.

Table 6.1: Summary of Published Coal Tar Constituents

Coal Tar Constituent	Reported Concentration (W%)
Phenol	0.206%
2-Methylphenol	0.173%
3- & 4-Methylphenol	0.359%
2,4-Dimethylphenol	0.249%
Naphthalene	0.975%
Acenaphthylene	0.226%
Acenaphthene	0.0355%
Fluorene	0.172%
Phenanthrene	0.392%
Anthracene	0.138%
Fluoranthene	0.177%
Pyrene	0.187%
Benz(a)anthracene	0.0921%
Chrysene	0.0765%
Benzo(b)fluoranthene	0.0364%
Benzo(k)fluoranthene	0.0545%
Benzo(a)pyrene	0.0595%
Indeno(1,2,3-c,d)pyrene	0.0241%
Dibenz(a,h)anthracene	0.0099%
Benzo(g,h,i)perylene	0.025%
Benzene	0.0576%
Toluene	0.121%
Ethylbenzene	0.0156%
Xylene	0.151%
TPH C_6-C_9	0.377%
TPH C_{10}-C_{14}	40.2%
TPH C_{15}-C_{28}	65.4%
TPH C_{29}-C_{36}	12.4%

By review of **Table 6.1**, 4% of the constituents of coal tar have been speciated.

6.2 Estimation of Rate of Release of Volatile and Semi-Volatile Constituents

Rates of volatilisation from soils will be chemical specific and based on several physical parameters that control volatilisation of chemical constituents from soils. The flux of volatile constituents that will potentially volatilise from soils stockpiled and handled on the site has been estimated on the basis of the physical properties of the constituents. The potential emissions of constituents from contaminated soils into outdoor air can be predicted by the RISC modelling package. RISC provides estimates of vapour emission on the basis of:

- The depth at which the volatile constituents occur;
- The levels (i.e. concentrations) at which volatile constituents are present;
- Soil properties; and
- Chemical parameters related to the potential volatility of the constituents.

Two scenarios have been identified to characterise the potential release of volatile constituents from stockpiles on the site including:

- Evaporation / volatilisation of constituents from soils during tipping / bulk movement of the soils; and
- Evaporation / volatilisation of constituents from soils as soils are left exposed on the site surface during remediation.

It is anticipated that an increased rate of volatilisation would occur during the bulk handling of soils. However, this would be short term in nature and restricted in extent based on the extent of soils that may be dumped from a tipper.

It has been assumed that all constituents are present at a depth of 0.1 m for volatilisation from spread soils, and present at a shallower depth of 0.01 m for volatilisation from soils as they are tipped and handled in the filling / stockpile area. This is a conservative assumption, as the rates of vapour migration and discharge from the soil decrease with increasing depth of the constituents from the soil surface. Similar modelling as performed in NZ Ministry for the Environment (1999) '*Users Guide Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand*' has recommended a minimum diffusion distance of 0.1 m be used for the characterisation of excavation surfaces.

Modelling scenarios have been undertaken on the basis of a unit concentration of each constituent identified as potentially volatile. Vapour flux rates are reported by RISC from the source of impact in units of $g/cm^2/s$.

Soil properties for the modelling have been adopted as per the recommended soil properties provided to US EPA (19 June 2003) '*User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings*'. Soil values for sand have been used as an overall average noting that soils that may be stockpiled on the site range from gravelly fill materials to natural silty clay and weathered shale. Noting the hourly site watering required with the proposed dust controls, the highest of the recommended range of water filled porosities has been adopted in the modelling of area based sources. The median water filled porosity has been adopted to characterise soils at the time of placement and handling, noting that dust controls may not be applied to these soils immediately. The soil properties used in the modelling are summarised in **Table 6.2** following.

Table 6.2: Summary of Soil Properties Adopted for Modelling of Volatilisation of Constituents

Soil Property	Adopted Value	Comments

Total porosity	0.375	Sand, as per US EPA (2003)
Water filled porosity (tipped / handled soils)	0.053	Sand, as per US EPA (2003). Median value adopted for soils as received as fill material. Used for characterising water filled porosity of soils received and handled as fill, presumably for period prior to full implementation of dust controls
Water filled porosity (exposed areas)	0.253	Value for capillary fringe sands adopted on the basis of surfaces being regularly watered in model assumptions. Value as per US EPA (2003). Adopted for exposed areas of soils
Fraction organic carbon	0.3	Assumed, consistent with site measurements
Soil bulk density	1.66	Sand, as per US EPA (2003). Based on density of materials once the compaction standard has been achieved, noted to be greater than density adopted for loose / bulked soils as imported to the site.

The results of flux calculations for the fugitive emissions and handling emissions is summarised **Table 6.3** following. RISC model outputs for each of the constituents assessed are provided attached as **Appendix G**. Rates have only been calculated for those contaminants within coal assessed to be volatile and it is noted that only some of these contaminants are considered to be malodourus.

Table 6.3: Summary of Predicted Rates of Volatilisation Based on Unit Concentration of Constituents

Constituent	Rate of Volatilisation from Handled Soils ($g/cm^2/s$)	Rate of Volatilisation from Spread / Compacted Soils ($g/cm^2/s$)
Acenaphthene	$4.09*10^{-12}$	$2.00*10^{-14}$
Benzene	$6.43*10^{-9}$	$2.16*10^{-11}$
Ethylbenzene	$2.51*10^{-9}$	$9.37*10^{-12}$
Naphthalene	$3.81*10^{-11}$	$1.59*10^{-13}$
Toluene	$4.36*10^{-9}$	$1.55*10^{-11}$
Xylenes	$2.39*10^{-9}$	$8.79*10^{-12}$
TPH C_6-C_8 (aliphatic)	$3.79*10^{-10}$	$3.79*10^{-11}$
TPH $C_{>8}$-C_{16} (aliphatic)	$2.73*10^{-11}$	$2.73*10^{-12}$
TPH $C_{>8}$-C_{16} (aromatic)	$3.01*10^{-12}$	$3.01*10^{-13}$

6.2.1 Odour Thresholds of Volatile and Semi-Volatile Constituents

Odour thresholds of the most significant potentially malodorous constituents that may be present in fill materials stockpiled on the site have been summarised in **Table 6.4**. This has been undertaken as per a literature review of several available sources for each constituent. Each of the constituents in **Table 6.1** has been considered in this review.

Table 6.4: Summary of Odour Thresholds

Constituent	Odour Threshold	Source / Comments
Naphthalene	0.05 – 5.34 mg/m^3 0.0095 – 1.02 ppm Mean: 0.038 ppm	US EPA (1990) '*Reference Guide to Odour Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendments of 1990.*' A series of values are given reflecting various studies. The mean value is given as the geometric mean or recommended best estimate.
	0.44 mg/m^3	US EPA Air Toxics Web Site (2000) 'Naphthalene 91-20-3'. Thresholds derived from ATSDR Toxicological Profile and Journal of Applied Toxicology article (1983).
	0.44 mg/m^3 0.021 mg/L (water)	ATSDR (2005) 'Naphthalene, 1-methylnaphthalene and 2-methylnaphthalene'.
	0.0075 - 0.42 mg/m3	WHO (2010) '*WHO Guidelines for Indoor Air Pollutants – Selected Pollutants*'. Values taken from review of external studies.
	<0.3 ppm	CDC NIOSH (1978) '*Occupational Health Guideline for Naphthalene*'.
	<0.3 ppm	NTP (1992) '*NTP Technical Report on the Toxicology and Carcinogenesis Studies of Naphthalene in BC63F Mice*'.
	0.038 ppm	ScienceLab (2010) '*Material Safety Data Sheet: Naphthalene MSDS*'.
	2.5 ug/l	Young et al (1996) '*Taste and Odour Thresholds Concentrations of Potential Potable Water Contaminants*', Water Research Vol 30.2. Study indicated the odour threshold for contaminants present in water
	0.35 mg/m^3	Nagata, 1990 '*Measurement of Odor Threshold by Triangle Odor Bag Method*'
Adopted	*0.35 mg/m^3*	
Total Petroleum	No values provided	WHO (2004) '*Rolling Revision of the WHO*

Constituent	Odour Threshold	Source / Comments
Hydrocarbons		*Guidelines for Drinking-Water Quality*'. No specific value given – states that drinking water may be unacceptable below guideline values due to odour and taste thresholds.
Benzene	1.5 ppm (5 mg/m^3)	US EPA Air Toxics Web Site (2000) 'Benzene 71-43-2'.
	1.5 ppm (5 mg/m^3)	US EPA '*National Air Toxics Program: The Integrated Urban Strategy Report to Congress*'.
	34-119 ppm	ATSDR (2007) 'Toxicological Profile for Benzene'. From AIHA 1989 source.
	4.68 ppm (4.9 mg/m^3), 2.0 mg/L (water)	ToxNet (2005) 'Benzene CASRN 71-43-2' HSCB (2010) 'Benzene 71-43-2'
	8.6 mg/m^3	Nagata, 1990 '*Measurement of Odor Threshold by Triangle Odor Bag Method*'
Adopted	*5 mg/m^3*	
Toluene	1 mg/m^3	WHO (2000) '*Air Quality Guidelines for Europe*'.
	40 – 120 µg/l	WHO (1993) '*Guidelines for Drinking Water quality*'.
	2.9 ppm	US EPA Air Toxics Web Site (2000) 'Toluene 108-88-3'.
	2.9 ppm	Von Burg, (1993) 'Toxicology Update: Toluene', Journal of Applied Toxicology.
	8 ppm, 0.04-1 ppm (water)	ATSDR (2000) 'Toxicological Profile for toluene'.
	2.14 ppm (8 mg/m^3)	ToxNet (2006) 'Toluene CASRN 108-88-3'
	1.2 mg/m^3	Nagata, 1990 '*Measurement of Odor Threshold by Triangle Odor Bag Method*'
Adopted	*1 mg/m^3*	
Ethylbenzene	2 - 130 µg/l	WHO (1993) 'Guidelines for Drinking Water quality'
	2.3 ppm	US EPA Air Toxics Web Site (2000) 'Ethylbenzene 100-41-4'
	20-100 ppb	Von Burg, (1992) 'Toxicology Update: Toluene', Journal of Applied Toxicology Vol 12.1
	2.3 ppm ,2-2.6 ppm, 0.029 mg/L (water), 0.14 mg/L (water)	ATSDR (200) 'Toxicological Profile for Ethylbenzene'. Four sources cited for varying values
	140 ppm, 0.4 mg/m^3, 8.7 mg/m^3	ToxNet (2005) 'Ethylbenzene 100-41-4'.
	0.8 mg/m^3	Nagata, 1990 '*Measurement of Odor Threshold by Triangle Odor Bag Method*'
Adopted	*0.8 mg/m^3*	
Xylenes	20-1800 µg/L	WHO (1993) '*Guidelines for Drinking Water quality*'.
	100 mg/m^3	AIHA (1997) '*Odor Thresholds for Chemicals with Established Occupational Health Standards*'
	1.1 ppm	US EPA Air Toxics Web Site (2000) 'Xylenes (Mixed Isomers)'. M-xylene only
	1 ppm (mixed xylenes), 0.05 ppm (m-, p- or o-xylene)	ATSDR (2007) 'Toxicological Profile for Xylene'.
	6 mg/m^3	ToxNet (2001) 'Xylenes CASRN 1330-20-7'.
	0.2-1.7 mg/m^3	Nagata, 1990 '*Measurement of Odor Threshold by Triangle Odor Bag Method*'
Adopted	*0.2 mg/m^3*	
Acenaphthene	0.08 mg/l	Gemert & Nettenbreijer, (2003) '*Odour Thresholds – Compilation of Odour Threshold Values in Air, Water, and Other Media*'.
	0.08 ppm, 0.02-0.22 ppm, 0.51 ppm	ToxNet (2001) 'Acenaphthene CASRN 83-32-9'.
	0.08 ppm	Speclab (2001) '*Chemical Fact Sheet – Acenaphthene*'.
Adopted	*0.5 mg/m^3*	
Phenol	0.04 ppm	US EPA Air Toxics Web Site (2000) 'Phenol 108-95-2'.
	0.040 ppm, 7.9 ppm (water), 1 ppm (water)	ATSDR (2006) 'Toxicological Profile for Phenol'.
	0.022-0.094 mg/m^3 (0.006-0.024 ppm 0.047-0.5 ppm	ToxNet 'Phenol CASRN 108-95-2'
	0.02 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*0.02 mg/m^3*	
Cresol	0.00024-0.00044 mg/m^3 (0.0003 mg/m^3 adopted)	Nagata, 1990 '*Measurement of Odor Threshold by Triangle Odor Bag Method*'

With reference to the results of the analysis of a tar sample in **Table 6.1**, it is likely that malodorous constituents will occur together as mixtures. Several of these compounds are considered to have odours which members of the public may consider to be similar. On this basis, potential additive effects will need to be considered for the assessment of odours. For the purposes of this assessment, it has been assumed that malodorous constituents are restricted to the constituents listed in **Table 6.4**. The relative levels at which these constituents may occur has been based on the percentages summarised in **Table 6.1**. **Table 6.5** summarises the relative percentage of each speciated contaminant following as per the relative levels that each of the constituents occur as compared to other malodorous constituents in the soil samples.

Table 6.5: Summary of Adopted Relative Levels of Constituents in 'Tar Impacted Samples' and Adopted Odour Thresholds

Constituent	Relative Proportion (%) to all contaminants in tar sample	Relative Proportion (%) to sum of malodourous contaminants in tar sample	Adopted Odour Threshold (mg/m^3)
Benzene	0.01	0.5	5
Ethylbenzene	0.02	0.8	0.8
Toluene	0.1	4.3	1
Xylene (total)	0.15	6.5	0.2
Cresols	0.8	34.5	0.0003
Acenaphthene	0.04	1.7	0.5
Naphthalene	1.0	43.1	0.35
Phenol	0.2	8.6	0.02
SUM	2.32%	100%	

The adopted proportion of each constituent was used in the characterisation of soils for the derivation of soil based criteria for the protection of malodorous impacts during remediation works. While the list of malodourous contaminants has been based on speciated compounds detected in samples of free tar source material from the site it is noted that several other aliphatic or aromatic malodorous constituents may be present in impacted soils but have not been identified potentially causing the malodorous extent of the soils to be underestimated.

The assessment of soil data to the derived soil criteria is proposed to be undertaken by comparison of each constituent level to the constituent specific criteria. It is inconceivable that all malodourous constituents will be simultaneously present at concentrations at the full extent of the derived criteria. On this basis, where one constituent is at a concentration at the extent of the criteria, it is likely that the majority of the remaining constituents will be at levels below, and potentially well below, the adopted proportion of the constituent in a malodorous soil. This will be sufficient to account for potential malodorous effects of other constituents which have not been identified in **Table 6.5**.

6.3 Maximum Allowable Rate of Odour Emission

Dispersion modelling was completed assessing a series of Zones on the site that may be used for stockpiling of soil to determine the minimum dilution of a unit odour emission from the area / activity to the nearest receptor, as present on the site boundary. Each of the zones adopted are shown in **Figure 9** and summarised in **Table 6.6**.

Table 6.6: Summary of Stockpile Zone Details

Stockpile Zone	SW Corner Easting	SW Corner Northing	Length (m)	Width (m)
Zone 1	332359.35	6247736.66	32.00	25.00
Zone 2	332338.29	6247710.05	45.00	25.00
Zone 3	332278.29	6247729.67	50.00	10.00
Zone 4	332294.54	6247673.88	15.00	15.00
Zone 5	332284.68	6247633.20	20.00	20.00

The modelling scenarios undertaken are summarised in **Table 6.7** following. Modelling has considered daytime and night time conditions, and daytime and night time site boundaries as shown on **Figure 11.**

Table 6.7: Summary of Odour Release Scenarios

Stockpile Zone	Description	Odour Sources
1	Placement of malodorous fill materials on Zone 1	VHZ1AO, VHZ1BO
	Fugitive emissions from uncovered stockpiles on Zone 1	VFZ1AO, VFZ1BO
2	Placement of uncovered malodorous fill materials on Zone 2	VHZ2AO, VHZ2BO
	Fugitive emissions from uncovered stockpiles on Zone 2	VFZ2AO, VFZ2BO
3	Placement of uncovered malodorous fill materials on Zone 3	VHZ3AO, VHZ3BO
	Fugitive emissions from uncovered stockpiles on Zone 3	VFZ3AO, VFZ3BO
4	Placement of uncovered malodorous fill materials on Zone 4	VHZ4AO, VHZ4BO
	Fugitive emissions from uncovered stockpiles on Zone 4	VFZ4AO, VFZ4BO
5	Placement of uncovered malodorous fill materials on Zone 5	VHZ5AO, VHZ5BO
	Fugitive emissions from uncovered stockpiles on Zone 5	VFZ5AO, VFZ5BO

Modelling has been undertaken for daytime and night time receptor location scenarios. This has included two model runs using receptor locations for each of the daytime and night time conditions respectively. Daytime receptor locations have been assessed against emissions occurring during the hours of 6am to 7pm for the duration of the modelling.

The minimum dilutions, as assessed based on inclusion of peak to mean ratios, and reported at a 99.0% confidence level, have been calculated for each of the sub-areas. The reciprocal of these values is the maximum total odour emission (OU/s) that is permitted to occur from each area. Maximum total odour emissions are summarised in **Table 6.8** following as per odour emissions from the compacted soils, and odour emissions from soil handling and stockpiling activities within each zone. Spreadsheet calculations are provided as **Appendix G**.

Table 6.8: Summary of Minimum Odour Emission Dilutions

Site Area	Soil Handling (Minimum Odour Dilution Factor)	Fugitive / Area Emissions (Minimum Odour Dilution Factor)
Zone 1	17	2020
Zone 2	17	2010
Zone 3	9	1965
Zone 4	13	1986
Zone 5	13	2030

6.4 Rate of Odour Emission Calculated Based on Levels of Soil Impact

Full details of the characterisation of air emissions are provided in **Section 5**. The rate of vapour release for surface soils and soil handling activities in **Table 5.6** was adopted as a flux ($g/cm^2/s$) as based on a unit concentration of each constituent. Additionally the relative level of malodorous constituents within impacted soils, as summarised in **Table 5.5,** was adopted for the odour emission rate. The allowable level of total odour that can be discharged from each of the soil zones can be calculated by the odour emission dilution factors provided in **Table 6.8**. Only the lowest of the odour dilutions for the handling emissions has been used in the calculations.

Results are presented in **Table 6.9** for the maximum allowable levels of malodorous constituents to be stockpiled onsite uncovered based on soil modelling results. The criteria are based on calculations using both the handling and fugitive emissions soil modelling results.

Table 6.9: Summary of Maximum Allowable Levels of Malodorous Constituents

Constituent	Criteria (mg/kg)	Comments
Benzene	2.5	-
Ethylbenzene	5	-
Toluene	10	-
Xylene (total)	10	-
Cresols	_	Non volatile, no limits requiring covering from odour potential

Acenaphthene	35	-
Naphthalene	25	-
Phenol	40	-

It is noted that malodorous materials may potentially be present in soils placed across the site, and being handled as soils being received at the same time. Soil criteria for each scenario have been based on an acceptable level of odour of 2 OU/m^3 at the external receptor locations Where contaminants in soils are present at the acceptable levels in handled and emplaced soils, there is a potential that significant combined odour effects may occur. However, this is considered unlikely to cause the acceptable level of odour to be exceeded. Handling activities can only occur during daytime periods. By comparison of the worst case 99.0 percentile daytime and night time levels of odour dilution as predicted from diffuse sources, the worst case 99.0 percentile night time level is found to be four times higher than the day time level. Hence, a soil criterion based on the night time level of dilution of odours is considered not likely to pose significant levels of odour emission during daytime periods, and additive handling emissions during daytime periods would not be anticipated to be present at the adopted assessment criteria.

While the criteria provided in **Table 6.9** are inclusive of stockpiles placed in Zone 5 (i.e. closest to the adjacent Burren Street residences), in practice it is considered that placement of uncovered stockpiles in Zone 5 will not be acceptable. In particular if uncovered stockpiles are placed in Zone 5 for an extended period it will be difficult to control particulate emissions from this area impacting the adjacent residences during unfavourable wind conditions. Accordingly the controls for stockpiles external to the enclosure described in **Section 8** and **Appendix B** require any stockpiles placed in Zone 5 to be covered at all times.

7 Estimation of Air Quality Impacts

Based on the characterisation of potential emissions described in **Section 5**, the following sections detailed the methods used for dispersion modelling and the assessment of impacts on nearfield receptors.

DEC (2005) nominates three levels of modelling that can be used to assess air quality impacts. A level 1 assessment has been undertaken here. The level 1 assessment is characterised as being a preliminary assessment, using worst case meteorological data and conservative estimates of air emissions. Maximum levels only as reported by the modelling are compared to air quality criteria.

7.1 Modelling

AUSPLUME v.6 is the DEC (2005) approved dispersion model for use in most simple near-field applications in NSW, where coastal effects and complex terrain are of no concern. AUSPLUME is a Gaussian plume model, based on the assumption that cross-sections through elevated plumes from point sources of pollution have a Gaussian (or normal) distribution of concentration.

A number of limitations are noted for AUSPLUME in DEC (2005) which are not considered to apply for the modelling undertaken on the site. To limit the potential for these limitations to distort assessment of the proposed works, the AUSPLUME modelling was restricted to impacts over short distances only.

7.1.1 Meteorological Data

Modelling has been undertaken using two years of hourly meteorological data as collected at the OEH operated meteorological station located at Randwick, approximately 4km south-east of the site. The data has been supplemented with some records as collected at Sydney Airport meteorological station. The preparation and analysis of the meteorological data is detailed in **Appendix A**.

This Randwick meteorological station is the closest available meteorological station to the Macdonaldtown site. The meteorological data collected at this site is considered appropriately representative of meteorological conditions at the Macdonaldtown site, and considered appropriate for the level of modelling and air quality assessment completed here.

7.1.2 Terrain Data

The terrain of the Macdonaldtown Site and the surrounding area has been characterised by the preparation of a broad grid based terrain file on the basis of historical orthophoto maps and immediate surrounding area. Orthophoto maps are provided with 2m contour intervals. The modelling grid has been set over a sufficient area to comprise each of the individual receptor locations nominated in **Table 6.1**.

7.2 Identification of Near-Field Receptors

The site and surrounding area have been reviewed. An aerial photo showing the site is shown on **Figure 10** with each of the receptor locations relative to the site dimensions shown. The following receptors, summarised in **Table 7.1**, are identified in proximity of the site, as shown by corresponding numbers on **Figure 10**.

Table 7.1: Summary of Receptors

Receptor No.	Description	Distance from Site	Easting	Northing
1	1 Leamington St Erskineville	100m North	332244	6247859
2	Railway Offices, within Stabling Shed	20m North	332263	6247744
3	Railway Workshops, nearest to site	60m East	332269	6247645
4	95 Railway Pde Erskineville	100m South	332342	6247537
5	15 Burren St Erskineville	10m West	332265	6247624
6	31 Burren St Erskineville	10m West	332252	6247669

Modelling has been undertaken to determine potential impacts in to outdoor air at each of the receptors.

7.3 Air Impact Assessment Methodology

The air quality impact assessment has been undertaken by the following process:

- Air quality controls have been nominated in **Section 4** for each activity which is found to have potentially unacceptable air emissions;
- Particulate and/or odour emission rates for each activity which will potentially cause air emissions under controlled conditions has been individually modelled for each receptor to determine maximum 1 second, 1 hour, 24 hour and annual concentrations as appropriate for each of the constituents. Emission rates adopted for each activity that may generate air emissions were identified in **Table 5.6** and are listed in **Tables 7.2** to **7.6** as per the parameters that have been used to characterise the activity in AUSPLUME; and
- Levels of particulates / odours / chemical constituents as emitted for each activity and predicted at each of the identified discrete receptors under the controlled conditions have been directly compared to the applicable air quality criteria (**Table 5.1**) are summarised in **Table 7.9**. This includes consideration of the background level of the constituent;
- The calculations, for total particulate levels, have also been used with chemical specific emission factors in **Section 10** to complete the health impact assessment for the works.

7.4 Modelling of Each Release Scenario

Each of the sources of air emissions modelled and modelling parameters has been summarised in **Tables 6.2** to **6.8** with results calculated for each of the discrete receptors as listed in **Table 6.1,** in close proximity of the site. Co-ordinates are provided in MGA56 and heights in m AHD as interpreted from orthophoto maps. All modelling results are summarised in **Appendix D**.

It is noted that each of the modelling scenarios has assumed that air quality controls are enforced on the site. Derivation of the appropriate air quality controls required assessment of air emissions during uncontrolled, or worst case conditions. The particulate and/or odour emission rates and modelling results for all worst case conditions are summarised in **Appendix E**.

Table 7.2: Summary of Modelling Parameters – Surface Soils Excavation

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate ($g/m^2/s$)
Surface soils, excavation and stockpiling	TSP	VEX1T	Area	20m	20m	45	332314	6247685	16.5	7am – 5pm (10 hours)	$3.30 \times 10^{-4} \times U^{1.3}$
	PM_{10}	VEX1P	Area	20m	20m	45	332314	6247685	16.5	7am – 5pm (10 hours)	$1.56 \times 10^{-4} \times U^{1.3}$
	Benzene (max)	VEX1BE	Area	20m	20m	45	332314	6247685	16.5	7am – 5pm (10 hours)	Particulates $1.38 \times 10^{-10} \times U^{1.3}$
	B(a)P (max)	VEX1BP	Area	20m	20m	45	332314	6247685	16.5	7am – 5pm (10 hours)	Particulates $1.12 \times 10^{-7} \times U^{1.3}$
Surface soils, fugitive emissions from stockpiles	TSP	F1T	Area	10m	10m	0	332314	6247685	16.5	Continuous	7.02×10^{-7}
	PM_{10}	F1P	Area	10m	10m	0	332314	6247685	16.5	Continuous	3.46×10^{-7}
	Benzene (max)	F1BEP F1BEV	Area	10m	10m	0	332314	6247685	16.5	Continuous	Particulates 2.86×10^{-12} Vapours 7.02×10^{-12}
	B(a)P (max)	F1BPP	Area	10m	10m	0	332314	6247685	16.5	Continuous	Particulates 1.83×10^{-10}

Table 7.3: Summary of Modelling Parameters – Fill Materials Behind Retaining Wall Excavation

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate ($g/m^2/s$ or $OU/m^2/s$)
Fill materials behind retaining wall, excavation and stockpiling	TSP	VEX2T	Area	5	5	80	332271	6247720	18	7am – 5pm (10 hours)	$3.17*10^{-4} * U^{1.3}$
	PM_{10}	VEX2P	Area	5	5	80	332271	6247720	18	7am – 5pm (10 hours)	$1.50*10^{-4} * U^{1.3}$
	Benzene (max)	VEX2BE	Area	5	5	80	332271	6247720	18	7am – 5pm (10 hours)	Particulates $4.75*10^{-9} * U^{1.3}$
	B(a)P (max)	VEX2BP	Area	5	5	80	332271	6247720	18	7am – 5pm (10 hours)	Particulates $4.75*10^{-8} * U^{1.3}$
	Odour	VEX2OU	Area	5	5	80	332271	6247720	18	Continuous	7.3
Fill materials behind retaining wall, fugitive emissions from stockpiles	TSP	F2T	Area	10	10	0	332283	6247718	17.5	Continuous	$7.02*10^{-7}$
	PM_{10}	F2P	Area	10	10	0	332283	6247718	17.5	Continuous	$3.46*10^{-7}$
	Benzene (max)	F2BEP F2BEV	Area	10	10	0	332283	6247718	17.5	Continuous	Particulates $1.07*10^{-11}$ Vapours $2.52*10^{-11}$
	B(a)P (max)	F2BPP	Area	10	10	0	332283	6247718	17.5	Continuous	Particulates $1.07*10^{-10}$
	Odour	F2OU	Area	10	10	0	332283	6247718	17.5	Continuous	7.3

Table 7.4: Summary of Modelling Parameters – Northern Gasholder Excavation

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate (g/m2/s or OU/m2/s)
Northern Gasholder, excavation and stockpiling	TSP	VEX3T	Area	20	20	0	332276	6247697	17.5	7am – 5pm (10 hours)	$2.54*10^{-6} * U^{1.3}$
	PM_{10}	VEX3P	Area	20	20	0	332276	6247697	17.5	7am – 5pm (10 hours)	$1.20*10^{-6} * U^{1.3}$
	Benzene (max)	VEX3BE	Area	20	20	0	332276	6247697	17.5	7am – 5pm (10 hours)	Particulates $3.81*10^{-11} * U^{1.3}$
	B(a)P (max)	VEX3BP	Area	20	20	0	332276	6247697	17.5	7am – 5pm (10 hours)	Particulates $3.81*10^{-10} * U^{1.3}$
	Odour	VEX3OU	Area	20	20	0	332276	6247697	17.5	Continuous	0.073
Northern gasholder, fugitive emissions from stockpiles	TSP	F3T	Area	10	10	0	332296	6247702	17.5	Continuous	$2.7*10^{-8}$
	PM_{10}	F3P	Area	10	10	0	332296	6247702	17.5	Continuous	$1.4*10^{-8}$
	Benzene (max)	F3BEP F3BEV	Area	10	10	0	332296	6247702	17.5	Continuous	Particulates $4.1*10^{-13}$ Vapours $9.7*10^{-13}$
	B(a)P (max)	F3BPP	Area	10	10	0	332296	6247702	17.5	Continuous	Particulates $4.1*10^{-12}$
	Odour	F3OU	Area	10	10	0	332296	6247702	17.5	Continuous	0.073

Table 7.5: Summary of Modelling Parameters – Former Gasworks Area Excavation

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate ($g/m^2/s$ or $OU/m^2/s$)
Former gasworks area, excavation and stockpiling	TSP	VEX4T	Area	15	15	0	332296	6247695	17.5	7am – 5pm (10 hours)	$9.02*10^{-6} * U^{1.3}$
	PM_{10}	VEX4P	Area	15	15	0	332296	6247695	17.5	7am – 5pm (10 hours)	$4.27*10^{-6} * U^{1.3}$
	Benzene (max)	VEX4BE	Area	15	15	0	332296	6247695	17.5	7am – 5pm (10 hours)	Particulates $1.8*10^{-10} * U^{1.3}$
	B(a)P (max)	VEX4BP	Area	15	15	0	332296	6247695	17.5	7am – 5pm (10 hours)	Particulates $4.01*10^{-9} * U^{1.3}$
	Odour	VEX4OU	Area	15	15	0	332296	6247695	17.5	Continuous	0.073
Former gasworks area, fugitive emissions from stockpiles	TSP	F4T	Area	10	10	0	332296	6247695	17.5	Continuous	$2.7*10^{-8}$
	PM_{10}	F4P	Area	10	10	0	332296	6247695	17.5	Continuous	$1.4*10^{-8}$
	Benzene (max)	F4BEP F4BEV	Area	10	10	0	332296	6247695	17.5	Continuous	Particulates $5.4*10^{-13}$ Vapours $1.3*10^{-11}$
	B(a)P (max)	F4BPP	Area	10	10	0	332296	6247695	17.5	Continuous	Particulates $1.2*10^{-11}$
	Odour	F4OU	Area	10	10	0	332296	6247695	17.5	Continuous	0.073

Table 7.6: Summary of Modelling Parameters – Haulage Roads Within Site

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate ($g/m^2/s$)
Haulage roads	TSP	HAT	Area	5	60	0	332312	6247672	16	7am – 5pm (10 hours)	$2.86*10^{-5}$
	PM_{10}	HAP	Area	5	60	0	332312	6247672	16	7am – 5pm (10 hours)	$1.79*10^{-5}$

Table 7.7: Summary of Modelling Parameters – Soil Treatment / Remediation Activities

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate ($g/m^2/s$ or $OU/m^2/s$)
Bioremediation of soils[1]	TSP	T2T	Area	65	15	60	332338	6247714	17	Continuous	$3.15*10^{-8}$
	PM_{10}	T2PM	Area	65	15	60	332338	6247714	17	Continuous	$1.4*10^{-8}$
	Benzene (max)	T2BEP T2BEV	Area	65	15	60	332338	6247714	17	Continuous	Particulates $5.4*10^{-13}$ Vapours $1.3*10^{-12}$
	B(a)P (max)	T2BPP	Area	65	15	60	332338	6247714	17	Continuous	Particulates $1.2*10^{-13}$
	Odour	T2OU	Area	65	15	60	332338	6247714	17	Continuous	0.073

Note: 1. Also accounts for potential emissions from stockpiled soils associated with the stabilisation / immobilisation works

Table 7.8: Summary of Modelling Parameters – Groundwater Emissions and Water Treatment

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate (g/s, $g/m^2/s$, OU/s or $OU/m^2/s$)
Groundwater treatment	Benzene (max)	WTBE	Point	-	-	-	332298	6247702	17.5	Continuous during working hours	$9.7*10^{-5}$
	B(a)P (max)	WTBP	Point	-	-	-	332298	6247702	17.5	Continuous during working hours	$8.0*10^{-7}$
	Odour	WTOU	Point	-	-	-	332298	6247702	17.5	Continuous during working hours	0.3
Pooled water evaporation	Benzene (max)	PWBE	Area	20	20	0	332293	6247716	15	Continuous	$7.8*10^{-7} * U^{0.8}/T^{1.47}$
	B(a)P (max)	PWBP	Area	20	20	0	332293	6247716	15	Continuous	$1.6*10^{-7} * U^{0.8}/T^{1.47}$
	Odour	PWOU	Area	20	20	0	332293	6247716	15	Continuous	0.3

Table 7.9: Summary of Modelled Air Pollutant Levels Under Controlled Site Conditions (µg/m³ or OU)

Scenario	Pollutant	Averaging Time	Criteria	Receptor ID					
				1	2	3	4	5	6
Surface soils remediation	TSP	Annual	90	3.02E+00	9.11E+00	1.31E+01	1.19E+00	1.14E+01	1.15E+01
	PM_{10}	24 hour	50	1.40E+01	3.70E+01	2.92E+01	5.91E+00	2.00E+01	2.46E+01
	PM_{10}	Annual	30	1.42E+00	4.28E+00	6.17E+00	5.59E-01	5.37E+00	5.44E+00
	Benzene	1 hour	29	3.16E-03	1.16E-02	1.16E-02	3.18E-03	9.67E-03	1.16E-02
	Benzo(a)pyrene	1 hour	0.4	2.30E-02	8.41E-02	8.45E-02	2.31E-02	6.92E-02	8.43E-02
Fill materials behind northern retaining wall remediation	TSP	Annual	90	3.80E+00	3.87E+01	2.09E+01	8.29E-01	8.68E+00	4.23E+01
	PM_{10}	24 hour	50	1.81E+00	3.31E+01	2.63E+00	4.48E-01	1.69E+00	4.51E+00
	PM_{10}	Annual	30	1.86E+00	1.89E+01	1.02E+01	4.17E-01	4.28E+00	2.07E+01
	Benzene	1 hour	29	1.26E-02	1.24E-02	8.09E-03	8.41E-04	4.70E-03	9.26E-03
	Benzo(a)pyrene	1 hour	0.4	1.25E-01	1.19E-01	7.44E-02	6.96E-03	4.11E-02	8.89E-02
	Odour	1 second	2 OU	1.92E-01	1.06E+00	3.85E-01	1.29E-01	3.01E-01	6.32E-01
Northern gasholder remediation	TSP	Annual	90	5.30E-02	4.69E-01	1.61E-01	9.15E-03	8.22E-02	3.37E-01
	PM_{10}	24 hour	50	2.59E-02	5.99E-03	3.41E-03	6.53E-04	3.15E-03	5.82E-03
	PM_{10}	Annual	30	1.73E-01	1.92E+00	3.02E-01	4.56E-02	1.79E-01	6.19E-03
	Benzene	1 hour	29	1.75E-05	1.54E-04	6.55E-05	8.44E-06	3.87E-05	1.03E-04
	Benzo(a)pyrene	1 hour	0.4	1.71E-04	1.52E-03	6.40E-04	8.05E-05	3.76E-04	1.01E-03
	Odour	1 second	2 OU	3.30E-02	1.79E-01	1.11E-01	2.93E-02	8.28E-02	1.45E-01
Former gasworks area remediation	TSP	Annual	90	9.44E-02	4.74E-01	3.51E-01	1.89E-02	2.14E-01	4.90E-01
	PM_{10}	24 hour	50	3.84E-01	1.78E+00	6.40E-01	1.08E-01	4.12E-01	1.06E+00
	PM_{10}	Annual	30	4.51E-02	2.26E-02	1.68E-01	9.04E-03	1.02E-01	2.34E-01
	Benzene	1 hour	29	3.25E-04	1.69E-03	1.28E-03	3.10E-04	9.56E-04	2.10E-04
	Benzo(a)pyrene	1 hour	0.4	9.38E-04	5.49E-03	3.40E-03	5.32E-04	2.48E-03	4.35E-03
	Odour	1 second	2 OU	1.00E-01	4.90E-01	3.70E-01	9.93E-02	2.82E-01	4.69E-01
Haulage roads	TSP	Annual	90	3.59E-01	1.26E+00	2.22E+00	6.02E-01	2.15E+00	1.93E+00
	PM_{10}	24 hour	50	1.72E+00	6.83E+00	9.83E+00	2.43E+00	6.79E+00	7.99E+00
	PM_{10}	Annual	30	2.25E-01	7.91E-01	1.39E+00	3.77E-01	1.35E+00	1.21E+00
Soil treatment	TSP	Annual	90	7.70E-04	1.60E-03	2.74E-03	3.16E-03	3.00E-03	2.12E-03
	PM_{10}	24 hour	50	3.08E-03	7.31E-03	9.55E-03	9.14E-03	1.21E-02	8.32E-03

Scenario	Pollutant	Averaging Time	Criteria	Receptor ID					
				1	2	3	4	5	6
(bioremediation)	PM_{10}	Annual	30	3.99E-04	8.29E-04	1.42E-03	1.64E-03	1.56E-03	1.15E-03
	Benzene	1 hour	29	5.58E-06	1.26E-05	3.21E-06	7.86E-06	8.47E-06	9.20E-06
	Benzo(a)pyrene	1 hour	0.4	3.64E-05	8.02E-05	5.75E-05	5.12E-05	5.52E-05	6.00E-05
	Odour	1 second	2 OU	2.21E-01	4.94E-01	3.50E-01	3.12E-01	3.36E-01	3.65E-01
Groundwater pooling and treatment	Benzene	1 hour	29	4.50E-01	3.74E+00	1.76E+00	2.60E-01	1.08E+00	2.67E+00
	Benzo(a)pyrene	1 hour	0.4	7.21E-03	6.42E-02	2.71E-02	3.40E-03	1.59E-02	4.26E-02
	Odour	1 second	2 OU	9.98E-04	1.71E-03	1.56E-03	3.47E-04	5.36E-04	1.02E-03

BOLD denotes exceedance of criteria at receptor location

7.5 Source / Activity Specific Modelling Results

Modelling results are summarised in **Table 7.9**, with further detailed results of each AUSPLUME modelled source provided in **Appendix D**. Results are provided for each source of air emissions for 1 second, 1 hour, 24 hour and 90 day averaging times (used for comparison to annual based criteria) as appropriate to the corresponding assessment criterion. The maximum of all results calculated at each receptor location is summarised in **Table 7.9**. Assessment criteria were not exceeded for each proposed activity under the controlled conditions.

The proposed program of air quality controls appears adequate to protect against adverse air quality impacts occurring as a results of the remediation works, and noting the following conservativism built into the modelled scenarios:

- The maximum levels, as modelled using the 2 years of meteorological data have only been reported, and consequently account for worst case weather and atmospheric conditions;
- With respect to the results of modelling of particulate levels, assessed as TSP and PM_{10} concentrations and generally based on annual levels, it noted that many of the sources assessed are short term in nature with durations substantially less than a year. For the purposes of the screening exercise conducted with this modelling it was assumed that each of these sources will be continuous throughout the modelling period, with the maximum 90 day (three month) concentration reported and compared to the 'annual' criteria. This approach was applied to ensure a conservative approach to the assessment.
- No correction factor has been applied to account for no work occurring on Sundays for the duration of the project; and
- Use of maximum concentrations of constituents in assessing contaminant emission rates.

Particulate (TSP and PM_{10}) criteria are provided as annual averages. To provide a conservative assessment, the maximum three monthly concentration has been predicted using the model for comparison to the annual criteria. No correction factor has been applied to the three monthly concentration even though works on site will only occur 6 days a week, rather than the modelled seven days. The results for TSP and PM_{10} concentrations based on the combined emissions sources indicates that application of the nominated controls will be effective in preventing emissions above the adopted criteria. Dust deposition levels at all receptor locations were also within the assessment criteria, noting that, to maintain a conservative approach, the 1 hour averaging time result has been compared to the one month averaging time assessment criteria. These results confirm the proposed program of air quality controls should be sufficient to prevent unacceptable dust emissions.

Similarly results of benzene and benzo(a)pyrene concentrations at each receptor location are within the adopted criteria and indicate that the nominated controls will be effective in preventing unacceptable emissions. Given these significant levels of conservatism in the modelling and the inclusion of VOC monitoring in air within the AQMP, it is considered that the proposed controls will be sufficient to prevent unacceptable toxin emissions. Further consideration of the impact of air toxin emissions on the exposed populations is provided in the health risk assessment (**Section 10**).

7.6 Assessment of Control Performance

In order to confirm the performance of the proposed air quality controls assessment of the combination of sources that may occur during the works on the site has been conducted.

Table 7.10 summarises the combined predicted emissions at each receptor for each stage of the remediation works (summarised in **Table 3.1**).

Additionally a dust deposition value has been calculated at each receptor based on the combined activities. Results of the anticipated emissions at receptor locations based on these combined sources are provided in **Table 7.10**. Modelling outputs are included in **Appendix D**.

The maximum of all results calculated at each receptor location is summarised in **Table 7.10**. This has included consideration of maximum concentrations of chemical constituents as may occur on the site, as appropriate for comparison to 1 hour modelling criteria.

7.6.1 Particulates

For particulate (TSP and PM_{10}) criteria, it s noted that at Receptors 1, 2, 3, 5and 6 the PM10 concentration (annual averaging period) and background value exceeds the adopted assessment criteria of 30. The air quality controls are considered to be adequately protective of users at Receptors 1, 2, 3, 5and 6 noting that:

- the modelled maximum three monthly average has been compared to the assessment criteria for the annual average;
- The combined total includes the background value; and
- As discussed in **Section 7.5** no correction factor has been applied to the three monthly concentration even though works on site will only occur 6 days a week, rather than the modelled seven days.

Noting also that comparison of the PM10 value for a 24 hour averaging period at Receptors 1, 2, 3, 5and 6 are less than the corresponding criterion, it is considered that the results for TSP and PM_{10} concentrations based on the combined emissions sources indicates that application of the nominated controls will be effective in preventing emissions above the adopted criteria.

7.6.2 Dust

Dust deposition levels at all receptor locations were also within the assessment criteria, noting that, to maintain a conservative approach, the 1 hour averaging time result has been compared to the one month averaging time assessment criteria. These results confirm the proposed program of air quality controls should be sufficient to prevent unacceptable dust emissions.

7.6.3 Benzo(a)pyrene

With the exception of benzo(a)pyrene concentrations at receptors 2 and 6, it is noted that the combined results of benzene and benzo(a)pyrene concentrations at each receptor location are within the adopted criteria and indicate that the nominated controls will be effective in preventing unacceptable emissions. With respect to the benzo(a)pyrene exceedances at Receptors 2 and 6 the impact of the air toxin emissions on the exposed populations is provided in the health risk assessment (**Section 10**). Given these significant levels of conservatism in the modelling and the inclusion of VOC monitoring in air within the AQMP, it is considered that the proposed controls will be sufficient to prevent unacceptable toxin emissions.

7.6.4 Odour

Calculated odour emissions at all receptor locations are within the assessment criteria. Given the conservatism built into the modelled scenario, it is considered that the proposed controls are sufficient to prevent unacceptable odour emissions. The program of odour controls proposed are considered to be best practice, and while they may not be capable of completely eliminating offensive odours, they will be sufficient to reduce the duration of odour releases and provide a framework for monitoring and refining the odour management during remediation.

Table 7.10: Summary of Combined Emissions Under Controlled Site Conditions (µg/m³ or OU)

Pollutant	Concentration at Receptor (µg/m³ unless otherwise specified)						Criteria
	1	2	3	4	5	6	
Remediation Stage 1							
TSP -surface soils	3.02	9.11	13.12	1.19	11.42	11.51	**90**
TSP - northern retaining wall	1.39	20.23	2.79	0.21	1.37	7.30	
TSP - Haulage Roads	0.359	1.26	2.22	0.602	2.15	1.93	
Background Value	30	30	30	30	30	30	
Sum of Combined Emissions	**34.77**	**60.60**	**48.12**	**31.99**	**44.94**	**50.74**	
PM10 (Annual) -surface soils	14.01	37.05	29.17	5.91	19.96	24.56	**30**
PM10 (Annual) - northern retaining wall	1.81	33.14	2.63	0.45	1.69	4.51	
PM10 (Annual) Haulage Roads	1.72	6.83	9.83	2.436	6.79	7.99	
Background Value	14	14	14	14	14	14	
Sum of Combined Emissions	**31.53**	**91.02**	**55.63**	**22.79**	**42.43**	**51.05**	
PM10 (24 hr) -surface soils	1.42	4.28	6.17	0.56	5.37	5.44	**50**
PM10 (24 hr) - northern retaining wall	0.26	4.29	0.50	0.05	0.28	1.10	
PM10 (24 hr) - Haulage Roads	0.225	0.791	1.39	0.377	1.35	1.21	
Background Value	16	16	16	16	16	16	
Sum of Combined Emissions	**17.91**	**25.37**	**24.06**	**16.99**	**23.00**	**23.74**	
Benzene -surface soils	3.16E-03	0.01	0.01	3.18E-03	0.01	0.01	**29**
Benzene - northern retaining wall	1.26E-02	0.01	0.01	8.41E-04	0.00	0.01	
Sum of Combined Emissions	**0.02**	**0.02**	**0.02**	**4.02E-03**	**0.01**	**0.02**	
Benzo(a)pyrene -surface soils	0.02	0.08	0.08	0.02	0.07	0.08	**0.4**
Benzo(a)pyrene - northern retaining wall	0.01	0.07	0.02	0.00	0.01	0.03	
Sum of Combined Emissions	**0.03**	**0.15**	**0.10**	**0.03**	**0.08**	**0.11**	
Odour - northern retaining wall (reported in OU)	**0.19**	**1.06**	**0.39**	**0.13**	**0.30**	**0.63**	**2**
Dust Deposition (g/m2/month)	**0.31**	**1.31**	**1.13**	**0.35**	**1.05**	**1.09**	**2**
Remediation Stage 2							
TSP -northern gasholder	5.30E-02	4.69E-01	1.61E-01	9.15E-03	8.22E-02	3.37E-01	**90**
TSP - former gasholder	9.44E-02	4.74E-01	3.51E-01	1.89E-02	2.14E-01	4.90E-01	
TSP - haulage roads	3.59E-01	1.26	2.22	6.02E-01	2.15	1.93	
Background Value	30	30	30	30	30	30	
Sum of Combined Emissions	**30.51**	**32.20**	**32.73**	**30.63**	**32.45**	**32.76**	
PM10 (Annual) -northern gasholder	2.59E-02	5.99E-03	3.41E-03	6.53E-04	3.15E-03	5.82E-03	**30**
PM10 (Annual) - former gasholder	3.84E-01	1.78	6.40E-01	1.08E-01	4.12E-01	1.06	
PM10 (Annual) - haulage roads	1.72	6.83	9.83	2.43	6.79	7.99	
Background Value	14	14	14	14	14	14	
Sum of Combined Emissions	**16.13**	**22.62**	**24.47**	**16.54**	**21.21**	**23.06**	
PM10 (24 hr) -northern gasholder	1.73E-01	1.92	3.02E-01	4.56E-02	1.79E-01	6.19E-03	**50**
PM10 (24 hr) - former gasholder	4.51E-02	2.26E-02	1.68E-01	9.04E-03	1.02E-01	2.34E-01	
PM10 (24 hr) - haulage roads	1.72	6.83	9.83	2.43	6.79	7.99	
Background Value	16	16	16	16	16	16	
Sum of Combined Emissions	**17.94**	**24.77**	**26.30**	**18.48**	**23.07**	**24.23**	

Pollutant	Concentration at Receptor (µg/m^3 unless otherwise specified)						Criteria
	1	2	3	4	5	6	
Benzene -northern gasholder	1.26E-02	1.24E-02	8.09E-03	8.41E-04	4.70E-03	9.26E-03	29
Benzene - former gasholder	2.25E-01	7.91E-01	1.39	3.77E-01	1.35	1.21	
Benzene - groundwater and water treatment	4.50E-01	3.74	1.76	2.60E-01	1.08	2.67	
Sum of Combined Emissions	**0.69**	**4.54**	**3.15**	**0.64**	**2.44**	**3.89**	
Benzo(a)pyrene -northern gasholder	1.71E-04	1.52E-03	6.40E-04	8.05E-05	3.76E-04	1.01E-03	0.4
Benzo(a)pyrene - former gasholder	9.38E-04	5.49E-03	3.40E-03	5.32E-04	2.48E-03	4.35E-03	
Benzo(a)pyrene - groundwater and water treatment	7.21E-02	6.42E-01	2.71E-01	3.40E-02	1.59E-01	4.26E-01	
Sum of Combined Emissions	**0.07**	**0.65**	**0.28**	**0.03**	**0.16**	**0.43**	
Odour -northern gasholder	3.30E-02	1.79E-01	1.11E-01	2.93E-02	8.28E-02	1.45E-01	2
Odour - former gasholder	1.00E-01	4.90E-01	3.70E-01	9.93E-02	2.82E-01	4.69E-01	
Odour - groundwater and water treatment	9.98E-04	1.71E-03	1.56E-03	3.47E-04	5.36E-04	1.02E-03	
Sum of Combined Emissions (reported in OU)	**0.13**	**0.67**	**0.48**	**0.13**	**0.37**	**0.62**	
Dust Deposition (g/m2/month)	**0.31**	**1.23**	**1.1**	**0.34**	**1.03**	**1.02**	**2**
Stage 3 Remediation Works							
TSP - bioremediation	7.70E-04	1.60E-03	2.74E-03	3.16E-03	3.00E-03	2.12E-03	90
TSP - haulage roads	3.59E-01	1.26	2.22	6.02E-01	2.15	1.93	
Background Value	30	30	30	30	30	30	
Sum of Combined Emissions	**30.36**	**31.26**	**32.22**	**30.61**	**32.15**	**31.93**	
PM10 (Annual) - bioremediation	3.08E-03	7.31E-03	9.55E-03	9.14E-03	1.21E-02	8.32E-03	30
PM10 (Annual) - haulage roads	1.72	6.83	9.83	2.43	6.79	7.99	
Background Value	14	14	14	14	14	14	
Sum of Combined Emissions	**15.72**	**20.84**	**23.84**	**16.44**	**20.80**	**22.00**	
PM10 (24 hr) - bioremediation	3.99E-04	8.29E-04	1.42E-03	1.64E-03	1.56E-03	1.15E-03	50
PM10 (24 hr) - haulage roads	2.25E-01	7.91E-01	1.39	3.77E-01	1.35	1.21	
Background Value	16	16	16	16	16	16	
Sum of Combined Emissions	**16.23**	**16.79**	**17.39**	**16.38**	**17.35**	**17.21**	
Benzene - bioremediation	5.58E-06	1.26E-05	3.21E-06	7.86E-06	8.47E-06	9.20E-06	29
Benzene - groundwater and water treatment	4.50E-01	3.74	1.76	2.60E-01	1.08	2.67	
Sum of Combined Emissions	**0.45**	**3.74**	**1.76**	**0.26**	**1.08**	**2.67**	
Benzo(a)pyrene - bioremediation	3.64E-05	8.02E-05	5.75E-05	5.12E-05	5.52E-05	6.00E-05	0.4
Benzo(a)pyrene - groundwater and water treatment	7.21E-02	6.42E-01	2.71E-01	3.40E-02	1.59E-01	4.26E-01	
Sum of Combined Emissions	**7.21E-02**	**0.64**	**0.27**	**3.41E-02**	**0.16**	**0.43**	
Odour - bioremediation	2.21E-01	4.94E-01	3.50E-01	3.12E-01	3.36E-01	3.65E-01	2
Odour - groundwater and water treatment	9.98E-04	1.71E-03	1.56E-03	3.47E-04	5.36E-04	1.02E-03	
Sum of Combined Emissions (reported in OU)	**0.22**	**0.5**	**0.35**	**0.31**	**0.37**	**0.37**	
Dust Deposition (g/m2/month)	**0.31**	**1.23**	**1.1**	**0.34**	**1.03**	**1.02**	**2**

8 Air Emission Controls

The prediction of air quality impacts in **Section 7** has assumed that the air quality controls as listed in **Table 3.1** are to be employed on the site. Each of the air quality controls and the associated monitoring requirements are described in more detail following.

Table 8.1 Summary of Required Air Quality Controls

Site Area / Activity	Proposed Air Quality Control
Surface soil Excavations	Reduction of exposed *in-situ* materials to 400m^2 Dust suppression by hourly watering of all surfaces
Retaining Wall fill materials	Reduction of exposed *in-situ* materials to 25m^2 Dust suppression by hourly watering of all surfaces
Former gasworks area	Enclosure of excavations works, minimum required extent of enclosure shown on **Figure 6** Treatment of enclosure emissions prior to discharge.
Soil treatment - bioremediation	Enclosure of treatment works Treatment of enclosure emissions prior to discharge
Haulage Road use	Dust suppression by hourly watering of all surfaces
Groundwater	Relocation of water treatment plant to central section of the site as far removed from the Burren Street site frontage as possible, recommended location shown on **Figure 6** Enclosure of any areas used for splash filling of water treatment plant Ventilation from water treatment plant to be filtered Prevention of groundwater accumulating within excavations on the site. This may be achieved by pumping water out of the excavations as it infiltrates or if possible by pumping groundwater from adjacent wells

The descriptions in the following sections are anticipated to inform the preparation of the Air Quality Management Plan (**Appendix B**).

8.1 Particulate Emission Controls

Water will need to be regularly applied to disturbed areas within the remediation site. It is recommended that disturbed surfaces are watered by water cart at hourly intervals throughout the remediation works, and shall include:

- Areas of excavation;
- Areas of stockpiling;
- Areas of exposed soils where fugitive dusts may occur; and
- Haulage roads.

Where fugitive emissions are found to be significant, site operations should be reviewed as per the AQMP to consider whether changes to staging, covering or frequency of watering may results in reductions. Consideration may also be given to a sprinkler system installed around active excavation / soil handling areas to ensure that rates of water application to exposed surfaces are able to be maintained.

Additionally to prevent elevated levels of dusts impacting adjoining receptors during periods of non-favourable meteorological conditions (i.e. strong winds), it is recommended that excavation works external to the enclosure be ceased, or reduced, during periods of non-favourable meteorological conditions as identified during the site monitoring works.

Notwithstanding these recommendations, any works involving the excavation or handling of potential asbestos contaminated soils shall be undertaken subject to constant water application.

8.2 Controls for Reduction in Duration of Odour

The exposure of coal tar impacted materials has the potential to generate significant odour impacts. These odour impacts are unavoidable and are necessary in the disturbance of the contaminated soils and groundwater to effect the required excavation works. Being a tar based material, the odours are not unique and members of the public would be reasonably anticipated to be familiar with the odour characteristics. The following measures will require to be employed to minimise the potential impact of these materials:

- Enclosure of excavation works in areas of significant coal tar impact where the excavations works can be practically implemented. This is considered to at least include the northern gasholder and the tar wells located to the north of the gasholder. The minimum required extent of the enclosure is shown on **Figure 6**.

- Enclosure of works is not required in other areas of the site where lower levels of widespread coal tar impact are present. While these areas would be considered to have a reduced odour generation potential, excavation areas are required to be managed excavation such that:

  - No more than 400m^2 of *in-situ* materials are exposed in surface soil excavations;
  - No more than 25m^2 of *in-situ* materials are exposed in retaining wall fill excavations; and
  - Stockpiled materials to be left uncovered outside the enclosure for an extended period must be demonstrated to be compliant with the odour based criteria (**Section 4**).

  The remaining exposed surfaces in an excavation require control to prevent odour emissions. This may be undertaken by:

  - Covering of exposed malodourous soils by non-malodourous materials, secured plastic sheeting or low permeability geofabric;
  - Use of odour suppressants, or similar binding material (i.e. hydromulch) to 'seal' potentially malodourous surfaces;
  - Management of excavation staging and dimensions; and/or
  - Covering of all tipper loads.

  It is considered that these controls may also be required for validation purposes (i.e. to prevent cross contamination of remediated areas.)

- Install and operate an odour suppression system along the entire works boundary throughout the duration of the works. Odour suppression systems, consisting of the release of odour masking agents, have been found to be highly effective on other projects where substantial malodorous impacts have occurred;

- For works required outside of the enclosure, minimise the quantities of exposed coal tar impacted materials at all times. This can be achieved by the placement of excavations in stages with progressive backfilling, the covering of stockpiles and covering of inactive excavation areas;

- For works required outside of the enclosure, consistent application of an odour suppression agent to exposed surfaces within areas of excavation. This shall be undertaken by mixing of water used to control dust emissions with the odour suppression agent. The odour suppression agents have the effect of binding potentially malodorous emissions to soil particles; and
- For works required outside of the enclosure, dewatering of excavations to maintain water levels below excavation bases. The principal source of coal tar is anticipated to be impacted groundwater present within excavations. Where water levels can be maintained below the base of excavations, the surface soils will be found to rapidly volatilise the malodorous constituents of the coal tar impact, and then cause a reduced odour impact; and
- Any areas of splash filling associated with the water treatment plant require to be enclosed to control emissions. Emissions within the enclosed area require to be filtered through GAC filters.

The application of these controls will have the impact of preventing all odour emissions outside of working hours and restricting the duration of odour emissions that occur during working hours. It is considered unlikely that odour emissions from the works will be able to be eliminated. Odour emissions during the short term periods of vehicle movements into and out of the enclosure are unavoidable, as air releases during entry and exit cannot be completely eliminated. However the duration of these emissions will be minimal.

8.3 Enclosure of Odour Generating Works

The enclosure shall be constructed and operated in such a way that it is maintained under negative pressure. Exhaust fans should be provided to the enclosure so as to control air emissions to controlled points. By the use of exhaust fans at controlled points, air movement (and associated odour movement) at other openings such as the vehicle entry / exit point can be directed into the clad structure. Air emissions from the enclosure would require treatment through bag filters to remove particulates and granular activated carbon (GAC) filters to remove potential malodorous emissions. The GAC filters are effective at the removal of organic malodorous components of air flows.

8.4 Soil Treatment on Site

Where coal tar impacted soils are to be treated on site, treatment and associated soil stockpiling and handling activities shall occur within an enclosure. The enclosure shall be constructed and operated as described in **Section 8.3**. The enclosure shall be sufficiently sized to allow all associated stockpiling of malodorous soils. Stockpiling of malodorous soils undergoing treatment shall not occur outside of the enclosure. Stockpiling of malodours soils outside the enclosure is not preferred but if required may be possible subject to the material complying with the requirements of **Section 4** or by covering all exposed surfaces in a low permeability material that can be secured in place.

Alternately, treatment of malodorous materials may potentially be undertaken at the RailCorp nominated off-site facility at Chullora.

8.5 Performance of Air Emissions

The controls listed above are considered sufficient to allow the remediation to proceed and reduce emissions below criteria. The recommended measures have been categorised as having a ‘ high’ relative effectiveness in suppressing both volatilised contaminants and particulate matter in the ‘*Engineering Bulletin: Control of Air Emissions from Materials* *handling During Remediation*' (USEPA, 1991). The review noted that while temporary control technologies such as use of water sprays and foams were highly effective upon application, the effectiveness was noted to decrease significantly with time. Alternately the use of a physical barrier, such as an enclosure, around the majority of earthworks with collection and treatment of the emissions, was reported to be highly effective over time.

Furthermore the results of a trial excavation at a former landfill site in California, where excavation through mud, tar and 'char' wastes required control of sulphur dioxide and VOC emissions was documented in 1992 (USEPA 1992). The trial utilised the following air emission control technologies:

- An enclosure operated under negative pressure; and
- Use of vapour suppressing foam.

Perimeter monitoring conducted continually during the trial noted that total hydrocarbon concentrations did not exceed the established site criteria. Of the two air emissions suppression technologies used it was noted that the effectiveness of the enclosure did not reduce over time. In the vicinity of the treatment works that the efficiency of the vapour suppression foam reduced significantly as the time after application increased.

8.6 Monitoring

Notwithstanding the recommendations for air emission controls, and their demonstrated efficiency an air monitoring program will be required throughout the duration of the works. This shall include:

- Continual visual assessment of dust emissions during all facets of remediation works. No visible dust should be observed at any stage at site boundaries;
- Periodic particulate monitoring at site boundaries undertaken using real-time aerosol monitor;
- Assessment of odours by use of photo-ionisation detector, field olfactometer and field scientist observations;
- Daily monitoring of volatile constituents in emissions from the carbon filter forming part of the treatment system for the enclosure. When the measured concentrations exceed the nominated screening level the filter requires replacement and work within the enclosure shall be haltered until a new filter has been installed. The screening criteria to be adopted for the carbon filter emission during the remediation program has been nominated in the AQMP (**Appendix B**);
- Respirable fibres monitoring at discrete locations during all works involving the handling of areas of known asbestos impact (asbestos containing materials have been identified in fill materials on the site); and
- Dust deposition gauges maintained at two discrete locations at the site boundaries for the duration of the remediation works.

Full details of the required monitoring program are provided in the AQMP **(Appendix B).** The derivation of the VOC monitoring action criteria referred to in the AQMP has been detailed in **Appendix F**.

9 Greenhouse and Exhaust Emissions Assessment

The greenhouse gas emission assessment provided in the following section follows the methods detailed in the *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines June 2010* (Department of Climate Change and Energy Efficiency) and '*National Greenhouse Accounts (NGA) Factors*' and '*National Greenhouse Accounts (NGA) Factors*' (Department of Climate Change and Energy Efficiency, July 2010).

The guidelines provide reporting boundaries through a series of emission scopes as follows:

- Scope 1 (Direct Greenhouse) Emissions: defined as being '*... produced from sources within the boundary of an organisation and as a result of that organisation's activities*'.
- Scope 2 (Indirect Greenhouse) Emissions: defined as being '*...emissions generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services). The most important category of indirect emissions is from the consumption of electricity*'.
- Scope 3 (upstream and downstream) Emissions: defined as being other indirect emissions and '*...include upstream emissions generated in the extraction and production of fossil fuels, downstream emissions from transport of an organisation's product to customers, and emissions from contracted/outsourced activities. The appropriate emission factor for these activities depends on the parts of upstream production and downstream use considered in calculating emissions associated with the activity*.'

The greenhouse gas emission estimates provided in the following sections assumes that:

- any soil treatment works required will occur on the Chullora site only; and
- the greenhouse gas emissions of material disposed from the site to landfill, will be included in the emissions of the landfill site and are not attributable to the remediation works.

Accordingly the greenhouse gas and exhaust emissions generated during remediation works on the Macdonaldtown site are anticipated to be substantially generated by fuels during the excavation works.

9.1 Scope 1 Emissions

Scope 1 Emissions can include:

These emissions mainly arise from the following activities:

- generation of energy, heat, steam and electricity, including carbon dioxide and products of incomplete combustion (methane and nitrous oxide);
- manufacturing processes which produce emissions (for example, cement, aluminium and ammonia production);
- transportation of materials, products, waste and people; for example, use of vehicles owned and operated by the reporting organisation;
- fugitive emissions: intentional or unintentional GHG releases (such as methane emissions from coal mines, natural gas leaks from joints and seals); and
- on-site waste management, such as emissions from landfill sites

The main Scope 1 emissions anticipated for the Macdonaldtown site are those relating to vehicle movements and transport.

9.1.1 Fuel Consumption

Earthmoving equipment will be the most significant users of fuel during the excavation works. Earthmoving equipment is anticipated to primarily comprise:

- Excavators or other site plant; and
- Truck-and-dogs trailers.

Excavators are anticipated to be confined to the site, while truck-and-dog trailers are likely to be used to transport excavated materials off-site for disposal and/or treatment.

Further fuel is expected to be consumed by the use of air compressors on site as part of the water treatment system, and by a water cart used for dust suppression.

Fuel consumption estimates for each of item of equipment are detailed following. These are typically based on published values or estimates:

- Excavator or other plant (e.g. pug mill)– 40 litres/hour;
- Truck-and-dog trailer – 0.5 litre/km;
- Air compressor for groundwater pumps and treatment system– 30 litres/hour; and
- Water cart – 0.5 litres/km;

It was assumed that the truck-and-dog trailers will travel to one of two locations:

- Treatment location at Chullora, located 15 km from the site; or
- A waste disposal facility located in Western Sydney. As the disposal facility is yet to be determined, a representative round distance of 120 km per trip has been adopted.

Journeys returning treated material from Chullora to the site, and any remediation tasks completed on the Chullora site, have been included in the Air Quality Assessment completed for the Chullora site.

9.1.2 Mass of Excavated Materials

For the purposes of this assessment, it has been assumed all excavated materials containing asbestos materials and demolition waste will be excavated directly to a waste facility. From **Table 4.1**, this comprises an approximate quantity of materials of 3,765 m^3. From the EPA (2006) *'Standard Volume to Weight Conversion Factors'*, one cubic metre of material is equivalent to 1.4 tonnes, and results in an approximate mass of materials for disposal of 5, 300 tonnes.

Contaminated materials excavated on site are assumed to be transported to the Chullora facility for treatment. From **Table 4.1**, this comprises an approximate quantity of materials of 16, 215 m^3, which based on EPA (2006), results in an approximate mass of 22, 700 tonnes of material.

It is further assumed that surface soils, other than those impacted with free tar, will remain on site.

9.1.3 Greenhouse Gas Emission per Fuel Consumption Unit

The Department of Climate Change (2010) '*National Greenhouse Accounts (NGA) Factors*' reports 2.7 tonnes of CO_2 equivalent is produced per kilolitre of automotive diesel fuel consumed, based on the point source / fuel combustion scope.

9.1.4 Estimate of Scope 1 (Direct) Greenhouse Gas Emissions

For the purposes of this assessment, it has been assumed the carrying capacity of each truck-and-dog trailer approximates 30 tonnes. Therefore, it is anticipated that the following work will be required:

- 2 Excavators (or other plant) operating 9h/day for 154 days (6 months of works);
- 180 Truck-and-dog trailer round trips to a waste facility in west Sydney;
- 550 Truck-and-dog trailer round trips to the Chullora site (allows for delivery of untreated material only, emissions associated with return of treated material are included in the separate emissions assessment for the Chullora site);
- 1 Water Cart travelling 30 km/day * 154 days (6 months of works); and
- 1 Air Compressor operating 9h/day for 154 days (6 months of works).

Based on the above it is estimated that approximately 175 000 litres of diesel fuel will be used by the works. The conservatism of this estimate is considered sufficient to account for incidental uses of diesel fuels which will be generated by the project (i.e. delivery of materials, employee travel to and from site etc). Based on this value it is estimated that the remediation works will generate approximately 534 tonnes of CO_2 equivalent gases in direct emissions.

The calculations corresponding to this estimate are provided in **Appendix H**.

9.1.5 Estimate of Exhaust Emissions

By review of **Section 9.1.4** it is estimated that 175 000 litres of diesel will be used by site vehicles associated with the excavation works. NEPC (2008) summarises techniques for estimating the emissions of combustion engines, and **Section 5.4** outlines the use of emissions factors for emissions calculations. Table 21 of NEPC (2008) presents the emissions factors for heavy diesel powered vehicles, which are reproduced in **Table 9.1**.

A total estimate for emissions generated by exhausts for the site works is also summarised in **Table 9.1**. The calculations corresponding to this estimate are provided in **Appendix H**.

Table 9.1: Summary of Exhaust Emissions

Constituent	Emission Factor (kilograms per litre diesel)	Total Estimated Emission for Remediation Works (kg)
VOCs	0.0018	315
NO_x	0.023	4028
CO	0.0068	1191
PM_{10}	0.0018	315
SO_2	0.000017	2.98

The potential dispersion of these constituents has not been modelled for the site as they are considered insignificant in comparison of the exhaust emissions of the roadways bordering the site.

9.2 Scope 2 Emissions

Scope 2 Emissions comprise emissions generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services). The most important category of indirect emissions is from the consumption of electricity.

As discussed in **Section 9.1**, all plant and equipment used in the works will be powered by fuel. Consumption of purchased electricity is therefore considered unnecessary for the completion of the physical remediation works.

Given the actual treatment works have been assumed occur solely on the Chullora site, it is considered that no Scope 2 Greenhouse Gas Emissions will be generated by the proposed remediation works.

9.3 Scope 3 Emissions

Scope 3 Emissions comprise other emissions generated in the wider economy as a consequence of an organisation's activities (particularly from its demand for goods and services).

Given that end product of the remediation works will be material suitable to reuse on site or material suitable for disposal to landfill, it is considered that that no major emissions will be generated in the wider community. Emissions from material to be sent to landfill will be incorporated into the greenhouse gas emission calculations for those sites. Emissions from material reused on the site will be generally free of organic matter capable of generating greenhouse gas emissions. Additionally landuse patterns at the site are unlikely to change as a result of the remediation works such that significant greenhouse gas emissions are likely. Therefore it is considered that no Scope 3 Greenhouse Gas Emissions will be generated by the proposed remediation works.

9.4 Total Estimated Greenhouse Gas Emissions

Table 9.2 summarises the estimated Greenhouse gas emissions for the proposed remediation works on the Former Macdonaldtown gasworks site.

Table 9.2: Summary of Estimated Greenhouse Gas Emissions

Emissions Scope	Calculated Emissions (tonnes of CO_2 equivalent gases)
Scope 1 (direct)	473
Scope 2 (indirect)	-
Scope 3 (upstream and downstream)	-
Total	473

The total estimated greenhouse emissions for the site are considered to be relatively minor in comparison to greenhouse gas emissions generated on the roads surrounding the site.

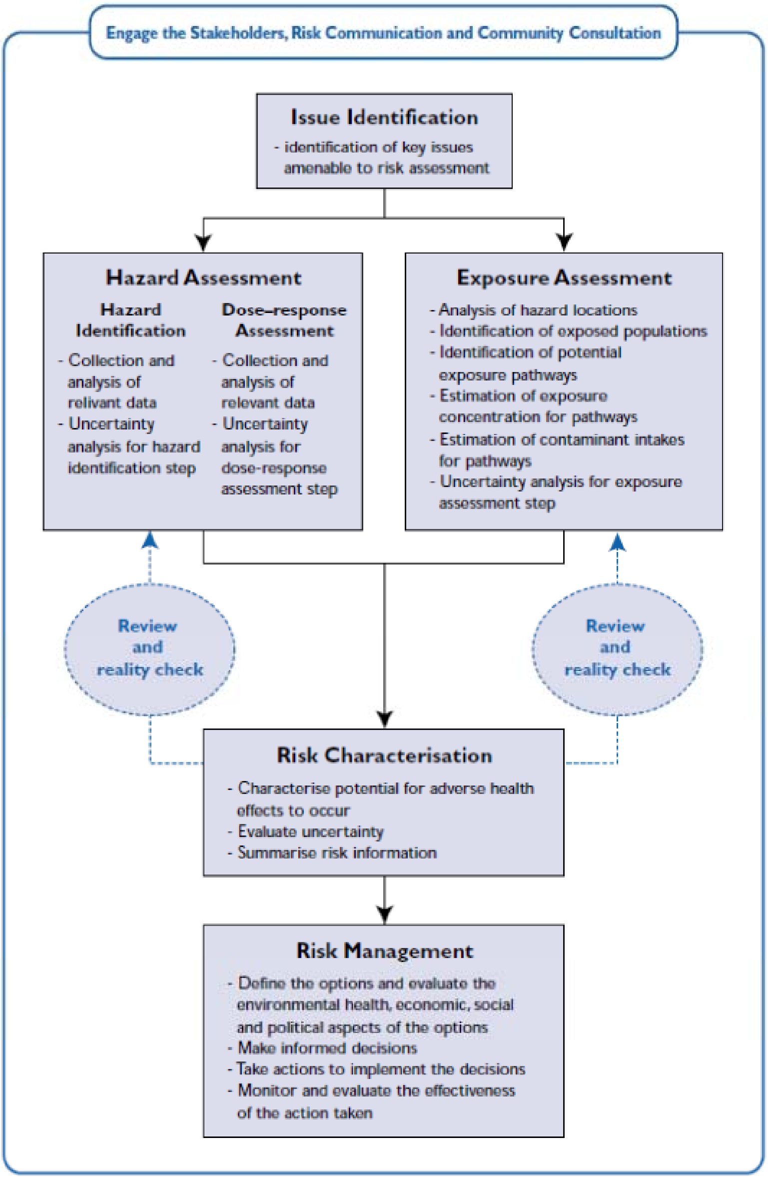
10 Health Risk Assessment

A health risk assessment has been additionally undertaken to estimate the potential quantum impact of the potential chemical atmospheric emissions from the remediation works on the Macdonaldtown Site on the surrounding population. This has been undertaken by the guidance provided to enHealth (2004) 'Environmental Health Risk Assessment Guidelines for assessing human health risks from environmental hazards'. The assessment has been conducted assuming the works are conducted in accordance with the controls measures recommended in **Table 8.1**.

10.1 Risk Assessment Process

Risk assessment is the process of estimating the potential impact of a chemical, physical, microbiological or psychosocial hazard on a specified human population or ecological system under a specific set of conditions and for a certain timeframe. A schematic of the risk assessment process is shown the diagram below (source: enHealth 2004).

- <u>Issue Identification</u> identifies issues amenable to risk assessment and assists in establishing a context for the risk assessment by a process of identifying the problems that the risk assessment needs to address. This includes the selection of Constituents of Potential Concern (COPC's) for the Macdonaldtown Site and each identified potential exposure population;
- <u>Hazard Assessment</u> including toxicological assessment and dose-response assessment. Toxicological assessment involves determining what types of (adverse) health effects might be caused by the agent; and how quickly the adverse health effects might be experienced and their duration. Dose-response assessment considers both qualitative and quantitative toxicity information to determine 'the incidence of adverse effects occurring in humans at different exposure levels';
- <u>Exposure Assessment</u> involves the determination of the frequency, extent, duration and character of exposures in the past, currently, and in the future. There is also the identification of exposed populations and particularly sensitive sub populations, and potential exposure pathways; and
- <u>Risk Characterisation</u> provides a qualitative and / or quantitative estimate, including attendant uncertainties, of the nature, severity and potential incidence of effects in a given population based on the hazard identification, and exposure assessments.



10.2 Issue Identification

Issue identification determines whether risk assessment is useful and establishes a context for the risk assessment by a process of identifying the concerns that the risk assessment needs to address. Issue identification draws on all relevant lines of information.

Issue identification comprises several phases:

1. Identification of environmental health issues (or an individual issue) and determining whether there are hazards amenable to risk assessment. This will involve demarcating 'hazards' from 'issues' and may require environmental sampling;
2. Putting the hazards into their environmental health context (clarification and prioritising of problems and hazards);
3. Identification of potential interactions between agents; and
4. Stating clearly why risk assessment is needed and the scope and objectives of the risk assessment. This will involve identifying problems for which information is,

or can be, available to undertake adequate risk assessments and problems which risk assessment cannot assist.

The health risk assessment is required to provide a definitive assessment of the potential health impacts of the air emissions, associated with the remediation of the Macdonaldtown site, to the surrounding potentially exposed community. Several of the potential speciated emissions have known toxicological effects. The most potentially toxic of these have been identified as benzene and benzo(a)pyrene. Risk assessment has considered each of the speciated constituents of benzene and benzo(a)pyrene as identified and quantified by air modelling as being present in the air emissions from the Macdonaldtown remediation.

10.3 Selection of Constituents of Potential Concern

Constituents of potential concern (COPCs) require to be selected to allow the subsequent risk assessment to be focussed to the most important constituents. This has been undertaken by the air quality assessment identifying benzene and benzo(a)pyrene as the most potentially toxic constituents present in air emissions from the works. Benzene and benzo(a)pyrene have been selected as COPCs for the health risk assessment.

10.4 Hazard Assessment

Enhealth (2002) provides advice as to the quality of toxicological data that is available to be used in risk assessments. Data is categorised as Level 1, 2 or 3 data. Level 1 sources are recommended as the preferred sources of chemical data. Level 1 sources, in the order of preference for which they are recommended to be used, include:

1. National Health and Medical Research Council documents and documents from other joint Commonwealth, State and Territory Health organisations. These may be a source of Australian guidance values. The Australian and New Zealand Environmental and Conservation Council is considered a suitable Commonwealth organisation to be included here;
2. ADI list from the Therapeutic Goods Administration;
3. World Health Organisation (WHO) documents. Australia is a party to the WHO process and has incorporated their material in a variety of environmental health criteria. A range of documents include those from the WHO/ILO/UNEP International Programme on Chemical Safety (IPCS) which produces Environmental Health Criteria monographs and Concise International Chemical Assessment documents (CICADs). Documents detailing international Acceptable Daily Intakes (ADI's), Tolerable Daily Intakes (TDI) or Tolerable Weekly Intakes (TWI) may be found in evaluations by the WHO/FAO Joint Meeting on Pesticide Residues (JMPR) and by the Joint FAO/WHO Expert Committee on Food Additives (JECFA);
4. enHealth Council documents;
5. National Environmental Health Forum documents distributed by the Commonwealth Department of Health and Ageing;
6. International Agency for Research on Cancer (IARC) Monographs;
7. WHO/FAO Joint Meeting on Pesticide Residues (JMPR) Monographs;
8. NICNAS Priority Existing Chemical (PEC) reports;

9. US Agency for Toxic Substances and Disease Registry (ATSDR) documents for general toxicological reviews and Reference Doses;
10. National Toxicology Program (NTP) carcinogenicity appraisals which report in detail the results of carcinogenicity tests on a wide range of chemicals;
11. OECD Standard Information Data Sets (SIDS) and SIDS Initial Assessment Reports (SIAR); and
12. US EPA Reference Doses.

Where a rare substance is being assessed, or insufficient data is available within Level 1 sources, then Level 2 sources may require to be researched. Level 2 sources include:

1. European Centre of Ecotoxicology and Toxicology of Chemicals (ECETOC): Monographs, JACC reports and Technical Reports;
2. Chemical Institute of Toxicology (CIIT) reports; and

Unpublished industry reports submitted for regulatory purposes. These may have restricted availability but information may be available in evaluation reports from regulatory agencies that have reviewed individual reports.

10.4.1 Review of Toxicological Sources

Each of these sources has been reviewed and appropriate toxicological values selected for the potential constituents released from the Macdonaldtown remediation. These are summarised in **Table 10.1** for non-threshold effects, and **Table 10.2** for threshold effects.

Table 10.1: Toxicity Criteria for Carcinogenic (Non-Threshold) Endpoints

Constituent	Inhalation Slope Factor $(mg/kg/day)^{-1}$	Discussion / Comments
Benzene	$2.1*10^{-2}$	Inhalation slope factor based on WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 5.2) unit risk of $6.0*10^{-6}$ $(\mu g/m^3)^{-1}$.
Benzo(a)pyrene	304	Inhalation slope factor based on WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 5.9) unit risk of $8.7*10^{-2}$ $(\mu g/m^3)^{-1}$.

Table 10.2: Toxicity Criteria for Non-Carcinogenic (Threshold) Endpoints

Constituent	Inhalation ADI, mg/kg/day	Discussion / Comments
Benzene	$2.9*10^{-3}$	Inhalation ADI based on ATSDR (August 2007) 'Toxicological Profile for Benzene' chronic duration inhalation exposure MRL of $10 \mu g/m^3$. More conservative than US EPA IRIS Database (2003) value.

10.5 Exposure Assessment

Potentially exposed populations have been identified by the identification of the discrete receptors in **Table 7.1** and shown on **Figure 10**. This includes properties used for residential, recreational and commercial purposes.

Exposure parameters are required for each of the potentially exposed populations. These are summarised in **Tables 10.3** to **10.5**.

Table 10.3: Global Parameters –Residential Receptor (Adult & Child) – Nearby Residents

Exposure Parameter	Units	Factor	Reference
Exposure Frequency	days/year	154	As per excavation duration of the 'surface soils' area. Considered upper estimate
Exposure Duration	months	6	Minimum averaging of toxicological data
Exposure Time	hours	10	As per duration of excavation activities. Found to contribute highest levels of COPCs
Body Weight	kg kg kg	13.2 34.5 70	Child 0-5 years, enHealth (2004) Child 6-15 years, Langley & Sobardo (1996) as per NEPC (1999) mean body weight for 10 year old child Adult 16+ years, NEPC (1999)
Averaging Time - non Threshold	years	70	NEPC (1999)
Averaging Time - Threshold	months	12	Minimum duration of threshold toxicological data

Table 10.4: Global Parameters – Adult Commercial / Industrial Workers

Exposure Parameter	Units	Factor	Reference
Exposure Frequency	days/year	240	enHealth (2004)
Exposure Duration	months	12	Maximum duration of receipt and handling of soils from Macdonaldtown
Exposure Time	hours	8	enHealth (2004)
Body Weight	kg	70	NEPC (1999)
Averaging Time - non Threshold	years	70	NEPC (1999)
Averaging Time - Threshold	months	12	Minimum duration of threshold toxicological data

Table 10.5: Inhalation Parameters

Exposure Parameter	Units	Factor	Reference
Industrial / Commercial Worker (indoors)	m^3/hour	1.33	Langley & Sobardo (1996) as per NEPC (1999). Based on slow walking and average of males and females.
Adult Residential / Recreational Receptor	m^3/hour	1.20	enHealth(2004). Average inhalation rate for light activity for an adult male
Child Residential / Recreational Receptor (6-15 years)	m^3/hour	0.78	enHealth(2004). Average inhalation rate for light activity for 10 year old child.
Child Residential / Recreational Receptor (0-5 years)	m^3/hour	0.63	Langley & Sobardo (1996). Young children, light activity

Risk modelling has been undertaken as per the guidance in US EPA (1989) 'Risk Assessment Guidance for Superfund, Volume 1 Human Health Evaluation Manual, Part A'. Exposure parameters have been used to estimate adjusted intake concentrations by the use of the following relationship:

CDI = (C * IR * ET * EF * ED) / (365 * AT * BW)

Where: CDI – chronic daily intake (mg/kg/day);

C – chemical concentration in air (mg/m^3)

IR – inhalation rate (m^3/h)

ET – exposure time (h/d)

EF – exposure frequency (day/year)

ED – exposure duration (years)

AT – averaging time (70 years for non threshold, ED for threshold)

BW – body weight (kg)

The modelling has been undertaken by assuming a direct exposure to the worse case 24h concentration of each constituent as base on the mean concentrations, as predicted for each particular receptor, for the complete duration of the works, being twelve months.

This is essentially the assumption that each of the assessed receptors is present downwind of the works for the entire duration of the works.

10.6 Risk Characterisation

10.6.1 Risk Measurement

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen. The slope factor (SF) converts estimated daily intakes averaged over a lifetime of exposure directly to incremental risk of an individual of developing cancer. Because relatively low intakes (compared to those experienced by test animals) occur with exposures on most contaminated sites it can generally be assumed that the dose response relationship is linear in the low-dose portion of the multistage model dose-response curve. Under this assumption the slope factor is constant and risk is directly related to intake. Thus the following linear based carcinogenic risk equation is used:

Risk = CDI * SF

where: Risk – unitless probability of an individual developing cancer;

CDI – chronic daily intake averaged over 70 years (mg/kg-day); and

SF – slope factor expressed in $(mg/kg\text{-}day)^{-1}$.

The slope factor is often an upper 95% percentile confidence limit of the probability of response based on experimental animal data used in the multistage model. Consequently the carcinogenic risk estimate will often be an upper bound estimate (US EPA, 1989).

The measure used to describe the potential for non carcinogenic toxicity to occur in an individual is not expressed as the probability of an individual suffering an adverse effect. Instead the potential for non carcinogenic effects is evaluated by comparing an exposure level over a specific time period with a reference dose derived for a similar exposure period. The ratio of exposure to toxicity is called a hazard quotient and is calculated as:

Noncancer hazard quotient = E / RfD

where: E – exposure level (or intake); and

RfD – reference dose (E and RfD are expressed in the same units (US EPA, 1989).

At most sites the potential health effects of more than one chemical require to be assessed. Potential additive effects of exposure to multiple chemicals require to be considered in risk assessment. US EPA (1989) recommends that carcinogenic risks are added.

To assess the overall potential for non-carcinogenic effects posed by more than one chemical a hazard index approach is used. This is undertaken by summing of all hazard quotients to determine a hazard index.

10.6.2 Adopted Risk Criteria

Acceptable risk guidelines are available from a range of national and international environmental agencies. These include:

- US EPA (1991) states that "Where the cumulative site risk to an individual based on a reasonable maximum exposure for both current and future land use is less than 10^{-4},…. action is generally not warranted unless there are adverse environmental impacts". Where the level of risk exceeds 10^{-4} it is recommended that remediation goals are developed based on a 10^{-6} cancer risk;
- WHO (1996) 'Guidelines for Drinking Water Quality' are based on a risk of 1 in 100,000 (1×10^{-5}); and
- NHMRC/ARMCANZ (1996) 'Australian Drinking Water Guidelines' nominate a negligible level of risk of 1 in 1,000,000 (1×10^{-6}).

No formal policy exists for the acceptable level of cancer risk, however it has been the experience of JBS that NSW, ACT and Victorian Environmental Auditors generally consider risks in the range of 1 in 100,000 (1×10^{-5}) to be acceptable. This level of acceptable risk will be adopted for the Works.

For the purposes of this risk assessment an acceptable level of risk is defined as risk less than 1×10^{-5} incremental lifetime risk of cancer.

10.6.3 Risk Estimates

Incremental risks and hazard indexes have been summed for each of the discrete receptors and are summarised in **Table 10.6**. Risk calculations have been undertaken on the basis of the following constituent levels:

- Benzo(a)pyrene: 0.005 to 0.025 µg/m^3; and
- Benzene: 0.0007 to 0.0076 µg/m^3.

The concentrations selected were the highest 24 hour averaging time concentrations reported at any receptor location and are based on:

- The 'annual' level of total suspended particulate as predicted for the site with air quality controls applied; and
- Consideration of vapour emissions only from areas of the site outside of the enclosed area as per the reduced areas of soils potentially subject to volatilisation processes.

Additionally it was assumed that at any one time, the population at each receptor location will be exposed to emissions from only one source area on the site. This is based on:

- the spatial distribution of site activities to be undertaken external to the enclosure (i.e. retaining wall excavations at the north and surface soil excavations generally in the southern and eastern portion of the site); and
- Review of the windrose data for the site indicates that emissions from the northern and southeastern portions of the site are unlikely to reach the receptor locations at the same time.

Based on the dispersion modelling results summarised in **Table 7.9** the works undertaken as part of the Stage 1 remediation works are likely to generate the greatest concentration of particulate air emissions. To ensure a conservative assessment the health risk assessment assumed that the Stage 1 emissions occurred for the likely duration of active remediation works (i.e. 6 months). Additionally as the results of dispersions modelling in

Table 7.10 indicates that emissions from the water treatment system and groundwater will potentially contribute the highest concentrations of air toxins to receptors these sources have also been included. It is noted that when remediation works commence the dispersion modelling results indicate that emissions to air will decrease by at least one order of magnitude once the Stage 1 works are completed.

The selection of the highest concentration reported, across all receptor locations, from any one source area on the site was therefore considered to be appropriate. Hazard index and risk level calculations based on the highest reported receptor location concentration are provided in **Appendix I** and summarise in **Table 10.6**.

Table 10.6: Summary of Worst Case Risk and Hazard Estimates

Receptor ID	Receptor ID	Hazard Index	Risk[1]
1	1 Leamington St Erskineville	7.94×10^{-3}	6.2×10^{-7}
2	Railway Offices, within Stabling Shed	3.3×10^{-2}	9.77×10^{-6}
3	Railway Workshops, nearest to site	1.55×10^{-2}	3.4×10^{-6}
4	95 Railway Pde Erskineville	7.32×10^{-4}	5.14×10^{-7}
5	15 Burren St Erskineville	9.54×10^{-3}	2.02×10^{-6}
6	31 Burren St Erskineville	2.3×10^{-2}	5.77×10^{-6}
Notes 1: risk to child resident at receptor location			

Assuming the proposed controls (**Table 7.2**) are maintained each of the predicted levels of hazard and risk levels is well below the adopted criteria.

11 Conclusions and Recommendations

An assessment of the potential air quality impacts of remediation works at the former Macdonaldtown gasworks has been undertaken.

The objectives of this air quality assessment were to:

- Estimate potential air emissions including particulates, potential chemical constituents and odours from the proposed remediation works;
- Identify the requirement and type of air emission controls required;
- Undertake dispersion modelling of air emissions to determine potential impacts to nearby receptors and adjoining properties;
- Assess the effectiveness of proposed air emission controls;
- Undertake a health risk assessment to determine potential health impacts of speciated chemical constituents identified as occurring from the works to nearby receptors and adjoining properties;
- Based on results of air modelling, assess compliance with relevant OEH and NEPC published criteria; and
- Estimate the greenhouse contribution of the proposed works.

A range of activities that may be undertaken with the gasworks remediation has been considered in the air quality assessment including:

- Excavation, handling and stockpiling of low level contaminated soils;
- Excavation , handling and stockpiling of coal tar contaminated soils;
- Movement of site vehicles over non-paved site haulage roads;
- Treatment of coal tar contaminated soils on-site by stabilisation / immobilisation;
- Treatment of coal tar contaminated soils on-site by bioremediation;
- Dewatering of coal tar impacted groundwater from excavations and operation of a water treatment plant; and
- Potential pooling and evaporation of coal tar impacted groundwater within site excavations.

The assessment has been initially completed by undertaking air modelling to determine worst case impacts for a range of representative receptor locations in close proximity of the site. A number of conservative assumptions, including the complete absence of any air quality controls, has been assumed in the air modelling to allow the identification of all site activities that will require air quality controls. Modelling results have been compared to OEH published and endorsed air quality criteria.

A number of air quality controls have been designed to reduce the air emissions from the proposed works. These include:

- Excavation Works: Water will be applied to disturbed areas at least hourly within the remediation site. Areas of coal tar impacted soil excavation will require addition of an odour suppression agent to the water sprays. Notwithstanding this recommendation, any works involving the excavation or handling of potential asbestos contaminated soils shall be undertaken subject to constant water application;

- Enclosure of Remediation Works: The excavation of soils impacted with high levels of coal tar anticipated in proximity of the northern gasholder and the former tar wells to the north of the gasholder shall require encapsulation within a ventilation controlled enclosure. Air discharges from the enclosure shall be through a controlled air filtering system designed to remove malodorous emissions and particulates;

- Soils Treatment on Site: Where treatment of coal tar impacted soils (as defined by the soil criteria summarised in **Table 11.1**) is proposed to occur on site this shall also be required to occur within a ventilation controlled enclosure. The enclosure shall be sufficiently sized to accommodate both the soil treatment works and the associated stockpiling;

- Odour Control: The presence of the coal tar impacted soils and groundwater on the site causes them to be highly malodorous on exposure during excavation and when stockpiled. A number of measures require implementation to minimise the impacts of odours including, in some sections of the site, enclosure of any excavation and soil handling works with treatment of air emissions to remove odours. In areas unsuited to the enclosure of soil handling activities, control measures shall include the minimisation of areas of exposed soils by works staging and covering of stockpiles, covering of tippers used to transport materials on the site, enclosure and controlled ventilation of any areas of splash filling the water treatment plant, installation and operation of an odour suppression system on the site boundary, application of odour suppression agents with dust control sprays during excavation and soil handling works and prevention of the exposure of contaminated groundwater saturated soils by control of water levels in open excavations. Materials with chemical concentrations exceeding those stipulated in **Table 11.1** shall not be stockpiled outside of enclosure without odour controls;

- Air Treatment System Monitoring: daily monitoring of volatile constituents will be required in emissions from the carbon filter forming part of the treatment system for the enclosure. When the measured concentrations exceed the nominated screening level the filter requires replacement and work within the enclosure shall be halted until a new filter has been installed;

- Site Monitoring: Site monitoring will be required, including assessment for particles less than 10 micron in diameter (PM_{10}), malodorous emissions, levels of volatile organic compounds, respirable fibres and dust deposition. Where site monitoring identifies potential exceedances of acceptable levels of dust or odour, site practices shall be reviewed, or the particular dust / odour generating activity ceased until more favourable meteorological conditions occur or revised mitigation practices are adopted;

- Deep Excavations: Infiltrating coal tar impacted groundwater is to be prevented from accumulating within excavations by removing any ponded groundwater generated during the remediation works; and

- Monitoring: An atmospheric monitoring program requires to be implemented at the site boundary and adjoining residential areas to continually assess levels of airborne pollutants and offensive odours being generated by the works.

Monitoring shall include dust and particulate, odour, asbestos and volatile constituents.

Table 11.1: Summary of Maximum Allowable Levels of Malodorous Constituents

Constituent	Criteria (mg/kg)	Comments
Benzene	2.5	-
Ethylbenzene	5	-
Toluene	10	-
Xylene (total)	10	-
Cresols	_	Non volatile, no limits requiring covering from odour potential
Acenaphthene	35	-
Naphthalene	25	-
Phenol	40	-

Notwithstanding the implementation of these air quality controls, it is considered likely that localised detections of coal tar odours will occur in close proximity of the site for the duration of the works. However the level of impact is not considered to be offensive, and is unavoidable in achieving the environmental rehabilitation of the site. The program of odour controls proposed are considered to be best practice, and while they may not be capable of completely eliminating offensive odours, they will be sufficient to reduce the duration of odour releases and provide a framework for monitoring and refining the odour management during remediation. The Human Health Risk Assessment has also shown that the proposed works will not pose an unacceptable risk to the health of nearby receptors.

An Air Quality Management Plan (AQMP) detailing the requirements for the aforementioned controls and monitoring requirements has been prepared for the remediation program. The proposed controls are considered to be best practice for the proposed remediation works. The recommended controls above are identified as having a 'High' relative effectiveness (USEPA, 1991). Enclosures of soil handling works, with collection and treatment of air emissions, has been demonstrated as effective in protecting the surrounding community on other sites heavily impacted with tar (USEPA 1992).

Greenhouse gas emissions associated with the proposed works were assessed. While the proposed remediation strategy will generate some greenhouse gases from standard fuel based emissions, the controls proposed in the Air Quality Management Plan for the project will reduce the magnitude of these emissions and minimise the associated fugitive emissions. The provision to enable contaminated soil to be treated will reduce the volume of material being sent to landfill. These inclusions are consistent with the objectives and commitments of the NSW Greenhouse Plan and *Action for Air: The NSW Government's 25 year Air Quality Management Plan*, that are relevant to waste minimisation.

12 References

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USEPA Superfund, Office of Emergency and Remedial Response (1991) '*Engineering Bulletin: Control of Air Emissions From Materials Handling During Remediation*' EPQ/540/2-91/023, October 1991

US EPA (2004) 'Methods for Estimating Fugitive Air Emissions of Radionuclides from Diffuse Sources at DoE Facilities'

13 Limitations

This report has been prepared for use by the client who commissioned the works in accordance with the project brief only and has been based in part on information obtained from other parties. The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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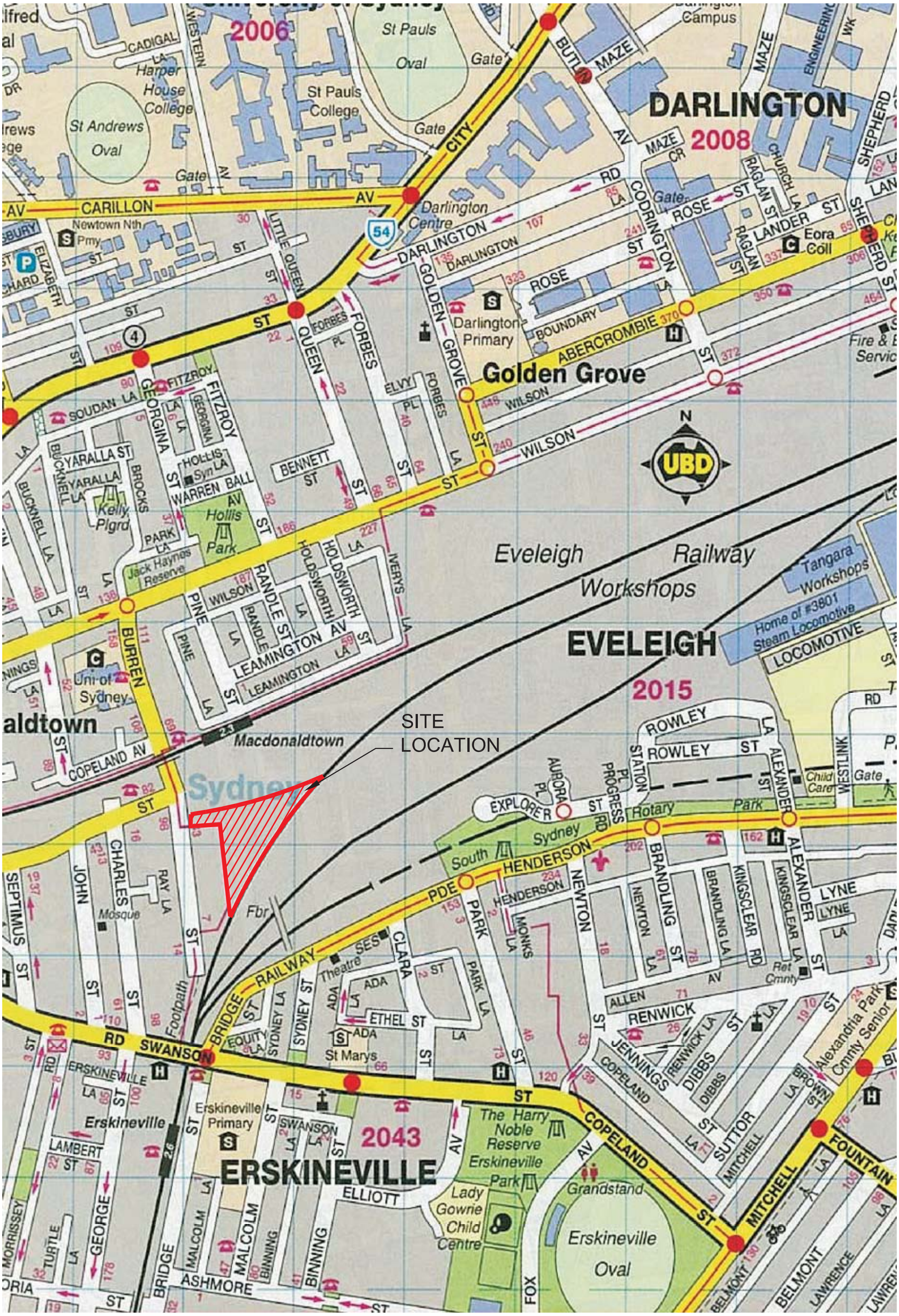
This report does not provide a complete assessment of the potential hazards associated with the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of potential hazards, JBS Environmental Pty Ltd reserves the right to review the report in the context of the additional information.

Figures



0 500m
Approximate scale

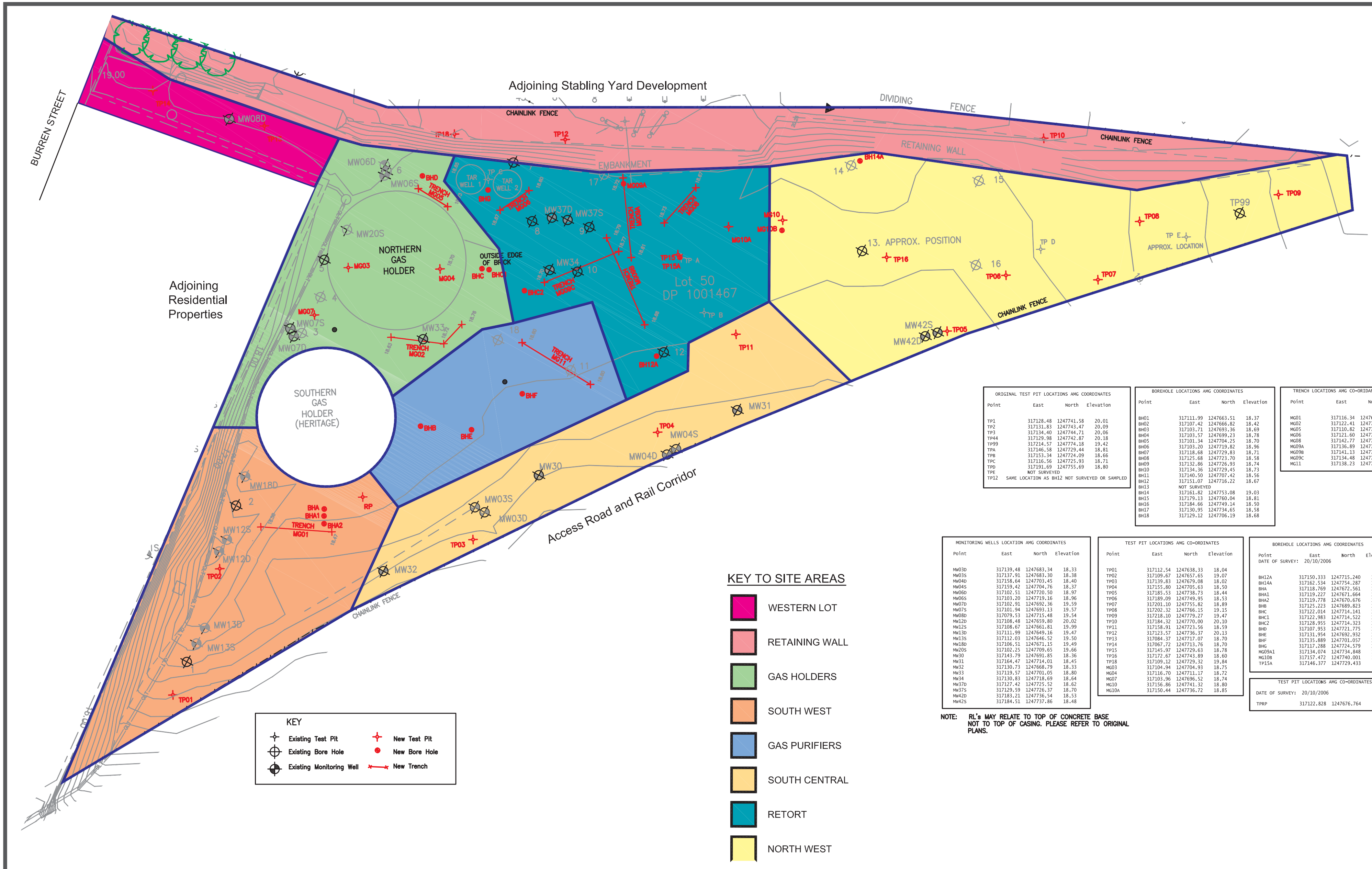
Figure 1 **Site Location (Macdonaldtown)**

CH2M Hill (2007)
Note- All locations shown are approximate only

0 100m
Approximate scale

Figure 2 **Current Macdonaldtown Site Plan**

CH2M Hill (2007)
Note- All locations shown are approximate only



KEY TO SITE AREAS

- WESTERN LOT
- RETAINING WALL
- GAS HOLDERS
- SOUTH WEST
- GAS PURIFIERS
- SOUTH CENTRAL
- RETORT
- NORTH WEST

ORIGINAL TEST PIT LOCATIONS AMG COORDINATES

Point	East	North	Elevation
TP1	317128.48	1247741.58	20.01
TP2	317131.83	1247743.47	20.09
TP3	317134.40	1247744.71	20.06
TP44	317129.98	1247742.87	20.18
TP99	317214.57	1247774.18	19.42
TPA	317146.58	1247729.44	18.81
TPB	317153.34	1247724.09	18.66
TPC	317116.56	1247725.93	18.71
TPD	317191.69	1247755.69	18.80
TPE	NOT SURVEYED		
TP12	SAME LOCATION AS BH12 NOT SURVEYED OR SAMPLED		

BOREHOLE LOCATIONS AMG COORDINATES

Point	East	North	Elevation
BH01	317111.99	1247663.51	18.37
BH02	317107.42	1247666.82	18.42
BH03	317103.71	1247693.36	18.69
BH04	317103.57	1247699.23	18.78
BH05	317101.34	1247704.25	18.70
BH06	317103.20	1247719.82	18.96
BH07	317118.68	1247729.83	18.71
BH08	317125.68	1247723.70	18.58
BH09	317132.86	1247726.93	18.74
BH10	317134.36	1247729.45	18.73
BH11	317140.50	1247707.42	18.56
BH12	317151.07	1247716.22	18.67
BH13	NOT SURVEYED		
BH14	317161.82	1247753.08	19.03
BH15	317179.13	1247760.04	18.81
BH16	317184.66	1247749.14	18.50
BH17	317130.95	1247734.65	18.58
BH18	317129.12	1247706.19	18.68

TRENCH LOCATIONS AMG CO-ORIDANTES

Point	East	North
MG01	317116.34	1247667.86
MG02	317122.41	1247701.92
MG05	317110.82	1247719.75
MG06	317121.60	1247725.15
MG08	317142.77	1247736.07
MG09A	317136.89	1247730.85
MG09B	317141.13	1247722.61
MG09C	317134.48	1247721.27
MG11	317138.23	1247707.26

MONITORING WELLS LOCATION AMG COORDINATES

Point	East	North	Elevation
MW03D	317139.48	1247683.34	18.33
MW03S	317137.91	1247683.30	18.38
MW04D	317158.64	1247703.45	18.40
MW04S	317159.42	1247704.76	18.37
MW06D	317102.51	1247720.50	18.97
MW06S	317103.20	1247719.16	18.96
MW07D	317102.91	1247692.36	19.59
MW07S	317101.94	1247693.13	19.57
MW08D	317079.53	1247715.48	19.54
MW12D	317108.48	1247659.80	20.02
MW12S	317108.67	1247661.81	19.99
MW13D	317111.99	1247649.16	19.47
MW13S	317112.03	1247646.52	19.50
MW18D	317106.51	1247671.15	19.49
MW20S	317102.25	1247709.65	19.66
MW30	317143.79	1247691.85	18.36
MW31	317164.47	1247714.01	18.45
MW32	317130.73	1247668.79	18.33
MW33	317119.57	1247701.05	18.80
MW34	317130.83	1247718.69	18.64
MW37D	317127.42	1247725.52	18.62
MW37S	317129.59	1247726.37	18.70
MW42D	317183.21	1247736.54	18.53
MW42S	317184.51	1247737.86	18.48

NOTE: RL's MAY RELATE TO TOP OF CONCRETE BASE NOT TO TOP OF CASING. PLEASE REFER TO ORIGINAL PLANS.

TEST PIT LOCATIONS AMG CO-ORDINATES

Point	East	North	Elevation
TP01	317112.54	1247638.33	18.04
TP02	317109.67	1247657.65	19.07
TP03	317139.83	1247679.08	18.02
TP04	317155.80	1247705.63	18.50
TP05	317185.53	1247738.73	18.44
TP06	317189.09	1247749.95	18.53
TP07	317201.10	1247755.82	18.89
TP08	317202.32	1247766.15	19.15
TP09	317218.10	1247779.27	19.47
TP10	317184.32	1247770.00	20.10
TP11	317158.91	1247723.56	18.59
TP12	317123.57	1247736.37	20.13
TP13	317084.37	1247717.07	18.70
TP14	317067.72	1247713.76	18.70
TP15	317145.97	1247729.63	18.78
TP16	317172.67	1247743.89	18.60
TP18	317109.12	1247729.32	19.84
MG03	317104.94	1247704.93	18.75
MG04	317116.70	1247711.17	18.72
MG07	317103.96	1247696.52	18.74
MG10	317156.86	1247741.32	18.80
MG10A	317150.44	1247736.72	18.85

BOREHOLE LOCATIONS AMG COORDINATES

Point	East	North	Elevation
DATE OF SURVEY: 20/10/2006			
BH12A	317150.333	1247715.240	18.63
BH14A	317162.534	1247754.287	18.89
BHA	317118.769	1247672.561	18.46
BHA1	317119.227	1247671.664	18.41
BHA2	317119.778	1247670.676	18.48
BHB	317125.223	1247689.823	18.49
BHC	317122.014	1247714.141	18.78
BHC1	317122.983	1247714.522	18.75
BHC2	317128.955	1247714.323	18.66
BHD	317107.953	1247721.775	18.86
BHE	317131.954	1247692.932	18.50
BHF	317135.889	1247701.057	18.56
BHG	317117.288	1247724.579	18.61
MG09A1	317134.074	1247734.848	18.44
MG10B	317157.472	1247740.001	18.82
TP15A	317146.377	1247729.433	18.80

TEST PIT LOCATIONS AMG CO-ORDINATES

DATE OF SURVEY: 20/10/2006

TPRP	317122.828	1247676.764	18.37

JBS ENVIRONMENTAL

0 50m

Approximate scale

Figure 3 **Site Areas**

CH2M Hill (2007)

Note- All locations shown are approximate only

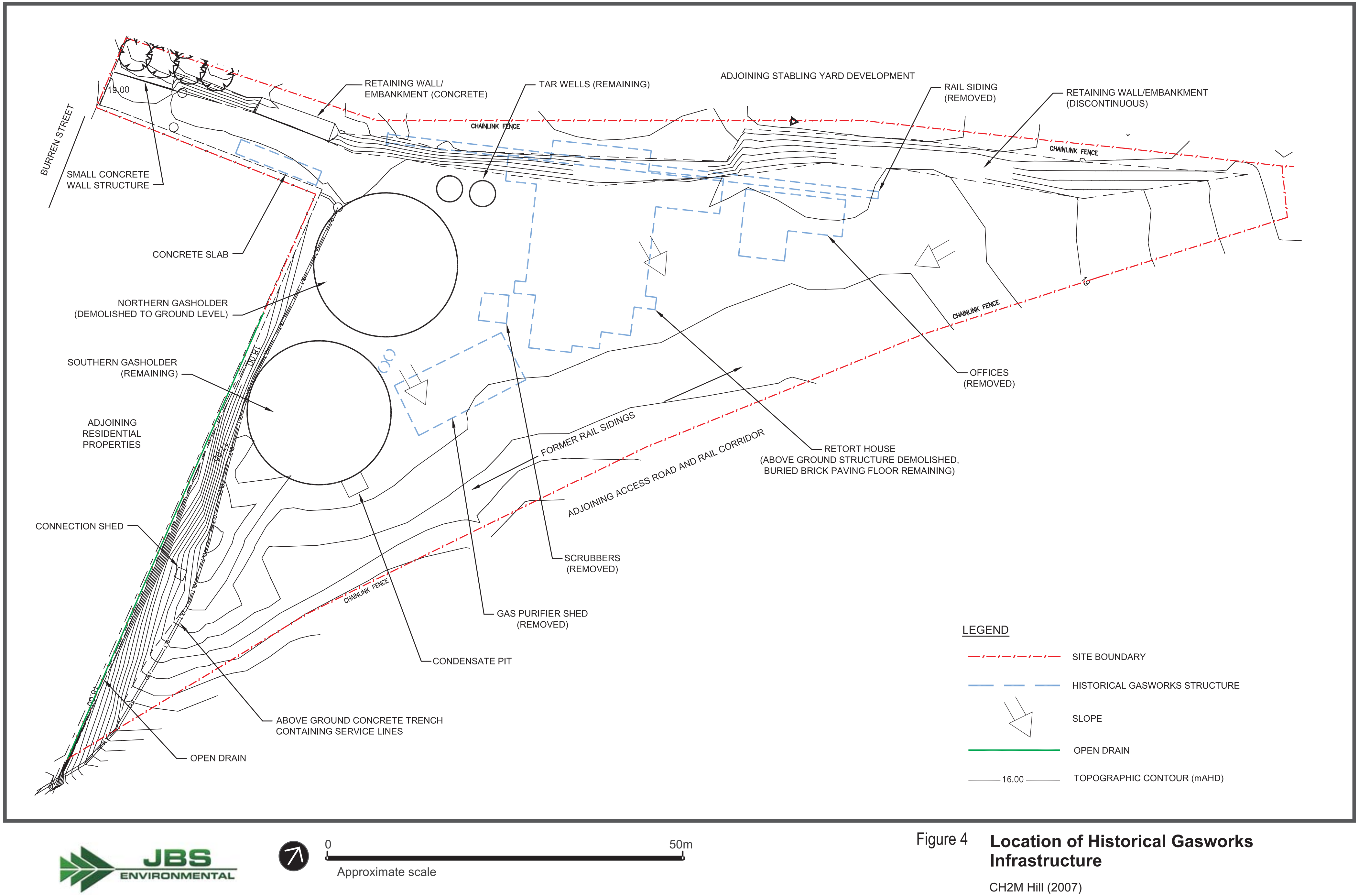
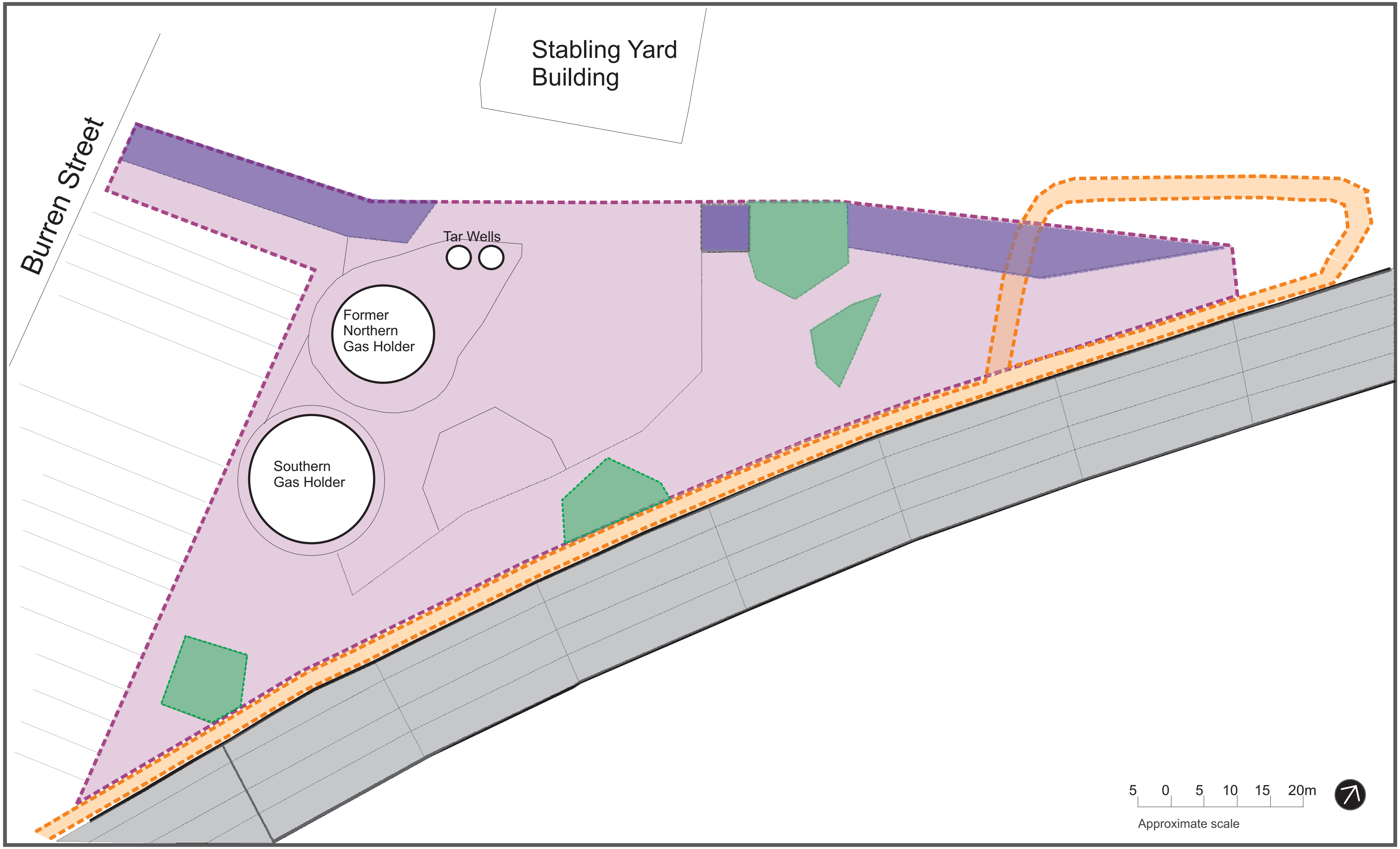


Figure 4 **Location of Historical Gasworks Infrastructure**

CH2M Hill (2007)
Note- All locations shown are approximate only



JBS ENVIRONMENTAL

Site Boundary

Task 1A - assessment of blue area for suitability to remain on site

Task 1B - installation of access road turning circle

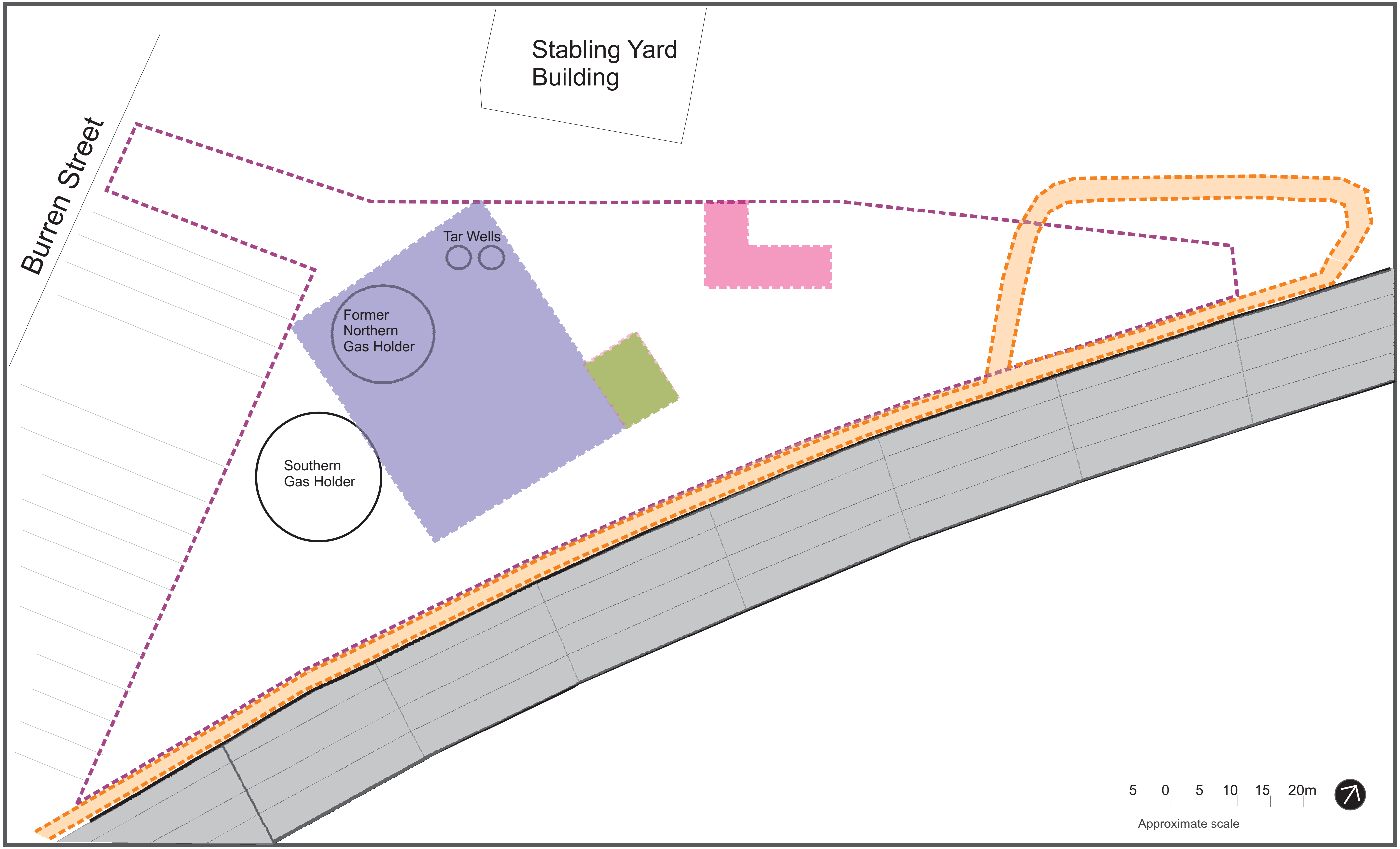
Task 1C - strip off top 0.5 of fill (for remediation by cement stabilisation)

Task 1D - Excavate and validate hotspots (for remediation by cement stabilisation)

Figure 5

Former Macdonaldtown Gasworks - Remediation Stage One Works

As adapted from Figure 4 CH2M Hill 2007

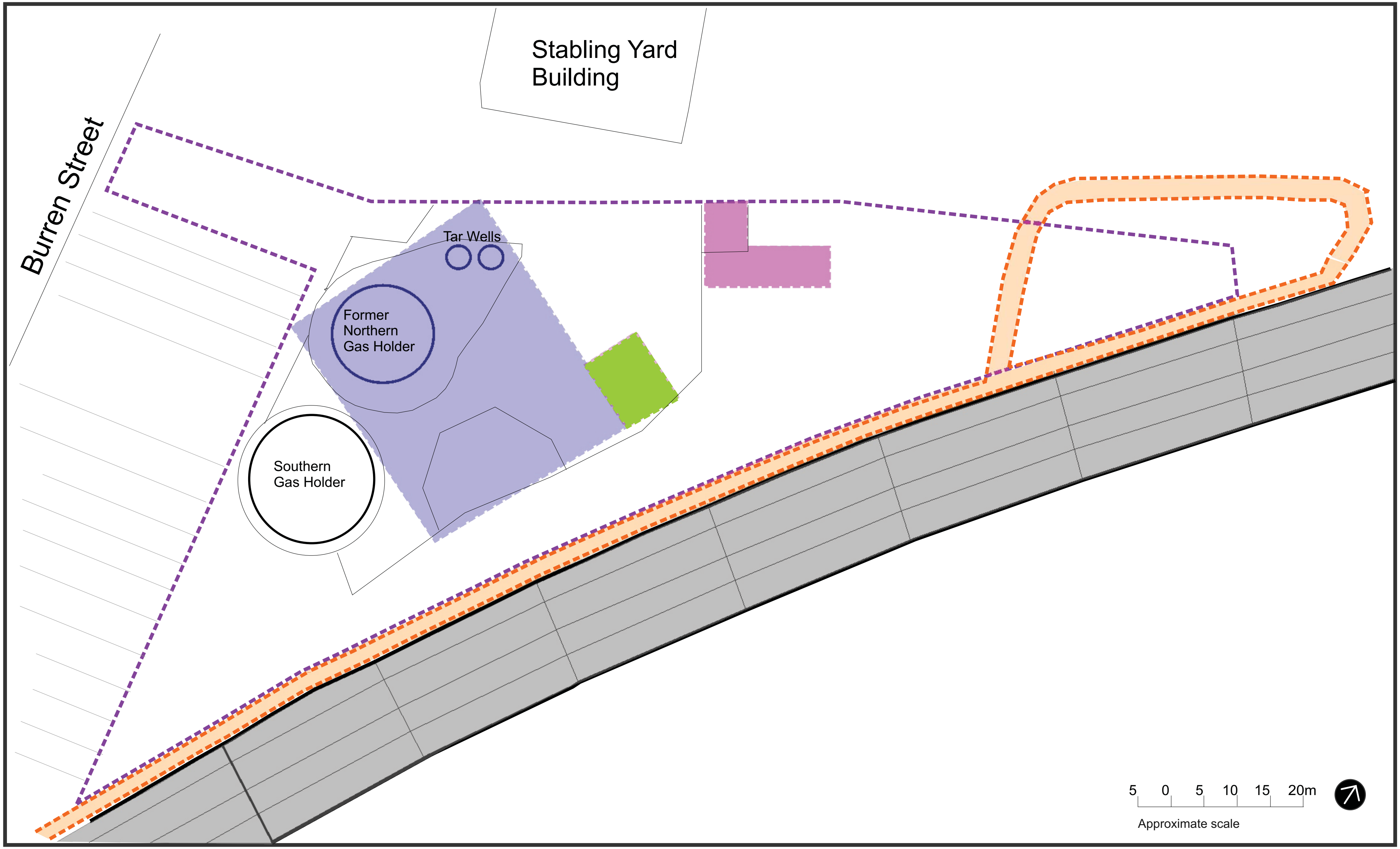


Site Boundary
Temporary Enclosure
Air Emissions Treatment System
Water Treatment System
Site Access Road
Water Treatment System

JBS ENVIRONMENTAL

Figure 6 **Macdonaldtown Remediation Proposed Site Setup**

As adapted from Figure 4 CH2M Hill 2007



Site Boundary

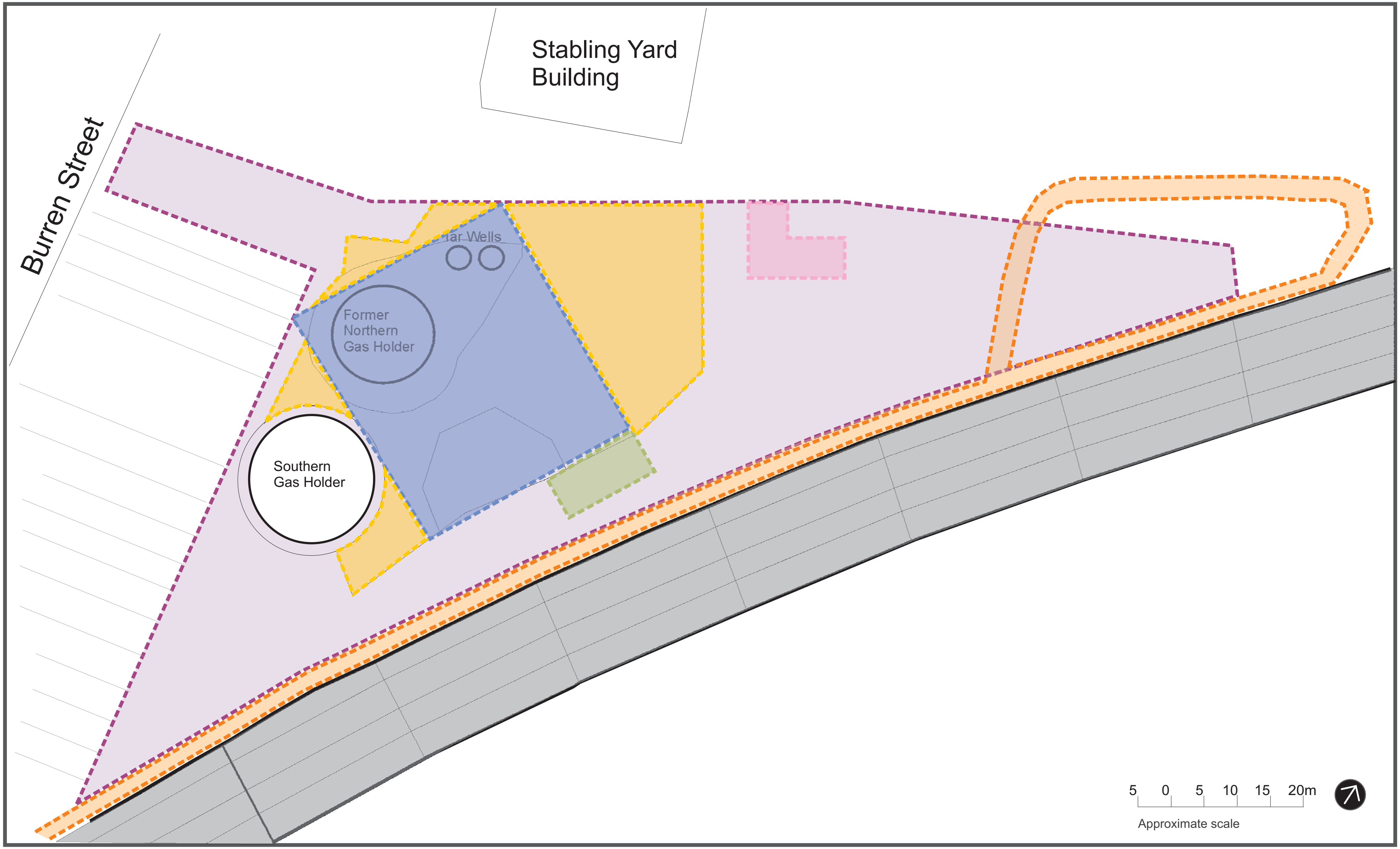
Task 2A - install & commission enclosure, water treatment plant and air emissions treatment system

Task 2B - excavate and validate area within enclosure

Task 2C reinstate with VENM of imported materials to site level external to enclosure

Figure 7 **Former Macdonaldtown Gasworks - Remediation Stage 2**

As adapted from Figure 4 CH2M Hill 2007



JBS ENVIRONMENTAL

Site Boundary

Task 3A - excavate areas of impact and assess potential for bioremediation

Potential Stockpiling areas

Figure 8 **Former Macdonaldtown Gasworks - Remediation Stage Three Works**

As adapted from Figure 4 CH2M Hill 2007

LEGEND

Zone suitable for placement of uncovered stockpiles provided criteria below are satisfied

Contaminant	Odour Based Criteria for Uncovered Stockpiling (mg/kg)
Benzene	2.5
Ethylbenzene	5
Toluene	10
Xylene (total)	10
Cresols	_
Acenaphthene	35
Naphthalene	25
Phenol	40

Zone unsuitable for placement of uncovered stockpiles

JBS ENVIRONMENTAL

0 100m
Approximate scale

Figure 9 **Stockpiling Zones**

CH2M Hill (2007)
Note- All locations shown are approximate only

JBS ENVIRONMENTAL

0
100m
Approximate scale

Figure 10 **Location of Receptors in Proximity of Site**

Department of Lands (2010)
Note- All locations shown are approximate only

Figure 11 **Adopted Boundaries for Assessment of Odour Impacts**

Appendix A

Meteorological Data

Site-Specific Input Meteorological data file for AUSPLUME

Macdonaldtown-2007/08

This file was exclusively compiled for **JBS Group** By pDs Consultancy; Air Modelling and Meteorology Experts.

pDs Consultancy
@2010

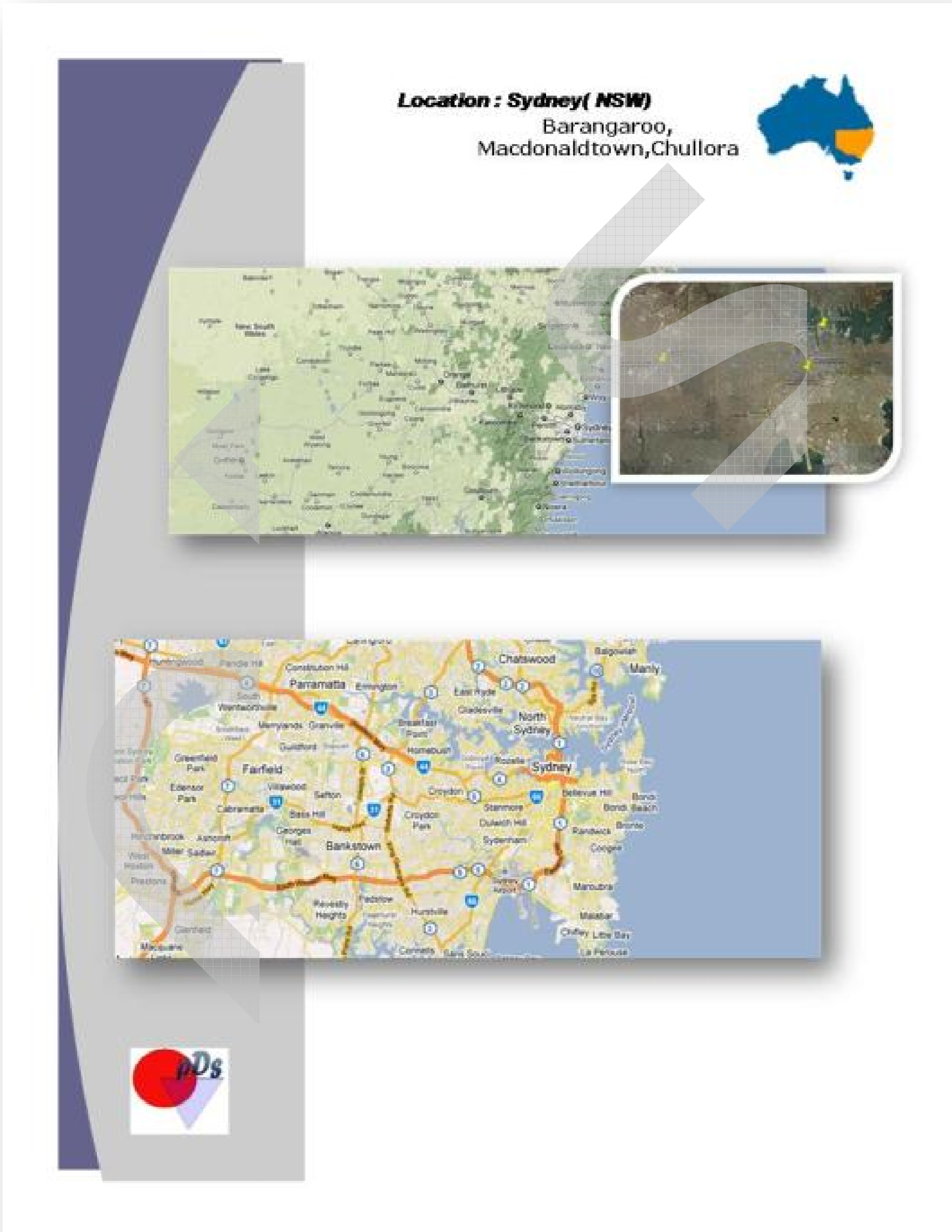
Introduction

Some air quality assessments are demanding site-specific meteorological data to assess the impact using Gaussian plume models. This data should represent the area of concern (near source) and the meteorological parameters should characterise the transport and dispersion conditions.

Meteorological input is crucial in Gaussian plume modelling. Therefore compilation of input meteorological data files should be done meeting the procedures and algorithms set by environment regulators. It is always preferred to collect mandatory data such as wind speed, direction, sigamatheta (Calculated from Wind Direction measurements) and ambient temperature onsite. And again instrumentations and siting should meet Australian Standard (AS2923 -ambient air guide for measurement of horizontal wind for air quality applications).

Unfortunately, there were no meteorological data colleting stations in the vicinity of the location **Macdonaldtown in NSW**. So it was decided to generate AUSPLUME type meteorological data file running prognostic meteorological module in TAPM (The Air Pollution Model developed by CSIRO, Australia). Two year long data is requested and latest available 2007 and 2008 Synoptic (Source CSIRO/BoM) data were used to initialise the model for simulations.

LOCATION:


Location : Sydney(NSW)
Barangaroo,
Macdonaldtown,Chullora
Chatswood
Manly
Parramatta
North Sydney
Fairfield
Sydney
Bankstown

The AUSPLUME type meteorological data for **Macdonaldtown, NSW** was generated running TAPM in the following manner

- in 3 nested grids, inner most grid with 1000m resolution.
- with high resolution topography (9 second DEM).
- verifying vegetation and soil type match with interested area-**Macdonaldtown.**

-Strictly followed DECCW set procedure.

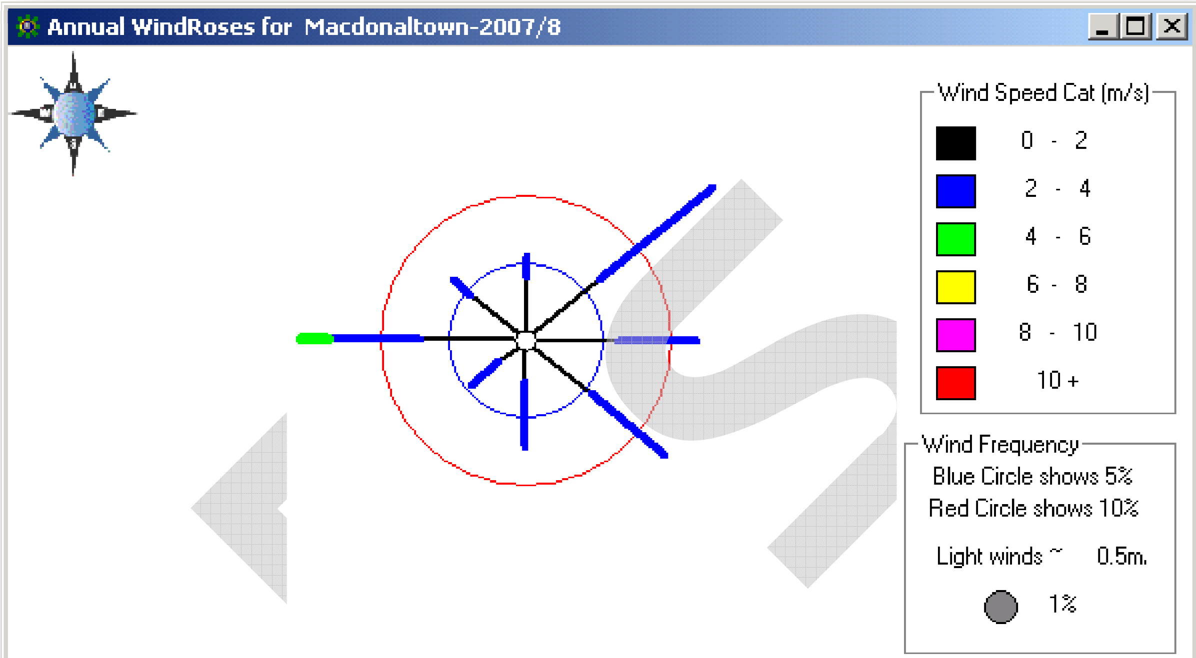
Analysis

Data Coverage

Season	No. of Days	Percentage
Summer (181 days)	181	100%
Autumn (184 days)	184	100%
Winter(184 days)	184	100%
Spring (182 days)	182	100%
Annual (365/6 days)	365/366	100%

All seasons are very well represented.

ANNUAL WINDROSES

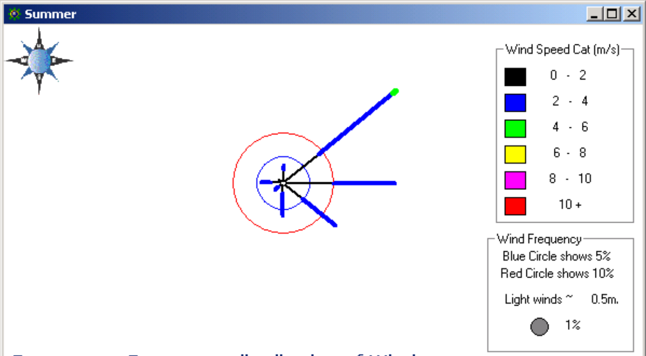


Percentage Frequency distribution of Winds

Speed Cat/Dir	NE	E	SE	S	SW	W	NW	N	Total Speed Freq
0 - 2	7.9	6.9	6.6	3.6	2.9	7.2	5.8	5.0	46%
2 - 4	12.3	6.7	8.1	6.1	3.3	7.3	2.8	2.2	49%
4 - 6	0.8	0.0	0.2	1.0	0.5	2.1	0.6	0.0	5%
6 - 8	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	%
8 - 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
10 +	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
Total Dir Freq	21%	14%	15%	11%	7%	17%	9%	7%	

SEASONAL WINDROSES

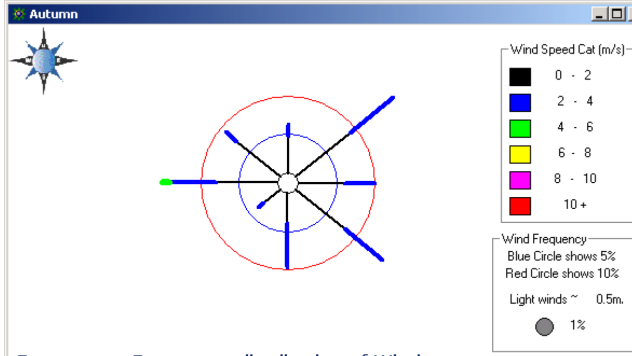
Summer



Percentage Frequency distribution of Winds

Speed Cat/Dir	NE	E	SE	S	SW	W	NW	N	Total Speed Freq
0 - 2	10.5	11.0	5.9	2.6	1.4	2.7	1.9	3.3	39%
2 - 4	22.6	13.0	10.4	6.1	1.0	2.0	0.4	1.1	57%
4 - 6	1.9	0.1	0.4	0.4	0.0	0.9	0.4	0.0	4%
6 - 8	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	%
8 - 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
10 +	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
Total Dir Freq	35%	24%	17%	9%	2%	6%	3%	4%	

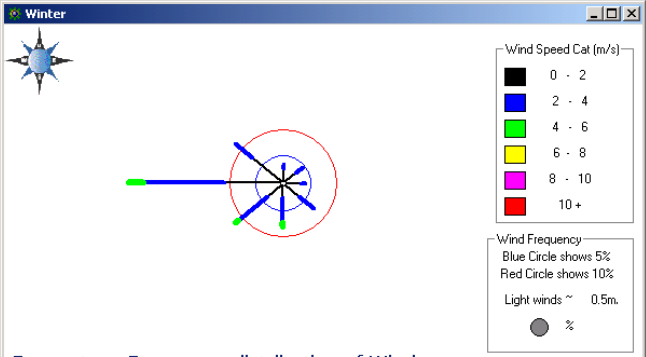
Autumn



Percentage Frequency distribution of Winds

Speed Cat/Dir	NE	E	SE	S	SW	W	NW	N	Total Speed Freq
0 - 2	10.1	6.8	9.2	5.0	3.1	8.7	8.1	6.9	58%
2 - 4	8.7	4.4	7.7	7.1	1.6	6.1	2.6	2.1	40%
4 - 6	0.0	0.0	0.0	0.3	0.2	1.0	0.3	0.0	2%
6 - 8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
8 - 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
10 +	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
Total Dir Freq	19%	11%	17%	12%	5%	16%	11%	9%	

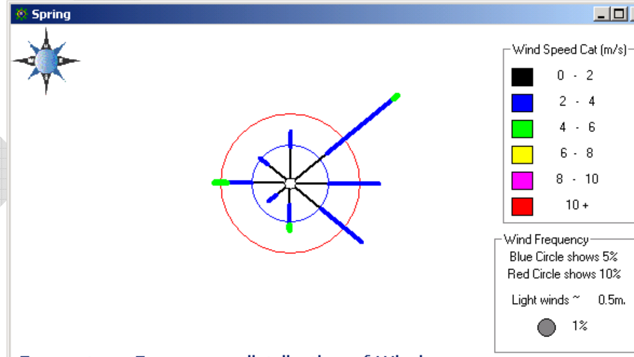
Winter



Percentage Frequency distribution of Winds

Speed Cat/Dir	NE	E	SE	S	SW	W	NW	N	Total Speed Freq
0 - 2	3.7	3.9	4.8	3.0	4.3	11.5	8.4	3.5	43%
2 - 4	2.5	1.4	4.8	6.9	8.2	16.8	5.7	1.9	48%
4 - 6	0.0	0.0	0.2	2.0	1.5	3.8	0.9	0.0	8%
6 - 8	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	%
8 - 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
10 +	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
Total Dir Freq	6%	5%	10%	12%	14%	32%	15%	5%	

Spring



Percentage Frequency distribution of Winds

Speed Cat/Dir	NE	E	SE	S	SW	W	NW	N	Total Speed Freq
0 - 2	7.2	6.0	6.5	3.9	2.8	5.6	4.6	6.4	43%
2 - 4	15.8	8.2	9.6	4.3	2.4	4.3	2.2	3.5	50%
4 - 6	1.4	0.0	0.0	1.3	0.4	2.6	0.8	0.0	6%
6 - 8	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	%
8 - 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
10 +	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	%
Total Dir Freq	24%	14%	16%	10%	6%	13%	8%	10%	

ANNUAL STABILITY DISTRIBUTION

Stability Category	% Distribution	Avg Wind Speed	Avg Temperature	Avg Mixing Height
A	13	2.6	21.7	670
B	18	3.	20.5	628
C	14	2.6	18.2	556
D	29	1.8	16.5	252
E	14	1.8	15.8	202
F	11	2.1	17.9	247

Statistics of Macdonaldtown (NSW) input Meteorological data file-2007/08

STAB Cat	Stat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
A	Max of Temp	34.0	29.0	32.0	25.0	26.0	20.0	19.0	23.0	28.0	31.0	29.0	33.0	34.0
	Min of Temp	21.0	21.0	18.0	17.0	15.0	13.0	12.0	12.0	13.0	14.0	18.0	19.0	12.0
	Average of Temp	25.0	25.2	25.3	21.9	20.0	16.9	15.1	16.8	19.2	21.9	23.1	24.9	22.9
	Max of WS	3.4	3.4	3.4	3.3	3.3	1.9	3.4	3.4	3.4	3.4	3.4	3.4	3.4
	Min of WS	0.5	1.0	0.5	0.5	0.5	0.5	0.9	0.6	0.5	0.5	1.0	0.5	0.5
	Average of WS	2.9	2.8	2.6	2.0	1.5	1.4	1.8	2.1	2.4	2.5	2.8	2.7	2.5
	Max of MixH	1995	1496	1995	1496	1496	1437	1413	1978	1953	1553	1995	2494	2494
	Min of MixH	183	179	150	258	344	477	335	199	173	150	184	163	150
	Average of MixH	667	679	650	746	717	790	850	992	843	595	619	705	698
B	Max of Temp	37.0	29.0	34.0	26.0	27.0	22.0	21.0	26.0	31.0	34.0	29.0	33.0	37.0
	Min of Temp	17.0	18.0	16.0	11.0	12.0	10.0	9.0	9.0	11.0	11.0	16.0	18.0	9.0
	Average of Temp	24.1	23.1	22.8	20.3	19.2	16.2	15.0	16.2	18.5	21.0	21.4	22.9	20.6
	Max of WS	4.8	4.6	4.4	4.9	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.9
	Min of WS	0.5	0.6	0.5	0.6	0.5	0.5	0.7	0.5	0.6	0.5	0.5	1.0	0.5
	Average of WS	3.2	2.8	2.6	2.3	2.2	2.4	2.6	2.9	2.9	2.9	3.1	3.1	2.8
	Max of MixH	2992	1340	1995	1995	1496	1481	1995	1995	1995	2494	2317	2992	2992
	Min of MixH	86	77	79	87	97	137	134	124	93	63	78	92	63
	Average of MixH	586	544	679	735	654	695	836	947	800	560	563	644	673
C	Max of Temp	37.0	26.0	33.0	28.0	26.0	22.0	22.0	26.0	31.0	35.0	28.0	31.0	37.0
	Min of Temp	16.0	17.0	14.0	9.0	10.0	9.0	7.0	7.0	9.0	10.0	15.0	16.0	7.0
	Average of Temp	21.7	21.0	21.2	18.7	17.4	15.0	13.5	14.8	16.3	19.8	18.8	20.8	18.1
	Max of WS	4.2	3.7	4.0	5.3	5.0	5.3	6.5	5.3	5.8	5.8	6.4	6.0	6.5
	Min of WS	0.6	0.7	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5
	Average of WS	2.4	2.2	2.1	2.2	2.0	2.6	2.6	2.7	2.6	2.6	2.5	2.7	2.5
	Max of MixH	2504	1570	1550	1995	1574	1995	1642	1995	2494	2494	2047	2992	2992
	Min of MixH	58	50	50	50	50	50	71	57	50	50	50	52	50
	Average of MixH	302	284	349	422	394	510	646	621	606	574	494	465	478
D	Max of Temp	34.0	26.0	32.0	26.0	25.0	21.0	21.0	25.0	30.0	33.0	28.0	29.0	34.0
	Min of Temp	15.0	15.0	13.0	9.0	9.0	8.0	6.0	7.0	8.0	10.0	12.0	15.0	6.0
	Average of Temp	20.6	20.4	19.7	17.7	15.4	13.9	11.9	12.4	14.6	17.0	17.7	19.1	16.5
	Max of WS	4.1	3.0	5.2	4.4	4.6	5.5	6.3	6.7	5.5	5.0	6.1	4.8	6.7
	Min of WS	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Average of WS	1.8	1.6	1.6	1.6	1.4	2.2	2.0	2.0	1.9	1.8	1.8	1.7	1.8
	Max of MixH	909	997	1072	1995	1352	1995	1539	1995	2269	2523	2028	1730	2523
	Min of MixH	50	50	50	50	50	50	50	50	50	50	50	50	50
	Average of MixH	184	177	179	175	162	288	325	300	280	252	229	190	228
E	Max of Temp	29.0	24.0	27.0	21.0	22.0	18.0	18.0	20.0	22.0	25.0	23.0	25.0	29.0
	Min of Temp	17.0	16.0	14.0	13.0	11.0	10.0	7.0	9.0	10.0	11.0	13.0	16.0	7.0
	Average of Temp	20.6	20.2	20.0	18.0	16.2	14.1	12.3	12.4	14.2	16.2	17.7	19.5	16.4
	Max of WS	3.7	3.8	4.6	3.3	4.5	5.0	5.0	4.9	4.8	4.5	5.0	4.8	5.0
	Min of WS	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	Average of WS	1.8	1.7	1.7	1.6	1.6	2.5	2.3	2.1	1.7	1.8	1.7	1.9	1.9

	Max of MixH	394	371	553	1673	997	997	1247	1417	866	1138	997	1042	1673
	Min of MixH	50	66	50	50	50	50	50	50	50	50	63	50	50
	Average of MixH	173	159	162	160	174	256	364	279	198	213	192	204	217
F	Max of Temp	29.0	25.0	25.0	23.0	22.0	19.0	18.0	22.0	27.0	28.0	24.0	26.0	29.0
	Min of Temp	17.0	16.0	18.0	16.0	15.0	11.0	10.0	11.0	12.0	11.0	14.0	17.0	10.0
	Average of Temp	22.1	20.0	20.7	18.8	17.7	14.2	13.7	15.0	16.9	18.8	18.6	20.9	17.2
	Max of WS	3.5	3.5	3.1	3.1	3.5	3.5	3.5	3.4	3.5	3.5	3.5	3.5	3.5
	Min of WS	1.1	1.4	1.3	1.3	1.1	1.5	1.3	1.1	1.0	1.1	1.3	1.3	1.0
	Average of WS	2.3	2.4	2.3	2.3	2.1	2.6	2.4	2.1	2.2	1.9	2.3	2.1	2.2
	Max of MixH	493	702	371	299	997	1107	1236	1247	1496	1195	585	956	1496
	Min of MixH	100	174	100	100	50	100	100	50	100	50	150	100	50
	Average of MixH	233	301	201	192	282	324	394	280	289	206	218	246	272

Disclaimer

Compilation of input meteorological data file for AUSPLUME was done under the supervision of qualified and experienced meteorologists. Although all due care has been taken, we cannot give any warranty, nor accept any liability (except that required by law) in relation to the information given, its completeness or its applicability to a particular problem. These data and other material are supplied on the condition that you agree to indemnify us and hold us harmless from and against all liability, losses, claims, proceedings, damages, costs and expenses, directly or indirectly relating to, or arising from the use of or reliance on the data and material which we have supplied.

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Appendix B

Air Quality Monitoring Plan

Air Quality Management Plan

Incoll Management Pty Ltd

On behalf of
Rail Corporation NSW

Former Macdonaldtown Gasworks

August 2011
JBS 40913 – 15972 Revision C

Air Quality Management Plan

Incoll Management Pty Ltd
On behalf of
Rail Corporation NSW

Former Macdonaldtown Gasworks

August 2011
JBS 40913 – 15972 Rev C
JBS Environmental Pty Ltd

Table of Contents

Figures

Appendices

List of Abbreviations

A list of the common abbreviations used throughout this report is provided below.

- As Arsenic
- Cd Cadmium
- Cr Chromium
- Cu Copper
- BTEX Benzene, Toluene, Ethylbenzene and Xylenes
- B(a)P Benzo (a) pyrene
- DECCW NSW Department of Environment, Climate Change and Water
- DQO Data Quality Objectives
- DP Deposited Plan
- EPA New South Wales Environment Protection Authority
- Hg Mercury
- HIL Health Based Investigation Level
- LOR Limit of Reporting
- MAH Monocyclic Aromatic Hydrocarbon
- Ni Nickel
- OCP Organochlorine Pesticide
- SAR Site Audit Report
- SAS Site Audit Statement
- PAH Polycyclic Aromatic Hydrocarbons
- Pb Lead
- PIL Phytotoxicity Based Investigation Level
- PCB Polychlorinated Biphyenyls
- PQL Practical Quantitation Limit
- QA/QC Quality Assurance/Quality Control
- RPD Relative Percentage Difference
- TPH Total Petroleum Hydrocarbons (C_6-C_9 and C_{10}-C_{36})
- Zn Zinc

1 Introduction

1.1 Introduction and Objectives

JBS Environmental Pty Ltd was engaged by Incoll Management Pty Ltd (Incoll) to prepare an Air Quality Management Plan (AQMP) for the proposed remediation works on the site of the former Macdonaldtown Gasworks, Erskineville, NSW (**Figure 1**). The AQMP is required to monitor and control potential air emissions from the proposed works. The provisions of the AQMP has been incorporated into the Environmental Management Plan (EMP) prepared for the project.

An Air Quality Assessment[1] (AQA) has been prepared for the remediation program at the former gasworks site. The AQA assessed a range of potential sources for air emissions into the surrounding area. It was assessed that unacceptable levels of air pollutants will not occur at the surrounding areas during the site works where a range of control and monitoring provisions are implemented on the site. The AQMP has been prepared to document the recommended control and monitoring works as identified by the AQA.

This AQMP is solely for remedial works undertaken at the former Macdonaldtown Gasworks. Treatment works undertaken at the designated off site facility at the Chullora Railway Workshops are discussed in a separate report as follows '*Air Quality Management Plan, Former Macdonaldtown Gasworks – Chullora Materials Receipt Facility*' JBS Environmental Pty Ltd 40913-16613 Revision C, August 2011.

1.2 Site Identification

The site undergoing remediation (the Site) is located on Burren St, Erskineville NSW. The Site location is shown in **Figure 1** and details provided in **Table 1**. The Site details are summarised below and described in more detail in the following sections.

Table 1 Site Details

Lot/DP	Part Lot 50 in DP 1001467
Address	Burren Street, Erskineville, NSW
Local Government Authority	City of Sydney
Site Zoning	'Railways Zone' in Sydney Regional Environmental Management Plan 26
Current Use	Vacant Land
Geographical Co-ordinates	Lat: -33.917° North, Long: 151.199° East (southern corner)
Site Area	7,732m^2

A Site layout plan is provided as **Figure 2**. This plan has been adopted from previous CH2M HILL studies completed on the Site.

The Site has been previously delineated into eight areas by CH2M Hill (March 2007) '*Delineation & Characterisation Sampling and review of Remedial Options*' (CH2M Hill 2007a). These areas are shown on **Figure 3** and include:

[1] *Air Quality Assessment– Former Macdonaldtown Erskineville, NSW* JBS Environmental Pty Ltd August 2011 (JBS 2011)

- Gasholders: encompasses both Gasholder structures adjoining the western boundary. The Southern Gasholder remains intact with the superstructure standing approximately 12 metres above the ground surface. The above ground structure of the Northern Gasholder has been demolished, however the brick annulus structure remains intact beneath the ground;
- Retort: encompasses the footprint of the former Retort House, Tar Wells, Condensers, Coal and Shale Storage areas and other building structures associated with the gasworks operations (office, amenities, etc). These buildings and structures have been demolished and associated structures are no longer visible above the ground surface. However some underground structures remain in place, including the two Tar Wells, pipework, brick flooring and foundations and concrete slabs;
- Gas Purifier: encompasses the footprint of the former Purifier Beds, Scrubbers and Gas Meters. Similar to the Retort Area, structures only remain buried below the ground surface, with no above ground structures remaining;
- Northeast: includes the majority of the northeast section of the Site;
- South Central: includes the portion along the central southeast boundary;
- Southwest: includes the majority of the southern area of the Site;
- Retaining Wall: includes the filled area embankment along the northern Site boundary; and
- Western Lot: includes the small rectangular section of land that extends west to Burren Street.

A site inspection was completed by JBS on the 25th March 2010. The Site was found to be overgrown with vegetation. Several stockpiles of predominantly soil and railway ballast based materials were located over the eastern portion of the Site, which were being removed during the site inspection. It was reported by RailCorp representatives that the observed works were being undertaken to remove all stockpiled materials. The northernmost former gasholder was observed as a circular area of exposed brickwork. The southernmost gasholder was observed to be substantially intact. Brick and metallic debris presumably associated with the former operation of the Site as a gasworks was distributed throughout the remainder of the property.

1.2.1 Surrounding Landuse

Surrounding land-uses include:

- North – Covered rail sidings are present adjoining the northern boundary of the former gasworks. Further north is Macdonaldtown station and associated rail corridor;
- South-east – A noise barrier and access roadway is located adjoining the south-eastern boundary of the Site. Further south is the rail corridor associated with the Illawarra and south-west rail corridor; and
- West – Residences fronting Burren St, Erskineville are located adjoining the western boundary of the Site. Residences consist of detached and semi-detached low and medium density dwellings and small yard areas. The residential area of Erskineville is located further west.

1.3 Purpose

This AQMP has been designed to ensure, that the risk to the remediation workforce on the former gasworks site, adjoining railway and residential properties, and the surrounding environment is acceptable. This will be achieved by the implementation of a number of ongoing monitoring and management measures pertaining to the proposed demolition and earthworks and associated environmental management works.

The AQMP is intended to form part of the EMP being prepared for the site.

1.4 Responsibilities

The remediation works on the site shall be undertaken under the guidance of a Principal Contractor who is yet to be appointed. The Principal Contractor will be responsible for the implementation of the majority of procedures provided in the AQMP and EMP. It is noted that where the specific procedures are technical or complex in nature then the Remediation Consultant as appointed to the project shall fulfil the requirements of the procedure, or advise the appropriate implementation of the procedure.

A formal list of procedures is provided to the AQMP based on an assessment of potential environmental emissions from anticipated site works required for the demolition, earthworks and building works. Specific responsibilities are nominated for the implementation of these procedures within the relevant procedure.

1.5 Proposed Demolition and Earthworks on the Site

The demolition and earthworks are proposed to be undertaken in distinct stages as described following:

- Demolition component of the works including the removal of any former gasworks buildings and infrastructure not considered items of significant heritage and archaeological potential, and includes the connection Shed, former tar wells, condensate pits and existing concrete pavement overlying areas of contaminated soils.
- Excavation component of the works consisting of the installation of excavation support as required and excavation of soils identified as contaminated.
- Dewatering of proposed area of excavation by the installation of dewatering spears to allow excavation of soils below the depth of the water table.
- Stockpiling of the soils within a controlled location on the Site to facilitate remediation of the material, or later backfilling, dependent on the contaminated status of the soils. Where the proposed remediation works required on soils involve treatment, either on or off site, the remediation process may require licensing under the *Protection of the Environment Operations* (POEO) Act 1997; and
- Backfilling of excavations with fill materials characterised as being environmentally and geotechnically suitable for placement within the Site sub-surface.

The works are being undertaken to facilitate remediation works.

1.5.1 Demolition

The demolition stage of the works will be the initial stage of the works. The demolition works will include the removal of all above ground infrastructure on site that is assessed to be:

- not an item of significant heritage or archaeological potential; and
- an on-going source of contamination.

In undertaking demolition works RailCorp shall only use WorkCover accredited contractors. All demolition works shall be undertaken as per relevant statutes and Australian and International Standards.

The majority of the demolished materials will be transported off-site for recycling. This will include the concrete and masonry wastes from removal of Site pavements. All other wastes shall be transported to an appropriately licenced facility for processing.

1.5.2 Earthworks

The proposed earthworks are designed to allow the associated remediation activities to be undertaken.

Substantial environmental data are available for the Site to characterise the extent of contaminated soils and groundwater. The areas of the Site which are known to be contaminated and have been identified in the proposed earthworks program include:

- The central part of the northern Site boundary;
- The central part of the western Site boundary;
- The centre of the Site, including an apparent 'primary tar source zone', approximately 10 m east of the Southern Gas Holder; and
- Shallow areas potentially across the remainder of the Site.

The earthworks shall include:

- Installation of soil retention structures (i.e. shoring) as required to protect adjoining properties and heritage items during proposed excavation works;
- In areas of impacted soil, excavation of overlying non-impacted material, if present, and stockpiling separately on the Site;
- Dewatering of areas of proposed excavation of impacted soils. The water accumulated during dewatering may require treatment;
- Excavation of impacted soils in source zones within a purpose built tented enclosure;
- Excavation of impacted soils external to the tented enclosure and transport into the enclosure as required;
- Treatment of suitable excavated impacted soil by bioremediation within the tented enclosure;
- Filling of excavations with the bioremediated soil or with clean, validated fill material assessed as suitable for use on the Site.

1.6 Proposed Treatment Works Off Site

Given the significant area restrictions on the Site , RailCorp has advised that a section of land contained within the Chullora Railway Workshops, located on Worth Street, Chullora, NSW is available for treatment of soil excavated from the site. The location of the treatment site is displayed in **Figure 4**. The potential treatment area is provided in **Figure 5**. A separate AQMP has been prepared for the proposed works at Chullora as follows '*Air Quality Management Plan, Former Macdonaldtown Gasworks – Chullora Materials Receipt Facility*' JBS Environmental Pty Ltd 40913-16613 Revision C, August 2011.

1.6.1 Proposed Treatment Works

The activities proposed to be completed on the Chullora treatment site are as follows:

- Receipt of contaminated soils / materials from the Macdonaldtown former gasworks remediation;
- Storage of contaminated soils / materials within stockpiles or similar;
- Treatment of contaminated soils / materials by immobilisation;

1.7 Excavation, Filling and Land Formation

Excavation, filling and land formation will involve reinstatement of the site with treated material validated as suitable for reuse on the site, or imported clean, fill material certified as VENM in accordance with the Remedial Action Plan (RAP) for the site.

The proposed filling will involve placement of up to 22 000m^3 of fill with reinstatement of to restore the pre-remediation levels.

1.8 Identification of Potential Air Emissions

Several potential sources of air emissions have been identified in the AQIA's prepared for the proposed works. These are briefly listed following in **Table 1.3**.

Table 1.3: Summary of Air Emissions

Stage	Task	Potential Emissions
Preliminary	Project planning and licensing	-
Site Establishment I	Setup of site offices, sediment and erosion controls	-
Remediation Stage I	1A – assessment/soil sampling of northern boundary retaining wall 1B- construction of internal turning circle, vegetation removal	Particulates
	1C – excavation/validation of the top 0.5m of fill material of the entire site surface. Transfer of excavated soil to Chullora for treatment prior to disposal to landfill	Particulates, Air Toxins
	1D – excavation/validation of four hotspots to depths of 1-2m	Particulates, Air Toxins
Site Establishment II	Installation of temporary enclosure, associated air extraction/treatment system and water treatment system	-

Stage	Task	Potential Emissions
Remediation Stage II	2A- commission air and water treatment system 2B – excavate/validate areas within enclosure. Transfer of excavated soil to Chullora for treatment prior to disposal to landfill 2C – reinstate enclosure excavation with imported Virgin Excavated Natural Material (VENM) or Excavated Natural material (ENM)	Particulates, air toxins, odours
Remediation Stage III	3A – excavate/validate areas external the enclosure. Excavated material unsuitable for onsite bioremediation within enclosure to be transferred to Chullora for treatment prior to disposal to landfill 3B –Material assessed as suitable for remediation by bioremediation to be stockpiled for treatment within enclosure 3C – reinstatement of site using VENM or ENM, landscaping as required	Particulates, air toxins, odours
Disestablishment	Decommissioning of air and water treatment plants, disestablishment of enclosure and site offices	-

The most significant potential emissions have been identified as occurring from:

- Particulate, chemical and odour emissions from soil excavation activities;
- Particulate, chemical and odour emissions from soils stockpiling and handling; and
- Particulate, chemical and odour emissions from the receipt and handling of fill materials.

1.9 Environmental Procedures

A number of environmental control and monitoring provisions have been recommended in the AQIA's prepared for the remediation program. These have been prepared as outline air quality management procedures, are provided in **Appendix A**, and are summarised in **Table 1.4** following.

Table 1.4: Summary of Air Quality Management Procedures

Procedure No.	Name
01	Dust and Airborne Hazard Control
02	Odour Prevention and Control
03	Odour Masking
04	Handling of Environmentally Impacted Material
05	Air Monitoring – Odours
06	Air Monitoring – Volatile Organic Compounds
07	Air Monitoring – Particulates
08	Air Monitoring – Asbestos
10	AQMP Review
11	Training

2 Limitations

This report has been prepared for use by the client who commissioned the works in accordance with the project brief only and has been based in part on information obtained from other parties. The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

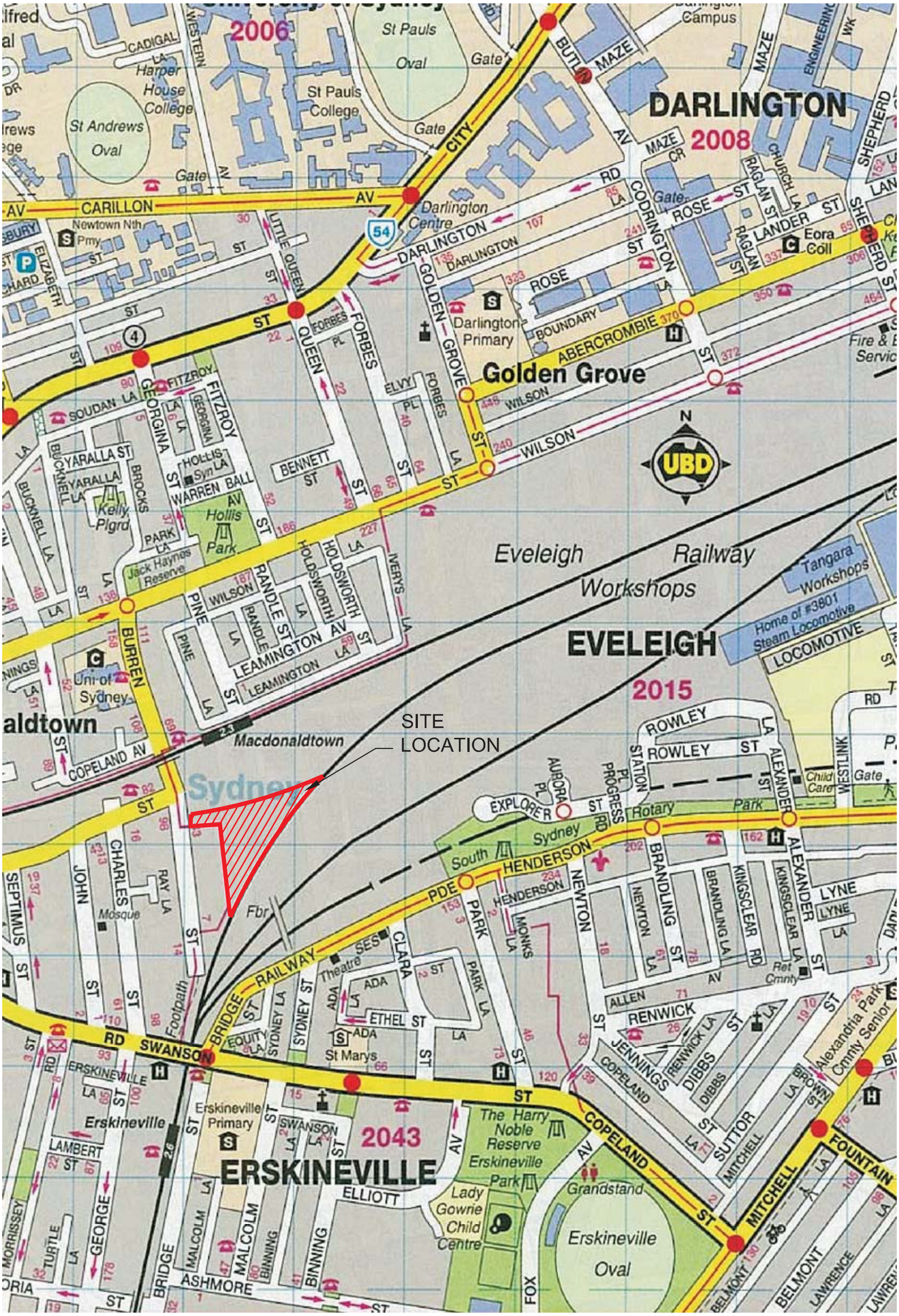
JBS Environmental Pty Ltd accepts no liability for use or interpretation by any person or body other than the client. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS Environmental Pty Ltd, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements and site history, not on sampling and analysis of all media at all locations for all potential contaminants.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS Environmental Pty Ltd reserves the right to review the report in the context of the additional information.

Figures



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0 500m
Approximate scale

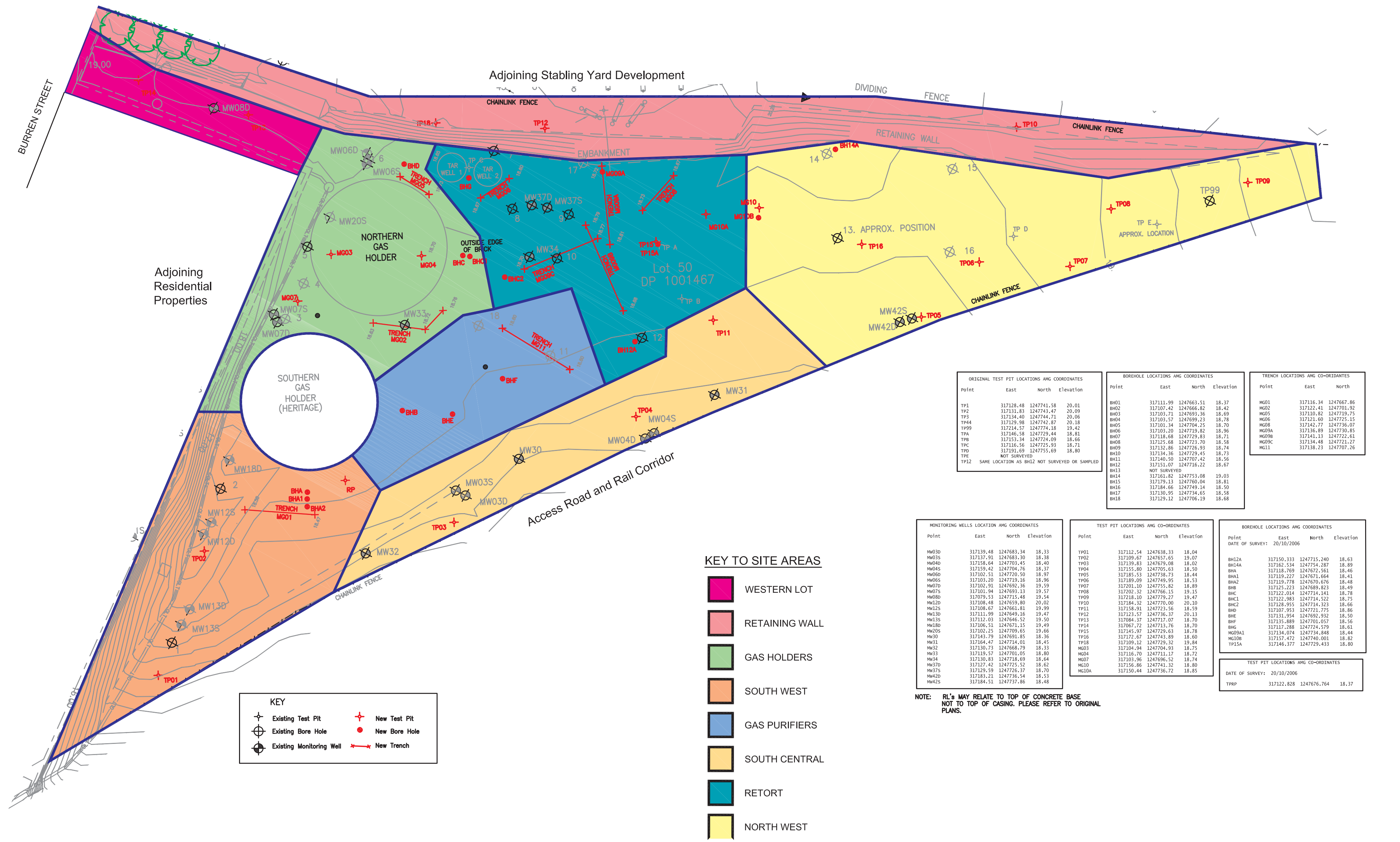
Figure 1 **Site Location (Macdonaldtown)**

CH2M Hill (2007)
Note- All locations shown are approximate only

0
100m
Approximate scale

Figure 2 **Current Macdonaldtown Site Plan**

CH2M Hill (2007)
Note- All locations shown are approximate only



ORIGINAL TEST PIT LOCATIONS AMG COORDINATES

Point	East	North	Elevation
TP1	317128.48	1247741.58	20.01
TP2	317131.83	1247743.47	20.09
TP3	317134.40	1247744.71	20.06
TP44	317129.98	1247742.87	20.18
TP99	317214.57	1247774.18	19.42
TPA	317146.58	1247729.44	18.81
TPB	317153.34	1247724.09	18.66
TPC	317116.56	1247725.93	18.71
TPD	317191.69	1247755.69	18.80
TPE	NOT SURVEYED		
TP12	SAME LOCATION AS BH12 NOT SURVEYED OR SAMPLED		

BOREHOLE LOCATIONS AMG COORDINATES

Point	East	North	Elevation
BH01	317111.99	1247663.51	18.37
BH02	317107.42	1247666.82	18.42
BH03	317103.71	1247693.36	18.69
BH04	317103.57	1247699.23	18.78
BH05	317101.34	1247704.25	18.70
BH06	317103.20	1247719.82	18.96
BH07	317118.68	1247729.83	18.71
BH08	317125.68	1247723.70	18.58
BH09	317132.86	1247726.93	18.74
BH10	317134.36	1247729.45	18.73
BH11	317140.50	1247707.42	18.56
BH12	317151.07	1247716.22	18.67
BH13	NOT SURVEYED		
BH14	317161.82	1247753.08	19.03
BH15	317179.13	1247760.04	18.81
BH16	317184.66	1247749.14	18.50
BH17	317130.95	1247734.65	18.58
BH18	317129.12	1247706.19	18.68

TRENCH LOCATIONS AMG CO-ORIDANTES

Point	East	North
MG01	317116.34	1247667.86
MG02	317122.41	1247701.92
MG05	317110.82	1247719.75
MG06	317121.60	1247725.15
MG08	317142.77	1247736.07
MG09A	317136.89	1247730.85
MG09B	317141.13	1247722.61
MG09C	317134.48	1247721.27
MG11	317138.23	1247707.26

MONITORING WELLS LOCATION AMG COORDINATES

Point	East	North	Elevation
MW03D	317139.48	1247683.34	18.33
MW03S	317137.91	1247683.30	18.38
MW04D	317158.64	1247703.45	18.40
MW04S	317159.42	1247704.76	18.37
MW06D	317102.51	1247720.50	18.97
MW06S	317103.20	1247719.16	18.96
MW07D	317102.91	1247692.36	19.59
MW07S	317101.94	1247693.13	19.57
MW08D	317079.53	1247715.48	19.54
MW12D	317108.48	1247659.80	20.02
MW12S	317108.67	1247661.81	19.99
MW13D	317111.99	1247649.16	19.47
MW13S	317112.03	1247646.52	19.50
MW18D	317106.51	1247671.15	19.49
MW20S	317102.25	1247709.65	19.66
MW30	317143.79	1247691.85	18.36
MW31	317164.47	1247714.01	18.45
MW32	317130.73	1247668.79	18.33
MW33	317119.57	1247701.05	18.80
MW34	317130.83	1247718.69	18.64
MW37D	317127.42	1247725.52	18.62
MW37S	317129.59	1247726.37	18.70
MW42D	317183.21	1247736.54	18.53
MW42S	317184.51	1247737.86	18.48

TEST PIT LOCATIONS AMG CO-ORDINATES

Point	East	North	Elevation
TP01	317112.54	1247638.33	18.04
TP02	317109.67	1247657.65	19.07
TP03	317139.83	1247679.08	18.02
TP04	317155.80	1247705.63	18.50
TP05	317185.53	1247738.73	18.44
TP06	317189.09	1247749.95	18.53
TP07	317201.10	1247755.82	18.89
TP08	317202.32	1247766.15	19.15
TP09	317218.10	1247779.27	19.47
TP10	317184.32	1247770.00	20.10
TP11	317158.91	1247723.56	18.59
TP12	317123.57	1247736.37	20.13
TP13	317084.37	1247717.07	18.70
TP14	317067.72	1247713.76	18.70
TP15	317145.97	1247729.63	18.78
TP16	317172.67	1247743.89	18.60
TP18	317109.12	1247729.32	19.84
MG03	317104.94	1247704.93	18.75
MG04	317116.70	1247711.17	18.72
MG07	317103.96	1247696.52	18.74
MG10	317156.86	1247741.32	18.80
MG10A	317150.44	1247736.72	18.85

BOREHOLE LOCATIONS AMG COORDINATES

Point	East	North	Elevation
DATE OF SURVEY: 20/10/2006			
BH12A	317150.333	1247715.240	18.63
BH14A	317162.534	1247754.287	18.89
BHA	317118.769	1247672.561	18.46
BHA1	317119.227	1247671.664	18.41
BHA2	317119.778	1247670.676	18.48
BHB	317125.223	1247689.823	18.49
BHC	317122.014	1247714.141	18.78
BHC1	317122.983	1247714.522	18.75
BHC2	317128.955	1247714.323	18.66
BHD	317107.953	1247721.775	18.86
BHE	317131.954	1247692.932	18.50
BHF	317135.889	1247701.057	18.56
BHG	317117.288	1247724.579	18.61
MG09A1	317134.074	1247734.848	18.44
MG10B	317157.472	1247740.001	18.82
TP15A	317146.377	1247729.433	18.80

TEST PIT LOCATIONS AMG CO-ORDINATES

DATE OF SURVEY: 20/10/2006

TPRP	317122.828	1247676.764	18.37

NOTE: RL's MAY RELATE TO TOP OF CONCRETE BASE NOT TO TOP OF CASING. PLEASE REFER TO ORIGINAL PLANS.

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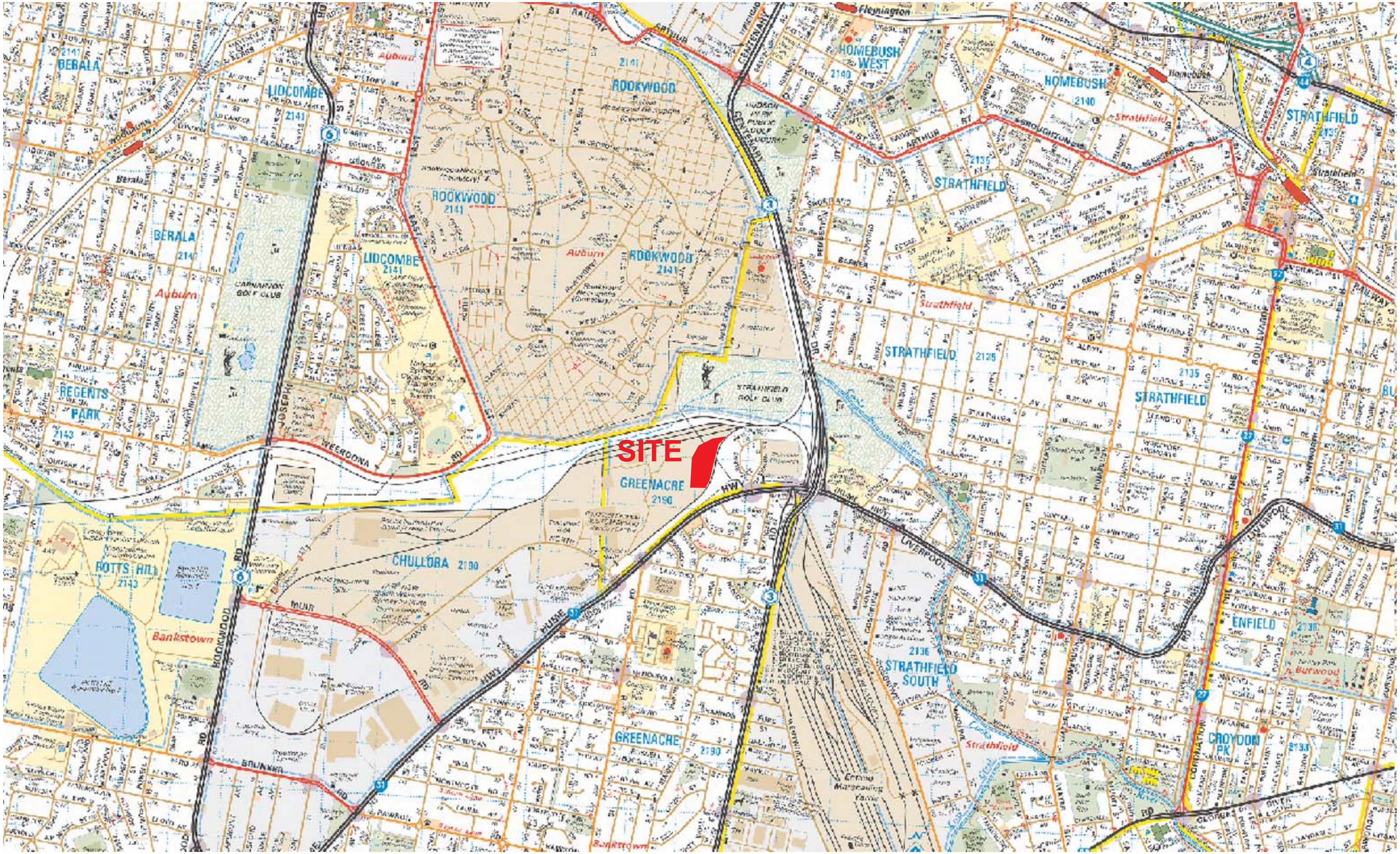
Figure 3 **Site Areas**

CH2M Hill (2007)

Note- All locations shown are approximate only



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0 1000m
Approximate scale

Figure 4 **Chullora (Treatment) Site Location**

Department of Lands (2010)
Note- All locations shown are approximate only

JBS ENVIRONMENTAL

0 50m
Approximate scale

Figure 5 **Chullora Site Plan**

Department of Lands (2010)
Note- All locations shown are approximate only

Appendix A

Air Quality Management Procedures

Odour Prevention and Control	AQMP01

Responsibility:	Head Contractor Environmental Consultant
Frequency:	Disturbance of potentially malodorous / impacted soils
Location:	All areas on site
Objective:	To minimise potential odour impacts

Procedure

Malodorous materials will be disturbed during remediation of the site. Coal tar based impact has been identified in soils underlying the majority of the site with the greatest impacts in soil observed in the vicinity of former Northern Gasholder and Retort House. Areas containing free tar (i.e. the former tar wells, pipework etc.) are also likely have the potential to generate offensive odours if exposed and/or disturbed.

Extensive measures require to be undertaken to control potential odour generation and odour emissions from the site as detailed below. The measures require to be sufficient to prevent recognition of offensive odours at residential and commercial properties in proximity of the site.

The construction and operation of the tented enclosure will be the main method of odour control. Odour control measures shall be employed within the tented enclosure comprising:

- Maintenance of the interior of the enclosure at a negative pressure relative to the surrounding environment. Where a negative pressure is able to be effectively maintained there is a reduced importance of the sealing of the enclosure with the surrounding ground level; and
- Venting of all emissions from the tented enclosure through a granular activated carbon (GAC) filter.

<u>Construction of GAC Odour Control Filters</u>

GAC odour control filters are required as described in EMP11 Tented Enclosure and the water treatment plant as described in EMP17 Groundwater Treatment. GAC filters shall be installed and operated as per the following requirements:

- All GAC filters used for odour control shall consist of three distinct units connected in series. The first and second unit shall be identically sized and the third unit must be at least 25% of the capacity of the preceeding units;
- An air sampling port shall be installed between the first and second filter vessel;
- The sizing of the GAC filters will require to be determined at the commencement of the works. The GAC filters shall be sufficiently sized so that at commissioning stage (under actual project conditions) there is no recognisable odour between the first and second filters. The potential for odour emissions to increase during the works shall be considered (where applicable) and correction factors determined where necessary to ensure appropriate sizing of filters; and

GAC Filters will become saturated during the source of the works. Monitoring is required to assess when Filter saturation occurs. This shall be undertaken by daily monitoring of the air sampling port between the first and second GAC filter using a PID. Where the PID records a reading above 10ppm, an air sample shall be collected and assessed for a recognisable odour. Where a recognisable odour is detected the filter shall be considered to be saturated and replaced with new GAC media.

<u>Odour Prevention Measures</u>

Tented Enclosure of Excavation and Soil Handling Works

Any works involving the disturbance of free tar or areas of malodourous soils within the former gasworks area or Northern Gasholder will need to be undertaken within a tented enclosure. Disturbance of these materials includes excavation, stockpiling, handling, treatment and vehicle loading The tented enclosure shall be designed and operated such that atmospheric emissions comply with those identified in relevant environmental guidelines at all times. These guidelines include:

- NEPC (1998) 'National Environment Protection Measure for Ambient Air Quality';
- Environmental criteria provided to NSW DEC (August 2005) 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales'; and
- Ambient air criteria provided to US EPA (2004) 'Region IX Preliminary Remediation Goals' for constituents not available in local literature.

No recognisable odours shall be discharged from the tented enclosure. The tented enclosure shall be constructed of a metal clad structure sufficiently sized to allow the operation of tippers, excavators and associated equipment required for the excavation, stockpiling and handling of soils and any associated equipment. Openings in the structure shall be minimised so as to reduce ventilation requirements.

Tippers and other heavy machinery shall be required to enter and exit the tented enclosure to allow the removal of soils. The following must apply to any tipper loads removing malodourous soil or other material from the tented enclosure:

- Tipper speeds when exiting the tented enclosure shall be minimised to the extent possible to prevent wake effects at the rear of the tipper causing uncontrolled release of odours. Where wake effects and associated discharge of recognisable odours are evident at tipper exit from the tented enclosure, then ventilation shall require to be increased; and
- Spraying of the exposed malodorous soil surface with an odour sealing solution. A mixture of 'Anotec 0307' (http://anotec.com.au/prod.htm) or similar and water may be suitable to be used for this purpose. Covering of the load to prevent particulate emissions.

Excavation of Malodorous Materials – Areas external to the Tented Enclosure

Any works involving the disturbance of free tar or areas of malodours soils external to the enclosure will require the following measures to be implemented to prevent odour emissions. These measures shall include (but are not limited to):

- Restriction of excavation areas in surface soils to no greater than $400m^2$;
- Restriction of excavation areas in the northern retaining wall area to no greater than $25m^2$;

Where larger sized excavations are required, area additional to above sizes shall be managed by:

- Tipping at the upwind portion of the site works to the extent possible to maximise dispersion distances to off-site properties (if possible); and / or
- Covering of all tipper loads; and / or
- Sealing of the malodorous stockpiled soil surface by covering. Appropriate sealing may include spraying of the malodorous surface with a hydromulch, or placement of a sufficient thickness of odourless soils over the malodorous materials; and/ or
- Spraying of the exposed malodorous soil surface with an odour sealing solution. A mixture of 'Anotec 0307' (http://anotec.com.au/prod.htm) or similar and water may be suitable to be used for this purpose. This may be prepared by the mixing of one 20L drum of Anotec 307 in 1,000L of water; and
- Continuous monitoring odours in accordance with **AQMP5.0 Odour Monitoring**.

Stockpiling of Soil – Areas external to the Tented Enclosure

Where stockpiles are to be left in place external to the tented enclosure they shall be covered in nonmalodourous materials, secured plastic sheeting or low permeability geofabric to prevent odourous emissions. If it is necessary for stockpiles to remain uncovered external to the tented enclosure then to prevent offensive odours at the site boundaries:

1. The uncovered stockpiles must not be placed in Zone 5 as shown on **AMP Fig1.1**;
2. The material must be demonstrated to contain concentrations below the following odour based criteria:

Contaminant	Odour Based Criteria for Uncovered Stockpiling (mg/kg)
Benzene	2.5
Ethylbenzene	5
Toluene	10
Xylene (total)	10
Cresols	_
Acenaphthene	35
Naphthalene	25
Phenol	40

Any materials stockpiled uncovered on site will remain subject to the management requirements of AQMP02 Odour Masking and AQMP03 Dust and Airborne Hazard Control;

Malodorous Materials Movement Scheduling – Areas external to the Tented Enclosure

Some malodorous materials will require removal from site without pre-treatment. Odour control measures may not be able to maintained when the material is in transit.

The Environmental Consultant appointed to the Project shall advise the most appropriate period of each day to undertake these works based on an assessment of meteorological conditions. Results of environmental monitoring as undertaken during these works, including odour and VOC assessment as per AQMP05 Air Monitoring – Odours and AQMP06 Air Monitoring – Volatile Organic Compounds, shall be used to confirm that the advised meteorological conditions are appropriate.

Conditions which maximise separation distances to downwind receptors and increase dispersion of emissions shall be favoured. Removal of malodorous materials from site shall be optimised during these periods to the extent possible. It is anticipated that this will typically comprise afternoon periods. The environmental consultant shall be aware that conditions that favour odour dispersion may not favour reduction in dust emissions.

Similarly where the environmental consultant advises that non favourable meteorological conditions are present, movement and handling of potentially malodorous materials outside the area of the tented enclosure will be prevented (where possible).

Handling / exposure of malodorous materials shall not occur during any periods where unacceptable levels of odour or VOC emissions are identified by AQMP05 Air Monitoring – Odours and / or AQMP06 Air Monitoring – Volatile Organic Compounds.

Odour Masking

All measures possible must be undertaken to prevent odour emissions prior to adopting odour masking measures as described in AQMP03 Odour Masking.

Odour Masking		AQMP02
Responsibility:	Head Contractor Environmental Consultant	
Frequency:	Disturbance of potentially malodorous / impacted soils	
Location:	All areas on site	
Objective:	To minimise potential odour impacts	

Procedure

Extensive measures are proposed to control odour emissions. The nature of the available odour controls means that they are not able to be immediately applied to sources of odour emissions. During some periods of the works momentary 'puffs' of odour may occur during the periods where odour controls are being implemented.

The degree of recognition of these odours will be able to be reduced by the operation of an odour masking system, however it is noted that the odour masking system shall not be used as a substitute for proper odour control technologies.

Odour Masking System

An odour masking system will require to be established along all site boundaries prior to the disturbance of potentially malodorous materials.

Once established, the odour masking system shall only be implemented where environmental monitoring identifies that all other odour control procedures have failed and odour emissions are unable to be prevented.

This system shall comprise the following:

- Provision of odour control solution consisting of a mixture of 'Anotec 0307' (http://anotec.com.au/prod.htm) or similar and water. This shall be prepared by the mixing of one 20L drum of Anotec 307 in 1,000L of water (or as per manufacturer's instructions for other products);
- Provision of an odour control solution spray system consisting of raised irrigation line (at least 1.5m above ground level) provided with sprinkler heads at a frequency of:
    - One head per 5m on the northern, eastern and southern boundaries; and
    - One head per 1.5m for the western site boundary;
- Sprinkler heads should be capable of delivering a fine mist of odour control solution with no discernible droplets; and
- Continuous supply of odour control solution to the raised irrigation line at a sufficient frequency to supply at least 100ml/minute to each sprinkler head included in the irrigation line.

Given the proximity of neighbouring residents along the western boundary, installation and operation of the odour masking system must be designed so that the odour masking solution does not affect the adjacent properties. This may require trials prior to the commencement of excavations and/or programming of works such that excavation of malodours soils does not occur during unfavourable conditions.

System Operation

The odour masking system shall not be used as a substitute for proper odour control technologies. The odour masking system shall only be used during periods where short duration puffs of odour may occur and only where all odour control technologies, as described in AQMP01 Odour Prevention and Control are being implemented.

The odour masking system shall operate for a maximum of four hours on any day. The operation of the Odour Masking System shall be recorded on Form AQMP02.1.

Odour Masking System Operation	Form AQMP02.1

Date	Commenced Operation	Ceased Operation	Wind Speed and Direction	Comments

Dust and Airborne Hazard Control		AQMP03
Responsibility:	Head Contractor	
Frequency:	All site works	
Location:	Site Areas External to the Tented Enclosure	
Objective:	To minimise dust emissions from demolition and earthworks.	

Procedure

Dust and Asbestos Risk

Excavation and handling of soils has the potential to generate dust emissions.

Asbestos containing materials have been found to be potentially present in fill materials located across the site in the vicinity of the former Northern Gasholder. Previous environmental assessments have identified that asbestos occurs within the bonded matrix of fibre cement fragments. At the time of assessment of these areas no testing was undertaken to identify the presence of free asbestos.

Addison et. al. ('The Release of Dispersed Asbestos from Soil', Institute of Occupational Medicine Report No. TM/88/14, September 1988) have found that very high levels of respirable dust must be generated before significant airborne concentrations of asbestos fibres were produced from soils contaminated with respirable asbestos fibres. It is considered that fibre cement sheet fragments must be subjected to intensive mechanical processes to cause the release of asbestos fibres.

Asbestos containing fibre cement fragments present in the site sub-surface on the site are not considered to pose a risk. However where the fragments are disturbed by excavation works asbestos fibres will potentially be released. Measures to control dust emissions will be sufficient to control potential asbestos emissions.

Standards

All operations on site are to be conducted so that concentrations of dust and other hazardous substances satisfy those stipulated in NSW DECCW published and endorsed guidelines. These guidelines include:

- NEPC (1998) 'National Environment Protection Measure for Ambient Air Quality' and
- Environmental criteria provided to NSW DEC (August 2005) 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales'.

Control

Measures shall be undertaken to reduce airborne emissions from site activities including:

- Water sprays used for dust suppression across unsealed areas of the site, stockpiles and other dust generating areas. All potential dust generating areas (i.e. areas of exposed soils) require to be watered on an hourly basis during periods of site operation or significant dust generation;
- A water misting system will be established on site boundaries of areas of soil handling in close proximity of residential properties;
- Stockpile heights shall be minimised where possible;
- Where stockpiles are to be left in place for significant periods of time, they shall be covered, or seeded to promote vegetation growth, to prevent dust emissions; and
- Where unfavourable meteorological conditions exist (i.e. strong winds directed at residential properties) site works shall be restricted to those with low potential for atmospheric emissions. This shall also include consideration of reduced production rates during these periods to minimise dust emissions.

Regular maintenance shall be undertaken of sprinkler heads, as used for dust control throughout the site, to prevent clogging.

It is noted that additional specific requirements have been developed for soils which are identified as potentially malodorous as detailed in AQMP01 Odour Control and AQMP04 Handling of Environmentally Impacted Soil which shall also reduce dust and potential asbestos emissions. The requirements of this procedure should be reviewed in accordance with the additional requirements of these other procedures.

Handling of Environmentally Impacted Soil		AQMP04
Responsibility:	Head Contractor Environmental Consultant	
Frequency:	Handling of environmentally impacted soils, including stockpiled soils and receipt of impacted materials	
Location:	Areas of site containing environmentally impacted soils	
Objective:	To control potential environmental emissions from contaminated soils	

Procedure

Potential hazardous emissions (dust, odour and vapours) may be released during the handling of environmentally impacted materials on the site. Measures shall be put in place to minimise such emissions. These measures shall include:

- Measures detailed in AQMP01 Odour Control;
- Measures detailed in AQMP02 Odour Masking;
- Measures detailed in AQMP03 Dust and Airborne Hazard Control;
- Transport of all impacted soils as per designated and marked 'impacted' and 'non-impacted' haul routes throughout the site. These routes shall be clearly identified on a site plan as posted within the Site. A heavy vehicle decontamination area shall be clearly marked on this plan. All persons engaged on the site shall be aware of the preferred haulage routes. The identification of preferred routes will assist in the appropriate placement and ready deployment of odour control methods, and prevent transport of impacted materials along site boundaries (where possible).

Where air quality management provisions are insufficient to allow compliance with monitoring criteria as detailed in AQMP05 Air Monitoring – Odours and/or AQMP06 Air Monitoring – Volatile Organic Compounds and/or AQMP07 Air Monitoring – Particulates and/or AQMP08 Air Monitoring – Asbestos, then the relevant works shall be ceased until more favourable meteorological conditions or more appropriate work methods are available. The Environmental Consultant shall advise more appropriate meteorological conditions.

Air Monitoring – Odours		AQMP05
Responsibility:	Head Contractor Site Auditor Environmental Consultant	
Frequency:	Handling / excavation of malodorous materials	
Location:	Site boundaries and nearby residential areas	
Objective:	To assess compliance with environmental standards for works	

Procedure

A program of atmospheric monitoring shall be undertaken throughout the earth works. The extent of required monitoring is described following:

Odour

Odour monitoring shall be undertaken by an appropriately qualified consultant at the downwind boundaries of the site. Odour monitoring shall be commenced prior to subsurface disturbance on the site. Odour monitoring shall be undertaken at three locations as a minimum spaced no greater than 20m along the downwind boundary at a frequency of:

- Hourly during periods of handling of potentially malodorous materials external to the tented enclosure; and
- A minimum of twice daily during other periods.

Odour monitoring shall further be undertaken at least once daily at the receptors nearest to the site, as shown on Figure AQMP5.1. This consists of the nearest residential locations.

Odour monitoring shall be undertaken using a 'Nasal Ranger' field olfactometer. A single odour measurement shall be undertaken at each monitoring location. Where an odour strength of 2-4 odour units or greater is recorded, an additional four odour measurements shall undertaken on a 1 minute basis. Odour measurements shall be recorded on Form AQMP05.1.

Where three (or more) of the total five readings record an odour strength of or in excess of 2-4 odour units (based on coal tar recognition):

- the odour masking system as described in AQMP02 Odour Masking shall be activated (where appropriate);
- monitoring shall be increased to an hourly frequency until the odour strengths recorded at all locations on the downwind boundary do not exceed 2 – 4 odour units over two consecutive hours. Once achieved the monitoring frequency may be returned to the minimum twice daily requirement; and
- the measures prescribed in AQMP01 Odour Prevention and Control shall be reviewed for adequacy in relation to site activities. Improvements or recommendations arising out of the review shall be incorporated into a revised AQMP for the site as per AQMP09 Review.

Personnel who undertake odour monitoring shall be non-smokers and shall be free of any nasal / sinus conditions that may affect the ability to detect / recognise odours.

Receptor No.	Description	Distance from Site	Easting	Northing
1	1 Leamington St Erskineville	100m North	332244	6247859
2	Railway Offices, within Stabling Shed	20m North	332263	6247744
3	Railway Workshops, nearest to site	60m East	332269	6247645
4	95 Railway Pde Erskineville	100m South	332342	6247537
5	15 Burren St Erskineville	10m West	332265	6247624
6	31 Burren St Erskineville	10m West	332252	6247669

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0 100m
Approximate scale

Figure 5.1 **Locations of Monitoring Locations**

Department of Lands (2010)
Note- All locations shown are approximate only

Date:____

Downwind Locations (complete as per monitoring periods)

7-8am ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:___________________________ _____________m/s

Measurements: 1.__________OU 2.___________OU 3.____________OU

Additional Measurements:____

____

8-9am ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:___________________________ _____________m/s

Measurements: 1.__________OU 2.___________OU 3.____________OU

Additional Measurements:____

____

9-10am ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:___________________________ _____________m/s

Measurements: 1.__________OU 2.___________OU 3.____________OU

Additional Measurements:____

____

10-11am ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:___________________________ _____________m/s

Measurements: 1.__________OU 2.___________OU 3.____________OU

Additional Measurements:____

____

11-12am ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:______________________________ ______________m/s

Measurements: 1.___________OU 2.____________OU 3._____________OU

Additional Measurements:____

12am-1pm ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:______________________________ ______________m/s

Measurements: 1.___________OU 2.____________OU 3._____________OU

Additional Measurements:____

1-2pm ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:______________________________ ______________m/s

Measurements: 1.___________OU 2.____________OU 3._____________OU

Additional Measurements:____

2-3pm ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:______________________________ ______________m/s

Measurements: 1.___________OU 2.____________OU 3._____________OU

Additional Measurements:____

3-4pm ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:______________________________ ______________m/s

Measurements: 1.___________OU 2.____________OU 3._____________OU

Additional Measurements:____

4-5pm ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:_____________________________ ______________m/s

Measurements: 1.___________OU 2.____________OU 3._____________OU

Additional Measurements:____

____

5-6pm ◇ No Malodorous Materials Handled

Boundary Assessed:____

Wind Direction and Velocity:_____________________________ ______________m/s

Measurements: 1.___________OU 2.____________OU 3._____________OU

Additional Measurements:____

____

Static Locations

Time:___________________________________

Wind Direction and Velocity:_____________________________ ______________m/s

Measurements: 1.___________OU 2.____________OU 3._____________OU

4.___________OU 5.____________OU 6._____________OU

Additional Measurements:____

____

Completed by: ____

Air Monitoring – Volatile Organic Compounds		AQMP06
Responsibility:	Head Contractor Site Auditor Environmental Consultant	
Frequency:	Handling / receipt / storage of malodorous materials	
Location:	All site works external to the tented enclosure	
Objective:	To assess compliance with environmental standards for works	

Procedure

A program of atmospheric monitoring shall be undertaken at the site throughout the remediation works outside the Soil Enclosure Area. The extent of required monitoring is described following:

Volatile Organic Compounds (VOCs) – Photo-Ionisation Detector

Assessment for VOCs shall be undertaken using a photo-ionisation detector (PID) provided with a 10.6eV bulb. Prior to use and at least on a daily basis the calibration of the PID shall be checked by comparison to a fresh air and isobutylene standard. The calibration check shall be recorded as per the appropriate PID calibration forms.

VOC monitoring shall be undertaken at all times in the proximity of handling of malodorous materials. Contaminants identified on the project site which have potentially significant health impacts are considered to occur within malodorous materials. The identification of malodorous materials is an appropriate measure for the potential presence of significant levels of VOCs.

The PID shall be maintained by an attended operator within a distance of approximately 2m during all periods of handling malodorous materials. Where the operator is unable to safely remain within 2m of the works area (consequent of heavy equipment or otherwise) the PID may be affixed to an excavator or similar in proximity of the works. PID measurements shall be undertaken as one hour averages.

The action level to assess PID readings requires to be determined on the basis of the separation distance to the nearest potentially exposed receptor. Locations of nearest receptors and separation distances are shown on Figure AQMP6.1 attached. The separation distance to the nearest receptor requires to be calculated by estimating the distance from the area of the malodorous materials to the nearest receptor. This is the sum of the distance from the site boundary to the receptor, and the downwind distance from the malodorous materials to the site boundary. The PID screening criteria are summarised following:

Separation Distance (m)	PID Screening Criteria (ppm)
50	0.1
100	0.2
150	0.3
200	0.3
250	0.4
300	0.4
350	0.5
400	0.5
450	0.6
500	0.6
600	0.7
700	0.7
800	0.8
900	0.9
1000	0.9

Where the screening criteria are exceeded then measures as required by EMP02 Odour Control shall be implemented to reduce VOC emissions. It is noted measures identified as appropriate for odour emissions are also appropriate for control of VOC emissions.

Subsequent to implementation of odour control measures, an additional air sample shall be required to be collected using a Draeger Tube.

All PID monitoring results require to be recorded on Form AQMP6.1. The recording of repeated elevated reading will require a substantial review of work methods in accordance with AQMP09 review.

Volatile Organic Compounds (VOCs) – Draeger Tube

Draeger tube samples require to be collected where the PID screening level is exceeded and the maximum PID reading for the day has been recorded. Draeger tube samples require to be specific to benzene.

Draeger tube ID 81081841 shall be used for sampling. This tube is specific to benzene and has a benzene detection limit of 0.5ppm. Draeger tube samples shall be collected at a height of 1.5m immediately overlying the malodorous materials. Some works may require to be temporarily ceased to allow collection of the sample.

Draeger tubes shall be sampled in strict accordance with the manufacturer specifications. Sampling shall be undertaken using a Draeger Accuro Pump. It shall be ensured that the recommended number of strokes are undertaken with the collection of each sample.

All Draeger tube monitoring results require to be recorded on Form AQMP6.1. The recording of repeated elevated reading will require a substantial review of work methods in accordance with AQMP09 review.

The Draeger tube action level shall be set at a detection of benzene overlying the source (0.5ppm). Where a detection is recorded and odour controls have been implemented, works shall require to be modified. This shall include consideration of:

- Cessation of works until more favourable meteorological conditions are available; and/or
- Reduction in scale of works with VOC impacted / malodorous materials.

Proposed Site Area Available for Remediation Works

50m contours from site

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0 50m
Approximate scale

Figure 6.1 **Approximate Radial Distance from Remediation Site**

Department of Lands (2010)
Note- All locations shown are approximate only

Air Monitoring – VOCs	Form AQMP06.1

Date:____

Sampling Locations at 2m Distance Downwind of Work Zone (complete as per monitoring periods)

7-8am ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

8-9am ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

9-10am ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

10-11am ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

11-12am ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

12am-1pm ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

1-2pm ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

2-3pm ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

3-4pm ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

4-5pm ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

5-6pm ◇ No Malodorous Materials Handled

Wind Direction and Velocity:______________________________ ______________m/s

Measurements (hourly average): ________________ ppm

Drager Tube sample: ◇ No Sample ◇ No Benzene Detection ◇ ___________ ppm

Comments:

Completed by: ____

Air Monitoring – Particulates / Dust		AQMP07
Responsibility:	Head Contractor Site Auditor Environmental Consultant	
Frequency:	Duration of earth works	
Location:	Site boundaries	
Objective:	To assess compliance with environmental standards for works	

Procedure

A program of atmospheric monitoring shall be undertaken throughout the earth works. The extent of required monitoring is described following:

Dusts – Realtime Particulate Monitoring

Assessment of realtime levels of dusts shall be undertaken by appropriately qualified personnel observing site boundaries. Where visible dusts are observable on the site boundaries then actual site measurements shall be undertaken by a 'DUSTTRAK' Aerosol Monitor at the downwind site boundary. The averaged level of PM_{10} (particulate matter less than 10 microns in diameter) over a period of 30s shall be required to be less than $50 \mu g/m^3$ at the downwind portion of the site boundary.

Where the acceptable level of dust is exceeded by real-time aerosol monitoring, then the measures prescribed in AQMP03 Dust and Airborne Hazard Control shall be reviewed for adequacy in relation to site activities. Improvements or recommendations arising out of the review shall be incorporated into a revised AQMP for the site as per AQMP08 AQMP Review.

All measurements shall be recorded in Form AQMP07.1.

Dusts – Deposition Monitoring

Dust deposition monitoring shall be undertaken by dust deposition gauges maintained permanently at three locations identified on Figure AQMP7.1. These locations have been determined on the basis of siting requirements in AS2922-1997 'Ambient Air – Guide for Siting of Sampling Units' to the extent possible. Collection and analysis of samples shall be undertaken in accordance with AS3580.10.1-2003 'Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method'. Samples shall be collected and analysed on a monthly basis throughout the works.

Where the level of dust deposition exceeds $2g/m^2$/month the implementation of AQMP03 Dust and Airborne Hazard Control shall be reviewed.

Dusts – Laboratory Analysis of Particulates

Confirmatory sampling shall be undertaken of the realtime particulate measurements being generated by the monitoring. This shall be undertaken by the fortnightly collection of an ambient air sample by a high volume sampling method. A high volume sampler shall be operated for a minimum period of 8 hours during site operation at a downwind location on the site boundary. Sample collection and analysis shall be in accordance with AS3580.9.6-1990 'Ambient Air – Determination of Suspended Particulate Matter PM_{10} – High Volume Sampler with Size Selective Inlet Gravimetric Method'.

Realtime measurements shall be taken at hourly intervals adjoining the sampler. The laboratory reported result of the high volume sampler shall be compared to the average of the realtime measurements. Where a significant discrepancy is identified (RPD>50% as calculated in accordance with AS4482.1-2005) the calibration of the Dusttrak (dust monitor) shall be confirmed by manufacturer service.

Repeated significant discrepancies in measurements will require revision of the AQMP in accordance with AQMP9 Review.

Air Monitoring – Dusts / Particulates	Form AQMP07.1

Date:____

Dusts Visible at Site Boundaries?

7-8am	◇ No	◇ Yes	____
8-9am	◇ No	◇ Yes	____
9-10am	◇ No	◇ Yes	____
10-11am	◇ No	◇ Yes	____
11-12am	◇ No	◇ Yes	____
12am-1pm	◇ No	◇ Yes	____
1-2pm	◇ No	◇ Yes	____
2-3pm	◇ No	◇ Yes	____
3-4pm	◇ No	◇ Yes	____
4-5pm	◇ No	◇ Yes	____
5-6pm	◇ No	◇ Yes	____

Dust-Trak Measurements

Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s
Time:______________________	Wind Direction & Speed:________________m/s

Completed by:____

Air Monitoring – Asbestos		AQMP08
Responsibility:	Head Contractor Site Auditor Environmental Consultant	
Frequency:	Duration of works in the vicinity of the former Northern Gasholder	
Location:	Site boundaries and nearby residential areas	
Objective:	To assess compliance with environmental standards for works	

Procedure

A program of atmospheric monitoring shall be undertaken throughout the earth works. The extent of required monitoring is described following:

Asbestos

Asbestos containing materials have been identified in shallow soils in the vicinity of the former northern gasholder.

When active excavation works occur in the vicinity of known areas of asbestos impacted fill, or other areas assessed by the environmental consultant as having a high potential to be impacted, asbestos monitoring shall be undertaken.

The potential generation of asbestos fibres shall be assessed by the daily static monitoring for asbestos fibres at three locations on the site boundary. These locations shall consist of at least one upwind and one downwind location. Sampling shall be undertaken in accordance with NIOSH Method 7400 'Asbestos and Other Fibres by PCM'. All results shall be required to meet the acceptance criteria as specified in the NOHSC 'Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres (2nd edition)' of <0.01 fibres/ml.

Where fibres are recorded in downwind locations then the presence of asbestos fibres shall be confirmed by analysis using TEM analysis (as per NIOSH method 7402). Where asbestos fibres are identified then dust control procedures shall be reviewed as in accordance with AQMP03 Dust and Airborne Hazard Control. The recording of asbestos fibres will require a substantial review of work methods in accordance with AQMP09 review.

AQMP Review		AQMP9
Responsibility:	Head Contractor Site Auditor Environmental Consultant RailCorp	
Frequency:	Subsequent to environment incidents. Subsequent to changes in program of works.	
Location:	Not applicable	
Objective:	To ensure that the AQMP is current and appropriate for the site	

Procedure

The Air Quality Management Plan shall be reviewed by the Environmental Consultant subsequent to either of the following:

- any environmental incident on the site;
- repeated exceedances of daily monitoring criteria for dust (AQMP 07), asbestos (AQMP 08), VOCs (AQMP 06) and/or odours (AQMP 05); or
- a significant modification to the implemented scope of works.

All new copies of Air Quality Management Plans shall be re-distributed to all parties by the Environmental Consultant. The Environmental Management Plan will require to be updated with the provisions of the revised Air Quality Management Plan.

On finalisation of revision, the Air Quality Management Plan shall be provided to the RailCorp for review / approval. The Authority shall advise acceptability of revisions (or otherwise) within seven days of receipt.

Training		**AQMP10**
Responsibility:	Head Contractor Environmental Consultant	
Frequency:	Throughout implementation of Environmental Management Plan and AQMP	
Location:	-	
Objective:	To ensure that persons responsible for preparation of the AQMP are competent.	

Procedure

Any person who is required to be responsible for technical / monitoring activities in relation to the implementation of the Air Quality Management Plan shall:

- Be inducted as the requirement and method of the specific activity by the Environmental Consultant or their nominated representative;
- Have undertaken the 24 hour Health and Safety Training for Hazardous Waste / Materials under OSHA 29 CFR 1910:120 or equivalent;
- Have an adequately acute sense of smell to allow operation of a nasal ranger (as confirmed by ability to detect n-butanol odour at a level of 40ppb by dynamic olfactometry in accordance with AS/NZS 4323.3:2001; CEN EN 13725:2003); and
- Have completed a Workcover approved Asbestos Removal Supervisor course or equivalent.

Document Status

Rev No.	Author	Reviewer	Approved for Issue		
		Name	Name	Signature	Date
A	Matt Parkinson/ Sumi Dorairaj	-	Draft for client review	-	26/11/2010
B	Matt Parkinson/ Sumi Dorairaj	Charlie Furr	Charlie Furr		14/12/2010
C	Sumi Dorairaj	Matthew Bennett	Draft for client review		09/08/11

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Appendix C

Calculation of Speciated Constituent Emission Rates

Appendix C – Calculation of Emissions of Speciated Constituents

Chemical specific estimates are required for the following potential emissions of constituents present in soil underlying the site:

- Chemical constituents that are sorbed to particulates released from the remediation works;
- Potentially volatile constituents that volatilise from soils handled on the remediation site; and
- Potentially volatile constituents that volatilise from pooled water as may occur in excavations, or from water treatment infrastructure.

Chemicals Sorbed to Particulates

The release of chemical constituents sorbed to soils has been estimated by simply multiplying the result for dust released by the percentage of impact of the particular constituent that is present in the source soils.

Estimates of constituents as present sorbed to dust particles are required for:

- Assessment to DECCW speciated criteria as provided for 1 hour duration;
- For use in risk calculations to determine levels of risk and hazard as may be posed to surrounding receptors.

Levels of chemical constituents have been assessed for the worse case scenario of air emissions from the site only, as detailed in Section 7.4 and Table 7.5. This has been undertaken by calculation of the product of maximum levels of constituents and maximum 1 hour levels of total suspended particulates to allow comparison to DECCW 1 hour criteria.

Volatilisation During Soil Handling and Stockpiling

The flux of volatile constituents as will potentially volatilise from soils stockpiled and handled on the Barangaroo Headland Park has been required to be estimated. The potential emissions of constituents from contaminated soils into outdoor air can be predicted by the RISC modelling package. RISC provides estimates of vapour emission on the basis of:

- The depth at which the volatile constituents occur;
- The levels at which volatile constituents present;
- Soil properties; and
- Chemical parameters related to the potential volatility of the constituents.

It has been assumed that all constituents are present at a depth of 0.1m. This is a conservative assumption, as the rates of vapour migration and discharge from the soil increase with increasing depth of the constituents from the soil surface. Similar modelling as performed in NZ Ministry for the Environment (1999) 'Users Guide Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand' has recommended a minimum diffusion distance of 0.1m be used in this modelling.

Modelling scenarios have been undertaken on the basis of maximum and average levels of constituents as per a similar logic described for the assessment of chemicals released with particulates. Maximum levels have been used for comparison to DECCW 1 hour criteria. Average levels have been used for comparison to DECCW annual chemical criteria (for the case of lead) and as a premise for risk and hazard calculations.

Vapour flux rates are reported by RISC from the source of impact in units of $g/cm^2/s$. A unit rate of flux, based on an area of $1m^2$ has been developed for a unit concentration (1mg/kg) of benzene and benzo(a)pyrene by modelling in RISC.

Soil properties for the modelling have been adopted as per the recommended soil properties provided to US EPA (19 June 2003) 'User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings'. The values as provided for sand have been used. Noting the site watering as required with the proposed dust controls, the highest of the recommended range of water filled porosities has been adopted in the modelling to characterise emissions from the site bas subject to dust controls. Standard dru values have been used for the worse case modelling. The soil properties as used in the modelling are summarised in **Table C1** following.

Table C1: Summary of Soil Properties Adopted for Modelling

Soil Property	Adopted Value	Comments
Total porosity	0.375	Sand, as per US EPA (2003)
Water filled porosity – dry sand	0.053	
Water filled porosity – with dust controls	0.253	Value for capillary fringe sands adopted on the basis of stockpile surface being regularly watered in model assumptions. Value as per US EPA (2003)
Fraction organic carbon	0.3	Assumed, consistent with site measurements
Soil bulk density	1.66	Sand, as per US EPA (2003)

A range of chemical parameters are required to characterise the potential volatilisation of soil constituents and movement of soil vapour. The most significant of these are summarised in **Table C2** following.

Table C2: Summary of Physical Properties of COPCs

COPC	Diffusivity in air	Diffusivity in water	Henry's Law constant	Soil-water partition coefficient	Organic carbon partition coefficient	Log of octonal water partition coefficient
	Da (cm2/s)	Dw (cm2/s)	H	KD (cm3/g)	KOC (L/kg)	Log KOW
Benzene	8.95*10-2	1.03*10-5	0.227	-	146	2.13
Benzo(a)pyrene	4.3*10-2	9.0*10-6	1.87*10-5	-	5.87*105	6.13

Model outputs as determine for dry sand and wet sand scenarios have been attached. Results are summarised following:

Table C3: Summary of Predicted Fluxes of Constituent Vapours ($g/m^2/s$ per mg/kg)

Constituent	Unit Flux from Dry Sands	Unit Flux from Wet Sands
Benzene	$6.43*10^{-6}$	$2.16*10^{-7}$
Benzo(a)pyrene	$7.63*10^{-14}$	$3.75*10^{-13}$

The unit flux rates require to be adjusted by the relevant concentration of the constituent for each area of the site where modelling is required. Environmental data for each area of the site is summarised in **Table C4**.

Table C4: Summary of Chemical Data

Parameter / Concentration	Benzene	Benzo(a)pyrene
C_{soil} Maximum, Surface Soils / Hot spots (mg/kg)	4.2[1]	339[1]
C_{soil} Average, Surface Soils / Hot spots (mg/kg)	0.24[1]	31.2[1]
C_{soil} Maximum, Northern Retaining Wall (mg/kg)	15[2]	150[2]
C_{soil} Average, Northern Retaining Wall (mg/kg)	1.2[2]	18.26[2]
C_{soil} Maximum, Northern Gasholder (mg/kg)	15[2]	150[2]
C_{soil} Average, Northern Gasholder (mg/kg)	1.2[2]	18.26[2]
C_{soil} Maximum, Operational Gasworks Area (mg/kg)	20[3]	444[3]
C_{soil} Average, Operational Gasworks Area (mg/kg)	1.4[3]	21[3]

Note: 1. Based on levels of impact reported for surface soils, ash and coke gravels.
2. Based on levels of impact reported for gravel, sand and demolition wastes.
3. Based on the highest of levels of impact reported for the remaining soil types in Table 5.2.

The calculated vapour emission rates for soils handled with the remediation works on the Macdonaldtown Site are summarised in **Tables C5** to **C8** for each of the soil handling scenarios.

Table C5: Estimated Emission Rates – Surface Soils and Contamination Hot Spots

Constituent	Soil Vapour – Maximum ($\mu g/m^2/s$)	Soil Vapour – Average ($\mu g/m^2/s$)
Benzene (dry sand)	2.70E-05	1.54E-06
Benzene (moist sand)	9.07E-07	5.18E-08
Benzo(a)pyrene (dry sand)	2.59E-11	2.38E-12
Benzo(a)pyrene (moist sand)	1.27E-10	1.17E-11

Table C6: Estimated Emission Rates – Fill Materials Behind Northern Retaining Wall

Constituent	Soil Vapour – Maximum ($\mu g/m^2/s$)	Soil Vapour – Average ($\mu g/m^2/s$)
Benzene (dry sand)	9.65E-05	7.72E-06
Benzene (moist sand)	3.24E-06	2.59E-07
Benzo(a)pyrene (dry sand)	1.14E-11	1.39E-12
Benzo(a)pyrene (moist sand)	5.63E-11	6.85E-12

Table C7: Estimated Emission Rates – Fill Materials Within Northern Gasholder

Constituent	Soil Vapour – Maximum ($\mu g/m^2/s$)	Soil Vapour – Average ($\mu g/m^2/s$)
Benzene (dry sand)	9.65E-05	7.72E-06
Benzene (moist sand)	3.24E-06	2.59E-07
Benzo(a)pyrene (dry sand)	1.14E-11	1.39E-12
Benzo(a)pyrene (moist sand)	5.63E-11	6.85E-12

Table C8: Estimated Emission Rates –Impacted Soils in Former Operational Gasworks Area

Constituent	Soil Vapour – Maximum ($\mu g/m^2/s$)	Soil Vapour – Average ($\mu g/m^2/s$)
Benzene (dry sand)	1.29E-04	9.00E-06
Benzene (moist sand)	4.32E-06	3.02E-07
Benzo(a)pyrene (dry sand)	3.39E-11	1.60E-12
Benzo(a)pyrene (moist sand)	1.67E-10	7.88E-12

The benzo(a)pyrene estimates of volatilisation and vapour generation are observed to be insignificant in relation to the benzo(a)pyrene criteria and the emissions of benzene. On this basis, the potential emissions of benzo(a)pyrene as soil vapours from soils have not been considered further in the modelling.

<u>Volatilisation during Transfer of Groundwater</u>

It has been assumed that transfer of groundwater consists of splash filling of storage vessels with transferred groundwater. Vapours are released from the shower that is formed by the transfer of the groundwater. The shower model as provided by NZ Ministry for the Environment (1999) has been used to estimate vapour emissions from this scenario.

The parameters provided to NZ Ministry for the Environment (1999) have been used to characterise the shower. It has been assumed that a droplet diameter is equal to 0.2m as advised by NZ Ministry for the Environment (1999). However a substantially reduced shower drop time of 1s has been used, in recognition that water is being discharged into a holding tank. Noting the likely limitations on the treatment system used to treat impacted water, it has been assumed that water is supplied at a rate of 60L/min (1L/s). A water temperature of 23°C has been used. As noted in the main document this is considered by JBS to be substantially below the likely inflow of groundwater into deep excavations or the emplaced trench. Results are summarised in **Table C9**.

Table C9: Estimated Emission Rates – Volatilisation from Transferred Water

Constituent	Vapour – Maximum (g/s)
Benzene	$9.7*10^{-3}$
Benzo(a)pyrene	$8*10^{-5}$

<u>Volatilisation from Pooled Groundwater in Deep Excavation</u>

Chemical constituents are found to be dissolved in groundwater, and would be anticipated to be similarly dissolved in groundwater that may pool within the deep excavation as placed on the site. It would be anticipated that where evaporation of pooled dewater occurs that dissolved constituents would be present in the water vapour at the same levels as the water mass. A water evaporation equation has simply been used, with the results adjusted for the proportion of water vapour anticipated to consist of the particular constituent. The dimensions of the northern gasholder have been used for the purposes of these calculations. The extent of the northern gasholder and the proximity to the nearest residential receptors causes this to be the most conservative scenario. Results are summarised in **Table C10**.

Table C10: Estimated Emission Rates – Volatilisation from Pooled Water

Constituent	**Vapour – Maximum ($g/m^2/s$)**
Benzene	$7.8*10^{-5} * U^{0.8}/T^{1.47}$
Benzo(a)pyrene	$1.6*10^{-5} * U^{0.8}/T^{1.47}$

By reference to **Table C10**, U is the wind speed over the water surface, as measured in m/s. This has been set equal to 10% of the wind speed in the meteorological data for each record based on the reduced wind speed within a sub-surface excavation as compared to a 10m high anemometer.

T is the ambient temperature of the water which is measured in Kelvin. It is noted that the vapour pressure of water has been set at 20°C in using the model. Though the vapour pressure would be anticipated to vary with changes in atmospheric temperatures. The amount of variation over the value as adopted at 20°C is not considered to be significant to vary this within the model.

Dry Sands Flux Estimates

FATE AND TRANSPORT MODEL OUTPUT FOR: Benzene

Start of model output for:
Johnson and Ettinger model for outdoor air
with volatile emissions from soil

Calculating Vapor Phase Concentration at Source:
(Using Equilibrium Partitioning Equation)

Inputs:

Total concentration in soil [mg/kg].........	1.0
Total porosity [-].........................	0.38
Air content [-]............................	0.32
Moisture content [-].......................	5.30E-02
Fraction organic carbon [-]................	3.00E-03
Organic carbon partitioning coeff. [ml/g]...	1.46E+02
Soil bulk density [g/cm3]..................	1.7
Henrys Law coeff. [-]......................	0.23
Chemical solubility [mg/l].................	1.79E+03

Outputs:

Calculated dissolved phase conc. [mg/l].....	1.9
Effective solubility [mg/l]................	1.79E+03

Source concentration is BELOW residual limit
because calculated dissolved phase conc.
is LESS than the effective solubility.

Dissolved phase conc. at source [mg/l]......	1.9
Source vapor concentration [g/cm^3].........	4.42E-07
Source vapor concentration [mg/m^3].........	4.42E+02
Residual level [mg/kg].....................	9.20E+02

(assuming pure chemical solubility)

VAPOR TRANSPORT FROM SOIL TO OUTDOOR AIR

Effective Diffusion Coefficient for Vadose zone

Total thickness of subunit [cm].............. 10.

Air-filled porosity [-]....................... 0.32

Water-filled porosity [-]..................... 5.30E-02

Total porosity [-]............................ 0.38

Effective diff. coeff. for subunit....[cm^2/s] 1.46E-02

Overall Effective Diffusion Coefficient (for all layers)

Overall diffusion path length [cm]................ 10.

Overall effective diffusion coefficient [cm^2/s]... 1.46E-02

Vapor Concentration and Flux at Source

Initial vapor conc. at source [g/cm^3]............ 4.42E-07

Initial vapor conc. at source [mg/m^3]............ 4.42E+02

Initial vapor flux rate [g/cm^2/s]................ 6.43E-10

Soil gas flow rate is zero (advection not considered in this model).

OUTDOOR AIR CONCENTRATION

Benzene

Time (yr)	Concentration Outdoors (mg/m^3)
1.0	1.61E-02

This is a steady-state model.

FATE AND TRANSPORT MODEL OUTPUT FOR: Benzo(a)pyrene

Start of model output for:

Johnson and Ettinger model for outdoor air
with volatile emissions from soil

Calculating Vapor Phase Concentration at Source:
(Using Equilibrium Partitioning Equation)

Inputs:

Total concentration in soil [mg/kg]......... 1.0
Total porosity [-].......................... 0.38
Air content [-]............................ 0.32
Moisture content [-]........................ 5.30E-02
Fraction organic carbon [-]................. 3.00E-03
Organic carbon partitioning coeff. [ml/g]... 5.87E+05
Soil bulk density [g/cm3].................. 1.7
Henrys Law coeff. [-]...................... 1.87E-05
Chemical solubility [mg/l]................. 1.62E-03

Outputs:

Calculated dissolved phase conc. [mg/l]..... 5.68E-04
Effective solubility [mg/l]................ 1.62E-03
Source concentration is BELOW residual limit
because calculated dissolved phase conc.
is LESS than the effective solubility.

Dissolved phase conc. at source [mg/l]...... 5.68E-04
Source vapor concentration [g/cm^3]......... 1.06E-14
Source vapor concentration [mg/m^3]......... 1.06E-05
Residual level [mg/kg]..................... 2.9
(assuming pure chemical solubility)

VAPOR TRANSPORT FROM SOIL TO OUTDOOR AIR

Effective Diffusion Coefficient for Vadose zone

Total thickness of subunit [cm].............. 10.

Air-filled porosity [-]....................... 0.32

Water-filled porosity [-]..................... 5.30E-02

Total porosity [-]............................ 0.38

Effective diff. coeff. for subunit....[cm^2/s] 7.19E-03

Overall Effective Diffusion Coefficient (for all layers)

Overall diffusion path length [cm]................ 10.

Overall effective diffusion coefficient [cm^2/s]... 7.19E-03

Vapor Concentration and Flux at Source

Initial vapor conc. at source [g/cm^3]............ 1.06E-14

Initial vapor conc. at source [mg/m^3]............ 1.06E-05

Initial vapor flux rate [g/cm^2/s]................ 7.63E-18

Soil gas flow rate is zero (advection not considered in this model).

OUTDOOR AIR CONCENTRATION

Benzo(a)pyrene

Time (yr)	Concentration Outdoors (mg/m^3)
1.0	1.91E-10

This is a steady-state model.

Moist Sands (Dust Controls) Flux Estimates

FATE AND TRANSPORT MODEL OUTPUT FOR: Benzene

Start of model output for:

Johnson and Ettinger model for outdoor air

with volatile emissions from soil

Calculating Vapor Phase Concentration at Source:

(Using Equilibrium Partitioning Equation)

Inputs:

Total concentration in soil [mg/kg]......... 1.0

Total porosity [-].......................... 0.38

Air content [-]............................ 0.12

Moisture content [-]........................ 0.25

Fraction organic carbon [-]................. 3.00E-03

Organic carbon partitioning coeff. [ml/g]... 1.46E+02

Soil bulk density [g/cm3]................... 1.7

Henrys Law coeff. [-]....................... 0.23

Chemical solubility [mg/l].................. 1.79E+03

Outputs:

Calculated dissolved phase conc. [mg/l]..... 1.6

Effective solubility [mg/l]................. 1.79E+03

Source concentration is BELOW residual limit

because calculated dissolved phase conc.

is LESS than the effective solubility.

Dissolved phase conc. at source [mg/l]...... 1.6

Source vapor concentration [g/cm^3]......... 3.74E-07

Source vapor concentration [mg/m^3]......... 3.74E+02

Residual level [mg/kg]...................... 1.09E+03

(assuming pure chemical solubility)

VAPOR TRANSPORT FROM SOIL TO OUTDOOR AIR

Effective Diffusion Coefficient for Vadose zone

Total thickness of subunit [cm].............. 10.

Air-filled porosity [-]...................... 0.12

Water-filled porosity [-].................... 0.25

Total porosity [-]........................... 0.38

Effective diff. coeff. for subunit....[cm^2/s] 5.76E-04

Overall Effective Diffusion Coefficient (for all layers)

Overall diffusion path length [cm]................ 10.

Overall effective diffusion coefficient [cm^2/s]... 5.76E-04

Vapor Concentration and Flux at Source

Initial vapor conc. at source [g/cm^3]............ 3.74E-07

Initial vapor conc. at source [mg/m^3]............ 3.74E+02

Initial vapor flux rate [g/cm^2/s]................ 2.16E-11

Soil gas flow rate is zero (advection not considered in this model).

OUTDOOR AIR CONCENTRATION

Benzene

Time (yr)	Concentration Outdoors (mg/m^3)
1.0	5.39E-04

This is a steady-state model.

FATE AND TRANSPORT MODEL OUTPUT FOR: Benzo(a)pyrene

Start of model output for:

Johnson and Ettinger model for outdoor air

with volatile emissions from soil

Calculating Vapor Phase Concentration at Source:

(Using Equilibrium Partitioning Equation)

Inputs:

Total concentration in soil [mg/kg]......... 1.0

Total porosity [-].......................... 0.38

Air content [-]............................ 0.12

Moisture content [-]........................ 0.25

Fraction organic carbon [-]................ 3.00E-03

Organic carbon partitioning coeff. [ml/g]... 5.87E+05

Soil bulk density [g/cm3].................. 1.7

Henrys Law coeff. [-]...................... 1.87E-05

Chemical solubility [mg/l]................. 1.62E-03

Outputs:

Calculated dissolved phase conc. [mg/l]..... 5.68E-04

Effective solubility [mg/l]................ 1.62E-03

Source concentration is BELOW residual limit

because calculated dissolved phase conc.

is LESS than the effective solubility.

Dissolved phase conc. at source [mg/l]...... 5.68E-04

Source vapor concentration [g/cm^3]......... 1.06E-14

Source vapor concentration [mg/m^3]......... 1.06E-05

Residual level [mg/kg]..................... 2.9

(assuming pure chemical solubility)

VAPOR TRANSPORT FROM SOIL TO OUTDOOR AIR

Effective Diffusion Coefficient for Vadose zone

Total thickness of subunit [cm].............. 10.

Air-filled porosity [-]...................... 0.12

Water-filled porosity [-].................... 0.25

Total porosity [-]........................... 0.38

Effective diff. coeff. for subunit....[cm^2/s] 3.53E-02

Overall Effective Diffusion Coefficient (for all layers)

Overall diffusion path length [cm]................ 10.

Overall effective diffusion coefficient [cm^2/s]... 3.53E-02

Vapor Concentration and Flux at Source

Initial vapor conc. at source [g/cm^3]............ 1.06E-14

Initial vapor conc. at source [mg/m^3]............ 1.06E-05

Initial vapor flux rate [g/cm^2/s]................ 3.75E-17

Soil gas flow rate is zero (advection not considered in this model).

OUTDOOR AIR CONCENTRATION

Benzo(a)pyrene

Time (yr)	Concentration Outdoors (mg/m^3)
1.0	9.38E-10

This is a steady-state model.

Appendix D

AUSPLUME Modelling Results and Modelling Files Outputs Controlled Conditions

AUSPLUME EMISSION RATE CALCULATIONS

										kg / tonne	m3 / day	tonnes / day		kg / m2 / sec	g / m2 / sec uncontrolled	g / m2 / sec with controls
Surface soils, excavation and stockpiling	TSP	VEX1T	Area	20	20	45	332314	6247685	16.5	2.81E-02	500	650	4.57E-02	1.2684E-06	1.27E-03	3.30E-04
	PM_{10}	VEX1P	Area	20	20	45	332314	6247685	16.5	1.33E-02	500	650	2.16E-02	6.00347E-07	6.00E-04	1.56E-04
	Benzene (max)	VEX1BE	Area	20	20	45	332314	6247685	16.5	1.18E-08	500	650	1.92E-08	5.32639E-13	5.33E-10	1.38E-10
										6.74E-09	500	650	-	-	-	-
	B(a)P (max)	VEX1BP	Area	20	20	45	332314	6247685	16.5	9.53E-06	500	650	1.55E-05	4.30174E-10	4.30E-07	1.12E-07
										8.77E-07	500	650	-	-	-	-
Fill materials behind retaining wall, excavation and stockpiling	TSP	VEX2T	Area	50	5	80	332271	6247720	18	2.81E-02	300	390	4.38E-02	1.21767E-06	1.22E-03	3.17E-04
	PM_{10}	VEX2P	Area	50	5	80	332271	6247720	18	1.33E-02	300	390	2.07E-02	5.76333E-07	5.76E-04	1.50E-04
	Benzene (max)	VEX2BE	Area	50	5	80	332271	6247720	18	4.22E-07	300	390	6.58E-07	1.82867E-11	1.83E-08	4.75E-09
				50	5					-	-	-	-	-	-	-
	B(a)P (max)	VEX2BP	Area	50	5	80	332271	6247720	18	4.22E-06	300	390	6.58E-06	1.82867E-10	1.83E-07	4.75E-08
				50	5					-	-	-	-	-	-	-
Northern Gasholder, excavation and stockpiling	TSP	VEX3T	Area	20	20	0	332276	6247697	17.5	2.81E-02	100	130	9.13E-03	2.53681E-07	2.54E-04	2.54E-06
	PM_{10}	VEX3P	Area	20	20	0	332276	6247697	17.5	1.33E-02	100	130	4.32E-03	1.20069E-07	1.20E-04	1.20E-06
	Benzene (max)	VEX3BE	Area	20	20	0	332276	6247697	17.5	4.22E-07	100	130	1.37E-07	3.80972E-12	3.81E-09	3.81E-11
	B(a)P (max)	VEX3BP	Area	20	20	0	332276	6247697	17.5	4.22E-06	100	130	1.37E-06	3.80972E-11	3.81E-08	3.81E-10
Former gasworks area, excavation and stockpiling	TSP	VEX4T	Area	15	15	0	332296	6247695	17.5	2.81E-02	200	260	3.25E-02	9.01975E-07	9.02E-04	9.02E-06
	PM_{10}	VEX4P	Area	15	15	0	332296	6247695	17.5	1.33E-02	200	260	1.54E-02	4.26914E-07	4.27E-04	4.27E-06
	Benzene (max)	VEX4BE	Area	15	15	0	332296	6247695	17.5	5.67E-07	200	260	6.55E-07	1.82E-11	1.82E-08	1.82E-10
										-	-	-	-	-	-	-
	B(a)P (max)	VEX4BP	Area	15	15	0	332296	6247695	17.5	0.0000125	200	260	1.44E-05	4.01235E-10	4.01E-07	4.01E-09
										-	-	-	-	-	-	-

Surface Soils and Hotspot Excavations

TSP	Annual		variable	3.02E+00	9.10E+00	1.31E+01	1.18E+00	1.14E+01	1.15E+01	VEX1T
			fugitive	2.39E-03	8.74E-03	1.64E-02	5.90E-03	1.83E-02	1.32E-02	F1T
		90	sum	3.02E+00	9.11E+00	1.31E+01	1.19E+00	1.14E+01	1.15E+01	SUM
PM_{10}	24 hour		variable	1.40E+01	3.70E+01	2.91E+01	5.89E+00	1.99E+01	2.45E+01	VEX1P
			fugitive	8.99E-03	4.52E-02	7.18E-02	1.74E-02	5.79E-02	5.52E-02	F1P
		50	sum	1.40E+01	3.70E+01	2.92E+01	5.91E+00	2.00E+01	2.46E+01	SUM
PM_{10}	Annual		variable	1.42E+00	4.28E+00	6.16E+00	5.56E-01	5.36E+00	5.43E+00	VEX1P
			fugitive	1.16E-03	4.24E-03	7.95E-03	2.87E-03	8.89E-03	6.43E-03	F1P
		30	sum	1.42E+00	4.28E+00	6.17E+00	5.59E-01	5.37E+00	5.44E+00	SUM
Benzene	1 hour		variable	3.16E-03	1.16E-02	1.16E-02	3.18E-03	9.67E-03	1.16E-02	VEX1BE
			fugitive	1.00E-06	3.70E-06	4.39E-06	1.48E-06	3.70E-06	4.64E-06	F1BEP+F1BEV
		29	sum	3.16E-03	1.16E-02	1.16E-02	3.18E-03	9.67E-03	1.16E-02	SUM
Benzo(a)pyrene	1 hour		variable	2.29E-02	8.39E-02	8.42E-02	2.30E-02	6.90E-02	8.40E-02	VEX1BP
			fugitive	6.21E-05	2.30E-04	2.73E-04	9.16E-05	2.29E-04	2.88E-04	F1BPP
		0.4	sum	2.30E-02	8.41E-02	8.45E-02	2.31E-02	6.92E-02	8.43E-02	SUM

Northern Retaining Wall Excavation

TSP	Annual		variable	1.39E+00	2.02E+01	2.76E+00	2.03E-01	1.35E+00	7.27E+00	VEX2T
			fugitive	4.03E-03	3.48E-02	2.56E-02	3.69E-03	1.86E-02	3.08E-02	F2T
		90	sum	1.39E+00	2.02E+01	2.79E+00	2.07E-01	1.37E+00	7.30E+00	SUM
PM_{10}	24 hour		variable	1.66E+00	3.14E+01	1.83E+00	3.05E-01	1.15E+00	3.70E+00	VEX2P
			fugitive	1.45E-01	1.74E+00	8.00E-01	1.43E-01	5.36E-01	8.08E-01	F2P
		50	sum	1.81E+00	3.31E+01	2.63E+00	4.48E-01	1.69E+00	4.51E+00	SUM
PM_{10}	Annual		variable	2.39E-01	4.12E+00	3.70E-01	3.09E-02	1.88E-01	9.43E-01	VEX2P
			fugitive	2.01E-02	1.74E-01	1.28E-01	1.84E-02	9.28E-02	1.54E-01	F2P
		30	sum	2.59E-01	4.29E+00	4.98E-01	4.93E-02	2.81E-01	1.10E+00	SUM
Benzene	1 hour		variable	1.24E-02	1.08E-02	7.12E-03	6.11E-04	3.87E-03	8.43E-03	VEX2BE
			fugitive	2.44E-04	1.61E-03	9.68E-04	2.30E-04	8.27E-04	8.30E-04	F2BEP+F2BEV
		29	sum	1.26E-02	1.24E-02	8.09E-03	8.41E-04	4.70E-03	9.26E-03	SUM
Benzo(a)pyrene	1 hour		variable	4.49E-03	5.77E-02	1.22E-02	1.62E-03	7.95E-03	2.53E-02	VEX2BP
			fugitive	1.34E-03	1.06E-02	3.20E-03	8.48E-04	2.36E-03	4.61E-03	F2BPP
		0.4	sum	5.83E-03	6.83E-02	1.54E-02	2.47E-03	1.03E-02	2.99E-02	SUM
Odour	1 second	2 OU	variable	1.29E-01	5.77E-01	2.35E-01	8.89E-02	1.90E-01	3.16E-01	VEX2OU
			fugitive	6.29E-02	4.79E-01	1.50E-01	3.97E-02	1.11E-01	3.16E-01	F2OU
			sum	1.92E-01	1.06E+00	3.85E-01	1.29E-01	3.01E-01	6.32E-01	SUM

Northern Gasholder Excavation

TSP	Annual		variable	5.29E-02	4.68E-01	1.60E-01	8.98E-03	8.14E-02	3.36E-01	VEX3T
			fugitive	1.24E-04	6.92E-04	9.36E-04	1.69E-04	8.18E-04	9.46E-04	F3T
		90	sum	5.30E-02	4.69E-01	1.61E-01	9.15E-03	8.22E-02	3.37E-01	SUM
PM_{10}	24 hour		variable	2.54E-02	2.24E-03	7.69E-04	4.31E-05	3.91E-04	1.61E-03	VEX3P
			fugitive	4.85E-04	3.75E-03	2.64E-03	6.10E-04	2.76E-03	4.21E-03	F3P
		50	sum	2.59E-02	5.99E-03	3.41E-03	6.53E-04	3.15E-03	5.82E-03	SUM
PM_{10}	Annual		variable	1.73E-01	1.92E+00	3.02E-01	4.55E-02	1.79E-01	5.70E-03	VEX3P
			fugitive	6.41E-05	3.59E-04	4.85E-04	8.76E-05	4.24E-04	4.90E-04	F3P
		30	sum	1.73E-01	1.92E+00	3.02E-01	4.56E-02	1.79E-01	6.19E-03	SUM
Benzene	1 hour		variable	1.69E-05	1.51E-04	6.34E-05	7.89E-06	3.71E-05	1.00E-04	VEX3BE
			fugitive	6.21E-07	3.35E-06	2.07E-06	5.51E-07	1.56E-06	2.71E-06	F3BEP+F3BEV
		29	sum	1.75E-05	1.54E-04	6.55E-05	8.44E-06	3.87E-05	1.03E-04	SUM
Benzo(a)pyrene	1 hour		variable	1.69E-04	1.51E-03	6.34E-04	7.89E-05	3.71E-04	1.00E-03	VEX3BP
			fugitive	1.84E-06	9.95E-06	6.15E-06	1.64E-06	4.63E-06	8.07E-06	F3BPP
		0.4	sum	1.71E-04	1.52E-03	6.40E-04	8.05E-05	3.76E-04	1.01E-03	SUM
Odour	1 second	2 OU	variable	1.73E-04	1.53E-03	6.46E-04	8.22E-05	3.80E-04	1.02E-03	VEX2OU
			fugitive	3.28E-02	1.77E-01	1.10E-01	2.92E-02	8.24E-02	1.44E-01	F2OU
			sum	3.30E-02	1.79E-01	1.11E-01	2.93E-02	8.28E-02	1.45E-01	SUM

Former Gasworks Areas

TSP	Annual		variable	9.44E-02	4.74E-01	3.51E-01	1.89E-02	2.14E-01	4.90E-01	VEX4T
			fugitive	1.16E-05	6.32E-05	1.00E-04	1.81E-05	8.82E-05	9.49E-05	F4T
		90	sum	9.44E-02	4.74E-01	3.51E-01	1.89E-02	2.14E-01	4.90E-01	SUM
PM_{10}	24 hour		variable	3.84E-01	1.78E+00	6.40E-01	1.07E-01	4.12E-01	1.06E+00	VEX4P
			fugitive	4.50E-05	2.76E-04	3.19E-04	6.65E-04	2.94E-04	4.31E-04	F4P
		50	sum	3.84E-01	1.78E+00	6.40E-01	1.08E-01	4.12E-01	1.06E+00	SUM
PM_{10}	Annual		variable	4.51E-02	2.26E-02	1.68E-01	9.03E-03	1.02E-01	2.34E-01	VEX4P
			fugitive	5.99E-06	3.28E-05	5.35E-05	9.39E-06	4.57E-05	4.92E-05	F4P
		30	sum	4.51E-02	2.26E-02	1.68E-01	9.04E-03	1.02E-01	2.34E-01	SUM
Benzene	1 hour		variable	4.20E-05	2.46E-04	1.52E-04	2.37E-05	1.11E-04	1.95E-04	VEX4BE
			fugitive	2.83E-04	1.44E-03	1.13E-03	2.86E-04	8.45E-04	1.45E-05	F4BEP + F4BEV
		29	sum	3.25E-04	1.69E-03	1.28E-03	3.10E-04	9.56E-04	2.10E-04	SUM
Benzo(a)pyrene	1 hour		variable	9.33E-04	5.46E-03	3.38E-03	5.27E-04	2.46E-03	4.32E-03	VEX4BP
			fugitive	5.07E-06	2.57E-05	2.02E-05	5.12E-06	1.51E-05	2.59E-05	F4BPP
		0.4	sum	9.38E-04	5.49E-03	3.40E-03	5.32E-04	2.48E-03	4.35E-03	SUM
Odour	1 second	2 OU	variable	6.95E-02	3.34E-01	2.47E-01	6.82E-02	1.90E-01	3.11E-01	VEX4OU
			fugitive	3.09E-02	1.56E-01	1.23E-01	3.11E-02	9.21E-02	1.58E-01	F4OU
			sum	1.00E-01	4.90E-01	3.70E-01	9.93E-02	2.82E-01	4.69E-01	

Haulage Roads

TSP	Annual	90	fugitive	3.59E-01	1.26E+00	2.22E+00	6.02E-01	2.15E+00	1.93E+00	HAT
PM_{10}	24 hour	50	fugitive	1.72E+00	6.83E+00	9.83E+00	2.43E+00	6.79E+00	7.99E+00	HAP
PM_{10}	Annual	30	fugitive	2.25E-01	7.91E-01	1.39E+00	3.77E-01	1.35E+00	1.21E+00	HAP

Bioremediation of Soils

				Receptor Location						AUSPLUME
				1	2	3	4	5	6	
TSP	Annual	90	fugitive	7.70E-04	1.60E-03	2.74E-03	3.16E-03	3.00E-03	2.12E-03	T2T
PM_{10}	24 hour	50	fugitive	3.08E-03	7.31E-03	9.55E-03	9.14E-03	1.21E-02	8.32E-03	T2PM
PM_{10}	Annual	30	fugitive	3.99E-04	8.29E-04	1.42E-03	1.64E-03	1.56E-03	1.15E-03	T2PM
Benzene	1 hour	29	fugitive	1.64E-06	3.69E-06	2.59E-06	2.31E-06	2.49E-06	2.70E-06	T2BEP
			fugitive	3.94E-06	8.88E-06	6.23E-07	5.55E-06	5.98E-06	6.50E-06	T2BEV
				5.58E-06	1.26E-05	3.21E-06	7.86E-06	8.47E-06	9.20E-06	sum
Benzo(a)pyrene	1 hour	0.4	fugitive	3.64E-05	8.02E-05	5.75E-05	5.12E-05	5.52E-05	6.00E-05	T2BPP results times 0.001
Odour	1 second	2 OU		2.21E-01	4.94E-01	3.50E-01	3.12E-01	3.36E-01	3.65E-01	T2ou

Groudnwater Emissions and Water Treatment

				Receptor Location						AUSPLUME
				1	2	3	4	5	6	
Benzene	1 hour	29	fugitive	1.03E-01	6.35E-01	4.55E-01	9.83E-02	3.21E-01	6.19E-01	WTBE
				3.47E-01	3.10E+00	1.30E+00	1.62E-01	7.62E-01	2.05E+00	PWBE
				4.50E-01	3.74E+00	1.76E+00	2.60E-01	1.08E+00	2.67E+00	sum
Benzo(a)pyrene	1 hour	0.4	fugitive	9.05E-04	5.56E-03	3.98E-03	8.16E-04	2.80E-03	5.39E-03	WTBP
				7.12E-02	6.36E-01	2.67E-01	3.32E-02	1.56E-01	4.21E-01	PWBP
				7.21E-02	6.42E-01	2.71E-01	3.40E-02	1.59E-01	4.26E-01	sum
Odour	1 second	2 OU	fugitive	9.98E-04	1.71E-03	1.56E-03	3.47E-04	5.36E-04	1.02E-03	TOU

Surface Soils – Excavation and Stockpiling

1 ____

40913 Macdonaldtown VEX1 variable sources

____

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

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40913 Macdonaldtown VEX1 variable sources

SOURCE GROUPS

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Group No.	Members
1	VEX1T
2	VEX1P
3	VEX1BE
4	VEX1BP

____

1 ____

40913 Macdonaldtown VEX1 variable sources

SOURCE CHARACTERISTICS

____

INTEGRATED AREA SOURCE: VEX1T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	20m	20m	45deg	5m	0m

(Constant) emission rate = 3.30E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX1P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	20m	20m	45deg	5m	0m

(Constant) emission rate =1.56E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX1BE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	20m	20m	45deg	5m	0m

(Constant) emission rate = 1.38E-10 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX1BP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	20m	20m	45deg	5m	0m

(Constant) emission rate = 1.12E-07 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

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1 ____

40913 Macdonaldtown VEX1 variable sources

RECEPTOR LOCATIONS

____

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\New folder (2)\RandExVar.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VEX1T VEX1P VEX1BE VEX1BP

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

1: 7.43E+01 @Hr15,08/06/07	4: 7.47E+01 @Hr08,04/07/07
2: 2.73E+02 @Hr07,16/06/07	5: 2.27E+02 @Hr16,28/01/07
3: 2.74E+02 @Hr16,05/02/07	6: 2.73E+02 @Hr16,18/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2

At the discrete receptors:

1: 3.50E+01 @Hr15,08/06/07	4: 3.51E+01 @Hr08,04/07/07
2: 1.28E+02 @Hr07,16/06/07	5: 1.07E+02 @Hr16,28/01/07
3: 1.29E+02 @Hr16,05/02/07	6: 1.29E+02 @Hr16,18/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 3

At the discrete receptors:

1: 3.16E+00 @Hr15,08/06/07	4: 3.18E+00 @Hr08,04/07/07
2: 1.16E+01 @Hr07,16/06/07	5: 9.67E+00 @Hr16,28/01/07
3: 1.16E+01 @Hr16,05/02/07	6: 1.16E+01 @Hr16,18/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 4

At the discrete receptors:

1: 2.29E+00 @Hr15,08/06/07	4: 2.30E+00 @Hr08,04/07/07
2: 8.39E+00 @Hr07,16/06/07	5: 6.99E+00 @Hr16,28/01/07
3: 8.42E+00 @Hr16,05/02/07	6: 8.40E+00 @Hr16,18/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 1

At the discrete receptors:

1: 2.98E+01 @Hr24,08/06/07	4: 1.25E+01 @Hr24,17/05/08
2: 7.87E+01 @Hr24,16/06/07	5: 4.23E+01 @Hr24,02/01/07
3: 6.18E+01 @Hr24,02/01/07	6: 5.20E+01 @Hr24,06/09/07

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
      AVERAGING TIME = 24 HOURS;  SOURCE GROUP No. 2

 At the discrete receptors:

  1: 1.40E+01 @Hr24,08/06/07     4: 5.89E+00 @Hr24,17/05/08
  2: 3.70E+01 @Hr24,16/06/07     5: 1.99E+01 @Hr24,02/01/07
  3: 2.91E+01 @Hr24,02/01/07     6: 2.45E+01 @Hr24,06/09/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
      AVERAGING TIME = 24 HOURS;  SOURCE GROUP No. 3

 At the discrete receptors:

  1: 1.27E+00 @Hr24,08/06/07     4: 5.32E-01 @Hr24,17/05/08
  2: 3.35E+00 @Hr24,16/06/07     5: 1.80E+00 @Hr24,02/01/07
  3: 2.63E+00 @Hr24,02/01/07     6: 2.21E+00 @Hr24,06/09/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
      AVERAGING TIME = 24 HOURS;  SOURCE GROUP No. 4

 At the discrete receptors:

  1: 9.16E-01 @Hr24,08/06/07     4: 3.85E-01 @Hr24,17/05/08
  2: 2.42E+00 @Hr24,16/06/07     5: 1.30E+00 @Hr24,02/01/07
  3: 1.90E+00 @Hr24,02/01/07     6: 1.60E+00 @Hr24,06/09/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 1

 At the discrete receptors:

  1: 3.02E+00 @Hr24,07/01/08     4: 1.18E+00 @Hr24,28/12/08
  2: 9.10E+00 @Hr24,18/01/08     5: 1.14E+01 @Hr24,02/04/07
  3: 1.31E+01 @Hr24,01/04/07     6: 1.15E+01 @Hr24,01/04/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 2

 At the discrete receptors:

  1: 1.42E+00 @Hr24,07/01/08     4: 5.56E-01 @Hr24,28/12/08
  2: 4.28E+00 @Hr24,18/01/08     5: 5.36E+00 @Hr24,02/04/07
  3: 6.16E+00 @Hr24,01/04/07     6: 5.43E+00 @Hr24,01/04/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 3

 At the discrete receptors:

  1: 1.28E-01 @Hr24,07/01/08     4: 5.02E-02 @Hr24,28/12/08
  2: 3.87E-01 @Hr24,18/01/08     5: 4.84E-01 @Hr24,02/04/07
  3: 5.57E-01 @Hr24,01/04/07     6: 4.91E-01 @Hr24,01/04/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 4

 At the discrete receptors:

  1: 9.16E-01 @Hr24,08/06/07     4: 3.85E-01 @Hr24,17/05/08
  2: 2.42E+00 @Hr24,16/06/07     5: 1.30E+00 @Hr24,02/01/07
  3: 1.90E+00 @Hr24,02/01/07     6: 1.60E+00 @Hr24,06/09/07
```

Surface Soils – Fugitive Emissions

1 ____

40913 Macdonaldtown F1 fugitive emission

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Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

____

____

40913 Macdonaldtown F1 fugitive emission

SOURCE GROUPS

____

Group No.	Members
1	F1T
2	F1P
3	F1BE
4	F1BP

1

40913 Macdonaldtown F1 fugitive emission

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: F1T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	10m	10m	45deg	5m	0m

(Constant) emission rate = 7.00E-07 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F1P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	10m	10m	45deg	5m	0m

(Constant) emission rate = 3.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F1BE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	10m	10m	45deg	5m	0m

(Constant) emission rate = 2.90E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F1BP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	10m	10m	45deg	5m	0m

(Constant) emission rate = 1.80E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown F1 fugitive emission

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

```
 1: 2.41E-01 @Hr24,17/10/08     4: 3.56E-01 @Hr21,27/08/07
 2: 8.93E-01 @Hr20,13/03/07     5: 8.92E-01 @Hr21,04/05/08
 3: 1.06E+00 @Hr22,02/09/07     6: 1.12E+00 @Hr18,13/07/08
```

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2

At the discrete receptors:

```
 1: 1.17E+00 @Hr24,17/10/08     4: 1.73E+00 @Hr21,27/08/07
 2: 4.34E+00 @Hr20,13/03/07     5: 4.33E+00 @Hr21,04/05/08
 3: 5.15E+00 @Hr22,02/09/07     6: 5.44E+00 @Hr18,13/07/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 3

At the discrete receptors:

```
 1: 1.00E+00 @Hr24,17/10/08     4: 1.48E+00 @Hr21,27/08/07
 2: 3.70E+00 @Hr20,13/03/07     5: 3.70E+00 @Hr21,04/05/08
3: 4.39E+00 @Hr22,02/09/07     6: 4.64E+00 @Hr18,13/07/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 4

At the discrete receptors:

```
 1: 6.21E-01 @Hr24,17/10/08     4: 9.16E-01 @Hr21,27/08/07
 2: 2.30E+00 @Hr20,13/03/07     5: 2.29E+00 @Hr21,04/05/08
 3: 2.73E+00 @Hr22,02/09/07     6: 2.88E+00 @Hr18,13/07/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 1

At the discrete receptors:

```
 1: 1.85E-02 @Hr24,24/12/08     4: 3.59E-02 @Hr24,08/05/07
 2: 9.31E-02 @Hr24,04/02/07     5: 1.19E-01 @Hr24,15/01/07
 3: 1.48E-01 @Hr24,25/12/08     6: 1.14E-01 @Hr24,06/02/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 2

At the discrete receptors:

```
 1: 8.99E-02 @Hr24,24/12/08     4: 1.74E-01 @Hr24,08/05/07
 2: 4.52E-01 @Hr24,04/02/07     5: 5.79E-01 @Hr24,15/01/07
 3: 7.18E-01 @Hr24,25/12/08     6: 5.52E-01 @Hr24,06/02/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 3

At the discrete receptors:

```
 1: 7.67E-02 @Hr24,24/12/08     4: 1.49E-01 @Hr24,08/05/07
 2: 3.86E-01 @Hr24,04/02/07     5: 4.93E-01 @Hr24,15/01/07
 3: 6.12E-01 @Hr24,25/12/08     6: 4.71E-01 @Hr24,06/02/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 4

At the discrete receptors:

```
 1: 4.76E-02 @Hr24,24/12/08     4: 9.23E-02 @Hr24,08/05/07
 2: 2.39E-01 @Hr24,04/02/07     5: 3.06E-01 @Hr24,15/01/07
 3: 3.80E-01 @Hr24,25/12/08     6: 2.92E-01 @Hr24,06/02/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 1

At the discrete receptors:

```
 1: 2.39E-03 @Hr24,14/01/08     4: 5.90E-03 @Hr24,25/03/08
 2: 8.74E-03 @Hr24,25/04/07     5: 1.83E-02 @Hr24,30/12/08
 3: 1.64E-02 @Hr24,01/04/07     6: 1.32E-02 @Hr24,14/04/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 2

At the discrete receptors:

```
 1: 1.16E-02 @Hr24,14/01/08     4: 2.87E-02 @Hr24,25/03/08
 2: 4.24E-02 @Hr24,25/04/07     5: 8.89E-02 @Hr24,30/12/08
 3: 7.95E-02 @Hr24,01/04/07     6: 6.43E-02 @Hr24,14/04/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 3

At the discrete receptors:

```
 1: 9.91E-03 @Hr24,14/01/08     4: 2.45E-02 @Hr24,25/03/08
 2: 3.62E-02 @Hr24,25/04/07     5: 7.58E-02 @Hr24,30/12/08
 3: 6.78E-02 @Hr24,01/04/07     6: 5.48E-02 @Hr24,14/04/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 4

At the discrete receptors:

```
 1: 6.15E-03 @Hr24,14/01/08     4: 1.52E-02 @Hr24,25/03/08
 2: 2.25E-02 @Hr24,25/04/07     5: 4.71E-02 @Hr24,30/12/08
 3: 4.21E-02 @Hr24,01/04/07     6: 3.40E-02 @Hr24,14/04/07
```

Fill material behind northern retaining wall - excavation

1 ____

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____

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

____

____

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SOURCE GROUPS

____

Group No.	Members
1	VEX2T
2	VEX2P
3	VEX2BE
4	VEX2BP

1

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SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VEX2T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 3.17E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX2P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 1.50E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX2BE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 4.75E-09 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX2BP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 4.75E-08 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

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RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5

3 332259 6247645 21.5 1.5 6 332252 6247669 17.0 1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\New folder (2)\RandExVar.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VEX2T VEX2P VEX2BE VEX2BP

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

1: 8.26E+01 @Hr16,24/02/07 4: 4.07E+01 @Hr16,31/08/08
2: 7.23E+02 @Hr10,08/06/07 5: 2.58E+02 @Hr07,14/09/07
3: 4.75E+02 @Hr16,21/01/07 6: 5.62E+02 @Hr16,19/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2

At the discrete receptors:

1: 4.00E+01 @Hr16,24/02/07 4: 1.97E+01 @Hr16,31/08/08
2: 3.50E+02 @Hr10,08/06/07 5: 1.25E+02 @Hr07,14/09/07
3: 2.30E+02 @Hr16,21/01/07 6: 2.72E+02 @Hr16,19/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 3

At the discrete receptors:

1: 1.24E+01 @Hr16,24/02/07 4: 6.11E+00 @Hr16,31/08/08
2: 1.08E+02 @Hr10,08/06/07 5: 3.87E+01 @Hr07,14/09/07
3: 7.12E+01 @Hr16,21/01/07 6: 8.43E+01 @Hr16,19/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 4

At the discrete receptors:

1: 1.24E+01 @Hr16,24/02/07 4: 6.11E+00 @Hr16,31/08/08
2: 1.08E+02 @Hr10,08/06/07 5: 3.87E+01 @Hr07,14/09/07
3: 7.12E+01 @Hr16,21/01/07 6: 8.43E+01 @Hr16,19/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 1

At the discrete receptors:

1: 2.68E+01 @Hr24,13/02/08 4: 7.49E+00 @Hr24,11/06/08
2: 2.77E+02 @Hr24,08/06/07 5: 4.09E+01 @Hr24,14/09/07
3: 7.89E+01 @Hr24,12/01/07 6: 1.52E+02 @Hr24,02/01/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 2

At the discrete receptors:

1: 1.30E+01 @Hr24,13/02/08 4: 3.62E+00 @Hr24,11/06/08
2: 1.34E+02 @Hr24,08/06/07 5: 1.98E+01 @Hr24,14/09/07
3: 3.82E+01 @Hr24,12/01/07 6: 7.38E+01 @Hr24,02/01/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 3

At the discrete receptors:

1: 4.02E+00 @Hr24,13/02/08 4: 1.12E+00 @Hr24,11/06/08
2: 4.15E+01 @Hr24,08/06/07 5: 6.13E+00 @Hr24,14/09/07
3: 1.18E+01 @Hr24,12/01/07 6: 2.29E+01 @Hr24,02/01/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 4

At the discrete receptors:

1: 4.02E+00 @Hr24,13/02/08 4: 1.12E+00 @Hr24,11/06/08
2: 4.15E+01 @Hr24,08/06/07 5: 6.13E+00 @Hr24,14/09/07
3: 1.18E+01 @Hr24,12/01/07 6: 2.29E+01 @Hr24,02/01/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 1

At the discrete receptors:

1: 3.80E+00 @Hr24,07/01/08 4: 8.25E-01 @Hr24,23/07/08
2: 3.87E+01 @Hr24,07/01/08 5: 8.66E+00 @Hr24,02/04/07
3: 2.09E+01 @Hr24,02/04/07 6: 4.23E+01 @Hr24,01/04/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 2
At the discrete receptors:

1: 1.84E+00 @Hr24,07/01/08 4: 3.99E-01 @Hr24,23/07/08
2: 1.87E+01 @Hr24,07/01/08 5: 4.19E+00 @Hr24,02/04/07
3: 1.01E+01 @Hr24,02/04/07 6: 2.05E+01 @Hr24,01/04/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 3

At the discrete receptors:

1: 5.71E-01 @Hr24,07/01/08 4: 1.24E-01 @Hr24,23/07/08
2: 5.80E+00 @Hr24,07/01/08 5: 1.30E+00 @Hr24,02/04/07
3: 3.13E+00 @Hr24,02/04/07 6: 6.34E+00 @Hr24,01/04/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 4
At the discrete receptors:

1: 5.71E-01 @Hr24,07/01/08 4: 1.24E-01 @Hr24,23/07/08
2: 5.80E+00 @Hr24,07/01/08 5: 1.30E+00 @Hr24,02/04/07
3: 3.13E+00 @Hr24,02/04/07 6: 6.34E+00 @Hr24,01/04/07

Fill material behind northern retaining wall - fugitive

1 ____

40913 Macdonaldtown northern retaining wall - fugitive

Concentration or deposition	Concentration
Emission rate units	grams/second
Concentration units	microgram/m3
Units conversion factor	1.00E+06
Constant background concentration	0.00E+00
Terrain effects	Egan method
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	No
Decay coefficient (unless overridden by met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Pasquill-Gifford
Vertical dispersion curves for sources <100m high	Pasquill-Gifford
Horizontal dispersion curves for sources >100m high	Briggs Rural
Vertical dispersion curves for sources >100m high	Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.800m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	PRIME method.
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown northern retaining wall - fugitive

SOURCE GROUPS

Group No.	Members
1	F2T
2	F2P
3	F2BEP F2BPP
4	F2BEV

1

40913 Macdonaldtown northern retaining wall - fugitive

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: F2T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	10m	0m

(Constant) emission rate = 7.00E-07 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	10m	0m

(Constant) emission rate = 3.50E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2BEP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 1.10E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2BPP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 1.10E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2BEV

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	10m	0m

(Constant) emission rate = 2.50E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown northern retaining wall - fugitive

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

1: 3.77E-01 @Hr23,01/09/08 4: 2.37E-01 @Hr24,08/12/07
2: 2.97E+00 @Hr02,03/04/07 5: 6.62E-01 @Hr20,12/06/08
3: 8.97E-01 @Hr24,23/01/08 6: 1.29E+00 @Hr01,11/11/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2

At the discrete receptors:

1: 1.88E+00 @Hr23,01/09/08 4: 1.19E+00 @Hr24,08/12/07
2: 1.49E+01 @Hr02,03/04/07 5: 3.31E+00 @Hr20,12/06/08
3: 4.48E+00 @Hr24,23/01/08 6: 6.45E+00 @Hr01,11/11/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 3

At the discrete receptors:

1: 2.44E+00 @Hr01,22/03/07 4: 2.30E+00 @Hr04,15/02/07
2: 1.61E+01 @Hr19,29/07/07 5: 8.27E+00 @Hr03,31/08/07
3: 9.68E+00 @Hr03,28/05/07 6: 8.30E+00 @Hr18,26/05/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 4

At the discrete receptors:

1: 1.34E+00 @Hr23,01/09/08 4: 8.48E-01 @Hr24,08/12/07
2: 1.06E+01 @Hr02,03/04/07 5: 2.36E+00 @Hr20,12/06/08
3: 3.20E+00 @Hr24,23/01/08 6: 4.61E+00 @Hr01,11/11/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 1

At the discrete receptors:

1: 2.89E-02 @Hr24,24/12/08 4: 2.87E-02 @Hr24,09/03/08
2: 3.49E-01 @Hr24,04/02/07 5: 1.07E-01 @Hr24,16/03/07
3: 1.62E-01 @Hr24,05/05/07 6: 1.62E-01 @Hr24,04/03/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 2

At the discrete receptors:

1: 1.45E-01 @Hr24,24/12/08 4: 1.43E-01 @Hr24,09/03/08
2: 1.74E+00 @Hr24,04/02/07 5: 5.36E-01 @Hr24,16/03/07
3: 8.08E-01 @Hr24,05/05/07 6: 8.08E-01 @Hr24,04/03/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 3

At the discrete receptors:

1: 1.53E-01 @Hr24,11/05/08 4: 3.31E-01 @Hr24,09/03/08
2: 1.43E+00 @Hr24,24/12/08 5: 1.38E+00 @Hr24,16/03/07
3: 2.09E+00 @Hr24,05/05/07 6: 2.38E+00 @Hr24,25/12/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 4

At the discrete receptors:

1: 1.03E-01 @Hr24,24/12/08	4: 1.02E-01 @Hr24,09/03/08
2: 1.25E+00 @Hr24,04/02/07	5: 3.83E-01 @Hr24,16/03/07
3: 5.77E-01 @Hr24,05/05/07	6: 5.77E-01 @Hr24,04/03/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 1

At the discrete receptors:

1: 4.03E-03 @Hr24,14/01/08	4: 3.69E-03 @Hr24,31/05/08
2: 3.48E-02 @Hr24,25/04/07	5: 1.86E-02 @Hr24,16/05/07
3: 2.56E-02 @Hr24,17/05/07	6: 3.08E-02 @Hr24,04/04/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 2

At the discrete receptors:

1: 2.01E-02 @Hr24,14/01/08	4: 1.84E-02 @Hr24,31/05/08
2: 1.74E-01 @Hr24,25/04/07	5: 9.28E-02 @Hr24,16/05/07
3: 1.28E-01 @Hr24,17/05/07	6: 1.54E-01 @Hr24,04/04/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 3

At the discrete receptors:

1: 2.59E-02 @Hr24,15/01/08	4: 3.93E-02 @Hr24,28/05/07
2: 2.23E-01 @Hr24,14/01/08	5: 2.56E-01 @Hr24,16/05/07
3: 3.79E-01 @Hr24,17/05/07	6: 4.35E-01 @Hr24,01/04/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 4

At the discrete receptors:

1: 1.44E-02 @Hr24,14/01/08	4: 1.32E-02 @Hr24,31/05/08
2: 1.24E-01 @Hr24,25/04/07	5: 6.63E-02 @Hr24,16/05/07
3: 9.16E-02 @Hr24,17/05/07	6: 1.10E-01 @Hr24,04/04/07

Fill material within northern gasholder - excavation

1 ____

40913 Macdonaldtown Northern Gasholder Excavation

____

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

____

____

40913 Macdonaldtown Northern Gasholder Excavation

SOURCE GROUPS

____

Group No.	Members
1	VEX3T
2	VEX3P
3	VEX3BE
4	VEX3BP

1

40913 Macdonaldtown Northern Gasholder Excavation

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VEX3T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 2.54E-06 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX3P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 1.20E-06 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX3BE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 3.81E-11 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX3BP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 3.81E-10 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

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RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5

```
 3  332259 6247645    21.5    1.5         6  332252 6247669    17.0    1.5
```

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\New folder (2)\RandExVar.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V   allocated: VEX3T VEX3P VEX3BE VEX3BP

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
        AVERAGING TIME = 1 HOUR;  SOURCE GROUP No. 1

 At the discrete receptors:

  1: 1.11E+00 @Hr15,27/01/07     4: 5.19E-01 @Hr16,31/08/08
  2: 9.93E+00 @Hr16,08/06/07     5: 2.44E+00 @Hr16,21/01/07
  3: 4.17E+00 @Hr16,21/01/07     6: 6.58E+00 @Hr15,12/01/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
        AVERAGING TIME = 1 HOUR;  SOURCE GROUP No. 2

 At the discrete receptors:

  1: 5.34E-01 @Hr15,27/01/07     4: 2.49E-01 @Hr16,31/08/08
  2: 4.77E+00 @Hr16,08/06/07     5: 1.17E+00 @Hr16,21/01/07
  3: 2.00E+00 @Hr16,21/01/07     6: 3.16E+00 @Hr15,12/01/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
        AVERAGING TIME = 1 HOUR;  SOURCE GROUP No. 3

 At the discrete receptors:

  1: 1.69E+00 @Hr15,27/01/07     4: 7.89E-01 @Hr16,31/08/08
  2: 1.51E+01 @Hr16,08/06/07     5: 3.71E+00 @Hr16,21/01/07
  3: 6.34E+00 @Hr16,21/01/07     6: 1.00E+01 @Hr15,12/01/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
        AVERAGING TIME = 1 HOUR;  SOURCE GROUP No. 4

 At the discrete receptors:

  1: 1.69E+00 @Hr15,27/01/07     4: 7.89E-01 @Hr16,31/08/08
  2: 1.51E+01 @Hr16,08/06/07     5: 3.71E+00 @Hr16,21/01/07
  3: 6.34E+00 @Hr16,21/01/07     6: 1.00E+01 @Hr15,12/01/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       AVERAGING TIME = 24 HOURS;  SOURCE GROUP No. 1

 At the discrete receptors:

  1: 3.61E-01 @Hr24,08/06/07     4: 9.47E-02 @Hr24,11/06/08
  2: 4.01E+00 @Hr24,08/06/07     5: 3.72E-01 @Hr24,14/09/07
  3: 6.29E-01 @Hr24,17/01/07     6: 1.19E+00 @Hr24,12/01/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
      AVERAGING TIME = 24 HOURS;  SOURCE GROUP No. 2

 At the discrete receptors:

  1: 1.73E-01 @Hr24,08/06/07     4: 4.55E-02 @Hr24,11/06/08
  2: 1.92E+00 @Hr24,08/06/07     5: 1.79E-01 @Hr24,14/09/07
  3: 3.02E-01 @Hr24,17/01/07     6: 5.70E-01 @Hr24,12/01/07
 ______________________________________________________________________________

1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
      AVERAGING TIME = 24 HOURS;  SOURCE GROUP No. 3
At the discrete receptors:

  1: 5.49E-01 @Hr24,08/06/07     4: 1.44E-01 @Hr24,11/06/08
  2: 6.09E+00 @Hr24,08/06/07     5: 5.65E-01 @Hr24,14/09/07
  3: 9.56E-01 @Hr24,17/01/07     6: 1.80E+00 @Hr24,12/01/07
 ______________________________________________________________________________

1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
      AVERAGING TIME = 24 HOURS;  SOURCE GROUP No. 4


 At the discrete receptors:

  1: 5.49E-01 @Hr24,08/06/07     4: 1.44E-01 @Hr24,11/06/08
  2: 6.09E+00 @Hr24,08/06/07     5: 5.65E-01 @Hr24,14/09/07
  3: 9.56E-01 @Hr24,17/01/07     6: 1.80E+00 @Hr24,12/01/07
 ______________________________________________________________________________

1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 1


 At the discrete receptors:

  1: 5.29E-02 @Hr24,07/01/08     4: 8.98E-03 @Hr24,23/07/08
  2: 4.68E-01 @Hr24,21/01/08     5: 8.14E-02 @Hr24,02/04/07
  3: 1.60E-01 @Hr24,02/04/07     6: 3.36E-01 @Hr24,02/04/07
 ______________________________________________________________________________

1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 2


 At the discrete receptors:

  1: 2.54E-02 @Hr24,07/01/08     4: 4.31E-03 @Hr24,23/07/08
  2: 2.24E-01 @Hr24,21/01/08     5: 3.91E-02 @Hr24,02/04/07
  3: 7.69E-02 @Hr24,02/04/07     6: 1.61E-01 @Hr24,02/04/07
 ______________________________________________________________________________

1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 3


 At the discrete receptors:

  1: 8.04E-02 @Hr24,07/01/08     4: 1.37E-02 @Hr24,23/07/08
  2: 7.11E-01 @Hr24,21/01/08     5: 1.24E-01 @Hr24,02/04/07
  3: 2.43E-01 @Hr24,02/04/07     6: 5.11E-01 @Hr24,02/04/07
 ______________________________________________________________________________

1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 4


 At the discrete receptors:

  1: 8.04E-02 @Hr24,07/01/08     4: 1.37E-02 @Hr24,23/07/08
  2: 7.11E-01 @Hr24,21/01/08     5: 1.24E-01 @Hr24,02/04/07
  3: 2.43E-01 @Hr24,02/04/07     6: 5.11E-01 @Hr24,02/04/07
 ______________________________________________________________________________
```

Fill material within northern gasholder -fugitive

1 ____

40913 Macdonaldtown Northern Gasholder Excavation - Fugitive

____

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

____

____

40913 Macdonaldtown Northern Gasholder Excavation

SOURCE GROUPS

____

Group No.	Members
1	F3T
2	F3P
3	F3BEP F3BEV
4	F3BPP

1

40913 Macdonaldtown Northern Gasholder Excavation - Fugitive

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: F3T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 2.70E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F3P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 1.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F3BEP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 4.10E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F3BEV

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 9.70E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F3BPP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 4.10E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Northern Gasholder Excavation

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

1: 1.21E+00 @Hr19,29/07/07 4: 1.08E+00 @Hr01,16/05/07
2: 6.56E+00 @Hr20,13/03/07 5: 3.05E+00 @Hr02,15/03/07
3: 4.05E+00 @Hr01,11/11/07 6: 5.31E+00 @Hr20,13/01/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2

At the discrete receptors:

1: 6.30E-01 @Hr19,29/07/07 4: 5.59E-01 @Hr01,16/05/07
2: 3.40E+00 @Hr20,13/03/07 5: 1.58E+00 @Hr02,15/03/07
3: 2.10E+00 @Hr01,11/11/07 6: 2.75E+00 @Hr20,13/01/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 3
At the discrete receptors:

1: 6.21E+00 @Hr19,29/07/07 4: 5.51E+00 @Hr01,16/05/07
2: 3.35E+01 @Hr20,13/03/07 5: 1.56E+01 @Hr02,15/03/07
3: 2.07E+01 @Hr01,11/11/07 6: 2.71E+01 @Hr20,13/01/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 4

At the discrete receptors:

1: 1.84E+00 @Hr19,29/07/07 4: 1.64E+00 @Hr01,16/05/07
2: 9.95E+00 @Hr20,13/03/07 5: 4.63E+00 @Hr02,15/03/07
3: 6.15E+00 @Hr01,11/11/07 6: 8.07E+00 @Hr20,13/01/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 1
At the discrete receptors:

1: 9.36E-02 @Hr24,24/12/08 4: 1.18E-01 @Hr24,15/03/08
2: 7.23E-01 @Hr24,04/02/07 5: 5.32E-01 @Hr24,05/05/07
3: 5.09E-01 @Hr24,04/03/08 6: 8.11E-01 @Hr24,25/12/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 2
At the discrete receptors:

1: 4.85E-02 @Hr24,24/12/08 4: 6.10E-02 @Hr24,15/03/08
2: 3.75E-01 @Hr24,04/02/07 5: 2.76E-01 @Hr24,05/05/07
3: 2.64E-01 @Hr24,04/03/08 6: 4.21E-01 @Hr24,25/12/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 3
At the discrete receptors:

1: 4.78E-01 @Hr24,24/12/08 4: 6.01E-01 @Hr24,15/03/08
2: 3.69E+00 @Hr24,04/02/07 5: 2.72E+00 @Hr24,05/05/07
3: 2.60E+00 @Hr24,04/03/08 6: 4.15E+00 @Hr24,25/12/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 4

At the discrete receptors:

```
  1: 1.42E-01 @Hr24,24/12/08     4: 1.79E-01 @Hr24,15/03/08
  2: 1.10E+00 @Hr24,04/02/07     5: 8.08E-01 @Hr24,05/05/07
  3: 7.73E-01 @Hr24,04/03/08     6: 1.23E+00 @Hr24,25/12/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 1
At the discrete receptors:

```
  1: 1.24E-02 @Hr24,14/01/08     4: 1.69E-02 @Hr24,31/05/08
  2: 6.92E-02 @Hr24,25/04/07     5: 8.18E-02 @Hr24,17/05/07
  3: 9.36E-02 @Hr24,30/12/08     6: 9.46E-02 @Hr24,30/12/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 2

At the discrete receptors:

```
  1: 6.41E-03 @Hr24,14/01/08     4: 8.76E-03 @Hr24,31/05/08
  2: 3.59E-02 @Hr24,25/04/07     5: 4.24E-02 @Hr24,17/05/07
  3: 4.85E-02 @Hr24,30/12/08     6: 4.90E-02 @Hr24,30/12/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 3

At the discrete receptors:

```
  1: 6.32E-02 @Hr24,14/01/08     4: 8.64E-02 @Hr24,31/05/08
  2: 3.54E-01 @Hr24,25/04/07     5: 4.18E-01 @Hr24,17/05/07
  3: 4.78E-01 @Hr24,30/12/08     6: 4.83E-01 @Hr24,30/12/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 4

At the discrete receptors:

```
  1: 1.88E-02 @Hr24,14/01/08     4: 2.57E-02 @Hr24,31/05/08
  2: 1.05E-01 @Hr24,25/04/07     5: 1.24E-01 @Hr24,17/05/07
  3: 1.42E-01 @Hr24,30/12/08     6: 1.44E-01 @Hr24,30/12/08
```

Fill material within former gasworks areas - excavation

____

40913 Macdonaldtown Former Gasworks Excavation

____

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

____

____

40913 Macdonaldtown Former Gasworks Excavation

SOURCE GROUPS

____

Group No.	Members
1	VEX4T
2	VEX4P
3	VEX4BE
4	VEX4BP

---

1 ---

40913 Macdonaldtown Former Gasworks Excavation

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VEX4T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	15m	15m	0deg	5m	0m

(Constant) emission rate = 99.02E-06 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX4P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	15m	15m	0deg	5m	0m

(Constant) emission rate = 4.27E-06 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX4BE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	15m	15m	0deg	5m	0m

(Constant) emission rate = 1.82E-10 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX4BP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	15m	15m	0deg	5m	0m

(Constant) emission rate = 4.01E-09 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

---

1 ---

40913 Macdonaldtown Former Gasworks Excavation

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5

2 332263 6247744 20.0 1.5 5 332265 6247624 16.0 1.5
3 332259 6247645 21.5 1.5 6 332252 6247669 17.0 1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying factors entered via the input file:
C:\Users\sdorairaj\Ausplume\New folder (2)\RandExVar.csv
For each stack source, hourly values within this file will be added to each declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VEX4T VEX4P VEX4BE VEX4BP

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

1: 2.10E+00 @Hr10,08/06/07 4: 1.18E+00 @Hr16,31/08/08
2: 1.23E+01 @Hr07,16/06/07 5: 5.53E+00 @Hr16,21/01/07
3: 7.61E+00 @Hr15,17/01/07 6: 9.73E+00 @Hr16,05/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2

At the discrete receptors:

1: 1.00E+00 @Hr10,08/06/07 4: 5.66E-01 @Hr16,31/08/08
2: 5.87E+00 @Hr07,16/06/07 5: 2.64E+00 @Hr16,21/01/07
3: 3.64E+00 @Hr15,17/01/07 6: 4.65E+00 @Hr16,05/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 3
At the discrete receptors:

1: 4.20E-01 @Hr10,08/06/07 4: 2.37E-01 @Hr16,31/08/08
2: 2.46E+00 @Hr07,16/06/07 5: 1.11E+00 @Hr16,21/01/07
3: 1.52E+00 @Hr15,17/01/07 6: 1.95E+00 @Hr16,05/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 4

At the discrete receptors:

1: 9.33E-02 @Hr10,08/06/07 4: 5.27E-02 @Hr16,31/08/08
2: 5.46E-01 @Hr07,16/06/07 5: 2.46E-01 @Hr16,21/01/07
3: 3.38E-01 @Hr15,17/01/07 6: 4.32E-01 @Hr16,05/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 1

At the discrete receptors:

1: 8.05E-01 @Hr24,08/06/07 4: 2.24E-01 @Hr24,11/06/08

2: 3.72E+00 @Hr24,16/06/07   5: 8.63E-01 @Hr24,12/01/07
3: 1.34E+00 @Hr24,12/01/07   6: 2.22E+00 @Hr24,02/01/07

---

1   HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 2

At the discrete receptors:

1: 3.84E-01 @Hr24,08/06/07   4: 1.07E-01 @Hr24,11/06/08
2: 1.78E+00 @Hr24,16/06/07   5: 4.12E-01 @Hr24,12/01/07
3: 6.40E-01 @Hr24,12/01/07   6: 1.06E+00 @Hr24,02/01/07

---

1   HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 3

At the discrete receptors:

1: 1.61E-01 @Hr24,08/06/07   4: 4.47E-02 @Hr24,11/06/08
2: 7.43E-01 @Hr24,16/06/07   5: 1.73E-01 @Hr24,12/01/07
3: 2.68E-01 @Hr24,12/01/07   6: 4.43E-01 @Hr24,02/01/07

---

1   HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 4

At the discrete receptors:

1: 3.58E-02 @Hr24,08/06/07   4: 9.94E-03 @Hr24,11/06/08
2: 1.65E-01 @Hr24,16/06/07   5: 3.83E-02 @Hr24,12/01/07
3: 5.95E-02 @Hr24,12/01/07   6: 9.85E-02 @Hr24,02/01/07

---

1   HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 1

At the discrete receptors:

1: 9.44E-02 @Hr24,07/01/08   4: 1.89E-02 @Hr24,23/07/08
2: 4.74E-01 @Hr24,18/01/08   5: 2.14E-01 @Hr24,02/04/07
3: 3.51E-01 @Hr24,02/04/07   6: 4.90E-01 @Hr24,01/04/07

---

1   HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 2

At the discrete receptors:

1: 4.51E-02 @Hr24,07/01/08   4: 9.03E-03 @Hr24,23/07/08
2: 2.26E-01 @Hr24,18/01/08   5: 1.02E-01 @Hr24,02/04/07
3: 1.68E-01 @Hr24,02/04/07   6: 2.34E-01 @Hr24,01/04/07

---

1   HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 3

At the discrete receptors:

1: 1.89E-02 @Hr24,07/01/08   4: 3.78E-03 @Hr24,23/07/08
2: 9.47E-02 @Hr24,18/01/08   5: 4.28E-02 @Hr24,02/04/07
3: 7.02E-02 @Hr24,02/04/07   6: 9.81E-02 @Hr24,01/04/07

---

1   HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 4

At the discrete receptors:

1: 4.20E-03 @Hr24,07/01/08   4: 8.40E-04 @Hr24,23/07/08

2: 2.11E-02 @Hr24,18/01/08	5: 9.51E-03 @Hr24,02/04/07
3: 1.56E-02 @Hr24,02/04/07	6: 2.18E-02 @Hr24,01/04/07

Former Gasworks Area – Fugitive

40913 Macdonaldtown Fomer Gasholder fugitive emissions

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Fomer Gasholder fugitive emissions

SOURCE GROUPS

Group No.	Members
1	F4T
2	F4P
3	F4BEP F4BEV
4	F4BPP

1

40913 Macdonaldtown Fomer Gasholder fugitive emissions

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: F4T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 2.70E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F4P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 1.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F4BEP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 5.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F4BPP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 1.20E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F4BEV

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 1.30E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Fomer Gasholder fugitive emissions

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

1: 1.14E+00 @Hr19,29/07/07 4: 1.15E+00 @Hr01,16/05/07
2: 5.79E+00 @Hr22,20/03/08 5: 3.41E+00 @Hr02,27/01/07
3: 4.54E+00 @Hr18,26/05/07 6: 5.83E+00 @Hr24,15/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2

At the discrete receptors:

1: 5.92E-01 @Hr19,29/07/07 4: 5.97E-01 @Hr01,16/05/07
2: 3.00E+00 @Hr22,20/03/08 5: 1.77E+00 @Hr02,27/01/07
3: 2.35E+00 @Hr18,26/05/07 6: 3.02E+00 @Hr24,15/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 3

At the discrete receptors:

1: 2.83E+00 @Hr19,29/07/07 4: 2.86E+00 @Hr01,16/05/07
2: 1.44E+01 @Hr22,20/03/08 5: 8.45E+00 @Hr02,27/01/07
3: 1.13E+01 @Hr18,26/05/07 6: 1.45E+01 @Hr24,15/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 4

At the discrete receptors:

1: 5.07E-01 @Hr19,29/07/07 4: 5.12E-01 @Hr01,16/05/07
2: 2.57E+00 @Hr22,20/03/08 5: 1.51E+00 @Hr02,27/01/07
3: 2.02E+00 @Hr18,26/05/07 6: 2.59E+00 @Hr24,15/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 1

At the discrete receptors:

1: 8.67E-02 @Hr24,24/12/08 4: 1.28E-01 @Hr24,15/03/08
2: 5.33E-01 @Hr24,04/02/07 5: 5.67E-01 @Hr24,05/05/07
3: 6.15E-01 @Hr24,04/03/08 6: 8.30E-01 @Hr24,25/12/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 2

At the discrete receptors:

1: 4.50E-02 @Hr24,24/12/08 4: 6.65E-02 @Hr24,15/03/08
2: 2.76E-01 @Hr24,04/02/07 5: 2.94E-01 @Hr24,05/05/07
3: 3.19E-01 @Hr24,04/03/08 6: 4.31E-01 @Hr24,25/12/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 3

At the discrete receptors:

```
 1: 2.15E-01 @Hr24,24/12/08     4: 3.18E-01 @Hr24,15/03/08
 2: 1.32E+00 @Hr24,04/02/07     5: 1.41E+00 @Hr24,05/05/07
 3: 1.53E+00 @Hr24,04/03/08     6: 2.06E+00 @Hr24,25/12/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 4
At the discrete receptors:

```
 1: 3.85E-02 @Hr24,24/12/08     4: 5.70E-02 @Hr24,15/03/08
 2: 2.37E-01 @Hr24,04/02/07     5: 2.52E-01 @Hr24,05/05/07
 3: 2.73E-01 @Hr24,04/03/08     6: 3.69E-01 @Hr24,25/12/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 1

At the discrete receptors:

```
 1: 1.16E-02 @Hr24,14/01/08     4: 1.81E-02 @Hr24,31/05/08
 2: 6.32E-02 @Hr24,25/04/07     5: 8.82E-02 @Hr24,17/05/07
 3: 1.03E-01 @Hr24,30/12/08     6: 9.49E-02 @Hr24,01/04/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 2

At the discrete receptors:

```
 1: 5.99E-03 @Hr24,14/01/08     4: 9.39E-03 @Hr24,31/05/08
 2: 3.28E-02 @Hr24,25/04/07     5: 4.57E-02 @Hr24,17/05/07
 3: 5.35E-02 @Hr24,30/12/08     6: 4.92E-02 @Hr24,01/04/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 3

At the discrete receptors:

```
 1: 2.87E-02 @Hr24,14/01/08     4: 4.50E-02 @Hr24,31/05/08
 2: 1.57E-01 @Hr24,25/04/07     5: 2.19E-01 @Hr24,17/05/07
 3: 2.56E-01 @Hr24,30/12/08     6: 2.35E-01 @Hr24,01/04/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 4

At the discrete receptors:

```
 1: 5.13E-03 @Hr24,14/01/08     4: 8.05E-03 @Hr24,31/05/08
 2: 2.81E-02 @Hr24,25/04/07     5: 3.92E-02 @Hr24,17/05/07
 3: 4.58E-02 @Hr24,30/12/08     6: 4.22E-02 @Hr24,01/04/07
```

Haulage Roads – Fugitive

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40913 Macdonaldtown Haulage Roads

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Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS

Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES

Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES

1 hour
24 hours
90 days

____

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40913 Macdonaldtown Haulage Roads

SOURCE GROUPS

____

Group No.	Members
1	HAT
2	HAP

____

1 ____

40913 Macdonaldtown Haulage Roads

SOURCE CHARACTERISTICS

____

INTEGRATED AREA SOURCE: HAT

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332312	6247672	16m	5m	60m	0deg	5m	0m

(Constant) emission rate = 2.86E-05 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: HAP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332312	6247672	16m	5m	60m	0deg	5m	0m

(Constant) emission rate = 1.79E-05 grams/second per square metre
No gravitational settling or scavenging.

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1 ____

40913 Macdonaldtown Haulage Roads

RECEPTOR LOCATIONS

____

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

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METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1
At the discrete receptors:

1: 3.43E+01 @Hr24,17/10/08 4: 3.76E+01 @Hr21,17/06/08
2: 8.13E+01 @Hr02,03/04/07 5: 7.81E+01 @Hr01,11/11/07
3: 7.76E+01 @Hr23,12/09/07 6: 6.99E+01 @Hr02,11/01/07
____

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2

At the discrete receptors:

1: 2.15E+01 @Hr24,17/10/08 4: 2.35E+01 @Hr21,17/06/08
2: 5.09E+01 @Hr02,03/04/07 5: 4.89E+01 @Hr01,11/11/07
3: 4.86E+01 @Hr23,12/09/07 6: 4.37E+01 @Hr02,11/01/07
____

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 1

At the discrete receptors:

```
 1: 2.74E+00 @Hr24,24/12/08     4: 3.88E+00 @Hr24,08/05/07
 2: 1.09E+01 @Hr24,04/02/07     5: 1.09E+01 @Hr24,04/03/08
 3: 1.57E+01 @Hr24,25/12/08     6: 1.28E+01 @Hr24,25/12/08
```

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 2

At the discrete receptors:

```
 1: 1.72E+00 @Hr24,24/12/08     4: 2.43E+00 @Hr24,08/05/07
 2: 6.83E+00 @Hr24,04/02/07     5: 6.79E+00 @Hr24,04/03/08
 3: 9.83E+00 @Hr24,25/12/08     6: 7.99E+00 @Hr24,25/12/08
```

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 1

At the discrete receptors:

```
 1: 3.59E-01 @Hr24,14/01/08     4: 6.02E-01 @Hr24,25/03/08
 2: 1.26E+00 @Hr24,25/04/07     5: 2.15E+00 @Hr24,30/12/08
 3: 2.22E+00 @Hr24,30/12/08     6: 1.93E+00 @Hr24,01/04/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 2

At the discrete receptors:

```
 1: 2.25E-01 @Hr24,14/01/08     4: 3.77E-01 @Hr24,25/03/08
 2: 7.91E-01 @Hr24,25/04/07     5: 1.35E+00 @Hr24,30/12/08
 3: 1.39E+00 @Hr24,30/12/08     6: 1.21E+00 @Hr24,01/04/07
```

Bioremediation – Fugitive

1 ____

40913 Macdonaldtown Soil Bioremediation Fixed Sources

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```
Concentration or deposition                          Concentration
Emission rate units                                  grams/second
Concentration units                                  microgram/m3
Units conversion factor                              1.00E+06
Constant background concentration                    0.00E+00
Terrain effects                                      Egan method
Smooth stability class changes?                      No
Other stability class adjustments ("urban modes")    None
Ignore building wake effects?                        No
Decay coefficient (unless overridden by met. file)   0.000
Anemometer height                                    10 m
Roughness height at the wind vane site               0.300 m

                  DISPERSION CURVES
Horizontal dispersion curves for sources <100m high  Pasquill-Gifford
Vertical  dispersion  curves for sources <100m high  Pasquill-Gifford
Horizontal dispersion curves for sources >100m high  Briggs Rural
Vertical  dispersion  curves for sources >100m high  Briggs Rural
Enhance horizontal plume spreads for buoyancy?       Yes
Enhance  vertical  plume spreads for buoyancy?       Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust  vertical  P-G formulae for roughness height? Yes
Roughness height                                     0.800m
Adjustment for wind directional shear                None

                  PLUME RISE OPTIONS
Gradual plume rise?                                  Yes
Stack-tip downwash included?                         Yes
Building downwash algorithm:                         PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions?          No
Disregard temp. gradients in the hourly met. file?   No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

  Wind Speed              Stability Class
   Category       A      B      C      D      E      F
 ________________________________________________________
      1         0.000  0.000  0.000  0.000  0.020  0.035
      2         0.000  0.000  0.000  0.000  0.020  0.035
      3         0.000  0.000  0.000  0.000  0.020  0.035
      4         0.000  0.000  0.000  0.000  0.020  0.035
      5         0.000  0.000  0.000  0.000  0.020  0.035
      6         0.000  0.000  0.000  0.000  0.020  0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are:  1.54,  3.09,  5.14,  8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
 1 hour
24 hours
 90 days
```

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40913 Macdonaldtown Soil Bioremediation Fixed Sources

SOURCE GROUPS

____

Group No.	Members
1	T2T
2	T2PM
3	T2BEP
4	T2BEV
5	T2BPP

1

40913 Macdonaldtown Soil Bioremediation Fixed Sources

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: T2T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 2.70E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T2PM

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 1.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T2BEP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 5.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T2BEV

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 1.30E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T2BPP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 1.20E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Soil Bioremediation Fixed Sources

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

1: 8.19E+00 @Hr21,11/05/08 4: 1.15E+01 @Hr20,21/04/07
2: 1.84E+01 @Hr18,07/05/08 5: 1.24E+01 @Hr20,04/05/07
3: 1.29E+01 @Hr06,01/05/08 6: 1.35E+01 @Hr23,29/10/07

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 3

At the discrete receptors:

1: 1.64E+01 @Hr21,11/05/08 4: 2.31E+01 @Hr20,21/04/07
2: 3.69E+01 @Hr18,07/05/08 5: 2.49E+01 @Hr20,04/05/07
3: 2.59E+01 @Hr06,01/05/08 6: 2.70E+01 @Hr23,29/10/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 4

At the discrete receptors:

1: 3.94E+00 @Hr21,11/05/08 4: 5.55E+00 @Hr20,21/04/07
2: 8.88E+00 @Hr18,07/05/08 5: 5.98E+00 @Hr20,04/05/07
3: 6.23E+00 @Hr06,01/05/08 6: 6.50E+00 @Hr23,29/10/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 5

At the discrete receptors:

1: 3.64E+00 @Hr21,11/05/08 4: 5.12E+00 @Hr20,21/04/07
2: 8.20E+00 @Hr18,07/05/08 5: 5.52E+00 @Hr20,04/05/07
3: 5.75E+00 @Hr06,01/05/08 6: 6.00E+00 @Hr23,29/10/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 1

At the discrete receptors:

1: 5.94E-01 @Hr24,29/11/07 4: 1.76E+00 @Hr24,16/03/07
2: 1.41E+00 @Hr24,21/02/08 5: 2.34E+00 @Hr24,25/12/08
3: 1.84E+00 @Hr24,25/12/08 6: 1.60E+00 @Hr24,10/11/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 2

At the discrete receptors:

1: 3.08E-01 @Hr24,29/11/07 4: 9.14E-01 @Hr24,16/03/07
2: 7.31E-01 @Hr24,21/02/08 5: 1.21E+00 @Hr24,25/12/08
3: 9.55E-01 @Hr24,25/12/08 6: 8.32E-01 @Hr24,10/11/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 3

At the discrete receptors:

```
 1: 3.99E-02 @Hr24,08/01/08     4: 1.64E-01 @Hr24,16/05/07
 2: 8.29E-02 @Hr24,09/05/08     5: 1.56E-01 @Hr24,01/04/07
 3: 1.42E-01 @Hr24,01/04/07     6: 1.15E-01 @Hr24,14/04/07
```

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 3

At the discrete receptors:

```
 1: 1.54E-01 @Hr24,08/01/08     4: 6.31E-01 @Hr24,16/05/07
 2: 3.20E-01 @Hr24,09/05/08     5: 6.01E-01 @Hr24,01/04/07
 3: 5.48E-01 @Hr24,01/04/07     6: 4.42E-01 @Hr24,14/04/07
```

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 4

At the discrete receptors:

```
 1: 3.71E-02 @Hr24,08/01/08     4: 1.52E-01 @Hr24,16/05/07
 2: 7.70E-02 @Hr24,09/05/08     5: 1.45E-01 @Hr24,01/04/07
 3: 1.32E-01 @Hr24,01/04/07     6: 1.06E-01 @Hr24,14/04/07
```

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 5

At the discrete receptors:

```
 1: 3.42E-02 @Hr24,08/01/08     4: 1.40E-01 @Hr24,16/05/07
 2: 7.10E-02 @Hr24,09/05/08     5: 1.33E-01 @Hr24,01/04/07
 3: 1.22E-01 @Hr24,01/04/07     6: 9.82E-02 @Hr24,14/04/07
```

Groundwater Treatment - fugitive

1

40913 Macdonaldtown Groundwater Treatment

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Groundwater Treatment

SOURCE GROUPS

Group No.	Members
1	WTBE
2	WTBP

1 ____

40913 Macdonaldtown Groundwater Treatment

SOURCE CHARACTERISTICS

____

POINT SOURCE: WTBE

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
332298	6247702	18m	2m	0.25m	25C	0.2m/s

No building wake effects.

Emission rates by hour of day in grams/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	9.70E-05	8	9.70E-05
9	9.70E-05	10	9.70E-05	11	9.70E-05	12	9.70E-05
13	9.70E-05	14	9.70E-05	15	9.70E-05	16	9.70E-05
17	9.70E-05	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

POINT SOURCE: WTBP

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
332298	6247702	18m	2m	0.25m	25C	0.0m/s

No building wake effects.

Emission rates by hour of day in grams/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	8.50E-06	8	8.50E-06
9	8.50E-06	10	8.50E-06	11	8.50E-06	12	8.50E-06
13	8.50E-06	14	8.50E-06	15	8.50E-06	16	8.50E-06
17	8.50E-06	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

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1 ____

40913 Macdonaldtown Groundwater Treatment

RECEPTOR LOCATIONS

____

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

____

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

____

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in microgram/m3)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

```
 1: 1.03E-01 @Hr08,19/05/07     4: 9.83E-02 @Hr07,01/07/08
 2: 6.35E-01 @Hr07,09/09/07     5: 3.21E-01 @Hr07,11/02/08
 3: 4.55E-01 @Hr07,25/05/08     6: 6.19E-01 @Hr07,22/04/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       AVERAGING TIME = 1 HOUR;  SOURCE GROUP No. 2

 At the discrete receptors:

 1: 9.05E-03 @Hr08,19/05/07     4: 8.61E-03 @Hr07,01/07/08
 2: 5.56E-02 @Hr07,09/09/07     5: 2.80E-02 @Hr07,11/02/08
 3: 3.98E-02 @Hr07,25/05/08     6: 5.39E-02 @Hr07,22/04/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
      AVERAGING TIME = 24 HOURS;  SOURCE GROUP No. 1

 At the discrete receptors:

 1: 4.30E-03 @Hr24,19/05/07     4: 9.31E-03 @Hr24,11/06/08
 2: 3.07E-02 @Hr24,08/09/07     5: 2.35E-02 @Hr24,25/06/07
 3: 2.65E-02 @Hr24,26/05/08     6: 3.62E-02 @Hr24,22/04/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
      AVERAGING TIME = 24 HOURS;  SOURCE GROUP No. 2

 At the discrete receptors:

 1: 3.77E-04 @Hr24,19/05/07     4: 8.13E-04 @Hr24,11/06/08
 2: 2.69E-03 @Hr24,08/09/07     5: 2.04E-03 @Hr24,25/06/07
 3: 2.32E-03 @Hr24,26/05/08     6: 3.15E-03 @Hr24,22/04/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 1

 At the discrete receptors:

 1: 1.07E-03 @Hr24,04/07/08     4: 9.53E-04 @Hr24,23/07/08
 2: 6.18E-03 @Hr24,04/06/08     5: 3.44E-03 @Hr24,04/04/07
 3: 5.38E-03 @Hr24,04/04/07     6: 7.11E-03 @Hr24,02/04/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in microgram/m3)
       90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 2


 At the discrete receptors:

 1: 9.40E-05 @Hr24,04/07/08     4: 8.33E-05 @Hr24,23/07/08
 2: 5.40E-04 @Hr24,04/06/08     5: 2.99E-04 @Hr24,04/04/07
 3: 4.71E-04 @Hr24,04/04/07     6: 6.18E-04 @Hr24,02/04/07
```

Odour Sources

1 ____

40913 Macdonaldtown Northern Gasholder Excavation

____

Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

____

____

40913 Macdonaldtown Northern Gasholder Excavation

SOURCE GROUPS

____

Group No.	Members
1	WTOU
2	VEX2OU
3	F2OU
4	VEX3OU
5	F3OU
6	VEX4OU
7	F4OU

8 T2OU
9 PWOU

---

1 ____

40913 Macdonaldtown Northern Gasholder Excavation

SOURCE CHARACTERISTICS

____

STACK SOURCE: WTOU

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
332298	6247702	18m	2m	1.00m	27C	2.0m/s

No building wake effects.
(Constant) emission rate = 3.00E-01 OUV/second
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX2OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	0deg	5m	0m

(Constant) emission rate = 1.17E+00 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 1.17E+00 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX3OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 7.30E-02 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F3OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 7.30E-02 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX4OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	15m	15m	0deg	5m	0m

(Constant) emission rate = 7.30E-02 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F4OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 7.30E-02 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T2OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 7.30E-02 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: PWOU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	17m	20m	20m	0deg	5m	0m

(Constant) emission rate = 7.30E-02 OUV/second per square metre
No gravitational settling or scavenging.

---

1 ____

40913 Macdonaldtown Northern Gasholder Excavation

RECEPTOR LOCATIONS

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The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

1: 9.98E-04 @Hr19,05/05/07 4: 3.47E-04 @Hr05,15/03/08
2: 1.71E-03 @Hr18,09/05/08 5: 5.36E-04 @Hr21,02/12/07
3: 1.56E-03 @Hr23,25/12/08 6: 1.02E-03 @Hr20,06/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2
At the discrete receptors:

1: 1.29E-01 @Hr19,29/07/07 4: 8.89E-02 @Hr01,16/05/07
2: 5.77E-01 0 @Hr22,02/03/08 5: 1.90E-01 @Hr05,01/03/07
3: 2.35E-01 @Hr03,28/05/07 6: 3.16E-01 @Hr18,26/05/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 3

At the discrete receptors:

1: 6.29E-01 @Hr23,01/09/08 4: 3.97E-02 @Hr24,08/12/07
2: 4.97E-01 @Hr02,03/04/07 5: 1.11E-01 @Hr20,12/06/08
3: 1.50E-01 @Hr24,23/01/08 6: 2.16E-01 @Hr01,11/11/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 4
At the discrete receptors:

1: 1.35E-01 @Hr01,10/12/08   4: 1.10E-01 @Hr24,30/01/07
2: 7.41E-01 @Hr03,07/07/07   5: 3.34E-01 @Hr20,05/05/07
3: 4.56E-01 @Hr02,15/03/07   6: 6.40E-01 @Hr04,23/01/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 5

At the discrete receptors:

1: 3.28E-02 @Hr19,29/07/07   4: 2.92E-02 @Hr01,16/05/07
2: 1.77E-01 @Hr20,13/03/07   5: 8.24E-02 @Hr02,15/03/07
3: 1.10E-01 @Hr01,11/11/07   6: 1.44E-01 @Hr20,13/01/08

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 6

At the discrete receptors:

1: 6.95E-02 @Hr19,29/07/07   4: 6.82E-02 @Hr21,02/06/07
2: 3.34E-01 @Hr20,13/03/07   5: 1.90E-01 @Hr23,19/04/07
3: 2.47E-01 @Hr04,18/02/07   6: 3.11E-01 @Hr22,02/09/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 7

At the discrete receptors:

1: 3.09E-02 @Hr19,29/07/07   4: 3.11E-02 @Hr01,16/05/07
2: 1.56E-01 @Hr22,20/03/08   5: 9.21E-02 @Hr02,27/01/07
3: 1.23E-01 @Hr18,26/05/07   6: 1.58E-01 @Hr24,15/02/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 8

At the discrete receptors:

1: 2.21E-01 @Hr21,11/05/08   4: 3.12E-01 @Hr20,21/04/07
2: 4.99E-01 @Hr18,07/05/08   5: 3.36E-01 @Hr20,04/05/07
3: 3.50E-01 @Hr06,01/05/08   6: 3.65E-01 @Hr23,29/10/07

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 9

At the discrete receptors:

1: 1.35E-01 @Hr01,10/12/08   4: 1.10E-01 @Hr24,30/01/07
2: 7.41E-01 @Hr03,07/07/07   5: 3.34E-01 @Hr20,05/05/07
3: 4.56E-01 @Hr02,15/03/07   6: 6.40E-01 @Hr04,23/01/07

Dust Deposition

____

40913 Macdonaldtown Deposition with controls

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Concentration or deposition   Dry deposition only
Emission load units   grams/second
Deposition units   milligram/m2
Units conversion factor   1.00E+03
Plume depletion due to dry removal mechanisms included.
Smooth stability class changes?   No
Other stability class adjustments ("urban modes")   None
Ignore building wake effects?   No
Decay coefficient (unless overridden by met. file)   0.000
Anemometer height   10 m
Roughness height at the wind vane site   0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy?   Yes
Enhance vertical plume spreads for buoyancy?   Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height   0.800m
Adjustment for wind directional shear   None

PLUME RISE OPTIONS
Gradual plume rise?   Yes
Stack-tip downwash included?   Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions?   No
Disregard temp. gradients in the hourly met. file?   No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

____

____

40913 Macdonaldtown Deposition with controls

SOURCE GROUPS

____

Group No.	Members
1	HATC3
2	F2T
3	F1T

____

1 ____

40913 Macdonaldtown Deposition with controls

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: HATC3

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332312	6247672	16m	5m	60m	0deg	5m	0m

(Constant) emission rate = 2.86E-05 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.1500	2.5	2.65
0.3400	6.0	2.65
0.5100	10.0	2.65

INTEGRATED AREA SOURCE: F2T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	16m	10m	10m	0deg	5m	0m

(Constant) emission rate = 7.00E-07 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.1500	2.5	2.65
0.3400	6.0	2.65
0.5100	10.0	2.65

INTEGRATED AREA SOURCE: F1T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332214	6247685	16m	10m	10m	0deg	5m	0m

(Constant) emission rate = 7.00E-07 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.1500	2.5	2.65
0.3400	6.0	2.65
0.5100	10.0	2.65

1

40913 Macdonaldtown Deposition with controls

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in milligram/m2)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 1

At the discrete receptors:

```
 1: 3.06E-01 @Hr24,17/10/08     4: 3.44E-01 @Hr21,17/06/08
 2: 1.23E+00 @Hr22,02/03/08     5: 1.03E+00 @Hr01,17/11/07
 3: 1.10E+00 @Hr02,15/01/07     6: 1.02E+00 @Hr06,01/05/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in milligram/m2)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 2

At the discrete receptors:

```
 1: 3.80E-03 @Hr23,01/09/08     4: 1.90E-03 @Hr24,08/12/07
 2: 5.93E-02 @Hr02,03/04/07     5: 8.15E-03 @Hr20,12/06/08
 3: 1.22E-02 @Hr24,23/01/08     6: 1.95E-02 @Hr01,11/11/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in milligram/m2)
AVERAGING TIME = 1 HOUR; SOURCE GROUP No. 3

At the discrete receptors:

```
 1: 2.58E-03 @Hr22,06/05/07     4: 1.84E-03 @Hr24,05/11/08
 2: 1.71E-02 @Hr20,29/07/07     5: 1.30E-02 @Hr21,13/10/07
 3: 2.23E-02 @Hr24,09/04/07     6: 4.56E-02 @Hr03,15/03/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in milligram/m2)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 1

At the discrete receptors:

```
 1: 1.10E+00 @Hr24,29/11/07     4: 1.31E+00 @Hr24,11/06/08
 2: 1.04E+01 @Hr24,12/02/07     5: 5.56E+00 @Hr24,28/12/08
 3: 7.83E+00 @Hr24,15/01/07     6: 7.75E+00 @Hr24,10/11/08
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in milligram/m2)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 2

At the discrete receptors:

```
 1: 1.21E-02 @Hr24,24/12/08     4: 6.25E-03 @Hr24,15/03/08
 2: 8.27E-01 @Hr24,12/02/07     5: 3.85E-02 @Hr24,06/03/08
 3: 6.39E-02 @Hr24,21/10/07     6: 1.03E-01 @Hr24,17/02/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in milligram/m2)
AVERAGING TIME = 24 HOURS; SOURCE GROUP No. 3

At the discrete receptors:

```
 1: 1.05E-02 @Hr24,24/11/07     4: 7.46E-03 @Hr24,03/05/07
 2: 6.52E-02 @Hr24,17/06/07     5: 4.49E-02 @Hr24,31/08/07
 3: 9.44E-02 @Hr24,31/08/07     6: 3.39E-01 @Hr24,27/06/07
```

---

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in milligram/m2)
90-DAY RUNNING AVERAGES; SOURCE GROUP No. 1

At the discrete receptors:

```
 1: 1.97E+01 @Hr24,09/01/08    4: 1.92E+01 @Hr24,25/03/08
 2: 1.70E+02 @Hr24,04/02/08    5: 1.57E+02 @Hr24,02/04/07
 3: 1.86E+02 @Hr24,01/04/07    6: 1.82E+02 @Hr24,01/04/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in milligram/m2)
        90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 2
At the discrete receptors:

 1: 2.44E-01 @Hr24,09/01/08    4: 8.79E-02 @Hr24,26/03/08
 2: 1.06E+01 @Hr24,25/04/07    5: 8.64E-01 @Hr24,19/03/08
 3: 1.59E+00 @Hr24,04/04/07    6: 2.93E+00 @Hr24,04/04/07
```

```
1       HIGHEST RECORDINGS FOR EACH RECEPTOR  (in milligram/m2)
        90-DAY RUNNING AVERAGES;  SOURCE GROUP No. 3


 At the discrete receptors:

 1: 1.61E-01 @Hr24,18/12/07    4: 1.49E-01 @Hr24,07/07/07
 2: 8.00E-01 @Hr24,25/11/08    5: 9.29E-01 @Hr24,07/07/07
 3: 2.18E+00 @Hr24,07/07/07    6: 1.02E+01 @Hr24,12/08/07
```

Appendix E

Uncontrolled (Worst Case) Conditions

AUSPLUME Modelling Results and Modelling Files Outputs

Table E1: Summary of Emission Rates Used for Worst Case Conditions

Source	Constituent	Emission Factor	Comments
Excavation and Stockpiling – Surface Soils	TSP	$2.81*10^{-2}*U^{1.3}$ kg/t	An excavation rate of 500m^3/day has been adopted in the modelling.
	PM_{10}	$1.33*10^{-2}*U^{1.3}$ kg/t	An excavation rate of 500m^3/day has been adopted in the modelling.
	Benzene	$1.18*10^{-8}*U^{1.3}$ kg/t (max) $6.74*10^{-9}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for surface soils, ash, coke and gravels
	Benzo(a)pyrene	$9.53*10^{-6}*U^{1.3}$ kg/t (max) $8.77*10^{-7}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for surface soils, ash, coke and gravels
Excavation and Stockpiling – Fill Materials behind Northern Retaining Wall	TSP	$2.81*10^{-2}*U^{1.3}$ kg/t	An excavation rate of 300m^3/day has been adopted in the modelling.
	PM_{10}	$1.33*10^{-2}*U^{1.3}$ kg/t	An excavation rate of 300m^3/day has been adopted in the modelling.
	Benzene	$4.22*10^{-7}*U^{1.3}$ kg/t (max) $3.37*10^{-8}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for gravels, sand and demolition wastes
	Benzo(a)pyrene	$4.22*10^{-6}*U^{1.3}$ kg/t (max) $5.14*10^{-7}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for gravels, sand and demolition wastes
	Odour	7.3 OU/m^2.s	Based on comparison of impacted soils to coal tar in **Section 5.9**
Excavation and Stockpiling – Northern Gasholder	TSP	$2.81*10^{-2}*U^{1.3}$ kg/t	An excavation rate of 100m^3/day has been adopted in the modelling.
	PM_{10}	$1.33*10^{-2}*U^{1.3}$ kg/t	An excavation rate of 100m^3/day has been adopted in the modelling.
	Benzene	$4.22*10^{-7}*U^{1.3}$ kg/t (max)	Using the maximum and mean benzene concentration recorded for gravels, sand and

Source	Constituent	Emission Factor	Comments
		$3.37*10^{-8}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	demolition wastes
	Benzo(a)pyrene	$4.22*10^{-6}*U^{1.3}$ kg/t (max) $5.14*10^{-7}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for gravels, sand and demolition wastes
	Odour	7.3 OU/m^2.s	Based on comparison of impacted soils to coal tar in **Section 5.9**
Excavation and Stockpiling – Former Gasworks Area	TSP	$2.81*10^{-2}*U^{1.3}$ kg/t	An excavation rate of $200m^3$/day has been adopted in the modelling.
	PM_{10}	$1.33*10^{-2}*U^{1.3}$ kg/t	An excavation rate of $200m^3$/day has been adopted in the modelling.
	Benzene	$5.62*10^{-7}*U^{1.3}$ kg/t (max) $3.93*10^{-8}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzene concentration recorded for each of the soil types assessed for the site.
	Benzo(a)pyrene	$1.25*10^{-5}*U^{1.3}$ kg/t (max) $5.90*10^{-7}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzo(a)pyrene concentration recorded for each of the soil types assessed for the site.
	Odour	7.3 OU/m^2.s	Based on comparison of impacted soils to coal tar in **Section 5.9**
Haulage Site Roads	TSP	0.177 kg/km (loaded trucks) 0.109 kg/km (unloaded trucks)	Maximum excavation rate will result in 65 return trips over longest length of roadway during a 10 hour day. A roadway length of 65m has been adopted for the modelling, with roadway use distributed over the duration of the modelling.
	PM_{10}	0.105 kg/km (loaded trucks) $7.09*10^{-2}$ kg/km (unloaded trucks)	Maximum excavation rate will result in 65 return trips over longest length of roadway during a 10 hour day. A roadway length of 65m has been adopted for the modelling, with roadway use distributed over the duration of the modelling.
Stockpiles (Fugitive Emissions) Surface Soil and Hotspots	TSP	0.85 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling. Surplus soils would generally be rapidly removed from the site.

Source	Constituent	Emission Factor	Comments
Remediation	PM_{10}	0.43 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling. Surplus soils would generally be rapidly removed from the site.
	Benzene	$3.57*10^{-6}$ tonnes/ha.year (max) $2.04*10^{-7}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for surface soils, ash, coke and gravels
	Benzo(a)pyrene	$2.88*10^{-4}$ tonnes/ha.year (max) $2.65*10^{-5}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for surface soils, ash, coke and gravels
Stockpiles (fugitive emissions) – Fill Materials behind Northern Retaining Wall	TSP	0.85 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling. Surplus soils would generally be rapidly removed from the site.
	PM_{10}	0.43 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling. Surplus soils would generally be rapidly removed from the site.
	Benzene	$1.26*10^{-5}$ tonnes/ha.year (max) $1.02*10^{-6}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for gravels, sand and demolition wastes
	Benzo(a)pyrene	$1.28*10^{-4}$ tonnes/ha.year (max) $1.55*10^{-5}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix A**	Using the maximum and mean benzo(a)pyrene concentration recorded for gravels, sand and demolition wastes
	Odour	7.3 $OU/m^2.s$	Requires to be based on likely extent of stockpiling with this stage. This can be assumed to be 10m * 10m. Based on comparison of impacted soils to coal tar in

Source	Constituent	Emission Factor	Comments
			Section 5.9.
Stockpiles (fugitive emissions) – Northern Gasholder	TSP	0.85 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling. Surplus soils would generally be rapidly removed from the site.
	PM_{10}	0.43 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling. Surplus soils would generally be rapidly removed from the site.
	Benzene	$1.26*10^{-5}$ tonnes/ha.year (max) $1.02*10^{-6}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzene concentration recorded for gravels, sand and demolition wastes
	Benzo(a)pyrene	$1.28*10^{-4}$ tonnes/ha.year (max) $1.55*10^{-5}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the maximum and mean benzo(a)pyrene concentration recorded for gravels, sand and demolition wastes
	Odour	7.3 OU/m^2.s	Requires to be based on likely extent of stockpiling with this stage. This can be assumed to be 10m * 10m. Based on comparison of impacted soils to coal tar in **Section 5.9**.
Stockpiles (fugitive emissions) – Former Gasworks Area	TSP	0.85 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling. Surplus soils would generally be rapidly removed from the site.
	PM_{10}	0.43 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 10m * 10m for the purposes of modelling. Surplus soils would generally be rapidly removed from the site.
	Benzene	$1.70*10^{-5}$ tonnes/ha.year (max) $1.19*10^{-6}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzene concentration recorded for each of the soil types assessed for the site.

Source	Constituent	Emission Factor	Comments
	Benzo(a)pyrene	$3.77*10^{-4}$ tonnes/ha.year (max) $1.79*10^{-5}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzo(a)pyrene concentration recorded for each of the soil types assessed for the site.
	Odour	7.3 OU/m^2.s	Requires to be based on likely extent of stockpiling with this stage. This can be assumed to be 10m * 10m. Based on comparison of impacted soils to coal tar in **Section 5.9**.
Stabilisation / Immobilisation of Soils	TSP	$4.8*10^{-2} + 2.81*10^{-2}*U^{1.3}$ kg/t	Requires to be based on soil treatment rate. Assumed to be 100m^3/day for the purposes of modelling.
	PM_{10}	$2.4*10^{-2} + 1.33*10^{-2}*U^{1.3}$ kg/t	Requires to be based on soil treatment rate. Assumed to be 100m^3/day for the purposes of modelling.
	Benzene	$5.62*10^{-7}*U^{1.3}$ kg/t (max) $3.93*10^{-8}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzene concentration recorded for each of the soil types assessed for the site.
	Benzo(a)pyrene	$1.25*10^{-5}*U^{1.3}$ kg/t (max) $5.90*10^{-7}*U^{1.3}$ kg/t (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzo(a)pyrene concentration recorded for each of the soil types assessed for the site.
	Odour	7.3 OU/m^2.s	Based on comparison of impacted soils to coal tar in **Section 5.9**
Bioremediation of Soils	TSP	0.85 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 1,000m^2 in the western portion of the site for the purposes of modelling.
	PM_{10}	0.43 tonnes/ha.year	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 1,000m^2 in the western portion of the site for the purposes of modelling.
	Benzene	$1.70*10^{-5}$ tonnes/ha.year (max) $1.19*10^{-6}$ tonnes/ha.year (mean)	Using the highest of the maximum and mean benzene concentration recorded for each of the soil types assessed for the site.

Source	Constituent	Emission Factor	Comments
		Vapour emission rate as per **Appendix C**	
	Benzo(a)pyrene	$3.77*10^{-4}$ tonnes/ha.year (max) $1.79*10^{-5}$ tonnes/ha.year (mean) Vapour emission rate as per **Appendix C**	Using the highest of the maximum and mean benzo(a)pyrene concentration recorded for each of the soil types assessed for the site.
	Odour	7.3 $OU/m^2.s$	Requires to be based on likely extent of stockpiling with this stage. This has been assumed to be an area of 1,000m^2 in the western portion of the site for the purposes of modelling. Based on comparison of impacted soils to coal tar in **Section 5.9**.
Groundwater Treatment / Transfer	Odour	0.3 $OU/m^2.s$	As per estimate rate for pooled water. Area of water column exposed to air needs to be considered. Conservative assumption is 1m^2.
	Benzene	Vapour emission rate as per **Appendix C**	Calculated in **Appendix C**.
	Benzo(a)pyrene	Vapour emission rate as per **Appendix C**	Calculated in **Appendix C**.
Pooled Groundwater	Odour	0.3 $OU/m^2.s$	As per estimated rate for pooled water. Pooled water assumed to be present across area of the northern gasholder (20m * 20m) for the purposes of modelling.
	Benzene	Vapour emission rate as per **Appendix C**	Calculated in **Appendix C**.
	Benzo(a)pyrene	Vapour emission rate as per **Appendix C**	Calculated in **Appendix C**.

Table E.2: Summary of Modelling Parameters – Surface Soils Excavation

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate ($g/m^2/s$)
Surface soils, excavation and stockpiling	TSP	VEX1T	Area	30m	20m	45	332314	6247685	16.5	7am – 5pm (10 hours)	$8.5*10^{-4} * U^{1.3}$
	PM_{10}	VEX1P	Area	30m	20m	45	332314	6247685	16.5	7am – 5pm (10 hours)	$4.0*10^{-4} * U^{1.3}$
	Benzene (max)	VEX1BE	Area	30m	20m	45	332314	6247685	16.5	7am – 5pm (10 hours)	Particulates $3.6*10^{-9} * U^{1.3}$
	B(a)P (max)	VEX1BP	Area	30m	20m	45	332314	6247685	16.5	7am – 5pm (10 hours)	Particulates $2.9*10^{-7} * U^{1.3}$
Surface soils, fugitive emissions from stockpiles	TSP	F1T	Area	10m	10m	0	332314	6247685	16.5	Continuous	$2.7*10^{-6}$
	PM_{10}	F1P	Area	10m	10m	0	332314	6247685	16.5	Continuous	$1.4*10^{-6}$
	Benzene (max)	F1BEP F1BEV	Area	10m	10m	0	332314	6247685	16.5	Continuous	Particulates $1.1 * 10^{-11}$ Vapours $2.7 * 10^{-11}$
	B(a)P (max)	F1BPP	Area	10m	10m	0	332314	6247685	16.5	Continuous	Particulates $9.1*10^{-10}$

Table E.3: Summary of Modelling Parameters – Fill Materials Behind Retaining Wall Excavation

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate ($g/m^2/s$ or $OU/m^2/s$)
Fill materials behind retaining wall, excavation and stockpiling	TSP	VEX2T	Area	50	5	80	332271	6247720	18	7am – 5pm (10 hours)	$1.2*10^{-3} * U^{1.3}$
	PM_{10}	VEX2P	Area	50	5	80	332271	6247720	18	7am – 5pm (10 hours)	$5.8*10^{-4} * U^{1.3}$
	Benzene (max)	VEX2BE	Area	50	5	80	332271	6247720	18	7am – 5pm (10 hours)	Particulates $1.8*10^{-8} * U^{1.3}$
	B(a)P (max)	VEX2BP	Area	50	5	80	332271	6247720	18	7am – 5pm (10 hours)	Particulates $1.8*10^{-7} * U^{1.3}$
	Odour	VEX2OU	Area	50	5	80	332271	6247720	18	Continuous	7.3
Fill materials behind retaining wall, fugitive emissions from stockpiles	TSP	F2T	Area	10	10	0	332283	6247718	17.5	Continuous	$2.7*10^{-6}$
	PM_{10}	F2P	Area	10	10	0	332283	6247718	17.5	Continuous	$1.4*10^{-6}$
	Benzene (max)	F2BEP F2BEV	Area	10	10	0	332283	6247718	17.5	Continuous	Particulates $4.1*10^{-11}$ Vapours $9.7*10^{-11}$
	B(a)P (max)	F2BPP	Area	10	10	0	332283	6247718	17.5	Continuous	Particulates $4.1*10^{-10}$
	Odour	F2OU	Area	10	10	0	332283	6247718	17.5	Continuous	7.3

Table E.4: Summary of Modelling Parameters – Northern Gasholder Excavation

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate (g/m2/s or OU/m2/s)
Northern Gasholder, excavation and stockpiling	TSP	VEX3T	Area	20	20	0	332276	6247697	17.5	7am – 5pm (10 hours)	$2.5*10^{-4} * U^{1.3}$
	PM_{10}	VEX3P	Area	20	20	0	332276	6247697	17.5	7am – 5pm (10 hours)	$1.2*10^{-4} * U^{1.3}$
	Benzene (max)	VEX3BE	Area	20	20	0	332276	6247697	17.5	7am – 5pm (10 hours)	Particulates $3.8*10^{-9} * U^{1.3}$
	B(a)P (max)	VEX3BP	Area	20	20	0	332276	6247697	17.5	7am – 5pm (10 hours)	Particulates $3.8*10^{-8} * U^{1.3}$
	Odour	VEX3OU	Area	20	20	0	332276	6247697	17.5	Continuous	7.3
Northern gasholder, fugitive emissions from stockpiles	TSP	F3T	Area	10	10	0	332296	6247702	17.5	Continuous	$2.7*10^{-6}$
	PM_{10}	F3P	Area	10	10	0	332296	6247702	17.5	Continuous	$1.4*10^{-6}$
	Benzene (max)	F3BEP F3BEV	Area	10	10	0	332296	6247702	17.5	Continuous	Particulates $4.1*10^{-11}$ Vapours $9.7*10^{-11}$
	B(a)P (max)	F3BPP	Area	10	10	0	332296	6247702	17.5	Continuous	Particulates $4.1*10^{-10}$
	Odour	F3OU	Area	10	10	0	332296	6247702	17.5	Continuous	7.3

Table E.5: Summary of Modelling Parameters – Former Gasworks Area Excavation

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate ($g/m^2/s$ or $OU/m^2/s$)
Former gasworks area, excavation and stockpiling	TSP	VEX4T	Area	15	15	0	332296	6247695	17.5	7am – 5pm (10 hours)	$9.0*10^{-4} * U^{1.3}$
	PM_{10}	VEX4P	Area	15	15	0	332296	6247695	17.5	7am – 5pm (10 hours)	$4.3*10^{-4} * U^{1.3}$
	Benzene (max)	VEX4BE	Area	15	15	0	332296	6247695	17.5	7am – 5pm (10 hours)	Particulates $1.8*10^{-8} * U^{1.3}$
	B(a)P (max)	VEX4BP	Area	15	15	0	332296	6247695	17.5	7am – 5pm (10 hours)	Particulates $4.0*10^{-7} * U^{1.3}$
	Odour	VEX4OU	Area	15	15	0	332296	6247695	17.5	Continuous	7.3
Former gasworks area, fugitive emissions from stockpiles	TSP	F4T	Area	10	10	0	332296	6247695	17.5	Continuous	$2.7*10^{-6}$
	PM_{10}	F4P	Area	10	10	0	332296	6247695	17.5	Continuous	$1.4*10^{-6}$
	Benzene (max)	F4BEP F4BEV	Area	10	10	0	332296	6247695	17.5	Continuous	Particulates $5.4*10^{-11}$ Vapours $1.3*10^{-10}$
	B(a)P (max)	F4BPP	Area	10	10	0	332296	6247695	17.5	Continuous	Particulates $1.2*10^{-9}$
	Odour	F4OU	Area	10	10	0	332296	6247695	17.5	Continuous	7.3

Table E.6: Summary of Modelling Parameters – Haulage Roads Within Site

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate ($g/m^2/s$)
Haulage roads	TSP	HAT	Area	5	60	0	332312	6247672	16	7am – 5pm (10 hours)	$1.1*10^{-4}$
	PM_{10}	HAP	Area	5	60	0	332312	6247672	16	7am – 5pm (10 hours)	$6.9*10^{-5}$

Table E.7: Summary of Modelling Parameters – Soil Treatment / Remediation Activities

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate ($g/m^2/s$ or $OU/m^2/s$)
Bioremediation of soils[2]	TSP	T2T	Area	65	15	60	332338	6247714	17	Continuous	$2.7*10^{-6}$
	PM_{10}	T2PM	Area	65	15	60	332338	6247714	17	Continuous	$1.4*10^{-6}$
	Benzene (max)	T2BEP T2BEV	Area	65	15	60	332338	6247714	17	Continuous	Particulates $5.4*10^{-11}$ Vapours $1.3*10^{-10}$
	B(a)P (max)	T2BPP	Area	65	15	60	332338	6247714	17	Continuous	Particulates $1.2*10^{-9}$
	Odour	T2OU	Area	65	15	60	332338	6247714	17	Continuous	7.3

Note: 1. Emissions consequent of concrete dusts

2. Also accounts for potential emissions from stockpiled soils associated with the stabilisation / immobilisation works

Table E.8: Summary of Modelling Parameters – Groundwater Emissions and Water Treatment

Source ID / Type	Pollutant	AUSPLUME ID	Type	X Length	Y Length	Angle	X Co-Ord	Y Co-Ord	Elevation	Time of Occurrence	Emission Rate (g/s, $g/m^2/s$, OU/s or $OU/m^2/s$)

Groundwater treatment	Benzene (max)	WTBE	Point	-	-	-	332298	6247702	17.5	Continuous during working hours	$9.7*10^{-3}$
	B(a)P (max)	WTBP	Point	-	-	-	332298	6247702	17.5	Continuous during working hours	$8.0*10^{-5}$
	Odour	WTOU	Point	-	-	-	332298	6247702	17.5	Continuous during working hours	0.3
Pooled water evaporation	Benzene (max)	PWBE	Area	20	20	0	332276	6247697	15	Continuous	$7.8*10^{-5} * U^{0.8}/T^{1.47}$
	B(a)P (max)	PWBP	Area	20	20	0	332276	6247697	15	Continuous	$1.6*10^{-5} * U^{0.8}/T^{1.47}$
	Odour	PWOU	Area	20	20	0	332276	6247697	15	Continuous	0.3

Table E.9: Summary of Worse Air Pollutant Levels with Assumption of No Site Controls (µg/m^3 or OU)

Scenario	Pollutant	Averaging Time	Criteria	Receptor ID					
				1	2	3	4	5	6
Surface soils remediation	TSP	Annual	90	1.67E+01	4.83E+01	7.14E+01	7.60E+00	6.52E+01	6.08E+01
	PM_{10}	24 hour	50	**7.82E+01**	**1.98E+02**	**1.59E+02**	3.61E+01	**1.23E+02**	**1.37E+02**
	PM_{10}	Annual	30	7.85E+00	2.27E+01	**3.36E+01**	3.56E+00	**3.06E+01**	2.86E+01
	Benzene	1 hour	29	1.77E-03	6.21E-03	6.29E-03	1.98E-03	5.42E-03	6.13E-03
	Benzo(a)pyrene	1 hour	0.4	1.92E-01	**6.71E-01**	**6.79E-01**	2.15E-01	**5.85E-01**	**6.61E-01**
Fill materials behind northern retaining wall remediation	TSP	Annual	90	1.41E+01	**1.22E+02**	**2.06E+02**	2.14E+01	**1.40E+02**	**2.37E+02**
	PM_{10}	24 hour	50	4.06E+01	**3.79E+02**	**5.50E+02**	**8.75E+01**	**3.64E+02**	**6.27E+02**
	PM_{10}	Annual	30	6.83E+00	**5.90E+01**	**9.99E+01**	1.04E+01	**6.76E+01**	**1.15E+02**
	Benzene	1 hour	29	2.00E-02	1.33E-01	7.96E-02	1.89E-02	6.80E-02	6.82E-02
	Benzo(a)pyrene	1 hour	0.4	2.04E-02	1.36E-01	8.04E-02	1.91E-02	6.86E-02	6.97E-02
	Odour	1 second	2 OU	**1.20E+01**	**6.70E+01**	**2.41E+01**	**8.02E+00**	**1.88E+01**	**3.32E+01**
Northern gasholder remediation	TSP	Annual	90	5.30E+00	**4.69E+01**	1.61E+01	9.15E-01	8.22E+00	**3.37E+01**
	PM_{10}	24 hour	50	1.73E+01	**1.92E+02**	3.04E+01	4.56E+00	1.82E+01	**5.74E+01**
	PM_{10}	Annual	30	2.55E+00	**2.24E+01**	7.74E+00	4.40E-01	3.95E+00	**1.61E+01**
	Benzene	1 hour	29	1.73E-03	1.53E-02	6.46E-03	8.22E-04	3.80E-03	1.02E-02
	Benzo(a)pyrene	1 hour	0.4	1.73E-02	1.53E-01	6.49E-02	8.28E-03	3.82E-02	1.02E-01
	Odour	1 second	2 OU	**1.68E+01**	**9.18E+01**	**5.66E+01**	**1.39E+01**	**1.16E+01**	**7.84E+01**
Former gasworks area remediation	TSP	Annual	90	9.45E+00	4.75E+01	3.52E+01	1.91E+00	2.15E+01	4.91E+01
	PM_{10}	24 hour	50	3.84E+01	**1.78E+02**	**6.43E+01**	1.14E+01	4.15E+01	**1.06E+02**
	PM_{10}	Annual	30	4.52E+00	2.26E+01	1.69E+01	9.12E-01	1.02E+01	2.34E+01

Scenario	Pollutant	Averaging Time	Criteria	Receptor ID					
				1	2	3	4	5	6
	Benzene	1 hour	29	4.49E-03	2.60E-02	1.63E-02	2.66E-03	1.19E-02	2.10E-02
	Benzo(a)pyrene	1 hour	0.4	9.38E-02	5.72E-02	3.58E-02	5.32E-02	2.48E-01	4.58E-02
	Odour	1 second	2 OU	**1.00E+01**	**4.90E+01**	**3.70E+01**	**9.93E+00**	**2.82E+01**	**4.69E+01**
Haulage roads	TSP	Annual	90	1.38E+00	4.86E+00	8.54E+00	2.32E+00	8.28E+00	7.43E+00
	PM_{10}	24 hour	50	6.62E+00	2.63E+01	3.79E+01	9.36E+00	2.62E+01	3.08E+01
	PM_{10}	Annual	30	1.76E+01	2.17E+01	1.49E+01	5.37E+00	1.34E+01	1.50E+01
Soil treatment	TSP	Annual	90	1.37E+01	5.03E+01	5.01E+01	1.11E+01	4.19E+01	5.47E+01
	PM_{10}	24 hour	50	**5.77E+01**	**2.19E+02**	**1.37E+02**	3.68E+01	**1.25E+02**	**1.95E+02**
	PM_{10}	Annual	30	6.84E+00	2.51E+01	2.53E+01	5.65E+00	2.13E+01	2.75E+01
	Benzene	1 hour	29	1.03E-02	4.08E-02	2.10E-02	7.98E-03	1.71E-02	2.56E-02
	Benzo(a)pyrene	1 hour	0.4	5.88E-02	2.67E-01	1.11E-01	2.84E-02	8.63E-02	1.33E-01
	Odour	1 second	2 OU	**3.58E+01**	**1.06E+02**	**3.50E+01**	**4.15E+01**	**5.69E+01**	**7.19E+01**
Groundwater pooling and treatment	Benzene	1 hour	29	4.50E+01	**3.74E+02**	**1.76E+02**	2.60E+01	**1.08E+02**	**2.67E+02**
	Benzo(a)pyrene	1 hour	0.4	**7.21E+00**	**6.42E+01**	**2.71E+01**	**3.40E+00**	**1.59E+01**	**4.26E+01**
	Odour	1 second	2 OU	5.53E-01	**3.05E+00**	1.88E+00	4.54E-01	1.37E+00	**2.63E+00**

BOLD denotes exceedance of criteria at receptor location

The maximum levels as modelled using the 2 years of meteorological data have only been reported, and consequently include the worst case scenarios only.

Assessment criteria were not exceeded for site activities relating to haul road useage, however exceedances of at least one of the adopted assessment criteria were identified for the remainder of activities that may occur on the site. These are summarised as the following:

<u>Surface Soils Excavation and Stockpiling</u>

- Particulate assessment criteria were exceeded for all receptors adopting a 24 hour averaging period. When the maximum 90 day concentrations are compared to the annual averaging period criteria exceedances were noted at two of the four receptor locations;
- Exceedance of benzo(a)pyrene criteria at four of six receptor locations based on the maximum concentration of benzo(a)pyrene potentially present in all soils on the site.

<u>Retaining Wall Soil Excavation and Stockpiling</u>

- Particulate assessment criteria adopting both the 24 hour and 90 day assessment criteria were exceeded at the majority of receptor locations; and
- Significant exceedances of odour criteria were determined at all receptor locations based on potential odour emissions from impacted retaining wall fill being 7.3Ou/m^2, which as discussed in **Section 5.9** is considered to be the appropriate to soils present in the source zone and tar impacted soil zones.

<u>Northern Gasworks Soil Excavation and Stockpiling</u>

- Particulate assessment criteria adopting both the 24 hour and 90 day assessment criteria were exceeded at two of the six receptor locations; and
- Significant exceedances of odour criteria were determined at all receptor locations based on potential odour emissions from the Northern Gasholder fill being 7.3Ou/m^2, which as discussed in **Section 5.9** is considered to be the worst case condition applicable to soils present in the source zone and tar impacted soil zones.

<u>Gasworks Area Soil Excavation and Stockpiling</u>

- Particulate assessment criteria adopting the 24 hour assessment criteria were exceeded at half of the receptor locations; and
- Significant exceedances of odour criteria were determined at all receptor locations based on potential odour emissions from the Gasworks area being 7.3Ou/m^2, which as discussed in **Section 5.9** is considered to be the appropriate for soils present in the source zone and tar impacted soil zones.

<u>Soils Treatment On-Site by Immobilisation / Stabilisation</u>

- Exceedance of the particulate assessment criteria for a 24 hour averaging period at five of the six receptor locations. It is noted that as a worst case assessment the modelling has assumed that bioremediation and stabilisation will occur on the site, and that stabilisation will results in fugitive emissions of cement;

- Significant exceedances of odour assessment criteria at all receptor locations, from soil treatment activities on worst case odour emissions from coal tar impacted soils; and
- Exceedance of benzo(a)pyrene criteria at all receptor locations based on the maximum concentration of benzo(a)pyrene potentially present in soils on the site.

Overall the results of the dispersion modelling indicate that where significant quantities of coal tar impacted soils are exposed to the atmosphere there is a high potential for malodorous impacts at adjoining properties.

With respect to the results of modelling of particulate levels, assessed as TSP and PM_{10} concentrations and generally based on annual levels, it noted that many of the sources assessed are short term in nature with durations substantially less than a year. For the purposes of the screening exercise conducted with this modelling it was assumed that each of these sources will be continuous throughout the modelling period, with the maximum 90 day (three month) concentration reported and compared to the 'annual' criteria. This approach was applied to ensure worst conditions were assessed. Further no correction factor has been applied to account for no work occurring on Sundays for the duration of the project.

The modelling has assumed other additional worst case conditions including maximum concentrations of constituents, worst case meteorological conditions, and no air quality controls in place during the site works.

Summarised Modelling Outputs

Surface Soils Excavation – Worse Case – Variable Emissions

1

40913 Macdonaldtown VEX1 surface soils variable emissions

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown VEX1 surface soils variable emissions

SOURCE GROUPS

Group No.	Members
1	VEX1T
2	VEX1P
3	VEX1BE
4	VEX1BP

1

40913 Macdonaldtown VEX1 surface soils variable emissions

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VEX1T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	30m	20m	45deg	5m	0m

(Constant) emission rate = 8.50E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX1P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	30m	20m	45deg	5m	0m

(Constant) emission rate = 4.00E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX1BE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	30m	20m	45deg	5m	0m

(Constant) emission rate = 3.60E-06 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX1BP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	30m	20m	45deg	5m	0m

(Constant) emission rate = 2.90E-06 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown VEX1 surface soils variable emissions

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

Surface Soils Excavation – Worse Case – Other Emissions
1

40913 Macdonaldtown VEX1 fugitive emissions

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown VEX1 fugitive emissions

SOURCE GROUPS

Group No.	Members
1	F1T
2	F1P
3	F1BEP
4	F1BEV
5	F1BPP

1

40913 Macdonaldtown VEX1 fugitive emissions

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: F1T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	30m	20m	45deg	5m	0m

(Constant) emission rate = 2.70E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F1P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	30m	20m	45deg	5m	0m

(Constant) emission rate = 1.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F1BEP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	30m	20m	45deg	5m	0m

(Constant) emission rate = 1.10E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F1BEV

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	30m	20m	45deg	5m	0m

(Constant) emission rate = 1.10E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F1BPP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332314	6247685	17m	30m	20m	45deg	5m	0m

(Constant) emission rate = 9.10E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown VEX1T

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

Fill Materials Behind Retaining Wall – Worse Case – Variable Emissions

1

40913 Macdonaldtown Retaining Walls - excavation and stockpiling

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Retaining Walls - excavation and stockpiling

SOURCE GROUPS

Group No.	Members
1	VEX2T
2	VEX2P
3	VEX2BE
4	VEX2BP

1

40913 Macdonaldtown Retaining Walls - excavation and stockpiling

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VEX2T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 1.20E-03 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX2P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 5.80E-04 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX2BE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 1.80E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX2BP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 1.80E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Retaining Walls - excavation and stockpiling

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

Fill Materials Behind Retaining Wall – Worse Case – Other Emissions

1

40913 Macdonaldtown Retaining Walls - excavation and stockpiling

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS

Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES

Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES

1 hour
24 hours
90 days

40913 Macdonaldtown Retaining Walls - excavation and stockpiling

SOURCE GROUPS

Group No.	Members
1	F2T
2	F2P
3	F2BEP F2BPP
4	F2BEV

1

40913 Macdonaldtown Retaining Walls - excavation and stockpiling

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: F2T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	10m	0m

(Constant) emission rate = 2.70E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	10m	0m

(Constant) emission rate = 1.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2BEP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 4.10E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2BPP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 4.10E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2BEV

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	10m	0m

(Constant) emission rate = 9.70E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Retaining Walls - excavation and stockpiling

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

1

40913 Macdonaldtown Northern Gasholder Excavation

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Northern Gasholder Excavation

SOURCE GROUPS

Group No.	Members
1	VEX3T
2	VEX3P
3	VEX3BE
4	VEX3BP

1

40913 Macdonaldtown Northern Gasholder Excavation

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VEX3T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 2.50E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX3P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 1.20E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX3BE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 3.80E-06 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX3BP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 3.80E-06 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Northern Gasholder Excavation

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\RandExVar.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VEX3T VEX3P VEX3BE VEX3BP

1

40913 Macdonaldtown Northern Gasholder Excavation

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Northern Gasholder Excavation

SOURCE GROUPS

Group No.	Members
1	F3T
2	F3P
3	F3BEP F3BPP
4	F3BEV

1

40913 Macdonaldtown Northern Gasholder Excavation

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: F3T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 2.70E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F3P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 1.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F3BEP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 4.10E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F3BPP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 4.10E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F3BEV

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 9.70E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Northern Gasholder Excavation

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

Former Gasworks Area – Worse Case – Variable Emissions

1

40913 Macdonaldtown Former Gasworks Excavation

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS

Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Former Gasworks Excavation

SOURCE GROUPS

Group No.	Members
1	VEX4T
2	VEX4P
3	VEX4BE
4	VEX4BP

1 ____

40913 Macdonaldtown Former Gasworks Excavation

SOURCE CHARACTERISTICS

____

INTEGRATED AREA SOURCE: VEX4T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	15m	15m	0deg	5m	0m

(Constant) emission rate = 9.00E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX4P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	15m	15m	0deg	5m	0m

(Constant) emission rate = 4.30E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX4BE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	15m	15m	0deg	5m	0m

(Constant) emission rate = 1.80E-06 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX4BP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	15m	15m	0deg	5m	0m

(Constant) emission rate = 4.00E-07 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

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1 ____

40913 Macdonaldtown Former Gasworks Excavation

RECEPTOR LOCATIONS

____

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\RandExVar.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VEX4T VEX4P VEX4BE VEX4BP

Former Gasworks Area – Worse Case – Other Emissions

40913 Macdonaldtown Former Gasworks fugitive emissions

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Former Gasworks fugitive emissions

SOURCE GROUPS

Group No.	Members
1	F4T
2	F4P
3	F4BEP F4BEV
4	F4BPP

1

40913 Macdonaldtown Fomer Gasholder fugitive emissions

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: F4T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 2.70E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F4P

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 1.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F4BEP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 5.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F4BPP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 1.20E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F4BEV

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 1.30E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Fomer Gasworks fugitive emissions

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

Haulage Roads – Worse Case

1

40913 Macdonaldtown Haulage Roads

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS

Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES

Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES

1 hour
24 hours
90 days

40913 Macdonaldtown Haulage Roads

SOURCE GROUPS

Group No.	Members
1	HAT
2	HAP

1

40913 Macdonaldtown Haulage Roads

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: HAT

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332312	6247672	16m	5m	60m	0deg	5m	0m

(Constant) emission rate = 1.10E-04 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: HAP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332312	6247672	16m	5m	60m	0deg	5m	0m

(Constant) emission rate = 6.90E-05 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Haulage Roads

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

Treatment / Remediation of Soils – Worse Case – Variable Emissions

1

40913 Macdonaldtown Soil Treatment 1 Variable Emissions

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Soil Treatment 1 Variable Emissions

SOURCE GROUPS

Group No.	Members
1	VT1T
2	VT1PM
3	VT1BP

1

40913 Macdonaldtown Soil Treatment 1 Variable Emissions

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VT1T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332305	6247712	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 2.50E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VT1PM

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332305	6247712	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 1.20E-04 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VT1BP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332305	6247712	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 1.10E-06 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Sopil Treatment 1 Variable Emissions

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\RandExVar.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V   allocated: VT1T   VT1PM VT1BP

Odour Sources – All Areas

1

40913 Macdonaldtown Odour Sources

Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS

Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

40913 Macdonaldtown Odour Sources

SOURCE GROUPS

Group No.	Members
1	WTOU
2	VEX2OU
3	F2OU
4	VEX3OU
5	F3OU
6	VEX4OU
7	F4OU
8	T1OU

9 T2OU
10 PWOU

---

1 ____

40913 Macdonaldtown Odour Sources

SOURCE CHARACTERISTICS

STACK SOURCE: WTOU

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
332298	6247702	18m	2m	1.00m	27C	2.0m/s

No building wake effects.
(Constant) emission rate = 3.00E-01 OUV/second
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX2OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	0deg	5m	0m

(Constant) emission rate = 7.30E+00 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 7.30E+00 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX3OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 7.30E+00 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F3OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247702	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 7.30E+00 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VEX4OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	15m	15m	0deg	5m	0m

(Constant) emission rate = 7.30E+00 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F4OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332296	6247695	18m	10m	10m	0deg	5m	0m

(Constant) emission rate = 7.30E+00 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T1OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332305	6247712	17m	20m	20m	0deg	5m	0m

(Constant) emission rate = 7.30E+00 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T2OU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 7.30E+00 OUV/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: PWOU

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	17m	20m	20m	0deg	5m	0m

(Constant) emission rate = 3.00E-01 OUV/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown OdourSources

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

Treatment / Remediation of Soils – Worse Case – Other Emissions

1

40913 Macdonaldtown Soil Stabilisation Fixed Emission Sources

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Soil Stabilisation Fixed Emission Sources

SOURCE GROUPS

Group No.	Members
1	T1T
2	T1PM
3	VT1BEP

1

40913 Macdonaldtown Soil Stabilisation Fixed Emission Sources

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: T1T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332305	6247712	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 4.30E-04 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T1PM

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332305	6247712	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 2.20E-04 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: VT1BEP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332305	6247712	18m	20m	20m	0deg	5m	0m

(Constant) emission rate = 5.10E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Soil Stabilisation Fixed Emission Sources

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

1

40913 Macdonaldtown Soil Bioremediation Fixed Sources

Concentration or deposition	Concentration
Emission rate units	grams/second
Concentration units	microgram/m3
Units conversion factor	1.00E+06
Constant background concentration	0.00E+00
Terrain effects	Egan method
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	No
Decay coefficient (unless overridden by met. file)	0.000

Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS

Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Soil Bioremediation Fixed Sources

SOURCE GROUPS

Group No.	Members
1	T2T
2	T2PM
3	T2BEP
4	T2BEV
5	T2BPP

1

40913 Macdonaldtown Soil Bioremediation Fixed Sources

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: T2T

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 2.70E-06 grams/second per square metre

No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T2PM

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 1.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T2BEP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 5.40E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T2BEV

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 1.30E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: T2BPP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247714	17m	65m	15m	60deg	5m	0m

(Constant) emission rate = 1.20E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Soil Bioremediation Fixed Sources

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

Groundwater Treatment and Pooled Water – Worse Case – Variable Emissions

40913 Macdonaldown Groundwater pooled water

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m
Averaging time for sigma-theta values 60 min.

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

40913 Macdonaldown Groundwater pooled water

SOURCE GROUPS

Group No.	Members
1	PWBE
2	PWBP

1

40913 Macdonaldown Groundwater pooled water

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VWBE

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	15m	20m	20m	0deg	5m	0m

(Constant) emission rate = 7.80E-05 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: PWBP

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332276	6247697	15m	20m	20m	0deg	5m	0m

(Constant) emission rate = 1.60E-05 grams/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldown Groundwater pooled water

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\RandPoolVa.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: PWBE PWBP

40913 Macdonaldtown Groundwater Treatment

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Groundwater Treatment

SOURCE GROUPS

Group No.	Members
1	WTBE
2	WTBP

1

40913 Macdonaldtown Groundwater Treatment

SOURCE CHARACTERISTICS

STACK SOURCE: WTBE

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
332298	6247702	18m	2m	0.25m	25C	0.2m/s

No building wake effects.

Emission rates by hour of day in grams/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	9.70E-03	8	9.70E-03
9	9.70E-03	10	9.70E-03	11	9.70E-03	12	9.70E-03
13	9.70E-03	14	9.70E-03	15	9.70E-03	16	9.70E-03
17	9.70E-03	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

STACK SOURCE: WTBP

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
332298	6247702	18m	2m	0.25m	25C	0.0m/s

No building wake effects.

Emission rates by hour of day in grams/second:

1	0.00E+00	2	0.00E+00	3	0.00E+00	4	0.00E+00
5	0.00E+00	6	0.00E+00	7	8.50E-05	8	8.50E-05
9	8.50E-05	10	8.50E-05	11	8.50E-05	12	8.50E-05
13	8.50E-05	14	8.50E-05	15	8.50E-05	16	8.50E-05
17	8.50E-05	18	0.00E+00	19	0.00E+00	20	0.00E+00
21	0.00E+00	22	0.00E+00	23	0.00E+00	24	0.00E+00

No gravitational settling or scavenging.

1

40913 Macdonaldtown Groundwater Treatment

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

40913 Macdonaldtown Retaining Walls Variable with controls

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Retaining Walls Variable with controls

SOURCE GROUPS

Group No.	Members
1	V2TC2
2	V2PC2
3	V2BEC2
4	V2BPC2

1

40913 Macdonaldtown Retaining Walls Variable with controls

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: V2TC2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	5m	2m	80deg	10m	0m

(Constant) emission rate = 4.00E-04 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: V2PC2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	5m	2m	80deg	10m	0m

(Constant) emission rate = 1.51E-04 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: V2BEC2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	5m	2m	80deg	10m	0m

(Constant) emission rate = 5.00E-07 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: V2BPC2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	5m	2m	80deg	10m	0m

(Constant) emission rate = 5.00E-07 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Retaining Walls Variable with controls

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

40913 Macdonaldtown Retaining Walls Excavation Fugitive Emissions - with controls

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Retaining Walls Fugitive Emissions with controls

SOURCE GROUPS

Group No.	Members
1	F2TC2
2	F2PC2
3	F2BEPC F2BEVC
4	F2BPPC

1

40913 Macdonaldtown Retaining Walls - with controls

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: F2TC2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	10m	0m

(Constant) emission rate = 7.00E-07 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2PC2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	10m	0m

(Constant) emission rate = 3.00E-07 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2BEPC

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 1.00E-07 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2BPPC

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332271	6247720	18m	50m	5m	80deg	10m	0m

(Constant) emission rate = 1.00E-06 grams/second per square metre
No gravitational settling or scavenging.

INTEGRATED AREA SOURCE: F2BEVC

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332283	6247718	18m	10m	10m	0deg	10m	0m

(Constant) emission rate = 2.50E-06 grams/second per square metre
No gravitational settling or scavenging.

1

40913 Macdonaldtown Retaining Walls Fugitive Emissions - with controls

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

40913 Macdonaldtown Deposition with controls

Concentration or deposition Dry deposition only
Emission load units grams/second
Deposition units milligram/m2
Units conversion factor 1.00E+03
Plume depletion due to dry removal mechanisms included.
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS

Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES

Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES

1 hour
24 hours
90 days

1

40913 Macdonaldtown Deposition with controls

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: HATC3

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332312	6247672	16m	5m	60m	0deg	5m	0m

(Constant) emission rate = 2.86E-05 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.1500	2.5	2.65
0.3400	6.0	2.65
0.5100	10.0	2.65

INTEGRATED AREA SOURCE: V2T2C2

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332312	6247672	16m	5m	2m	0deg	5m	0m

(Constant) emission rate = 1.04E-04 grams/second per square metre

Particle Mass fraction	Particle Size (micron)	Particle Density (g/cm3)
0.1500	2.5	2.65
0.3400	6.0	2.65
0.5100	10.0	2.65

1

40913 Macdonaldtown Deposition with controls

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

40913 Macdonaldtown Groundwater Treatment with controls

Concentration or deposition Concentration
Emission rate units grams/second
Concentration units microgram/m3
Units conversion factor 1.00E+06
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour
24 hours
90 days

40913 Macdonaldtown Groundwater Treatment with controls

SOURCE GROUPS

Group No.	Members
1	WTBEc
2	WTBPc

1

40913 Macdonaldtown Groundwater Treatment with controls

SOURCE CHARACTERISTICS

STACK SOURCE: WTBEc

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
332380	6247768	18m	2m	0.25m	25C	0.2m/s

No building wake effects.

Emission rates by hour of day in grams/second:

1 0.00E+00	2 0.00E+00	3 0.00E+00	4 0.00E+00
5 0.00E+00	6 0.00E+00	7 9.70E-03	8 9.70E-03
9 9.70E-03	10 9.70E-03	11 9.70E-03	12 9.70E-03
13 9.70E-03	14 9.70E-03	15 9.70E-03	16 9.70E-03
17 9.70E-03	18 0.00E+00	19 0.00E+00	20 0.00E+00
21 0.00E+00	22 0.00E+00	23 0.00E+00	24 0.00E+00

No gravitational settling or scavenging.

STACK SOURCE: WTBPc

X(m)	Y(m)	Ground Elev.	Stack Height	Diameter	Temperature	Speed
332380	6247768	18m	2m	0.25m	25C	0.0m/s

No building wake effects.

Emission rates by hour of day in grams/second:

1 0.00E+00	2 0.00E+00	3 0.00E+00	4 0.00E+00
5 0.00E+00	6 0.00E+00	7 8.50E-05	8 8.50E-05
9 8.50E-05	10 8.50E-05	11 8.50E-05	12 8.50E-05
13 8.50E-05	14 8.50E-05	15 8.50E-05	16 8.50E-05
17 8.50E-05	18 0.00E+00	19 0.00E+00	20 0.00E+00
21 0.00E+00	22 0.00E+00	23 0.00E+00	24 0.00E+00

No gravitational settling or scavenging.

1

40913 Macdonaldtown Groundwater Treatment with controls

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332244	6247859	26.0	1.5	4	332342	6247537	16.0	1.5
2	332263	6247744	20.0	1.5	5	332265	6247624	16.0	1.5
3	332259	6247645	21.5	1.5	6	332252	6247669	17.0	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

Appendix F

Calculations of Speciated Constituent Monitoring Thresholds

A PID action level has been required to be derived for the assessment of coal tar emissions during the remediation of the Macdonaldtown site. This has been undertaken by a review of the likely constituents of coal tar vapours and an assessment of potentially toxic effects of constituents at nearby potentially sensitive receptors.

Characterisation of Constituents of Coal Tar

Analysis of free coal tar has been reported in CH2M Hill (March 2007) 'Delineation & Characterisation Sampling and Review of Remedial Options Former Macdonaldtown Gasworks – Burren Street, Erskineville NSW' (CH2M Hill 2007). The coal tar was sampled from coal identified within a pipe on the former Macdonaldtown gasworks being assessed. Though these coal tar results have not been collected from the Barangaroo site, the Macdonaldtown gasworks operated over a similar period and undertook similar processes.

The results of analysis are summarised following for each substance reported above laboratory detection limits at a significant concentration.

Table F1: Summary of Published Coal Tar Constituents

Coal Tar Constituent	Reported Concentration (W%)
Phenol	0.206%
2-Methylphenol	0.173%
3- & 4-Methylphenol	0.359%
2,4-Dimethylphenol	0.249%
Naphthalene	0.975%
Acenaphthylene	0.226%
Acenaphthene	0.0355%
Fluorene	0.172%
Phenanthrene	0.392%
Anthracene	0.138%
Fluoranthene	0.177%
Pyrene	0.187%
Benz(a)anthracene	0.0921%
Chrysene	0.0765%
Benzo(b)fluoranthene	0.0364%
Benzo(k)fluoranthene	0.0545%
Benzo(a)pyrene	0.0595%
Indeno(1,2,3-c,d)pyrene	0.0241%
Dibenz(a,h)anthracene	0.0099%
Benzo(g,h,i)perylene	0.025%
Benzene	0.0576%
Toluene	0.121%
Ethylbenzene	0.0156%
Xylene	0.151%
TPH C_6-C_9	0.377%
TPH C_{10}-C_{14}	40.2%
TPH C_{15}-C_{28}	65.4%
TPH C_{29}-C_{36}	12.4%

By review of **Table F1**, 4% of the constituents of coal tar have been speciated. It is considered that the reported speciated constituents represent the most potentially toxic coal tar constituents.

Chemical Properties and PID Detection Characteristics of Coal Tar Constituents

Table F2 following summarises the reported vapour pressures for each of the speciated constituents in **Table F1**. Vapour pressures have been sourced from accessing the Risk Assessment Information System database on the 1st November 2011.

It is anticipated that a photo-ionization detector (PID) will be used to assess vapour levels during the works. PID ionization potentials and correction factors are also reported in **Table F2**. PID ionization potentials have been based on RAE Systems Inc (2010) 'Technical Note TN-106 Correction factors, Ionization Energies and Calibration

Characteristics' as based on the results provided for a 10.6 eV bulb and calibration to isobutylene.

Table F2: Summary of Vapour Pressure and PID Measurement Parameters for Identified Coal Tar Constituents

Coal Tar Constituent	Vapour Pressure (mm Hg)	Ionization Energy (eV)	Correction Factor
Phenol	0.35	8.51	1.0
2-Methylphenol	0.11	8.29	0.5
3- & 4-Methylphenol	0.11-0.17	8.35-8.5	1-1.4
2,4-Dimethylphenol	0.10	-	-
Naphthalene	$8.50*10^{-2}$	8.13	0.42
Acenaphthylene	$6.68*10^{-3}$	-	-
Acenaphthene	$2.15*10^{-3}$	-	-
Fluorene	$6.00*10^{-4}$	-	-
Phenanthrene	$1.21*10^{-4}$	-	-
Anthracene	$6.53*10^{-6}$	-	-
Fluoranthene	$9.22*10^{-6}$	-	-
Pyrene	$4.50*10^{-6}$	-	-
Benz(a)anthracene	$2.10*10^{-7}$	-	-
Chrysene	$6.23*10^{-9}$	-	-
Benzo(b)fluoranthene	$5.00*10^{-7}$	-	-
Benzo(k)fluoranthene	$9.65*10^{-10}$	-	-
Benzo(a)pyrene	$5.49*10^{-9}$	-	-
Indeno(1,2,3-c,d)pyrene	$1.25*10^{-10}$	-	-
Dibenz(a,h)anthracene	$9.55*10^{-10}$	-	-
Benzo(g,h,i)perylene	$1.00*10^{-10}$	-	-
Benzene	94.8	9.25	0.53
Toluene	28.4	8.82	0.5
Ethylbenzene	9.6	8.77	0.52
Xylene	7.99	8.44-8.56	0.39-0.46

As per the relationship for vapours above liquids as provided in ASTM (2002) 'Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites', the extent of vapour that would be anticipated to occur above coal tar will be linearly related to constituent vapour pressure and mole fraction (taken to be equivalent to weight percentage).

For the purposes of assessing coal tar emissions as may be detected by a photo-ionisation detector (PID), it has been assumed that detectable concentration of coal tar constituents as may be recorded by a PID will consist solely of constituents which have been identified by the speciated analysis and have PID correction factors recorded. This is a conservative assumption as vapour emissions would consist of substantially higher concentrations of aliphatic constituents (by comparison of the sum of 4% of speciated constituents to the reported level of TPH C_6-C_9 and C_{10}-C_{14}). This will cause the level of the more toxic constituents as may be present in PID sampled vapours, particularly including benzene, to be substantially overpredicted.

Using the reported weight percentage, vapour pressure and PID correction factor, the anticipated relative levels of constituents in PID assessed vapours is summarised in **Table F3** following:

Table F3: Summary of Anticipated Relative Level of Constituents in PID Readings

Coal Tar Constituent	Mass Fraction (%)	Vapour Pressure (mm Hg)	Correction Factor	Anticipated Fraction of PID Reading
Phenol	0.206	0.35	1.0	0.01
2-Methylphenol	0.173	0.11	0.5	0.002
3- & 4-Methylphenol	0.359	0.11-0.17	1-1.4	0.01
Naphthalene	0.975	$8.50*10^{-2}$	0.42	0.006
Benzene	0.0576	94.8	0.53	0.54
Toluene	0.121	28.4	0.5	0.32
Ethylbenzene	0.0156	9.6	0.52	0.01
Xylene	0.151	7.99	0.39-0.46	0.09

Based on **Table F3**, it has been assumed that benzene will compose a significant proportion of potential coal tar vapour emissions. From review of the health risk assessment (HRA) as performed with the air quality impact assessment (AQIA), benzene is also found to be the most potentially toxic constituent of those identified in vapour.

Where it is assumed that benzene comprises half the reported PID readings, it is considered that assessment of coal tar emissions on the basis of benzene emissions will be suitably protective of potentially toxic effects of other constituents that may be present.

Toxicological Review of Benzene and Setting Site Specific Action Criteria

The risk assessment parameters as provided to the HRA have been used to derive a risk based criteria for benzene. As noted in the HRA ATSDR (August 2007) 'Toxicological Profile for Benzene' provides a chronic duration inhalation exposure MRL of 10µg/m^3 (0.003ppm). Exposure parameters on the basis of the anticipated duration of the works require to be applied to the adopted benzene threshold to determine a criteria that requires to be complied with at the site boundary. These are summarised following:

- Conversion of 6 days working for a seven day week; and
- Conversion of 11 hour work day (7am to 6pm) for 24 hour day.

Based on these corrections, the benzene action criteria is set at 0.008ppm. On the basis that benzene is anticipated to comprise 50% of a vapour measurement as taken using the PID, this is a PID action level of 0.016ppm. This level will require to be satisfied at the site boundary. This level is observed to be well below the typical PID detection limit of 0.1ppm.

Assessment of Dispersion of Emissions from Source to Receptors

PID measurements will require to be undertaken at the source of the potential volatile emissions (i.e. the work zone). Emissions at the work zone will be subject to dispersion processes prior to discharge from the site boundary. GRI (1996) 'Management of Manufactured Gas Plant Sites' provides a near field box model for the ready estimation of contaminant dispersion over near field distances. The model is relatively simple and easy to apply, making it appropriate for use here and later inclusion in the AQMP. The model is further reported to be conservative.

The box model is provided in GRI (1996) as:

$C_a = Q / (H_b.W_b.u_m)$

Where: C_a – concentration of contaminant in ambient air (µg/m^3)

Q – emission rate of contaminant (µg/s)

H_b – Downwind height of box (m)

W_b – width of box, crosswind dimension of area of contamination (m)

U_m – wind speed through the box (m/s)

Table F4 is provided in GRI (1996) to estimate the height of the box, and by function, the extent of dispersion.

Table F4: Box Model Parameters

Length of Side of Box (m)	Box Height (m)
10	1.4
20	2.1
30	2.7
40	3.3
50	3.8
60	4.3
70	4.8
80	5.3
90	5.8
100	6.2
150[1]	7.9[1]
200[1]	9.6[1]
250[1]	11.1[1]
300[1]	12.5[1]
350[1]	13.8[1]
400[1]	15.0[1]
450[1]	16.2[1]
500[1]	17.4[1]
600[1]	19.6[1]
700[1]	21.6[1]
800[1]	23.6[1]
900[1]	25.5[1]
1000[1]	27.3[1]

Note: 1. Estimated by extrapolation

PID measurements are proposed to be taken as close to the source of potentially volatile emissions as possible. It is estimated that field personnel would be able to take measurements within 2m downwind of the source of the volatile emissions based on the proximity of earthmoving equipment. These emissions would be anticipated to be diluted prior to the site boundary. By the use of the box model the rate of dilution will be a function of the distance of the source to the nearest downwind receptor. An equivalent box height of 0.47m is estimated at a distance of 2m. The extent of dilution is found to be the box height at 2m as divided by the box height of the distance of the nearest downwind receptor. The basis of this calculation is shown on **Figure F1**.

Derivation of PID Action Level for Site Screening

Criteria to the work zone measurements will require to be applied on the basis of the downwind distance to the nearest potentially exposed receptor. The distance to the nearest affected receptor will be on the basis on the wind direction as per **Figure F1**. The downwind distance requires to be measured as per the wind direction. Criteria, on the basis of separation distance, to be applied at the work zone for PID screening are summarised in **Table F5** following.

Proposed Site Area Available for Remediation Works

50m contours from site

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0 50m
Approximate scale

Figure 6.1 **Approximate Radial Distance from Remediation Site**

Department of Lands (2010)
Note- All locations shown are approximate only

Table F5: Work Zone Criteria on the Basis of Separation Distance

Separation Distance (m)	PID Screening Criteria (ppm)
50	0.1
100	0.2
150	0.3
200	0.3
250	0.4
300	0.4
350	0.5
400	0.5
450	0.6
500	0.6
600	0.7
700	0.7
800	0.8
900	0.9
1000	0.9

Where this PID screening criteria is exceeded, compound specific monitoring shall require to be undertaken using alternate measurement techniques.

Appendix F

Calculation of Temporary Stockpile Odour Calculations

Macdonaldtown Boundary Co-ordinates for Odour Dilution Assessment

Daytime Conditions

Boundary A

	Easting	Northing
1	332278.88	6247615.90
2	332277.38	6247624.59
3	332275.64	6247637.46
4	332273.53	6247649.70
5	332274.52	6247663.72
6	332272.92	6247674.01
7	332271.55	6247687.49
8	332269.20	6247700.52
9	332343.39	6247692.00

Boundary B

	Easting	Northing
1	332342.53	6247707.03
2	332262.55	6247725.75
3	332271.34	6247725.66
4	332278.61	6247730.86
5	332342.09	6247714.55
6	332294.65	6247739.93

Boundary C

	Easting	Northing
1	332431.92	6247742.68
2	332435.35	6247735.10
3	**332438.69**	6247729.11

Boundary D

	Easting	Northing
1	332358.44	6247640.49
2	332366.43	6247650.69
3	332373.63	6247653.74
4	332380.53	6247662.07
5	332386.26	6247666.43
6	332396.03	6247676.93
7	332405.01	6247680.28
8	332412.44	6247686.26
9	332421.71	6247688.23
10	332428.07	6247691.95
11	332421.14	6247672.20
12	332441.92	6247700.93
13	332420.70	6247679.71
14	332454.04	6247708.61
15	332420.27	6247687.23
16	332466.73	6247716.72
17	332419.83	6247694.74
18	332478.94	6247726.40
19	332419.40	6247702.26
20	332495.20	6247734.92
21	332418.96	6247709.77
22	332509.31	6247742.72

Boundary E

	Easting	Northing
1	332330.4	6247536.6
2	332338.2	6247541.2
3	332344.4	6247543.7
4	332351.4	6247546.9
5	332358.6	6247551.1
6	332365.9	6247554.2
7	332381.88	6247559.42
8	332390.15	6247564.59
9	332399.05	6247569.49
10	332407.86	6247574.09
11	332417.04	6247579.21
12	332425.86	6247583.51
13	332435.16	6247588.23
14	332423.87	6247577.39
15	332423.44	6247584.90
16	332461.95	6247601.09

Macdonaldtown Boundary Co-ordinates for Odour Dilution Assessment

Nighttime Conditions

Boundary A

	Easting	Northing
1	332278.88	6247615.90
2	332277.38	6247624.59
3	332275.64	6247637.46
4	332273.53	6247649.70
5	332274.52	6247663.72
6	332272.92	6247674.01
7	332271.55	6247687.49
8	332269.20	6247700.52
9	332343.39	6247692.00

Boundary B

	Easting	Northing
1	332206.71	6247808.37
2	332216.55	6247810.74
3	332225.43	6247815.84
4	332233.42	6247819.09
5	332242.41	6247822.40
6	332250.96	6247826.29
7	332259.94	6247829.60
8	332269.11	6247833.12
9	332305.78	6247814.85
10	332288.42	6247840.78
11	332305.34	6247822.37
12	332308.73	6247848.30
13	332304.91	6247829.88
14	332329.97	6247857.06
15	332304.47	6247837.40
16	332351.00	6247865.82
17	332304.04	6247844.91
18	332372.60	6247875.21

Boundary C

	Easting	Northing
1	332535.54	6247699.72
2	332530.31	6247710.78
3	332525.55	6247720.68
4	332520.77	6247730.98
5	332515.97	6247741.47
6	332521.95	6247748.40
7	332531.48	6247752.74
8	332552.02	6247733.74
9	332550.29	6247761.96
10	332551.59	6247741.26

Boundary D

	Easting	Northing
1	332358.44	6247640.49
2	332366.43	6247650.69
3	332373.63	6247653.74
4	332380.53	6247662.07
5	332386.26	6247666.43
6	332396.03	6247676.93
7	332405.01	6247680.28
8	332412.44	6247686.26
9	332421.71	6247688.23
10	332428.07	6247691.95
11	332421.14	6247672.20
12	332441.92	6247700.93
13	332420.70	6247679.71
14	332454.04	6247708.61
15	332420.27	6247687.23
16	332466.73	6247716.72
17	332419.83	6247694.74
18	332478.94	6247726.40
19	332419.40	6247702.26
20	332495.20	6247734.92
21	332418.96	6247709.77
22	332509.31	6247742.72

Boundary E

	Easting	Northing
1	332330.4	6247536.6
2	332338.2	6247541.2
3	332344.4	6247543.7
4	332351.4	6247546.9
5	332358.6	6247551.1
6	332365.9	6247554.2
7	332381.88	6247559.42
8	332390.15	6247564.59
9	332399.05	6247569.49
10	332407.86	6247574.09
11	332417.04	6247579.21
12	332425.86	6247583.51
13	332435.16	6247588.23
14	332423.87	6247577.39
15	332423.44	6247584.90
16	332461.95	6247601.09
17	332471.2	6247605.8
18	332480.3	6247610.5
19	332488.8	6247614.2
20	332496.7	6247618.6
21	332505.4	6247624.1
22	332515.2	6247627.9

Odour Criteria Derivation

Step 1. AUSPLUME 99% odour values at boundary assuming 1 odour unit at source

	Zone 1 Daytime		Zone 2 Daytime		Zone 3 Daytime		Zone 4 Daytime		Zone 5 Daytime
	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%
average emission rate (OU/m3)		**0.003005**		**0.00213**		**0.0033**		**0.010665**	
Boundary Receptor ID Handling Emissions									
56	1.69E-04	35.56	1.20E-04	3.56E+01	4.44E-04	1.49E+01	1.33E-03	1.61E+01	7.46E-04
55	1.63E-04	36.80	1.16E-04	3.68E+01	4.03E-04	1.64E+01	1.08E-03	1.97E+01	6.10E-04
54	1.60E-04	37.66	1.13E-04	3.77E+01	3.81E-04	1.73E+01	1.03E-03	2.07E+01	5.79E-04
53	1.65E-04	36.47	1.17E-04	3.65E+01	4.14E-04	1.60E+01	1.17E-03	1.83E+01	6.55E-04
52	1.63E-04	36.92	1.15E-04	3.69E+01	3.97E-04	1.66E+01	1.08E-03	1.97E+01	6.08E-04
51	1.65E-04	36.47	1.17E-04	3.65E+01	3.88E-04	1.70E+01	1.07E-03	1.99E+01	6.04E-04
50	1.67E-04	36.03	1.18E-04	3.60E+01	3.94E-04	1.67E+01	1.04E-03	2.05E+01	5.86E-04
49	1.64E-04	36.62	1.16E-04	3.66E+01	3.99E-04	1.66E+01	1.02E-03	2.10E+01	5.72E-04
48	1.57E-04	38.18	1.12E-04	3.82E+01	4.02E-04	1.64E+01	9.88E-04	2.16E+01	5.56E-04
47	1.50E-04	40.12	1.06E-04	4.02E+01	4.02E-04	1.64E+01	9.57E-04	2.23E+01	5.38E-04
46	1.52E-04	39.49	1.08E-04	3.95E+01	3.79E-04	1.74E+01	9.34E-04	2.28E+01	5.26E-04
45	1.49E-04	40.39	1.05E-04	4.04E+01	3.74E-04	1.76E+01	9.46E-04	2.26E+01	5.32E-04
44	1.42E-04	42.38	1.00E-04	4.24E+01	3.64E-04	1.81E+01	9.28E-04	2.30E+01	5.22E-04
43	1.42E-04	42.35	1.01E-04	4.24E+01	3.55E-04	1.86E+01	9.51E-04	2.24E+01	5.35E-04
42	1.39E-04	43.33	9.82E-05	4.34E+01	3.48E-04	1.90E+01	9.40E-04	2.27E+01	5.29E-04
41	1.36E-04	44.13	9.65E-05	4.42E+01	3.36E-04	1.97E+01	9.32E-04	2.29E+01	5.24E-04
40	3.25E-04	18.47	2.31E-04	1.85E+01	5.78E-04	1.14E+01	8.90E-04	2.40E+01	5.01E-04
39	2.98E-04	20.14	2.11E-04	2.02E+01	7.17E-04	9.20E+00	1.37E-03	1.56E+01	7.68E-04
38	3.36E-04	17.90	2.38E-04	1.79E+01	6.18E-04	1.07E+01	9.64E-04	2.21E+01	5.43E-04
37	2.93E-04	20.50	2.08E-04	2.05E+01	7.30E-04	9.04E+00	1.46E-03	1.46E+01	8.22E-04
36	3.23E-04	18.61	2.29E-04	1.86E+01	6.88E-04	9.60E+00	1.07E-03	2.00E+01	6.01E-04
35	2.80E-04	21.49	1.98E-04	2.15E+01	7.19E-04	9.18E+00	1.51E-03	1.41E+01	8.50E-04
34	3.17E-04	18.96	2.25E-04	1.90E+01	6.98E-04	9.46E+00	1.17E-03	1.82E+01	6.59E-04
33	2.69E-04	22.31	1.91E-04	2.23E+01	7.07E-04	9.34E+00	1.55E-03	1.38E+01	8.71E-04
32	3.05E-04	19.70	2.16E-04	1.97E+01	7.00E-04	9.42E+00	1.30E-03	1.64E+01	7.31E-04
31	2.57E-04	23.39	1.82E-04	2.34E+01	6.81E-04	9.69E+00	1.58E-03	1.35E+01	8.89E-04
30	3.02E-04	19.91	2.14E-04	1.99E+01	7.05E-04	9.37E+00	1.38E-03	1.54E+01	7.78E-04
29	2.61E-04	23.07	1.85E-04	2.31E+01	6.47E-04	1.02E+01	1.63E-03	1.31E+01	9.16E-04
28	2.84E-04	21.15	2.01E-04	2.12E+01	7.18E-04	9.20E+00	1.53E-03	1.40E+01	8.60E-04
27	2.75E-04	21.89	1.94E-04	2.19E+01	7.12E-04	9.27E+00	1.57E-03	1.36E+01	8.84E-04
26	2.67E-04	22.53	1.89E-04	2.25E+01	6.90E-04	9.56E+00	1.55E-03	1.38E+01	8.71E-04
25	2.59E-04	23.23	1.83E-04	2.33E+01	6.45E-04	1.02E+01	1.54E-03	1.39E+01	8.65E-04
24	2.43E-04	24.69	1.72E-04	2.47E+01	5.84E-04	1.13E+01	1.58E-03	1.35E+01	8.88E-04
23	2.37E-04	25.40	1.68E-04	2.54E+01	5.52E-04	1.20E+01	1.62E-03	1.32E+01	9.09E-04
22	2.31E-04	25.99	1.64E-04	2.60E+01	5.35E-04	1.23E+01	1.62E-03	1.31E+01	9.13E-04
21	2.25E-04	26.66	1.60E-04	2.67E+01	5.32E-04	1.24E+01	1.58E-03	1.35E+01	8.90E-04
20	2.14E-04	28.04	1.52E-04	2.81E+01	5.28E-04	1.25E+01	1.54E-03	1.39E+01	8.66E-04
19	2.08E-04	28.92	1.47E-04	2.89E+01	4.92E-04	1.34E+01	1.41E-03	1.51E+01	7.92E-04
18	3.41E-04	17.65	2.41E-04	1.77E+01	7.03E-04	9.39E+00	1.17E-03	1.83E+01	6.57E-04
17	3.34E-04	17.98	2.37E-04	1.80E+01	7.01E-04	9.42E+00	1.11E-03	1.92E+01	6.26E-04
16	3.21E-04	18.72	2.28E-04	1.87E+01	6.77E-04	9.76E+00	1.10E-03	1.94E+01	6.19E-04
15	1.48E-04	40.75	1.05E-04	4.08E+01	2.55E-04	2.59E+01	4.24E-04	5.03E+01	2.39E-04
14	1.31E-04	45.84	9.29E-05	4.59E+01	4.70E-05	1.41E+02	6.25E-04	3.41E+01	3.52E-04
13	1.52E-04	39.64	1.07E-04	3.97E+01	2.98E-04	2.22E+01	3.87E-04	5.52E+01	2.17E-04
12	1.52E-04	39.57	1.08E-04	3.96E+01	3.17E-04	2.08E+01	4.21E-04	5.06E+01	2.37E-04
11	1.46E-04	41.25	1.03E-04	4.13E+01	3.13E-04	2.11E+01	5.04E-04	4.23E+01	2.83E-04
10	1.62E-04	37.17	1.15E-04	3.72E+01	7.73E-05	8.54E+01	6.00E-04	3.56E+01	3.38E-04
9	1.94E-04	31.04	1.37E-04	3.11E+01	2.20E-04	3.00E+01	6.65E-04	3.21E+01	3.74E-04
8	1.57E-04	38.23	1.11E-04	3.83E+01	3.41E-04	1.93E+01	3.30E-04	6.47E+01	1.86E-04
7	1.56E-04	38.53	1.11E-04	3.86E+01	3.55E-04	1.86E+01	3.47E-04	6.15E+01	1.95E-04
6	1.50E-04	40.07	1.06E-04	4.01E+01	3.68E-04	1.79E+01	4.41E-04	4.84E+01	2.48E-04
5	1.49E-04	40.39	1.05E-04	4.04E+01	3.67E-04	1.80E+01	5.29E-04	4.03E+01	2.98E-04
4	1.46E-04	41.31	1.03E-04	4.14E+01	3.56E-04	1.85E+01	7.74E-04	2.76E+01	4.35E-04
3	1.46E-04	41.14	1.04E-04	4.12E+01	3.57E-04	1.85E+01	8.90E-04	2.40E+01	5.01E-04
2	1.47E-04	40.83	1.04E-04	4.09E+01	3.51E-04	1.88E+01	9.69E-04	2.20E+01	5.45E-04
1	1.45E-04	41.53	1.03E-04	4.16E+01	3.55E-04	1.86E+01	1.00E-03	2.12E+01	5.65E-04
minimum dilution factor		17.65		17.66		9.04		13.11	

Odour Criteria Derivation

Step 1. AUSPLUME 99% odour values at boundary assuming 1 odour unit at source

	Zone 1 Daytime		Zone 2 Daytime		Zone 3 Daytime		Zone 4 Daytime		Zone 5 Daytime
	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%
average emission rate (OU/m3)		**0.003005**		**0.00213**		**0.0033**		**0.010665**	
Boundary Receptor ID									
FUGITIVE									
1	2.07E-04	0.00E+00	2.47E-04	0.00E+00	2.23E-04	0.00E+00	3.29E-04	0.00E+00	3.66E-04
2	1.87E-04	0.00E+00	2.27E-04	0.00E+00	1.94E-04	0.00E+00	2.89E-04	0.00E+00	3.67E-04
3	1.83E-04	0.00E+00	2.14E-04	0.00E+00	1.84E-04	0.00E+00	2.75E-04	0.00E+00	3.61E-04
4	1.92E-04	0.00E+00	2.28E-04	0.00E+00	1.97E-04	0.00E+00	3.03E-04	0.00E+00	3.78E-04
5	1.89E-04	0.00E+00	2.23E-04	0.00E+00	1.89E-04	0.00E+00	2.87E-04	0.00E+00	3.67E-04
6	1.93E-04	0.00E+00	2.17E-04	0.00E+00	1.84E-04	0.00E+00	2.80E-04	0.00E+00	3.70E-04
7	1.90E-04	0.00E+00	2.06E-04	0.00E+00	1.76E-04	0.00E+00	2.63E-04	0.00E+00	3.53E-04
8	1.96E-04	0.00E+00	2.05E-04	0.00E+00	1.75E-04	0.00E+00	2.51E-04	0.00E+00	3.30E-04
9	1.93E-04	0.00E+00	2.03E-04	0.00E+00	1.69E-04	0.00E+00	2.51E-04	0.00E+00	3.22E-04
10	1.87E-04	0.00E+00	2.07E-04	0.00E+00	1.66E-04	0.00E+00	2.41E-04	0.00E+00	3.04E-04
11	1.79E-04	0.00E+00	2.10E-04	0.00E+00	1.61E-04	0.00E+00	2.35E-04	0.00E+00	3.04E-04
12	1.79E-04	0.00E+00	2.05E-04	0.00E+00	1.57E-04	0.00E+00	2.31E-04	0.00E+00	2.98E-04
13	1.78E-04	0.00E+00	1.97E-04	0.00E+00	1.60E-04	0.00E+00	2.33E-04	0.00E+00	2.80E-04
14	1.69E-04	0.00E+00	1.94E-04	0.00E+00	1.59E-04	0.00E+00	2.25E-04	0.00E+00	2.79E-04
15	1.65E-04	0.00E+00	1.95E-04	0.00E+00	1.61E-04	0.00E+00	2.27E-04	0.00E+00	2.79E-04
16	1.60E-04	0.00E+00	1.90E-04	0.00E+00	1.62E-04	0.00E+00	2.27E-04	0.00E+00	2.69E-04
17	3.16E-04	0.00E+00	2.42E-04	0.00E+00	2.43E-04	0.00E+00	1.63E-04	0.00E+00	1.18E-04
18	3.81E-04	0.00E+00	3.64E-04	0.00E+00	3.78E-04	0.00E+00	2.58E-04	0.00E+00	1.97E-04
19	3.44E-04	0.00E+00	2.57E-04	0.00E+00	2.78E-04	0.00E+00	1.79E-04	0.00E+00	1.29E-04
20	3.75E-04	0.00E+00	3.66E-04	0.00E+00	3.78E-04	0.00E+00	2.75E-04	0.00E+00	2.07E-04
21	3.54E-04	0.00E+00	2.90E-04	0.00E+00	2.96E-04	0.00E+00	1.99E-04	0.00E+00	1.44E-04
22	3.67E-04	0.00E+00	3.72E-04	0.00E+00	3.80E-04	0.00E+00	2.89E-04	0.00E+00	2.14E-04
23	3.66E-04	0.00E+00	3.22E-04	0.00E+00	3.36E-04	0.00E+00	2.20E-04	0.00E+00	1.60E-04
24	3.49E-04	0.00E+00	3.71E-04	0.00E+00	3.75E-04	0.00E+00	3.17E-04	0.00E+00	2.22E-04
25	3.57E-04	0.00E+00	3.43E-04	0.00E+00	3.57E-04	0.00E+00	2.41E-04	0.00E+00	1.78E-04
26	3.30E-04	0.00E+00	3.60E-04	0.00E+00	3.68E-04	0.00E+00	3.24E-04	0.00E+00	2.37E-04
27	3.54E-04	0.00E+00	3.52E-04	0.00E+00	3.66E-04	0.00E+00	2.62E-04	0.00E+00	1.94E-04
28	3.11E-04	0.00E+00	3.48E-04	0.00E+00	3.59E-04	0.00E+00	3.39E-04	0.00E+00	2.49E-04
29	3.58E-04	0.00E+00	3.57E-04	0.00E+00	3.79E-04	0.00E+00	2.97E-04	0.00E+00	2.14E-04
30	3.52E-04	0.00E+00	3.70E-04	0.00E+00	3.75E-04	0.00E+00	3.11E-04	0.00E+00	2.22E-04
31	3.40E-04	0.00E+00	3.82E-04	0.00E+00	3.78E-04	0.00E+00	3.15E-04	0.00E+00	2.35E-04
32	3.20E-04	0.00E+00	3.82E-04	0.00E+00	3.71E-04	0.00E+00	3.33E-04	0.00E+00	2.52E-04
33	3.02E-04	0.00E+00	3.74E-04	0.00E+00	3.60E-04	0.00E+00	3.33E-04	0.00E+00	2.68E-04
34	2.79E-04	0.00E+00	3.45E-04	0.00E+00	3.32E-04	0.00E+00	3.49E-04	0.00E+00	2.84E-04
35	2.78E-04	0.00E+00	3.19E-04	0.00E+00	3.24E-04	0.00E+00	3.63E-04	0.00E+00	2.91E-04
36	2.68E-04	0.00E+00	3.02E-04	0.00E+00	3.01E-04	0.00E+00	3.77E-04	0.00E+00	3.22E-04
37	2.62E-04	0.00E+00	2.90E-04	0.00E+00	3.04E-04	0.00E+00	3.87E-04	0.00E+00	3.42E-04
38	2.47E-04	0.00E+00	2.79E-04	0.00E+00	2.85E-04	0.00E+00	3.79E-04	0.00E+00	3.64E-04
39	3.71E-04	0.00E+00	3.12E-04	0.00E+00	3.25E-04	0.00E+00	2.17E-04	0.00E+00	1.63E-04
40	3.71E-04	0.00E+00	3.07E-04	0.00E+00	3.16E-04	0.00E+00	2.06E-04	0.00E+00	1.61E-04
41	3.70E-04	0.00E+00	2.92E-04	0.00E+00	2.95E-04	0.00E+00	2.04E-04	0.00E+00	1.52E-04
42	1.43E-04	0.00E+00	1.16E-04	0.00E+00	6.27E-07	0.00E+00	1.61E-04	0.00E+00	1.74E-04
43	3.15E-05	0.00E+00	0.00E+00 -		3.85E-04	0.00E+00	2.52E-04	0.00E+00	2.09E-04
44	1.63E-04	0.00E+00	1.34E-04	0.00E+00	0.00E+00 -		1.25E-04	0.00E+00	1.69E-04
45	1.68E-04	0.00E+00	1.44E-04	0.00E+00	7.81E-13	0.00E+00	1.15E-04	0.00E+00	1.66E-04
46	1.62E-04	0.00E+00	1.52E-04	0.00E+00	3.35E-07	0.00E+00	1.22E-04	0.00E+00	1.60E-04
47	7.59E-05	0.00E+00	0.00E+00 -		3.91E-04	0.00E+00	2.60E-04	0.00E+00	2.16E-04
48	1.86E-04	0.00E+00	1.75E-06	0.00E+00	3.74E-04	0.00E+00	2.71E-04	0.00E+00	2.39E-04
49	1.78E-04	0.00E+00	1.63E-04	0.00E+00	5.66E-05	0.00E+00	5.68E-05	0.00E+00	1.41E-04
50	1.84E-04	0.00E+00	1.75E-04	0.00E+00	1.72E-04	0.00E+00	1.47E-05	0.00E+00	1.19E-04
51	1.82E-04	0.00E+00	1.85E-04	0.00E+00	2.37E-04	0.00E+00	4.40E-06	0.00E+00	7.63E-05
52	1.76E-04	0.00E+00	1.93E-04	0.00E+00	2.57E-04	0.00E+00	7.38E-06	0.00E+00	2.88E-05
53	1.72E-04	0.00E+00	1.98E-04	0.00E+00	2.45E-04	0.00E+00	5.77E-05	0.00E+00	8.98E-07
54	1.78E-04	0.00E+00	1.96E-04	0.00E+00	2.49E-04	0.00E+00	1.28E-04	0.00E+00	4.27E-12
55	1.72E-04	0.00E+00	1.97E-04	0.00E+00	2.43E-04	0.00E+00	2.05E-04	0.00E+00	1.21E-09
56	1.74E-04	0.00E+00	1.94E-04	0.00E+00	2.40E-04	0.00E+00	2.38E-04	0.00E+00	1.22E-06
minimum dilution factor		0.00E+00		0.00E+00		0		0	

	Zone 1 Nighttime		Zone 2 Nighttime		Zone 3 Nighttime		Zone 4 Nighttime		Zone 5 Nighttime	
Dilution factor for 2 ou criteria	AUSPLUME Odour concentration	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria
0.006		**0.003005**		**0.00213**		**0.0033**		**0.010665**		**0.006**
Handling Emissions										
16.10	5.60E-05	1.07E+02	3.97E-05	1.07E+02	1.05E-04	6.31E+01	1.87E-04	1.14E+02	0.0002336	51.37
19.68	4.21E-05	1.43E+02	2.99E-05	1.43E+02	6.87E-05	9.61E+01	9.30E-05	2.29E+02	0.0001162	103.27
20.72	4.91E-05	1.22E+02	3.48E-05	1.22E+02	8.43E-05	7.83E+01	1.12E-04	1.91E+02	0.0001394	86.08
18.31	4.55E-05	1.32E+02	3.23E-05	1.32E+02	7.52E-05	8.78E+01	1.19E-04	1.79E+02	0.0001492	80.43
19.72	4.47E-05	1.35E+02	3.17E-05	1.34E+02	7.09E-05	9.31E+01	1.03E-04	2.07E+02	0.0001289	93.10
19.88	4.65E-05	1.29E+02	3.30E-05	1.29E+02	6.92E-05	9.53E+01	9.07E-05	2.35E+02	0.0001134	105.82
20.48	5.16E-05	1.17E+02	3.65E-05	1.17E+02	7.02E-05	9.40E+01	7.62E-05	2.80E+02	0.00009529	125.93
21.00	5.66E-05	1.06E+02	4.01E-05	1.06E+02	7.63E-05	8.65E+01	6.74E-05	3.17E+02	0.00008422	142.48
21.59	6.74E-05	8.92E+01	4.78E-05	8.92E+01	8.92E-05	7.40E+01	6.41E-05	3.33E+02	0.00008016	149.70
22.29	7.59E-05	7.92E+01	5.38E-05	7.92E+01	1.01E-04	6.55E+01	5.73E-05	3.72E+02	0.00007159	167.62
22.83	9.41E-05	6.39E+01	6.67E-05	6.38E+01	1.30E-04	5.09E+01	5.15E-05	4.15E+02	0.00006432	186.57
22.56	1.01E-04	5.97E+01	7.14E-05	5.97E+01	1.52E-04	4.34E+01	5.08E-05	4.20E+02	0.00006352	188.92
22.98	1.08E-04	5.54E+01	7.69E-05	5.54E+01	1.69E-04	3.90E+01	5.67E-05	3.76E+02	0.00007083	169.42
22.43	1.13E-04	5.30E+01	8.04E-05	5.30E+01	1.91E-04	3.46E+01	6.41E-05	3.33E+02	0.0000801	149.81
22.70	1.17E-04	5.12E+01	8.31E-05	5.13E+01	2.06E-04	3.20E+01	6.95E-05	3.07E+02	0.00008689	138.11
22.88	1.27E-04	4.75E+01	8.98E-05	4.74E+01	2.28E-04	2.89E+01	8.20E-05	2.60E+02	0.0001025	117.07
23.96	8.33E-05	7.21E+01	5.90E-05	7.22E+01	1.77E-04	3.73E+01	2.12E-04	1.01E+02	0.0002652	45.25
15.63	2.13E-06	2.82E+03	1.51E-06	2.82E+03	2.76E-05	2.39E+02	1.04E-04	2.05E+02	0.0001303	92.10
22.12	8.34E-05	7.20E+01	5.91E-05	7.21E+01	1.66E-04	3.97E+01	2.03E-04	1.05E+02	0.0002531	47.41
14.60	1.99E-06	3.02E+03	1.41E-06	3.02E+03	3.31E-05	1.99E+02	1.19E-04	1.80E+02	0.0001482	80.97
19.97	6.62E-05	9.07E+01	4.69E-05	9.08E+01	1.61E-04	4.09E+01	1.81E-04	1.18E+02	0.0002256	53.19
14.11	1.48E-06	4.06E+03	1.05E-06	4.06E+03	3.26E-05	2.02E+02	1.34E-04	1.59E+02	0.0001675	71.64
18.20	5.28E-05	1.14E+02	3.74E-05	1.14E+02	1.39E-04	4.74E+01	1.81E-04	1.18E+02	0.0002257	53.17
13.78	1.46E-06	4.11E+03	1.04E-06	4.11E+03	3.12E-05	2.12E+02	1.40E-04	1.52E+02	0.0001749	68.61
16.43	3.09E-05	1.94E+02	2.19E-05	1.94E+02	1.17E-04	5.64E+01	1.69E-04	1.26E+02	0.000211	56.87
13.49	1.43E-06	4.21E+03	1.01E-06	4.21E+03	2.61E-05	2.53E+02	1.56E-04	1.36E+02	0.0001954	61.41
15.42	1.31E-05	4.60E+02	9.25E-06	4.60E+02	9.29E-05	7.11E+01	1.59E-04	1.35E+02	0.0001981	60.58
13.11	1.37E-06	4.38E+03	9.72E-07	4.38E+03	2.26E-05	2.92E+02	1.57E-04	1.36E+02	0.000196	61.22
13.95	3.69E-06	1.63E+03	2.61E-06	1.63E+03	5.07E-05	1.30E+02	1.54E-04	1.39E+02	0.0001925	62.34
13.57	1.68E-06	3.58E+03	1.19E-06	3.58E+03	3.52E-05	1.87E+02	1.46E-04	1.47E+02	0.0001818	66.01
13.78	7.52E-07	8.00E+03	5.33E-07	8.00E+03	1.65E-05	4.00E+02	1.20E-04	1.78E+02	0.0001501	79.95
13.87	9.34E-07	6.43E+03	6.62E-07	6.44E+03	8.15E-06	8.10E+02	1.17E-04	1.83E+02	0.0001456	82.42
13.52	1.71E-06	3.52E+03	1.21E-06	3.52E+03	2.82E-06	2.34E+03	8.69E-05	2.46E+02	0.0001086	110.50
13.20	6.32E-06	9.51E+02	4.48E-06	9.51E+02	2.38E-06	2.77E+03	6.91E-05	3.09E+02	0.00008632	139.02
13.14	1.07E-05	5.63E+02	7.58E-06	5.62E+02	4.11E-06	1.61E+03	5.23E-05	4.08E+02	0.00006531	183.74
13.49	2.03E-05	2.96E+02	1.44E-05	2.97E+02	1.00E-05	6.60E+02	3.33E-05	6.40E+02	0.00004166	288.05
13.86	2.99E-05	2.01E+02	2.12E-05	2.01E+02	1.59E-05	4.15E+02	1.92E-05	1.11E+03	0.00002404	499.17
15.15	4.94E-05	1.22E+02	3.50E-05	1.22E+02	3.70E-05	1.78E+02	7.76E-06	2.75E+03	0.000009697	1237.50
18.26	1.79E-05	3.36E+02	1.27E-05	3.36E+02	5.97E-05	1.11E+02	1.17E-04	1.83E+02	0.000146	82.19
19.17	1.26E-05	4.77E+02	8.93E-06	4.77E+02	4.65E-05	1.42E+02	1.04E-04	2.06E+02	0.0001296	92.59
19.40	8.88E-06	6.77E+02	6.29E-06	6.77E+02	3.50E-05	1.89E+02	8.25E-05	2.59E+02	0.0001031	116.39
50.25	9.19E-06	6.54E+02	6.51E-06	6.54E+02	1.08E-05	6.11E+02	3.02E-06	7.06E+03	0.000003779	3175.44
34.11	1.46E-06	4.11E+03	1.04E-06	4.12E+03	1.07E-08	6.16E+05	3.29E-07	6.48E+04	4.113E-07	29175.78
55.20	1.67E-05	3.59E+02	1.19E-05	3.59E+02	2.38E-05	2.77E+02	2.81E-06	7.59E+03	0.000003515	3413.94
50.63	2.25E-05	2.67E+02	1.59E-05	2.67E+02	2.91E-05	2.27E+02	3.46E-06	6.17E+03	0.000004318	2779.06
42.34	2.80E-05	2.14E+02	1.99E-05	2.14E+02	3.99E-05	1.66E+02	7.95E-06	2.68E+03	0.000009941	1207.12
35.56	3.53E-06	1.70E+03	2.50E-06	1.71E+03	6.42E-08	1.03E+05	4.41E-07	4.83E+04	5.518E-07	21747.01
32.08	1.24E-05	4.85E+02	8.78E-06	4.85E+02	1.15E-06	5.73E+03	8.08E-07	2.64E+04	0.000001009	11892.96
64.66	3.21E-05	1.87E+02	2.27E-05	1.87E+02	3.49E-05	1.89E+02	9.45E-07	2.26E+04	0.000001181	10160.88
61.48	3.68E-05	1.63E+02	2.61E-05	1.63E+02	4.01E-05	1.65E+02	6.60E-07	3.23E+04	8.243E-07	14557.81
48.43	4.74E-05	1.27E+02	3.37E-05	1.27E+02	5.41E-05	1.22E+02	1.31E-06	1.62E+04	0.000001641	7312.61
40.30	5.52E-05	1.09E+02	3.91E-05	1.09E+02	7.26E-05	9.09E+01	3.09E-06	6.90E+03	0.000003864	3105.59
27.57	6.67E-05	9.01E+01	4.73E-05	9.00E+01	9.87E-05	6.69E+01	1.15E-05	1.85E+03	0.00001441	832.76
23.97	7.70E-05	7.80E+01	5.46E-05	7.80E+01	1.28E-04	5.17E+01	2.67E-05	7.98E+02	0.0000334	359.28
22.02	8.70E-05	6.91E+01	6.16E-05	6.91E+01	1.57E-04	4.20E+01	5.17E-05	4.13E+02	0.0000646	185.76
21.24	9.08E-05	6.62E+01	6.43E-05	6.62E+01	1.75E-04	3.76E+01	7.15E-05	2.98E+02	0.00008933	134.33
13.11		47.47		47.43		28.90		100.52		45.25

	Zone 1 Nighttime		Zone 2 Nighttime		Zone 3 Nighttime		Zone 4 Nighttime		Zone 5 Nighttime	
Dilution factor for 2 ou criteria	AUSPLUME Odour concentration	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria	AUSPLUME Odour concentration 99%	Dilution factor for 2 ou criteria
0.006		**0.003005**		**0.00213**		**0.0033**		**0.010665**		**0.006**
FUGITIVE										
0.00E+00	6.42E-04	3.12E+03	4.55E-04	4.40E+03	1.44E-03	1.39E+03	1.05E-03	1.90E+03	5.92E-04	3.38E+03
0.00E+00	6.36E-04	3.14E+03	4.51E-04	4.43E+03	1.52E-03	1.32E+03	7.68E-04	2.60E+03	4.32E-04	4.63E+03
0.00E+00	6.20E-04	3.23E+03	4.39E-04	4.56E+03	1.59E-03	1.26E+03	4.26E-04	4.69E+03	2.40E-04	8.33E+03
0.00E+00	5.95E-04	3.36E+03	4.22E-04	4.74E+03	1.60E-03	1.25E+03	2.32E-04	8.62E+03	1.30E-04	1.54E+04
0.00E+00	5.65E-04	3.54E+03	4.00E-04	5.00E+03	1.52E-03	1.32E+03	8.42E-05	2.38E+04	4.74E-05	4.22E+04
0.00E+00	5.37E-04	3.72E+03	3.81E-04	5.25E+03	1.34E-03	1.49E+03	4.79E-05	4.18E+04	2.70E-05	7.41E+04
0.00E+00	4.99E-04	4.01E+03	3.53E-04	5.67E+03	1.17E-03	1.71E+03	2.95E-05	6.78E+04	1.66E-05	1.20E+05
0.00E+00	4.59E-04	4.36E+03	3.25E-04	6.15E+03	1.16E-03	1.72E+03	3.43E-05	5.83E+04	1.93E-05	1.04E+05
0.00E+00	8.23E-05	2.43E+04	5.83E-05	3.43E+04	9.31E-04	2.15E+03	1.45E-05	1.38E+05	8.14E-06	2.46E+05
0.00E+00	2.60E-05	7.69E+04	1.84E-05	1.09E+05	3.32E-04	6.02E+03	2.21E-05	9.05E+04	1.24E-05	1.61E+05
0.00E+00	4.44E-04	4.50E+03	3.15E-04	6.35E+03	1.17E-03	1.71E+03	1.75E-04	1.14E+04	9.84E-05	2.03E+04
0.00E+00	3.74E-04	5.35E+03	2.65E-04	7.55E+03	1.24E-03	1.61E+03	7.58E-05	2.64E+04	4.26E-05	4.69E+04
0.00E+00	3.17E-04	6.31E+03	2.25E-04	8.89E+03	1.30E-03	1.54E+03	5.52E-05	3.62E+04	3.11E-05	6.43E+04
0.00E+00	1.27E-05	1.57E+05	9.00E-06	2.22E+05	2.29E-04	8.73E+03	3.52E-05	5.68E+04	1.98E-05	1.01E+05
0.00E+00	1.69E-04	1.18E+04	1.20E-04	1.67E+04	1.41E-03	1.42E+03	3.90E-05	5.13E+04	2.19E-05	9.13E+04
0.00E+00	5.86E-05	3.41E+04	4.15E-05	4.82E+04	1.56E-03	1.28E+03	2.78E-03	7.19E+02	1.56E-03	1.28E+03
0.00E+00	8.55E-05	2.34E+04	6.06E-05	3.30E+04	1.55E-03	1.29E+03	2.77E-03	7.22E+02	1.56E-03	1.28E+03
0.00E+00	1.19E-04	1.68E+04	8.40E-05	2.38E+04	1.53E-03	1.31E+03	2.85E-03	7.02E+02	1.61E-03	1.24E+03
0.00E+00	4.39E-04	4.56E+03	3.11E-04	6.43E+03	1.58E-03	1.27E+03	5.79E-04	3.45E+03	3.26E-04	6.13E+03
0.00E+00	3.76E-04	5.32E+03	2.67E-04	7.49E+03	1.56E-03	1.28E+03	5.70E-04	3.51E+03	3.21E-04	6.23E+03
0.00E+00	3.43E-04	5.83E+03	2.43E-04	8.23E+03	1.56E-03	1.28E+03	7.33E-04	2.73E+03	4.12E-04	4.85E+03
0.00E+00	2.78E-04	7.19E+03	1.97E-04	1.02E+04	1.59E-03	1.26E+03	8.30E-04	2.41E+03	4.67E-04	4.28E+03
0.00E+00	2.42E-04	8.26E+03	1.71E-04	1.17E+04	1.59E-03	1.26E+03	9.89E-04	2.02E+03	5.56E-04	3.60E+03
0.00E+00	1.76E-04	1.14E+04	1.25E-04	1.60E+04	1.58E-03	1.27E+03	1.29E-03	1.55E+03	7.24E-04	2.76E+03
0.00E+00	1.73E-04	1.16E+04	1.23E-04	1.63E+04	1.58E-03	1.27E+03	1.64E-03	1.22E+03	9.22E-04	2.17E+03
0.00E+00	1.61E-04	1.24E+04	1.14E-04	1.75E+04	1.59E-03	1.26E+03	1.93E-03	1.04E+03	1.08E-03	1.85E+03
0.00E+00	1.99E-04	1.01E+04	1.41E-04	1.42E+04	1.57E-03	1.27E+03	2.26E-03	8.85E+02	1.27E-03	1.57E+03
0.00E+00	2.08E-04	9.62E+03	1.48E-04	1.35E+04	1.54E-03	1.30E+03	2.46E-03	8.13E+02	1.38E-03	1.45E+03
0.00E+00	3.11E-04	6.43E+03	2.20E-04	9.09E+03	1.56E-03	1.28E+03	2.30E-03	8.70E+02	1.29E-03	1.55E+03
0.00E+00	2.50E-04	8.00E+03	1.77E-04	1.13E+04	1.46E-03	1.37E+03	2.81E-03	7.12E+02	1.58E-03	1.27E+03
0.00E+00	2.54E-04	7.87E+03	1.80E-04	1.11E+04	1.54E-03	1.30E+03	2.24E-03	8.93E+02	1.26E-03	1.59E+03
0.00E+00	3.08E-04	6.49E+03	2.18E-04	9.17E+03	1.63E-03	1.23E+03	3.03E-03	6.60E+02	1.70E-03	1.18E+03
0.00E+00	1.98E-04	1.01E+04	1.40E-04	1.43E+04	1.57E-03	1.27E+03	2.21E-03	9.05E+02	1.25E-03	1.60E+03
0.00E+00	3.80E-04	5.26E+03	2.69E-04	7.43E+03	1.65E-03	1.21E+03	3.15E-03	6.35E+02	1.77E-03	1.13E+03
0.00E+00	1.46E-04	1.37E+04	1.03E-04	1.94E+04	1.58E-03	1.27E+03	2.17E-03	9.22E+02	1.22E-03	1.64E+03
0.00E+00	4.47E-04	4.47E+03	3.17E-04	6.31E+03	1.58E-03	1.27E+03	3.20E-03	6.25E+02	1.80E-03	1.11E+03
0.00E+00	1.00E-04	2.00E+04	7.11E-05	2.81E+04	1.58E-03	1.27E+03	2.20E-03	9.09E+02	1.24E-03	1.61E+03
0.00E+00	5.36E-04	3.73E+03	3.80E-04	5.26E+03	1.48E-03	1.35E+03	3.19E-03	6.27E+02	1.79E-03	1.12E+03
0.00E+00	6.69E-05	2.99E+04	4.74E-05	4.22E+04	1.56E-03	1.28E+03	2.22E-03	9.01E+02	1.25E-03	1.60E+03
0.00E+00	5.93E-04	3.37E+03	4.20E-04	4.76E+03	1.40E-03	1.43E+03	3.11E-03	6.43E+02	1.75E-03	1.14E+03
0.00E+00	6.02E-04	3.32E+03	4.26E-04	4.69E+03	1.41E-03	1.42E+03	3.09E-03	6.47E+02	1.74E-03	1.15E+03
0.00E+00	5.96E-04	3.36E+03	4.22E-04	4.74E+03	1.41E-03	1.42E+03	2.99E-03	6.69E+02	1.68E-03	1.19E+03
0.00E+00	5.87E-04	3.41E+03	4.16E-04	4.81E+03	1.42E-03	1.41E+03	3.02E-03	6.62E+02	1.70E-03	1.18E+03
0.00E+00	6.10E-04	3.28E+03	4.32E-04	4.63E+03	1.42E-03	1.41E+03	3.05E-03	6.56E+02	1.71E-03	1.17E+03
0.00E+00	6.27E-04	3.19E+03	4.44E-04	4.50E+03	1.41E-03	1.42E+03	3.03E-03	6.60E+02	1.70E-03	1.18E+03
0.00E+00	6.33E-04	3.16E+03	4.48E-04	4.46E+03	1.42E-03	1.41E+03	3.03E-03	6.60E+02	1.70E-03	1.18E+03
0.00E+00	6.20E-04	3.23E+03	4.39E-04	4.56E+03	1.41E-03	1.42E+03	3.03E-03	6.60E+02	1.71E-03	1.17E+03
0.00E+00	6.38E-04	3.13E+03	4.52E-04	4.42E+03	1.41E-03	1.42E+03	3.02E-03	6.62E+02	1.70E-03	1.18E+03
0.00E+00	6.39E-04	3.13E+03	4.53E-04	4.42E+03	1.39E-03	1.44E+03	3.05E-03	6.56E+02	1.72E-03	1.16E+03
0.00E+00	6.20E-04	3.23E+03	4.39E-04	4.56E+03	1.40E-03	1.43E+03	3.07E-03	6.51E+02	1.73E-03	1.16E+03
0.00E+00	6.42E-04	3.12E+03	4.55E-04	4.40E+03	1.40E-03	1.43E+03	3.07E-03	6.51E+02	1.73E-03	1.16E+03
0.00E+00	6.43E-04	3.11E+03	4.55E-04	4.40E+03	1.40E-03	1.43E+03	3.11E-03	6.43E+02	1.75E-03	1.14E+03
0.00E+00	6.43E-04	3.11E+03	4.56E-04	4.39E+03	1.40E-03	1.43E+03	3.13E-03	6.39E+02	1.76E-03	1.14E+03
0.00E+00	6.42E-04	3.12E+03	4.55E-04	4.40E+03	1.40E-03	1.43E+03	3.13E-03	6.39E+02	1.76E-03	1.14E+03
0.00E+00	6.42E-04	3.12E+03	4.55E-04	4.40E+03	1.39E-03	1.44E+03	3.10E-03	6.45E+02	1.74E-03	1.15E+03
0.00E+00	6.43E-04	3.11E+03	4.56E-04	4.39E+03	1.41E-03	1.42E+03	3.17E-03	6.31E+02	1.78E-03	1.12E+03
0		3110		4386		1212		625		1111

Appendix G

AUSPLUME Modelling Results and Spreadsheets for Stockpile Zone Calculations

Zone 1 Daytime Emissions

40913 Macdonaldtown Stockpile Zone Odour Sources

Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

40913 Macdonaldtown Stockpile Zone Odour Sources

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VFZ1AO

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332359	6247736	18m	32m	25m	-15deg	4m	20m

(Constant) emission rate = 1.00E+00 OUV/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Stockpile Zone Odour Sources

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332279	6247616	17.5	1.5	29	332421	6247672	17.5	1.5
2	332277	6247625	17.5	1.5	30	332442	6247701	17.5	1.5
3	332276	6247638	17.5	1.5	31	332421	6247680	17.5	1.5
4	332274	6247650	17.5	1.5	32	332454	6247709	17.5	1.5
5	332275	6247664	17.5	1.5	33	332420	6247687	17.5	1.5
6	332273	6247674	17.5	1.5	34	332467	6247717	17.5	1.5
7	332272	6247688	17.5	1.5	35	332420	6247695	17.5	1.5
8	332269	6247701	17.5	1.5	36	332479	6247727	17.5	1.5
9	332343	6247692	17.5	1.5	37	332419	6247703	17.5	1.5
10	332343	6247707	17.5	1.5	38	332495	6247735	17.5	1.5
11	332263	6247726	17.5	1.5	39	332419	6247710	17.5	1.5
12	332271	6247726	17.5	1.5	40	332509	6247743	17.5	1.5
13	332279	6247731	17.5	1.5	41	332330	6247537	17.5	1.5
14	332342	6247715	17.5	1.5	42	332338	6247541	17.5	1.5
15	332295	6247740	17.5	1.5	43	332344	6247544	17.5	1.5
16	332432	6247743	17.5	1.5	44	332351	6247547	17.5	1.5
17	332435	6247735	17.5	1.5	45	332359	6247551	17.5	1.5
18	332439	6247729	17.5	1.5	46	332366	6247554	17.5	1.5
19	332358	6247641	17.5	1.5	47	332382	6247560	17.5	1.5
20	332366	6247651	17.5	1.5	48	332390	6247565	17.5	1.5
21	332374	6247654	17.5	1.5	49	332399	6247570	17.5	1.5
22	332381	6247662	17.5	1.5	50	332408	6247574	17.5	1.5
23	332386	6247667	17.5	1.5	51	332417	6247579	17.5	1.5
24	332396	6247677	17.5	1.5	52	332426	6247584	17.5	1.5
25	332405	6247681	17.5	1.5	53	332435	6247588	17.5	1.5
26	332412	6247687	17.5	1.5	54	332424	6247578	17.5	1.5
27	332422	6247688	17.5	1.5	55	332423	6247585	17.5	1.5
28	332428	6247692	17.5	1.5	56	332462	6247601	17.5	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\Odour Emmission Files PTM\Zone1DFu.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VFZ1AO

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR

X (km):	332.119	332.162
Y (km)		
6248.028	3.75E-04 06,21/08/08	4.08E-04 06,21/08/08
6247.977	4.24E-04 07,09/09/07	4.62E-04 06,21/08/08
6247.926	4.07E-04 07,09/09/07	5.14E-04 07,09/09/07
6247.875	4.96E-04 07,08/09/07	4.97E-04 07,08/09/07
6247.822	4.99E-04 17,19/05/08	5.92E-04 07,08/09/07
6247.768	5.52E-04 06,26/01/07	6.18E-04 06,26/01/07
6247.712	5.54E-04 06,28/02/07	6.16E-04 18,24/08/07
6247.660	5.31E-04 07,19/03/08	5.87E-04 07,19/03/08
6247.604	4.25E-04 06,19/03/07	5.37E-04 06,19/03/07
6247.550	4.46E-04 06,19/03/07	4.94E-04 06,25/12/08
6247.493	3.94E-04 06,25/12/08	4.32E-04 07,25/05/08

X (km):	332.202	332.243
Y (km)		
6248.028	4.18E-04 08,16/05/08	4.73E-04 08,16/05/08
6247.977	5.01E-04 06,21/08/08	5.32E-04 08,16/05/08
6247.926	5.64E-04 07,09/09/07	5.96E-04 06,21/08/08
6247.875	5.63E-04 07,09/09/07	6.40E-04 07,09/09/07
6247.822	6.41E-04 07,08/09/07	5.53E-04 07,08/09/07
6247.768	6.40E-04 06,26/01/07	5.41E-04 06,26/01/07
6247.712	6.34E-04 06,02/11/08	5.64E-04 06,02/11/08
6247.660	5.68E-04 07,19/03/08	6.16E-04 06,19/03/07
6247.604	5.97E-04 06,19/03/08	6.25E-04 07,25/05/08
6247.550	5.36E-04 07,25/05/08	5.76E-04 06,10/11/08
6247.493	4.62E-04 06,10/11/08	4.97E-04 06,13/12/08

X (km):	332.285	332.326
Y (km)		
6248.028	4.77E-04 08,19/05/07	4.84E-04 08,30/06/08
6247.977	5.74E-04 08,19/05/07	5.32E-04 08,30/06/08
6247.926	6.34E-04 08,16/05/08	5.74E-04 08,19/05/07
6247.875	5.83E-04 06,21/08/08	6.70E-04 10,08/11/07
6247.822	5.46E-04 07,25/12/08	6.83E-04 10,08/09/07
6247.768	6.15E-04 09,02/08/07	5.71E-04 10,26/09/07
6247.712	5.15E-04 15,05/05/07	6.68E-04 15,05/05/07
6247.660	6.98E-04 10,03/06/08	6.19E-04 10,03/06/08
6247.604	6.40E-04 06,29/01/08	6.22E-04 07,05/05/07
6247.550	6.06E-04 06,07/12/08	6.20E-04 06,19/10/08
6247.493	5.23E-04 06,23/01/07	5.38E-04 07,03/06/08

X (km):	332.370	332.411
Y (km)		
6248.028	5.08E-04 06,22/03/07	5.09E-04 08,02/08/07
6247.977	5.87E-04 06,22/03/07	5.76E-04 08,02/08/07
6247.926	6.25E-04 06,22/03/07	5.83E-04 08,02/08/07
6247.875	6.04E-04 10,08/11/07	5.12E-04 06,04/02/07
6247.822	7.08E-04 07,29/01/08	6.93E-04 12,04/07/08
6247.768	2.06E-05 12,09/04/08	4.96E-04 11,05/04/08
6247.712	4.72E-04 11,18/04/07	6.68E-04 07,26/12/08
6247.660	7.24E-04 10,06/05/08	7.35E-04 09,26/10/07
6247.604	6.19E-04 10,06/05/08	6.13E-04 07,01/07/08

6247.550	6.26E-04 06,28/01/07	6.22E-04 15,14/06/07
6247.493	5.45E-04 06,28/01/07	5.41E-04 17,19/07/08

X (km):	332.452	332.493
Y (km)		
6248.028	4.57E-04 06,04/02/07	4.78E-04 06,04/02/07
6247.977	5.67E-04 06,04/02/07	5.40E-04 08,20/07/08
6247.926	6.37E-04 08,20/07/08	6.16E-04 06,25/10/07
6247.875	6.05E-04 06,25/10/07	6.41E-04 06,26/10/08
6247.822	6.64E-04 09,02/06/08	6.54E-04 09,02/06/08
6247.768	6.88E-04 08,27/12/07	7.10E-04 12,02/06/08
6247.712	6.50E-04 09,01/07/08	6.30E-04 11,02/06/08
6247.660	6.68E-04 08,02/11/07	6.17E-04 07,13/02/07
6247.604	6.37E-04 06,18/03/08	6.35E-04 07,12/03/08
6247.550	6.09E-04 06,17/02/07	5.82E-04 06,27/12/07
6247.493	5.26E-04 07,01/07/08	5.01E-04 07,02/08/07

X (km):	332.533
Y (km)	
6248.028	4.39E-04 06,25/10/07
6247.977	5.15E-04 06,25/10/07
6247.926	5.82E-04 06,28/02/08
6247.875	6.28E-04 06,22/04/07
6247.822	6.41E-04 07,01/05/08
6247.768	6.33E-04 07,15/02/07
6247.712	6.38E-04 07,13/05/08
6247.660	6.39E-04 06,21/03/07
6247.604	6.07E-04 06,11/10/07
6247.550	5.46E-04 07,25/08/07
6247.493	4.72E-04 06,27/12/07

At the discrete receptors:

1: 6.32E-04 @Hr06,15/01/07	29: 7.30E-04 @Hr09,26/10/07
2: 6.36E-04 @Hr06,15/01/07	30: 7.16E-04 @Hr08,02/11/07
3: 6.21E-04 @Hr10,03/06/08	31: 6.97E-04 @Hr09,26/10/07
4: 6.46E-04 @Hr10,03/06/08	32: 6.60E-04 @Hr08,02/11/07
5: 6.66E-04 @Hr10,03/06/08	33: 6.92E-04 @Hr08,26/10/08
6: 6.49E-04 @Hr10,03/06/08	34: 6.45E-04 @Hr11,02/06/08
7: 5.93E-04 @Hr10,03/06/08	35: 7.12E-04 @Hr08,15/03/08
8: 4.89E-04 @Hr10,03/06/08	36: 7.17E-04 @Hr11,02/06/08
9: 7.20E-04 @Hr10,04/04/07	37: 7.20E-04 @Hr07,26/12/08
10: 6.43E-04 @Hr10,04/04/07	38: 7.05E-04 @Hr11,02/06/08
11: 5.26E-04 @Hr10,16/12/07	39: 7.17E-04 @Hr07,26/12/08
12: 5.35E-04 @Hr10,16/12/07	40: 6.57E-04 @Hr11,02/06/08
13: 5.30E-04 @Hr10,16/12/07	41: 6.08E-04 @Hr07,03/06/08
14: 5.68E-04 @Hr15,05/05/07	42: 6.15E-04 @Hr08,25/06/07
15: 5.52E-04 @Hr13,27/05/08	43: 6.20E-04 @Hr07,17/02/07
16: 7.07E-04 @Hr07,21/12/08	44: 6.23E-04 @Hr06,16/01/07
17: 7.20E-04 @Hr13,25/05/08	45: 6.30E-04 @Hr06,16/01/07
18: 7.19E-04 @Hr13,25/05/08	46: 6.33E-04 @Hr06,28/01/07
19: 6.87E-04 @Hr10,06/05/08	47: 6.37E-04 @Hr07,12/06/08
20: 7.30E-04 @Hr10,06/05/08	48: 6.40E-04 @Hr06,11/02/08
21: 7.46E-04 @Hr10,06/05/08	49: 6.42E-04 @Hr17,19/07/08
22: 7.31E-04 @Hr10,06/05/08	50: 6.43E-04 @Hr15,14/06/07
23: 6.95E-04 @Hr10,06/05/08	51: 6.40E-04 @Hr06,03/10/07
24: 7.00E-04 @Hr07,21/01/07	52: 6.43E-04 @Hr07,01/07/08
25: 7.00E-04 @Hr15,03/06/07	53: 6.44E-04 @Hr07,05/10/07
26: 7.05E-04 @Hr07,11/10/07	54: 6.43E-04 @Hr07,01/07/08
27: 6.91E-04 @Hr08,26/10/08	55: 6.44E-04 @Hr07,01/07/08
28: 6.84E-04 @Hr07,26/12/08	56: 6.43E-04 @Hr06,19/02/07

Zone 2 Daytime Emissions

40913 Macdonaldtown Fugitive Stockpile Emissions Zone 2 Daytime

Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

40913 Macdonaldtown Fugitive Stockpile Emissions Zone 2 Daytime

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VFZ2AO

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332359	6247736	18m	32m	25m	-15deg	4m	20m

(Constant) emission rate = 1.00E+00 OUV/second per square metre

Hourly multiplicative factors will be used with this emission factor.

No gravitational settling or scavenging.

1

40913 Macdonaldtown Fugitive Stockpile Emissions Zone 2 Daytime

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332279	6247616	17.5	1.5	29	332421	6247672	17.5	1.5
2	332277	6247625	17.5	1.5	30	332442	6247701	17.5	1.5
3	332276	6247638	17.5	1.5	31	332421	6247680	17.5	1.5
4	332274	6247650	17.5	1.5	32	332454	6247709	17.5	1.5
5	332275	6247664	17.5	1.5	33	332420	6247687	17.5	1.5
6	332273	6247674	17.5	1.5	34	332467	6247717	17.5	1.5
7	332272	6247688	17.5	1.5	35	332420	6247695	17.5	1.5
8	332269	6247701	17.5	1.5	36	332479	6247727	17.5	1.5
9	332343	6247692	17.5	1.5	37	332419	6247703	17.5	1.5
10	332343	6247707	17.5	1.5	38	332495	6247735	17.5	1.5
11	332263	6247726	17.5	1.5	39	332419	6247710	17.5	1.5
12	332271	6247726	17.5	1.5	40	332509	6247743	17.5	1.5
13	332279	6247731	17.5	1.5	41	332330	6247537	17.5	1.5
14	332342	6247715	17.5	1.5	42	332338	6247541	17.5	1.5
15	332295	6247740	17.5	1.5	43	332344	6247544	17.5	1.5
16	332432	6247743	17.5	1.5	44	332351	6247547	17.5	1.5
17	332435	6247735	17.5	1.5	45	332359	6247551	17.5	1.5
18	332439	6247729	17.5	1.5	46	332366	6247554	17.5	1.5
19	332358	6247641	17.5	1.5	47	332382	6247560	17.5	1.5
20	332366	6247651	17.5	1.5	48	332390	6247565	17.5	1.5
21	332374	6247654	17.5	1.5	49	332399	6247570	17.5	1.5
22	332381	6247662	17.5	1.5	50	332408	6247574	17.5	1.5
23	332386	6247667	17.5	1.5	51	332417	6247579	17.5	1.5
24	332396	6247677	17.5	1.5	52	332426	6247584	17.5	1.5
25	332405	6247681	17.5	1.5	53	332435	6247588	17.5	1.5
26	332412	6247687	17.5	1.5	54	332424	6247578	17.5	1.5
27	332422	6247688	17.5	1.5	55	332423	6247585	17.5	1.5
28	332428	6247692	17.5	1.5	56	332462	6247601	17.5	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying factors entered via the input file:
C:\Users\sdorairaj\Ausplume\Odour Emmission Files PTM\Zone2DFu.csv
For each stack source, hourly values within this file will be added to each declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable,Emissions,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VFZ2AO

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR

X (km):	332.119	332.162
Y (km)		
6248.028	2.66E-04 06,21/08/08	2.89E-04 06,21/08/08
6247.977	3.00E-04 07,09/09/07	3.27E-04 06,21/08/08
6247.926	2.89E-04 07,09/09/07	3.64E-04 07,09/09/07
6247.875	3.51E-04 07,08/09/07	3.52E-04 07,08/09/07
6247.822	3.54E-04 17,19/05/08	4.19E-04 07,08/09/07
6247.768	3.91E-04 06,26/01/07	4.38E-04 06,26/01/07
6247.712	3.92E-04 06,28/02/07	4.37E-04 18,24/08/07
6247.660	3.76E-04 07,19/03/08	4.16E-04 07,19/03/08
6247.604	3.01E-04 06,19/03/07	3.81E-04 06,19/03/07
6247.550	3.16E-04 06,19/03/07	3.50E-04 06,25/12/08
6247.493	2.79E-04 06,25/12/08	3.06E-04 07,25/05/08

X (km):	332.202	332.243
Y (km)		
6248.028	2.96E-04 08,16/05/08	3.35E-04 08,16/05/08
6247.977	3.55E-04 06,21/08/08	3.77E-04 08,16/05/08
6247.926	4.00E-04 07,09/09/07	4.22E-04 06,21/08/08
6247.875	3.99E-04 07,09/09/07	4.53E-04 07,09/09/07
6247.822	4.54E-04 07,08/09/07	3.92E-04 07,08/09/07
6247.768	4.53E-04 06,26/01/07	3.83E-04 06,26/01/07
6247.712	4.49E-04 06,02/11/08	3.99E-04 06,02/11/08
6247.660	4.02E-04 07,19/03/08	4.36E-04 06,19/03/07
6247.604	4.23E-04 06,19/03/08	4.42E-04 07,25/05/08
6247.550	3.79E-04 07,25/05/08	4.08E-04 06,10/11/08
6247.493	3.27E-04 06,10/11/08	3.52E-04 06,13/12/08

X (km):	332.285	332.326
Y (km)		
6248.028	3.38E-04 08,19/05/07	3.43E-04 08,30/06/08
6247.977	4.07E-04 08,19/05/07	3.77E-04 08,30/06/08
6247.926	4.49E-04 08,16/05/08	4.07E-04 08,19/05/07
6247.875	4.13E-04 06,21/08/08	4.75E-04 10,08/11/07
6247.822	3.87E-04 07,25/12/08	4.84E-04 10,08/09/07
6247.768	4.35E-04 09,02/08/07	4.05E-04 10,26/09/07
6247.712	3.65E-04 15,05/05/07	4.73E-04 15,05/05/07
6247.660	4.95E-04 10,03/06/08	4.38E-04 10,03/06/08
6247.604	4.53E-04 06,29/01/08	4.41E-04 07,05/05/07
6247.550	4.29E-04 06,07/12/08	4.39E-04 06,19/10/08
6247.493	3.71E-04 06,23/01/07	3.81E-04 07,03/06/08

X (km):	332.370	332.411
Y (km)		
6248.028	3.60E-04 06,22/03/07	3.61E-04 08,02/08/07
6247.977	4.15E-04 06,22/03/07	4.08E-04 08,02/08/07
6247.926	4.42E-04 06,22/03/07	4.13E-04 08,02/08/07
6247.875	4.28E-04 10,08/11/07	3.63E-04 06,04/02/07
6247.822	5.02E-04 07,29/01/08	4.91E-04 12,04/07/08
6247.768	1.46E-05 12,09/04/08	3.51E-04 11,05/04/08
6247.712	3.34E-04 11,18/04/07	4.73E-04 07,26/12/08
6247.660	5.13E-04 10,06/05/08	5.21E-04 09,26/10/07

6247.604	4.38E-04 10,06/05/08	4.34E-04 07,01/07/08
6247.550	4.44E-04 06,28/01/07	4.40E-04 15,14/06/07
6247.493	3.86E-04 06,28/01/07	3.83E-04 17,19/07/08

X (km):	332.452	332.493
Y (km)		
6248.028	3.24E-04 06,04/02/07	3.38E-04 06,04/02/07
6247.977	4.02E-04 06,04/02/07	3.82E-04 08,20/07/08
6247.926	4.51E-04 08,20/07/08	4.37E-04 06,25/10/07
6247.875	4.29E-04 06,25/10/07	4.54E-04 06,26/10/08
6247.822	4.70E-04 09,02/06/08	4.63E-04 09,02/06/08
6247.768	4.87E-04 08,27/12/07	5.03E-04 12,02/06/08
6247.712	4.60E-04 09,01/07/08	4.46E-04 11,02/06/08
6247.660	4.73E-04 08,02/11/07	4.37E-04 07,13/02/07
6247.604	4.51E-04 06,18/03/08	4.50E-04 07,12/03/08
6247.550	4.31E-04 06,17/02/07	4.12E-04 06,27/12/07
6247.493	3.72E-04 07,01/07/08	3.55E-04 07,02/08/07

X (km):	332.533
Y (km)	
6248.028	3.11E-04 06,25/10/07
6247.977	3.65E-04 06,25/10/07
6247.926	4.12E-04 06,28/02/08
6247.875	4.45E-04 06,22/04/07
6247.822	4.54E-04 07,01/05/08
6247.768	4.48E-04 07,15/02/07
6247.712	4.52E-04 07,13/05/08
6247.660	4.53E-04 06,21/03/07
6247.604	4.30E-04 06,11/10/07
6247.550	3.87E-04 07,25/08/07
6247.493	3.34E-04 06,27/12/07

At the discrete receptors:

1: 4.47E-04 @Hr06,15/01/07	29: 5.17E-04 @Hr09,26/10/07
2: 4.50E-04 @Hr06,15/01/07	30: 5.07E-04 @Hr08,02/11/07
3: 4.40E-04 @Hr10,03/06/08	31: 4.94E-04 @Hr09,26/10/07
4: 4.58E-04 @Hr10,03/06/08	32: 4.67E-04 @Hr08,02/11/07
5: 4.72E-04 @Hr10,03/06/08	33: 4.90E-04 @Hr08,26/10/08
6: 4.60E-04 @Hr10,03/06/08	34: 4.57E-04 @Hr11,02/06/08
7: 4.20E-04 @Hr10,03/06/08	35: 5.05E-04 @Hr08,15/03/08
8: 3.46E-04 @Hr10,03/06/08	36: 5.08E-04 @Hr11,02/06/08
9: 5.10E-04 @Hr10,04/04/07	37: 5.10E-04 @Hr07,26/12/08
10: 4.55E-04 @Hr10,04/04/07	38: 4.99E-04 @Hr11,02/06/08
11: 3.73E-04 @Hr10,16/12/07	39: 5.08E-04 @Hr07,26/12/08
12: 3.79E-04 @Hr10,16/12/07	40: 4.66E-04 @Hr11,02/06/08
13: 3.75E-04 @Hr10,16/12/07	41: 4.31E-04 @Hr07,03/06/08
14: 4.02E-04 @Hr15,05/05/07	42: 4.36E-04 @Hr08,25/06/07
15: 3.91E-04 @Hr13,27/05/08	43: 4.39E-04 @Hr07,17/02/07
16: 5.00E-04 @Hr07,21/12/08	44: 4.41E-04 @Hr06,16/01/07
17: 5.10E-04 @Hr13,25/05/08	45: 4.46E-04 @Hr06,16/01/07
18: 5.09E-04 @Hr13,25/05/08	46: 4.48E-04 @Hr06,28/01/07
19: 4.87E-04 @Hr10,06/05/08	47: 4.51E-04 @Hr07,12/06/08
20: 5.17E-04 @Hr10,06/05/08	48: 4.54E-04 @Hr06,11/02/08
21: 5.29E-04 @Hr10,06/05/08	49: 4.55E-04 @Hr17,19/07/08
22: 5.17E-04 @Hr10,06/05/08	50: 4.56E-04 @Hr15,14/06/07
23: 4.92E-04 @Hr10,06/05/08	51: 4.53E-04 @Hr06,03/10/07
24: 4.96E-04 @Hr07,21/01/07	52: 4.55E-04 @Hr07,01/07/08
25: 4.96E-04 @Hr15,03/06/07	53: 4.56E-04 @Hr07,05/10/07
26: 5.00E-04 @Hr07,11/10/07	54: 4.55E-04 @Hr07,01/07/08
27: 4.90E-04 @Hr08,26/10/08	55: 4.56E-04 @Hr07,01/07/08
28: 4.85E-04 @Hr07,26/12/08	56: 4.56E-04 @Hr06,19/02/07

Zone 3 Daytime Emissions

40913 Macdonaldtown Fugitive Stockpile Emissions Sources Zone 3 Daytim

Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS

Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

40913 Macdonaldtown Fugitive Stockpile Emissions Sources Zone 3 Daytim

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VFZ3AO

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247710	18m	45m	25m	-15deg	4m	20m

(Constant) emission rate = 1.00E+00 OUV/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Fugitive Stockpile Emissions Sources Zone 3 Daytim

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332279	6247616	17.5	1.5	29	332421	6247672	17.5	1.5
2	332277	6247625	17.5	1.5	30	332442	6247701	17.5	1.5
3	332276	6247638	17.5	1.5	31	332421	6247680	17.5	1.5
4	332274	6247650	17.5	1.5	32	332454	6247709	17.5	1.5
5	332275	6247664	17.5	1.5	33	332420	6247687	17.5	1.5
6	332273	6247674	17.5	1.5	34	332467	6247717	17.5	1.5
7	332272	6247688	17.5	1.5	35	332420	6247695	17.5	1.5
8	332269	6247701	17.5	1.5	36	332479	6247727	17.5	1.5
9	332343	6247692	17.5	1.5	37	332419	6247703	17.5	1.5
10	332343	6247707	17.5	1.5	38	332495	6247735	17.5	1.5
11	332263	6247726	17.5	1.5	39	332419	6247710	17.5	1.5
12	332271	6247726	17.5	1.5	40	332509	6247743	17.5	1.5
13	332279	6247731	17.5	1.5	41	332330	6247537	17.5	1.5
14	332342	6247715	17.5	1.5	42	332338	6247541	17.5	1.5
15	332295	6247740	17.5	1.5	43	332344	6247544	17.5	1.5
16	332432	6247743	17.5	1.5	44	332351	6247547	17.5	1.5
17	332435	6247735	17.5	1.5	45	332359	6247551	17.5	1.5
18	332439	6247729	17.5	1.5	46	332366	6247554	17.5	1.5
19	332358	6247641	17.5	1.5	47	332382	6247560	17.5	1.5
20	332366	6247651	17.5	1.5	48	332390	6247565	17.5	1.5
21	332374	6247654	17.5	1.5	49	332399	6247570	17.5	1.5
22	332381	6247662	17.5	1.5	50	332408	6247574	17.5	1.5
23	332386	6247667	17.5	1.5	51	332417	6247579	17.5	1.5
24	332396	6247677	17.5	1.5	52	332426	6247584	17.5	1.5
25	332405	6247681	17.5	1.5	53	332435	6247588	17.5	1.5
26	332412	6247687	17.5	1.5	54	332424	6247578	17.5	1.5
27	332422	6247688	17.5	1.5	55	332423	6247585	17.5	1.5
28	332428	6247692	17.5	1.5	56	332462	6247601	17.5	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\Odour Emmission Files PTM\Zone3DFu.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions Zone 3 daytime,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VFZ3AO

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR

X (km):	332.119	332.162
Y (km)		
6248.028	8.82E-04 18,18/08/08	8.14E-04 18,18/08/08
6247.977	9.08E-04 07,09/09/07	1.01E-03 06,21/08/08
6247.926	1.02E-03 07,09/09/07	1.13E-03 07,09/09/07
6247.875	9.40E-04 07,08/09/07	1.19E-03 07,09/09/07
6247.822	1.23E-03 07,08/09/07	1.32E-03 07,08/09/07
6247.768	1.29E-03 17,19/05/08	1.39E-03 17,19/05/08
6247.712	1.30E-03 06,05/10/07	1.42E-03 06,05/10/07
6247.660	1.27E-03 06,02/11/08	1.40E-03 06,12/03/08
6247.604	1.10E-03 07,19/03/08	1.22E-03 06,19/03/07
6247.550	1.08E-03 06,19/03/07	1.21E-03 06,19/03/08
6247.493	9.65E-04 06,25/12/08	1.05E-03 07,25/05/08

X (km):	332.202	332.243
Y (km)		
6248.028	9.46E-04 08,16/05/08	9.96E-04 08,19/05/07
6247.977	1.02E-03 08,16/05/08	1.16E-03 08,16/05/08
6247.926	1.23E-03 06,21/08/08	1.28E-03 08,16/05/08
6247.875	1.36E-03 07,09/09/07	1.39E-03 06,21/08/08
6247.822	1.19E-03 07,08/09/07	1.31E-03 07,09/09/07
6247.768	1.31E-03 17,19/05/08	1.11E-03 09,02/08/07
6247.712	1.39E-03 07,09/06/08	1.10E-03 10,16/12/07
6247.660	1.41E-03 07,19/03/08	1.18E-03 10,03/06/08
6247.604	1.41E-03 06,19/03/07	1.40E-03 06,25/12/08
6247.550	1.28E-03 07,25/05/08	1.37E-03 06,10/11/08
6247.493	1.13E-03 06,10/11/08	1.21E-03 06,13/12/08

X (km):	332.285	332.326
Y (km)		
6248.028	8.94E-04 08,19/05/07	1.06E-03 08,30/06/08
6247.977	1.13E-03 08,19/05/07	1.22E-03 08,30/06/08
6247.926	1.35E-03 08,19/05/07	1.33E-03 08,30/06/08
6247.875	1.39E-03 08,16/05/08	1.36E-03 10,08/11/07
6247.822	1.14E-03 10,08/09/07	1.62E-03 10,08/11/07
6247.768	1.53E-03 07,11/11/08	1.30E-03 10,08/09/07
6247.712	1.17E-03 13,27/05/08	6.24E-04 11,29/03/08
6247.660	1.61E-03 10,03/06/08	1.57E-03 11,22/04/07
6247.604	1.31E-03 06,29/01/08	1.25E-03 10,06/05/08
6247.550	1.41E-03 07,11/02/08	1.41E-03 07,03/06/08
6247.493	1.26E-03 07,05/05/07	1.29E-03 07,17/02/07

X (km):	332.370	332.411
Y (km)		
6248.028	1.07E-03 06,22/03/07	1.02E-03 08,02/08/07
6247.977	1.25E-03 06,22/03/07	1.14E-03 08,02/08/07
6247.926	1.39E-03 06,22/03/07	1.23E-03 06,04/02/07
6247.875	1.33E-03 08,02/08/07	1.36E-03 06,04/02/07
6247.822	1.37E-03 11,27/12/07	1.24E-03 12,04/07/08
6247.768	1.03E-03 08,21/12/08	1.56E-03 14,24/05/08
6247.712	1.95E-04 10,03/03/08	1.43E-03 13,25/05/08
6247.660	1.58E-03 14,26/08/07	1.48E-03 08,15/03/08
6247.604	1.54E-03 10,06/05/08	1.47E-03 09,26/10/07

6247.550	1.40E-03 07,12/06/08	1.41E-03 07,01/07/08
6247.493	1.30E-03 07,12/06/08	1.28E-03 06,03/10/07

X (km):	332.452	332.493
Y (km)		
6248.028	9.63E-04 06,04/02/07	9.75E-04 08,20/07/08
6247.977	1.18E-03 06,04/02/07	1.10E-03 08,20/07/08
6247.926	1.35E-03 08,20/07/08	1.29E-03 06,25/10/07
6247.875	1.42E-03 06,25/10/07	1.40E-03 06,28/02/08
6247.822	1.24E-03 06,26/10/08	1.41E-03 06,22/04/07
6247.768	1.60E-03 09,02/06/08	1.39E-03 12,02/06/08
6247.712	1.63E-03 11,02/06/08	1.48E-03 11,02/06/08
6247.660	1.58E-03 08,02/11/07	1.37E-03 08,09/06/08
6247.604	1.37E-03 07,25/08/07	1.41E-03 06,11/10/07
6247.550	1.39E-03 07,25/06/07	1.33E-03 07,04/03/07
6247.493	1.23E-03 06,17/02/07	1.17E-03 06,19/02/07

X (km):	332.533
Y (km)	
6248.028	8.97E-04 06,25/10/07
6247.977	1.05E-03 06,25/10/07
6247.926	1.20E-03 06,28/02/08
6247.875	1.32E-03 06,25/11/07
6247.822	1.41E-03 06,12/11/08
6247.768	1.43E-03 07,14/04/07
6247.712	1.43E-03 06,11/11/07
6247.660	1.42E-03 07,01/06/07
6247.604	1.36E-03 06,13/03/08
6247.550	1.25E-03 07,19/05/07
6247.493	1.09E-03 07,04/03/07

At the discrete receptors:

1: 1.44E-03 @Hr10,03/06/08	29: 1.56E-03 @Hr08,02/11/07
2: 1.52E-03 @Hr10,03/06/08	30: 1.46E-03 @Hr13,25/05/08
3: 1.59E-03 @Hr10,03/06/08	31: 1.54E-03 @Hr08,03/03/07
4: 1.60E-03 @Hr10,03/06/08	32: 1.63E-03 @Hr11,02/06/08
5: 1.52E-03 @Hr10,03/06/08	33: 1.57E-03 @Hr08,10/09/07
6: 1.34E-03 @Hr10,03/06/08	34: 1.65E-03 @Hr11,02/06/08
7: 1.17E-03 @Hr15,05/05/07	35: 1.58E-03 @Hr09,01/07/08
8: 1.16E-03 @Hr08,23/04/08	36: 1.58E-03 @Hr09,13/07/08
9: 9.31E-04 @Hr09,15/02/07	37: 1.58E-03 @Hr09,11/10/07
10: 3.32E-04 @Hr15,05/05/07	38: 1.48E-03 @Hr09,13/07/08
11: 1.17E-03 @Hr13,27/05/08	39: 1.56E-03 @Hr13,25/05/08
12: 1.24E-03 @Hr13,27/05/08	40: 1.40E-03 @Hr07,15/02/07
13: 1.30E-03 @Hr13,27/05/08	41: 1.41E-03 @Hr08,25/06/07
14: 2.29E-04 @Hr11,29/03/08	42: 1.41E-03 @Hr07,17/02/07
15: 1.41E-03 @Hr09,02/08/07	43: 1.42E-03 @Hr06,16/01/07
16: 1.56E-03 @Hr08,27/12/07	44: 1.42E-03 @Hr06,28/01/07
17: 1.55E-03 @Hr07,02/01/08	45: 1.41E-03 @Hr06,28/01/07
18: 1.53E-03 @Hr14,25/05/08	46: 1.42E-03 @Hr07,12/06/08
19: 1.58E-03 @Hr10,06/05/08	47: 1.41E-03 @Hr17,19/07/08
20: 1.56E-03 @Hr14,26/08/07	48: 1.41E-03 @Hr15,14/06/07
21: 1.56E-03 @Hr07,21/01/07	49: 1.39E-03 @Hr07,01/07/08
22: 1.59E-03 @Hr12,18/06/08	50: 1.40E-03 @Hr06,17/03/08
23: 1.59E-03 @Hr15,03/06/07	51: 1.40E-03 @Hr06,17/02/07
24: 1.58E-03 @Hr08,26/10/08	52: 1.40E-03 @Hr07,02/08/07
25: 1.58E-03 @Hr07,26/12/08	53: 1.40E-03 @Hr06,18/03/08
26: 1.59E-03 @Hr08,03/03/07	54: 1.40E-03 @Hr07,02/08/07
27: 1.57E-03 @Hr09,01/07/08	55: 1.39E-03 @Hr07,02/08/07
28: 1.54E-03 @Hr09,01/07/08	56: 1.41E-03 @Hr07,12/03/08

Zone 4 Daytime Emissions

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 4

Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 4

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VFZ4AO

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332294	6247673	18m	45m	25m	-25deg	4m	20m

(Constant) emission rate = 1.00E+00 OUV/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 4

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332279	6247616	17.5	1.5	29	332421	6247672	17.5	1.5
2	332277	6247625	17.5	1.5	30	332442	6247701	17.5	1.5
3	332276	6247638	17.5	1.5	31	332421	6247680	17.5	1.5
4	332274	6247650	17.5	1.5	32	332454	6247709	17.5	1.5
5	332275	6247664	17.5	1.5	33	332420	6247687	17.5	1.5
6	332273	6247674	17.5	1.5	34	332467	6247717	17.5	1.5
7	332272	6247688	17.5	1.5	35	332420	6247695	17.5	1.5
8	332269	6247701	17.5	1.5	36	332479	6247727	17.5	1.5
9	332343	6247692	17.5	1.5	37	332419	6247703	17.5	1.5
10	332343	6247707	17.5	1.5	38	332495	6247735	17.5	1.5
11	332263	6247726	17.5	1.5	39	332419	6247710	17.5	1.5
12	332271	6247726	17.5	1.5	40	332509	6247743	17.5	1.5
13	332279	6247731	17.5	1.5	41	332330	6247537	17.5	1.5
14	332342	6247715	17.5	1.5	42	332338	6247541	17.5	1.5
15	332295	6247740	17.5	1.5	43	332344	6247544	17.5	1.5
16	332432	6247743	17.5	1.5	44	332351	6247547	17.5	1.5
17	332435	6247735	17.5	1.5	45	332359	6247551	17.5	1.5
18	332439	6247729	17.5	1.5	46	332366	6247554	17.5	1.5
19	332358	6247641	17.5	1.5	47	332382	6247560	17.5	1.5
20	332366	6247651	17.5	1.5	48	332390	6247565	17.5	1.5
21	332374	6247654	17.5	1.5	49	332399	6247570	17.5	1.5
22	332381	6247662	17.5	1.5	50	332408	6247574	17.5	1.5
23	332386	6247667	17.5	1.5	51	332417	6247579	17.5	1.5
24	332396	6247677	17.5	1.5	52	332426	6247584	17.5	1.5
25	332405	6247681	17.5	1.5	53	332435	6247588	17.5	1.5
26	332412	6247687	17.5	1.5	54	332424	6247578	17.5	1.5
27	332422	6247688	17.5	1.5	55	332423	6247585	17.5	1.5
28	332428	6247692	17.5	1.5	56	332462	6247601	17.5	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\Odour Emmission Files PTM\Zone4DFu.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions Zone 4 Day,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VFZ4AO

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR

X (km):	332.119	332.162
Y (km)		
6248.028	1.77E-03 08,16/05/08	1.92E-03 08,19/05/07
6247.977	1.93E-03 06,21/08/08	2.23E-03 08,16/05/08
6247.926	2.37E-03 06,21/08/08	2.37E-03 08,16/05/08
6247.875	2.67E-03 07,09/09/07	2.89E-03 06,21/08/08
6247.822	2.51E-03 07,09/09/07	3.10E-03 07,09/09/07
6247.768	3.09E-03 07,08/09/07	2.98E-03 07,08/09/07
6247.712	3.16E-03 06,26/01/07	2.99E-03 06,26/01/07
6247.660	3.16E-03 18,24/08/07	3.00E-03 18,24/08/07
6247.604	2.98E-03 07,19/03/08	2.84E-03 06,19/03/07
6247.550	2.87E-03 06,19/03/07	3.11E-03 06,25/12/08
6247.493	2.57E-03 06,25/12/08	2.80E-03 06,15/01/07

X (km):	332.202	332.243
Y (km)		
6248.028	1.95E-03 08,19/05/07	1.88E-03 08,30/06/08
6247.977	2.35E-03 08,19/05/07	2.09E-03 08,19/05/07
6247.926	2.71E-03 08,16/05/08	2.63E-03 08,19/05/07
6247.875	2.92E-03 08,16/05/08	3.09E-03 08,19/05/07
6247.822	3.11E-03 06,21/08/08	2.89E-03 08,16/05/08
6247.768	2.32E-03 07,09/09/07	2.96E-03 10,08/09/07
6247.712	2.60E-03 09,02/08/07	3.35E-03 09,02/08/07
6247.660	2.60E-03 08,23/04/08	2.80E-03 15,05/05/07
6247.604	3.08E-03 10,03/06/08	3.56E-03 10,03/06/08
6247.550	3.18E-03 06,15/01/07	3.09E-03 06,07/12/08
6247.493	2.95E-03 06,13/12/08	3.06E-03 06,23/01/07

X (km):	332.285	332.326
Y (km)		
6248.028	2.13E-03 08,30/06/08	2.13E-03 06,22/03/07
6247.977	2.50E-03 08,30/06/08	2.51E-03 06,22/03/07
6247.926	2.87E-03 08,30/06/08	2.90E-03 06,22/03/07
6247.875	3.06E-03 08,30/06/08	3.14E-03 08,02/08/07
6247.822	3.33E-03 10,08/11/07	2.62E-03 08,02/08/07
6247.768	3.36E-03 14,13/04/08	3.45E-03 11,27/12/07
6247.712	1.21E-03 10,26/09/07	8.07E-04 08,21/12/08
6247.660	2.05E-03 15,05/05/07	1.82E-03 10,03/03/08
6247.604	3.16E-03 09,30/06/08	3.37E-03 10,06/05/08
6247.550	2.93E-03 08,25/06/07	3.11E-03 10,06/05/08
6247.493	3.09E-03 07,17/02/07	3.08E-03 06,11/02/08

X (km):	332.370	332.411
Y (km)		
6248.028	2.02E-03 08,02/08/07	1.89E-03 06,04/02/07
6247.977	2.29E-03 08,02/08/07	2.33E-03 06,04/02/07
6247.926	2.48E-03 06,04/02/07	2.76E-03 06,04/02/07
6247.875	3.02E-03 06,04/02/07	2.98E-03 08,20/07/08
6247.822	2.90E-03 08,20/07/08	3.14E-03 08,16/08/07
6247.768	3.09E-03 09,19/02/08	3.35E-03 09,02/06/08
6247.712	3.38E-03 11,07/05/07	3.67E-03 12,02/06/08
6247.660	3.50E-03 09,01/07/08	3.27E-03 11,02/06/08
6247.604	3.48E-03 09,26/10/07	3.29E-03 08,02/11/07

6247.550	3.03E-03 06,17/02/07	3.13E-03 06,26/02/08
6247.493	3.04E-03 07,01/07/08	2.94E-03 07,02/08/07

X (km):	332.452	332.493
Y (km)		
6248.028	1.95E-03 06,04/02/07	1.79E-03 08,20/07/08
6247.977	2.25E-03 08,20/07/08	2.11E-03 06,25/10/07
6247.926	2.58E-03 06,25/10/07	2.42E-03 08,16/08/07
6247.875	2.94E-03 08,16/08/07	2.72E-03 06,26/10/08
6247.822	3.07E-03 06,25/11/07	2.97E-03 06,22/04/07
6247.768	3.14E-03 06,12/11/08	3.15E-03 07,01/05/08
6247.712	3.18E-03 12,02/06/08	3.17E-03 07,15/02/07
6247.660	3.03E-03 11,02/06/08	3.16E-03 07,16/08/07
6247.604	3.12E-03 06,11/01/07	3.09E-03 06,26/06/07
6247.550	3.08E-03 07,19/05/07	2.90E-03 07,13/02/07
6247.493	2.79E-03 06,26/02/08	2.59E-03 06,27/01/08

X (km):	332.533
Y (km)	
6248.028	1.73E-03 06,25/10/07
6247.977	1.97E-03 08,16/08/07
6247.926	2.23E-03 06,26/10/08
6247.875	2.49E-03 06,25/11/07
6247.822	2.73E-03 06,11/09/08
6247.768	2.91E-03 08,07/07/08
6247.712	2.98E-03 08,08/08/07
6247.660	2.97E-03 07,23/03/08
6247.604	2.85E-03 06,13/09/07
6247.550	2.64E-03 07,18/08/07
6247.493	2.37E-03 06,11/10/07

At the discrete receptors:

1: 3.38E-03 @Hr11,22/04/07	29: 3.57E-03 @Hr11,02/06/08
2: 3.48E-03 @Hr11,22/04/07	30: 3.37E-03 @Hr09,13/07/08
3: 3.48E-03 @Hr10,04/04/07	31: 3.64E-03 @Hr11,02/06/08
4: 3.22E-03 @Hr15,05/05/07	32: 3.14E-03 @Hr12,02/06/08
5: 2.37E-03 @Hr15,05/05/07	33: 3.62E-03 @Hr11,02/06/08
6: 1.82E-03 @Hr11,29/03/08	34: 3.15E-03 @Hr07,15/02/07
7: 1.57E-03 @Hr11,29/03/08	35: 3.65E-03 @Hr09,13/07/08
8: 2.11E-03 @Hr10,26/09/07	36: 3.20E-03 @Hr06,14/03/08
9: 1.70E-03 @Hr10,20/03/07	37: 3.65E-03 @Hr09,13/07/08
10: 1.83E-03 @Hr11,05/04/08	38: 3.17E-03 @Hr07,14/04/07
11: 3.23E-03 @Hr07,11/11/08	39: 3.66E-03 @Hr12,02/06/08
12: 2.87E-03 @Hr07,25/12/08	40: 3.12E-03 @Hr07,14/04/07
13: 2.77E-03 @Hr10,08/09/07	41: 3.10E-03 @Hr08,03/05/07
14: 1.93E-03 @Hr12,15/07/08	42: 3.07E-03 @Hr06,03/03/07
15: 2.73E-03 @Hr14,13/04/08	43: 3.06E-03 @Hr06,03/10/07
16: 3.26E-03 @Hr09,02/06/08	44: 3.04E-03 @Hr07,01/07/08
17: 3.19E-03 @Hr12,02/06/08	45: 3.03E-03 @Hr06,17/03/08
18: 3.27E-03 @Hr12,02/06/08	46: 3.03E-03 @Hr06,17/02/07
19: 3.51E-03 @Hr08,15/03/08	47: 3.04E-03 @Hr07,25/06/07
20: 3.53E-03 @Hr08,03/03/07	48: 3.04E-03 @Hr06,27/12/07
21: 3.48E-03 @Hr09,01/07/08	49: 3.05E-03 @Hr06,26/02/08
22: 3.45E-03 @Hr09,11/10/07	50: 3.07E-03 @Hr07,12/03/08
23: 3.40E-03 @Hr09,11/10/07	51: 3.09E-03 @Hr08,29/05/07
24: 3.50E-03 @Hr11,02/06/08	52: 3.11E-03 @Hr07,13/07/08
25: 3.66E-03 @Hr11,02/06/08	53: 3.14E-03 @Hr06,03/06/08
26: 3.67E-03 @Hr11,02/06/08	54: 3.13E-03 @Hr07,19/05/07
27: 3.60E-03 @Hr11,02/06/08	55: 3.10E-03 @Hr07,13/07/08
28: 3.55E-03 @Hr09,13/07/08	56: 3.17E-03 @Hr06,11/01/07

Zone 5 Daytime Emissions

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 5 Day

Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 5 Day

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VFZ5AO

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332294	6247673	18m	45m	25m	-25deg	4m	20m

(Constant) emission rate = 1.00E+00 OUV/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 5 Day

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332279	6247616	17.5	1.5	29	332421	6247672	17.5	1.5
2	332277	6247625	17.5	1.5	30	332442	6247701	17.5	1.5
3	332276	6247638	17.5	1.5	31	332421	6247680	17.5	1.5
4	332274	6247650	17.5	1.5	32	332454	6247709	17.5	1.5
5	332275	6247664	17.5	1.5	33	332420	6247687	17.5	1.5
6	332273	6247674	17.5	1.5	34	332467	6247717	17.5	1.5
7	332272	6247688	17.5	1.5	35	332420	6247695	17.5	1.5
8	332269	6247701	17.5	1.5	36	332479	6247727	17.5	1.5
9	332343	6247692	17.5	1.5	37	332419	6247703	17.5	1.5
10	332343	6247707	17.5	1.5	38	332495	6247735	17.5	1.5
11	332263	6247726	17.5	1.5	39	332419	6247710	17.5	1.5
12	332271	6247726	17.5	1.5	40	332509	6247743	17.5	1.5
13	332279	6247731	17.5	1.5	41	332330	6247537	17.5	1.5
14	332342	6247715	17.5	1.5	42	332338	6247541	17.5	1.5
15	332295	6247740	17.5	1.5	43	332344	6247544	17.5	1.5
16	332432	6247743	17.5	1.5	44	332351	6247547	17.5	1.5
17	332435	6247735	17.5	1.5	45	332359	6247551	17.5	1.5
18	332439	6247729	17.5	1.5	46	332366	6247554	17.5	1.5
19	332358	6247641	17.5	1.5	47	332382	6247560	17.5	1.5
20	332366	6247651	17.5	1.5	48	332390	6247565	17.5	1.5
21	332374	6247654	17.5	1.5	49	332399	6247570	17.5	1.5
22	332381	6247662	17.5	1.5	50	332408	6247574	17.5	1.5
23	332386	6247667	17.5	1.5	51	332417	6247579	17.5	1.5
24	332396	6247677	17.5	1.5	52	332426	6247584	17.5	1.5
25	332405	6247681	17.5	1.5	53	332435	6247588	17.5	1.5
26	332412	6247687	17.5	1.5	54	332424	6247578	17.5	1.5
27	332422	6247688	17.5	1.5	55	332423	6247585	17.5	1.5
28	332428	6247692	17.5	1.5	56	332462	6247601	17.5	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\Odour Emmission Files PTM\Zone5DFu.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable,Emissions Zone 5 Day,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VFZ5AO

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR

X (km):	332.119	332.162
Y (km)		
6248.028	9.98E-04 08,16/05/08	1.11E-03 18,01/06/07
6247.977	1.09E-03 06,21/08/08	1.25E-03 08,16/05/08
6247.926	1.34E-03 06,21/08/08	1.34E-03 08,16/05/08
6247.875	1.50E-03 07,09/09/07	1.63E-03 06,21/08/08
6247.822	1.41E-03 07,09/09/07	1.74E-03 07,09/09/07
6247.768	1.74E-03 07,08/09/07	1.68E-03 07,08/09/07
6247.712	1.78E-03 06,26/01/07	1.68E-03 06,26/01/07
6247.660	1.78E-03 18,24/08/07	1.69E-03 18,24/08/07
6247.604	1.68E-03 07,19/03/08	1.60E-03 06,19/03/07
6247.550	1.62E-03 06,19/03/07	1.75E-03 06,25/12/08
6247.493	1.45E-03 06,25/12/08	1.57E-03 06,15/01/07

X (km):	332.202	332.243
Y (km)		
6248.028	1.10E-03 08,19/05/07	1.06E-03 08,30/06/08
6247.977	1.32E-03 08,19/05/07	1.18E-03 08,19/05/07
6247.926	1.53E-03 08,16/05/08	1.48E-03 08,19/05/07
6247.875	1.64E-03 08,16/05/08	1.74E-03 08,19/05/07
6247.822	1.75E-03 06,21/08/08	1.63E-03 08,16/05/08
6247.768	1.31E-03 07,09/09/07	1.67E-03 10,08/09/07
6247.712	1.46E-03 09,02/08/07	1.88E-03 09,02/08/07
6247.660	1.46E-03 08,23/04/08	1.57E-03 15,05/05/07
6247.604	1.73E-03 10,03/06/08	2.01E-03 10,03/06/08
6247.550	1.79E-03 06,15/01/07	1.74E-03 06,07/12/08
6247.493	1.66E-03 06,13/12/08	1.72E-03 06,23/01/07

X (km):	332.285	332.326
Y (km)		
6248.028	1.20E-03 08,30/06/08	1.20E-03 06,22/03/07
6247.977	1.40E-03 08,30/06/08	1.41E-03 06,22/03/07
6247.926	1.62E-03 08,30/06/08	1.63E-03 06,22/03/07
6247.875	1.72E-03 08,30/06/08	1.77E-03 08,02/08/07
6247.822	1.87E-03 10,08/11/07	1.47E-03 08,02/08/07
6247.768	1.89E-03 14,13/04/08	1.94E-03 11,27/12/07
6247.712	6.78E-04 10,26/09/07	4.54E-04 08,21/12/08
6247.660	1.15E-03 15,05/05/07	1.02E-03 10,03/03/08
6247.604	1.78E-03 09,30/06/08	1.90E-03 10,06/05/08
6247.550	1.65E-03 08,25/06/07	1.75E-03 10,06/05/08
6247.493	1.74E-03 07,17/02/07	1.73E-03 06,11/02/08

X (km):	332.370	332.411
Y (km)		
6248.028	1.14E-03 08,02/08/07	1.06E-03 06,04/02/07
6247.977	1.29E-03 08,02/08/07	1.31E-03 06,04/02/07
6247.926	1.40E-03 06,04/02/07	1.55E-03 06,04/02/07
6247.875	1.70E-03 06,04/02/07	1.68E-03 08,20/07/08
6247.822	1.63E-03 08,20/07/08	1.77E-03 08,16/08/07
6247.768	1.74E-03 09,19/02/08	1.88E-03 09,02/06/08
6247.712	1.90E-03 11,07/05/07	2.06E-03 12,02/06/08
6247.660	1.97E-03 09,01/07/08	1.84E-03 11,02/06/08
6247.604	1.96E-03 09,26/10/07	1.85E-03 08,02/11/07

6247.550	1.71E-03 06,17/02/07	1.76E-03 06,26/02/08
6247.493	1.71E-03 07,01/07/08	1.66E-03 07,02/08/07

X (km):	332.452	332.493
Y (km)		
6248.028	1.10E-03 06,04/02/07	1.01E-03 08,20/07/08
6247.977	1.26E-03 08,20/07/08	1.19E-03 06,25/10/07
6247.926	1.45E-03 06,25/10/07	1.36E-03 08,16/08/07
6247.875	1.66E-03 08,16/08/07	1.53E-03 06,26/10/08
6247.822	1.73E-03 06,25/11/07	1.67E-03 06,22/04/07
6247.768	1.76E-03 06,12/11/08	1.77E-03 07,01/05/08
6247.712	1.79E-03 12,02/06/08	1.78E-03 07,15/02/07
6247.660	1.71E-03 11,02/06/08	1.78E-03 07,16/08/07
6247.604	1.76E-03 06,11/01/07	1.74E-03 06,26/06/07
6247.550	1.73E-03 07,19/05/07	1.63E-03 07,13/02/07
6247.493	1.57E-03 06,26/02/08	1.46E-03 06,27/01/08

X (km):	332.533
Y (km)	
6248.028	9.76E-04 06,25/10/07
6247.977	1.11E-03 08,16/08/07
6247.926	1.25E-03 06,26/10/08
6247.875	1.40E-03 06,25/11/07
6247.822	1.53E-03 06,11/09/08
6247.768	1.64E-03 08,07/07/08
6247.712	1.67E-03 08,08/08/07
6247.660	1.67E-03 07,23/03/08
6247.604	1.60E-03 06,13/09/07
6247.550	1.49E-03 07,18/08/07
6247.493	1.33E-03 06,11/10/07

At the discrete receptors:

1: 1.90E-03 @Hr11,22/04/07	29: 2.01E-03 @Hr11,02/06/08
2: 1.96E-03 @Hr11,22/04/07	30: 1.90E-03 @Hr09,13/07/08
3: 1.96E-03 @Hr10,04/04/07	31: 2.05E-03 @Hr11,02/06/08
4: 1.81E-03 @Hr15,05/05/07	32: 1.76E-03 @Hr12,02/06/08
5: 1.34E-03 @Hr15,05/05/07	33: 2.04E-03 @Hr11,02/06/08
6: 1.03E-03 @Hr11,29/03/08	34: 1.77E-03 @Hr07,15/02/07
7: 8.81E-04 @Hr11,29/03/08	35: 2.05E-03 @Hr09,13/07/08
8: 1.19E-03 @Hr10,26/09/07	36: 1.80E-03 @Hr06,14/03/08
9: 9.56E-04 @Hr10,20/03/07	37: 2.05E-03 @Hr09,13/07/08
10: 1.03E-03 @Hr11,05/04/08	38: 1.79E-03 @Hr07,14/04/07
11: 1.82E-03 @Hr07,11/11/08	39: 2.06E-03 @Hr12,02/06/08
12: 1.61E-03 @Hr07,25/12/08	40: 1.76E-03 @Hr07,14/04/07
13: 1.56E-03 @Hr10,08/09/07	41: 1.74E-03 @Hr08,03/05/07
14: 1.09E-03 @Hr12,15/07/08	42: 1.73E-03 @Hr06,03/03/07
15: 1.53E-03 @Hr14,13/04/08	43: 1.72E-03 @Hr06,03/10/07
16: 1.84E-03 @Hr09,02/06/08	44: 1.71E-03 @Hr07,01/07/08
17: 1.79E-03 @Hr12,02/06/08	45: 1.70E-03 @Hr06,17/03/08
18: 1.84E-03 @Hr12,02/06/08	46: 1.70E-03 @Hr06,17/02/07
19: 1.98E-03 @Hr08,15/03/08	47: 1.71E-03 @Hr07,25/06/07
20: 1.98E-03 @Hr08,03/03/07	48: 1.71E-03 @Hr06,27/12/07
21: 1.96E-03 @Hr09,01/07/08	49: 1.72E-03 @Hr06,26/02/08
22: 1.94E-03 @Hr09,11/10/07	50: 1.73E-03 @Hr07,12/03/08
23: 1.91E-03 @Hr09,11/10/07	51: 1.74E-03 @Hr08,29/05/07
24: 1.97E-03 @Hr11,02/06/08	52: 1.75E-03 @Hr07,13/07/08
25: 2.06E-03 @Hr11,02/06/08	53: 1.76E-03 @Hr06,03/06/08
26: 2.06E-03 @Hr11,02/06/08	54: 1.76E-03 @Hr07,19/05/07
27: 2.03E-03 @Hr11,02/06/08	55: 1.74E-03 @Hr07,13/07/08
28: 2.00E-03 @Hr09,13/07/08	56: 1.78E-03 @Hr06,11/01/07

Zone 1 Nighttime Emissions

40913 Macdonaldtown Fugitive Stockpile Emissions Zone 1 Night

Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

40913 Macdonaldtown Fugitive Stockpile Emissions Zone 1 Night

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VFZ1AO

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332359	6247736	18m	32m	25m	-15deg	4m	20m

(Constant) emission rate = 1.00E+00 OUV/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Fugitive Stockpile Emissions Zone 1 Night

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332279	6247616	17.5	1.5	29	332421	6247672	17.5	1.5
2	332277	6247625	17.5	1.5	30	332442	6247701	17.5	1.5
3	332276	6247638	17.5	1.5	31	332421	6247680	17.5	1.5
4	332274	6247650	17.5	1.5	32	332454	6247709	17.5	1.5
5	332275	6247664	17.5	1.5	33	332420	6247687	17.5	1.5
6	332273	6247674	17.5	1.5	34	332467	6247717	17.5	1.5
7	332272	6247688	17.5	1.5	35	332420	6247695	17.5	1.5
8	332269	6247701	17.5	1.5	36	332479	6247727	17.5	1.5
9	332343	6247692	17.5	1.5	37	332419	6247703	17.5	1.5
10	332343	6247707	17.5	1.5	38	332495	6247735	17.5	1.5
11	332263	6247726	17.5	1.5	39	332419	6247710	17.5	1.5
12	332271	6247726	17.5	1.5	40	332509	6247743	17.5	1.5
13	332279	6247731	17.5	1.5	41	332330	6247537	17.5	1.5
14	332342	6247715	17.5	1.5	42	332338	6247541	17.5	1.5
15	332295	6247740	17.5	1.5	43	332344	6247544	17.5	1.5
16	332432	6247743	17.5	1.5	44	332351	6247547	17.5	1.5
17	332435	6247735	17.5	1.5	45	332359	6247551	17.5	1.5
18	332439	6247729	17.5	1.5	46	332366	6247554	17.5	1.5
19	332358	6247641	17.5	1.5	47	332382	6247560	17.5	1.5
20	332366	6247651	17.5	1.5	48	332390	6247565	17.5	1.5
21	332374	6247654	17.5	1.5	49	332399	6247570	17.5	1.5
22	332381	6247662	17.5	1.5	50	332408	6247574	17.5	1.5
23	332386	6247667	17.5	1.5	51	332417	6247579	17.5	1.5
24	332396	6247677	17.5	1.5	52	332426	6247584	17.5	1.5
25	332405	6247681	17.5	1.5	53	332435	6247588	17.5	1.5
26	332412	6247687	17.5	1.5	54	332424	6247578	17.5	1.5
27	332422	6247688	17.5	1.5	55	332423	6247585	17.5	1.5
28	332428	6247692	17.5	1.5	56	332462	6247601	17.5	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\Odour Emmission Files PTM\Zone1NFu.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable Emissions Zone 1 night,,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VFZ1AO

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR

X (km):	332.119	332.162
Y (km)		
6248.028	4.12E-04 05,18/04/08	3.90E-04 20,22/10/07
6247.977	4.25E-04 05,06/02/07	4.61E-04 05,11/10/07
6247.926	4.52E-04 23,02/06/08	5.20E-04 05,06/02/07
6247.875	4.96E-04 23,02/06/08	5.73E-04 23,02/06/08
6247.822	5.22E-04 05,26/01/07	5.43E-04 05,26/01/07
6247.768	5.24E-04 05,29/01/08	5.74E-04 05,29/01/08
6247.712	5.53E-04 02,24/03/08	6.16E-04 02,24/03/08
6247.660	5.31E-04 05,25/12/08	5.87E-04 05,25/12/08
6247.604	4.93E-04 02,04/02/08	5.49E-04 05,01/01/08
6247.550	4.44E-04 05,01/01/08	4.94E-04 24,25/10/07
6247.493	4.05E-04 04,15/01/07	4.29E-04 05,15/01/07

X (km):	332.202	332.243
Y (km)		
6248.028	4.43E-04 05,29/11/08	4.50E-04 05,29/11/08
6247.977	4.62E-04 05,29/11/08	5.46E-04 05,29/11/08
6247.926	5.69E-04 05,11/10/07	5.64E-04 05,29/11/08
6247.875	5.78E-04 23,02/06/08	6.40E-04 05,11/10/07
6247.822	5.72E-04 23,02/06/08	6.01E-04 23,02/06/08
6247.768	6.01E-04 05,26/01/07	5.25E-04 05,26/01/07
6247.712	6.28E-04 02,24/03/08	5.52E-04 05,25/12/08
6247.660	6.30E-04 02,04/02/08	6.27E-04 05,01/01/08
6247.604	6.01E-04 05,26/10/07	6.34E-04 05,23/01/07
6247.550	5.38E-04 05,23/01/07	5.75E-04 05,18/11/07
6247.493	4.65E-04 05,18/11/07	4.95E-04 05,11/01/07

X (km):	332.285	332.326
Y (km)		
6248.028	3.58E-04 05,29/11/08	2.82E-04 21,21/03/07
6247.977	4.89E-04 05,29/11/08	3.25E-04 05,04/01/07
6247.926	6.18E-04 05,29/11/08	3.95E-04 05,29/11/08
6247.875	5.81E-04 05,29/11/08	4.51E-04 05,29/11/08
6247.822	4.20E-04 05,06/02/07	1.84E-04 05,29/11/08
6247.768	2.32E-04 05,26/01/07	8.15E-06 05,26/01/07
6247.712	2.91E-04 05,25/12/08	4.22E-05 05,26/10/07
6247.660	5.23E-04 05,23/01/07	3.61E-04 05,11/01/07
6247.604	6.34E-04 05,11/01/07	6.21E-04 03,20/07/08
6247.550	6.02E-04 02,31/08/08	6.22E-04 05,27/01/08
6247.493	5.23E-04 03,20/07/08	5.29E-04 05,27/01/08

X (km):	332.370	332.411
Y (km)		
6248.028	4.19E-04 05,02/11/07	5.11E-04 05,02/11/07
6247.977	4.84E-04 05,02/11/07	5.95E-04 05,02/11/07
6247.926	5.15E-04 05,02/11/07	6.39E-04 24,02/06/08
6247.875	4.03E-04 05,02/11/07	5.29E-04 23,15/11/08
6247.822	6.76E-05 05,02/11/07	1.66E-04 01,05/03/07
6247.768	4.44E-11 23,15/11/08	4.08E-06 05,30/11/07
6247.712	1.56E-06 05,18/11/08	2.51E-05 05,11/11/08
6247.660	2.69E-04 05,18/11/08	3.41E-04 05,19/11/08
6247.604	6.04E-04 05,18/11/08	6.17E-04 04,08/11/08

6247.550	6.24E-04 05,18/11/08	6.02E-04 02,05/03/07
6247.493	5.42E-04 05,18/11/08	5.37E-04 02,05/03/07

X (km):	332.452	332.493
Y (km)		
6248.028	4.82E-04 24,02/06/08	4.71E-04 23,15/11/08
6247.977	5.77E-04 23,15/11/08	5.45E-04 01,05/03/07
6247.926	6.18E-04 23,15/11/08	6.13E-04 05,24/10/07
6247.875	6.06E-04 05,24/10/07	5.40E-04 05,28/12/07
6247.822	3.80E-04 05,28/12/07	5.87E-04 05,18/12/08
6247.768	1.86E-04 05,12/11/08	5.07E-04 20,20/01/08
6247.712	2.54E-04 05,25/11/07	5.37E-04 04,30/10/08
6247.660	5.00E-04 05,26/01/08	6.17E-04 05,12/11/07
6247.604	6.34E-04 05,03/06/08	6.35E-04 05,26/01/08
6247.550	6.09E-04 05,19/11/08	5.81E-04 05,03/06/08
6247.493	5.24E-04 04,08/11/08	4.92E-04 05,19/11/08

X (km):	332.533
Y (km)	
6248.028	4.51E-04 01,05/03/07
6247.977	5.10E-04 05,24/10/07
6247.926	4.77E-04 05,24/10/07
6247.875	6.27E-04 05,28/12/07
6247.822	6.42E-04 05,30/11/07
6247.768	6.35E-04 20,20/01/08
6247.712	6.37E-04 19,17/02/08
6247.660	6.39E-04 05,22/12/08
6247.604	6.07E-04 05,11/11/08
6247.550	5.46E-04 05,26/01/08
6247.493	4.68E-04 05,03/06/08

At the discrete receptors:

1: 6.42E-04 @Hr05,18/11/07	29: 3.11E-04 @Hr05,03/06/08
2: 6.36E-04 @Hr05,31/10/08	30: 2.50E-04 @Hr05,09/10/07
3: 6.20E-04 @Hr05,23/01/07	31: 2.54E-04 @Hr05,07/12/08
4: 5.95E-04 @Hr05,23/01/07	32: 3.08E-04 @Hr01,24/03/08
5: 5.65E-04 @Hr24,25/10/07	33: 1.98E-04 @Hr05,19/10/08
6: 5.37E-04 @Hr05,01/01/08	34: 3.80E-04 @Hr22,27/04/07
7: 4.99E-04 @Hr02,04/02/08	35: 1.46E-04 @Hr05,26/01/08
8: 4.59E-04 @Hr02,04/02/08	36: 4.47E-04 @Hr21,27/04/07
9: 8.23E-05 @Hr05,11/01/07	37: 1.00E-04 @Hr05,25/01/08
10: 2.60E-05 @Hr05,18/11/07	38: 5.36E-04 @Hr24,03/02/08
11: 4.44E-04 @Hr02,24/03/08	39: 6.69E-05 @Hr01,31/08/08
12: 3.74E-04 @Hr02,24/03/08	40: 5.93E-04 @Hr01,10/11/07
13: 3.17E-04 @Hr02,24/03/08	41: 6.02E-04 @Hr05,27/01/08
14: 1.27E-05 @Hr05,23/01/07	42: 5.96E-04 @Hr05,27/01/08
15: 1.69E-04 @Hr02,24/03/08	43: 5.87E-04 @Hr05,18/11/08
16: 5.86E-05 @Hr24,03/02/08	44: 6.10E-04 @Hr05,18/11/08
17: 8.55E-05 @Hr19,17/02/08	45: 6.27E-04 @Hr05,18/11/08
18: 1.19E-04 @Hr04,30/10/08	46: 6.33E-04 @Hr05,18/11/08
19: 4.39E-04 @Hr05,18/11/08	47: 6.20E-04 @Hr02,05/03/07
20: 3.76E-04 @Hr05,18/11/08	48: 6.38E-04 @Hr02,05/03/07
21: 3.43E-04 @Hr05,18/11/08	49: 6.39E-04 @Hr02,05/03/07
22: 2.78E-04 @Hr02,05/03/07	50: 6.20E-04 @Hr04,08/11/08
23: 2.42E-04 @Hr02,05/03/07	51: 6.42E-04 @Hr04,08/11/08
24: 1.76E-04 @Hr05,03/12/07	52: 6.43E-04 @Hr05,03/12/07
25: 1.73E-04 @Hr05,19/11/08	53: 6.43E-04 @Hr05,19/11/08
26: 1.61E-04 @Hr05,03/06/08	54: 6.42E-04 @Hr04,08/11/08
27: 1.99E-04 @Hr05,26/01/08	55: 6.42E-04 @Hr04,08/11/08
28: 2.08E-04 @Hr05,25/01/08	56: 6.43E-04 @Hr05,03/06/08

Zoe 2 Nighttime Emissions

40913 Macdonaldtown Fugitive Stockpile Emissions Zone 2 Night

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Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

40913 Macdonaldtown Fugitive Stockpile Emissions Zone 2 Night

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VFZ2AO

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332359	6247736	18m	32m	25m	-15deg	4m	20m

(Constant) emission rate = 1.00E+00 OUV/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Fugitive Stockpile Emissions Zone 2 Night

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332279	6247616	17.5	1.5	29	332421	6247672	17.5	1.5
2	332277	6247625	17.5	1.5	30	332442	6247701	17.5	1.5
3	332276	6247638	17.5	1.5	31	332421	6247680	17.5	1.5
4	332274	6247650	17.5	1.5	32	332454	6247709	17.5	1.5
5	332275	6247664	17.5	1.5	33	332420	6247687	17.5	1.5
6	332273	6247674	17.5	1.5	34	332467	6247717	17.5	1.5
7	332272	6247688	17.5	1.5	35	332420	6247695	17.5	1.5
8	332269	6247701	17.5	1.5	36	332479	6247727	17.5	1.5
9	332343	6247692	17.5	1.5	37	332419	6247703	17.5	1.5
10	332343	6247707	17.5	1.5	38	332495	6247735	17.5	1.5
11	332263	6247726	17.5	1.5	39	332419	6247710	17.5	1.5
12	332271	6247726	17.5	1.5	40	332509	6247743	17.5	1.5
13	332279	6247731	17.5	1.5	41	332330	6247537	17.5	1.5
14	332342	6247715	17.5	1.5	42	332338	6247541	17.5	1.5
15	332295	6247740	17.5	1.5	43	332344	6247544	17.5	1.5
16	332432	6247743	17.5	1.5	44	332351	6247547	17.5	1.5
17	332435	6247735	17.5	1.5	45	332359	6247551	17.5	1.5
18	332439	6247729	17.5	1.5	46	332366	6247554	17.5	1.5
19	332358	6247641	17.5	1.5	47	332382	6247560	17.5	1.5
20	332366	6247651	17.5	1.5	48	332390	6247565	17.5	1.5
21	332374	6247654	17.5	1.5	49	332399	6247570	17.5	1.5
22	332381	6247662	17.5	1.5	50	332408	6247574	17.5	1.5
23	332386	6247667	17.5	1.5	51	332417	6247579	17.5	1.5
24	332396	6247677	17.5	1.5	52	332426	6247584	17.5	1.5
25	332405	6247681	17.5	1.5	53	332435	6247588	17.5	1.5
26	332412	6247687	17.5	1.5	54	332424	6247578	17.5	1.5
27	332422	6247688	17.5	1.5	55	332423	6247585	17.5	1.5
28	332428	6247692	17.5	1.5	56	332462	6247601	17.5	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\Odour Emmission Files PTM\Zone2NFu.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable,Emissions Zone 2 night,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VFZ2AO

1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR

X (km):	332.119	332.162
Y (km)		
6248.028	2.92E-04 05,18/04/08	2.76E-04 20,22/10/07
6247.977	3.01E-04 05,06/02/07	3.26E-04 05,11/10/07
6247.926	3.20E-04 23,02/06/08	3.68E-04 05,06/02/07
6247.875	3.51E-04 23,02/06/08	4.06E-04 23,02/06/08
6247.822	3.70E-04 05,26/01/07	3.85E-04 05,26/01/07
6247.768	3.71E-04 05,29/01/08	4.06E-04 05,29/01/08
6247.712	3.91E-04 02,24/03/08	4.37E-04 02,24/03/08
6247.660	3.76E-04 05,25/12/08	4.16E-04 05,25/12/08
6247.604	3.49E-04 02,04/02/08	3.89E-04 05,01/01/08
6247.550	3.14E-04 05,01/01/08	3.50E-04 24,25/10/07
6247.493	2.88E-04 04,15/01/07	3.04E-04 05,15/01/07

X (km):	332.202	332.243
Y (km)		
6248.028	3.14E-04 05,29/11/08	3.19E-04 05,29/11/08
6247.977	3.28E-04 05,29/11/08	3.87E-04 05,29/11/08
6247.926	4.03E-04 05,11/10/07	3.99E-04 05,29/11/08
6247.875	4.10E-04 23,02/06/08	4.54E-04 05,11/10/07
6247.822	4.05E-04 23,02/06/08	4.25E-04 23,02/06/08
6247.768	4.26E-04 05,26/01/07	3.72E-04 05,26/01/07
6247.712	4.45E-04 02,24/03/08	3.91E-04 05,25/12/08
6247.660	4.47E-04 02,04/02/08	4.44E-04 05,01/01/08
6247.604	4.26E-04 05,26/10/07	4.49E-04 05,23/01/07
6247.550	3.81E-04 05,23/01/07	4.08E-04 05,18/11/07
6247.493	3.30E-04 05,18/11/07	3.50E-04 05,11/01/07

X (km):	332.285	332.326
Y (km)		
6248.028	2.53E-04 05,29/11/08	2.00E-04 19,10/06/07
6247.977	3.46E-04 05,29/11/08	2.30E-04 05,04/01/07
6247.926	4.37E-04 05,29/11/08	2.79E-04 05,29/11/08
6247.875	4.12E-04 05,29/11/08	3.19E-04 05,29/11/08
6247.822	2.97E-04 05,06/02/07	1.30E-04 05,29/11/08
6247.768	1.64E-04 05,26/01/07	5.77E-06 05,26/01/07
6247.712	2.06E-04 05,25/12/08	2.99E-05 05,26/10/07
6247.660	3.70E-04 05,23/01/07	2.56E-04 05,11/01/07
6247.604	4.49E-04 05,11/01/07	4.40E-04 03,20/07/08
6247.550	4.26E-04 02,31/08/08	4.41E-04 05,27/01/08
6247.493	3.71E-04 03,20/07/08	3.75E-04 05,27/01/08

X (km):	332.370	332.411
Y (km)		
6248.028	2.96E-04 05,02/11/07	3.62E-04 05,02/11/07
6247.977	3.43E-04 05,02/11/07	4.21E-04 05,02/11/07
6247.926	3.65E-04 05,02/11/07	4.53E-04 24,02/06/08
6247.875	2.85E-04 05,02/11/07	3.75E-04 23,15/11/08
6247.822	4.79E-05 05,02/11/07	1.18E-04 01,05/03/07
6247.768	3.15E-11 23,15/11/08	2.89E-06 05,30/11/07
6247.712	1.10E-06 05,18/11/08	1.77E-05 05,11/11/08
6247.660	1.90E-04 05,18/11/08	2.41E-04 05,19/11/08
6247.604	4.28E-04 05,18/11/08	4.37E-04 04,08/11/08

6247.550	4.42E-04 05,18/11/08	4.26E-04 02,05/03/07
6247.493	3.84E-04 05,18/11/08	3.81E-04 02,05/03/07

X (km):	332.452	332.493
Y (km)		
6248.028	3.42E-04 24,02/06/08	3.34E-04 23,15/11/08
6247.977	4.09E-04 23,15/11/08	3.86E-04 01,05/03/07
6247.926	4.38E-04 23,15/11/08	4.34E-04 05,24/10/07
6247.875	4.29E-04 05,24/10/07	3.83E-04 05,28/12/07
6247.822	2.69E-04 05,28/12/07	4.16E-04 05,18/12/08
6247.768	1.32E-04 05,12/11/08	3.59E-04 20,20/01/08
6247.712	1.80E-04 05,25/11/07	3.80E-04 04,30/10/08
6247.660	3.54E-04 05,26/01/08	4.37E-04 05,12/11/07
6247.604	4.49E-04 05,03/06/08	4.50E-04 05,26/01/08
6247.550	4.31E-04 05,19/11/08	4.12E-04 05,03/06/08
6247.493	3.71E-04 04,08/11/08	3.48E-04 05,19/11/08

X (km):	332.533
Y (km)	
6248.028	3.19E-04 01,05/03/07
6247.977	3.61E-04 05,24/10/07
6247.926	3.38E-04 05,24/10/07
6247.875	4.44E-04 05,28/12/07
6247.822	4.55E-04 05,30/11/07
6247.768	4.50E-04 20,20/01/08
6247.712	4.51E-04 19,17/02/08
6247.660	4.53E-04 05,22/12/08
6247.604	4.30E-04 05,11/11/08
6247.550	3.87E-04 05,26/01/08
6247.493	3.31E-04 05,03/06/08

At the discrete receptors:

1: 4.55E-04 @Hr05,18/11/07	29: 2.20E-04 @Hr05,03/06/08
2: 4.51E-04 @Hr05,31/10/08	30: 1.77E-04 @Hr05,09/10/07
3: 4.39E-04 @Hr05,23/01/07	31: 1.80E-04 @Hr05,07/12/08
4: 4.22E-04 @Hr05,23/01/07	32: 2.18E-04 @Hr01,24/03/08
5: 4.00E-04 @Hr24,25/10/07	33: 1.40E-04 @Hr05,19/10/08
6: 3.81E-04 @Hr05,01/01/08	34: 2.69E-04 @Hr22,27/04/07
7: 3.53E-04 @Hr02,04/02/08	35: 1.03E-04 @Hr05,26/01/08
8: 3.25E-04 @Hr02,04/02/08	36: 3.17E-04 @Hr21,27/04/07
9: 5.83E-05 @Hr05,11/01/07	37: 7.11E-05 @Hr05,25/01/08
10: 1.84E-05 @Hr05,18/11/07	38: 3.80E-04 @Hr24,03/02/08
11: 3.15E-04 @Hr02,24/03/08	39: 4.74E-05 @Hr01,31/08/08
12: 2.65E-04 @Hr02,24/03/08	40: 4.20E-04 @Hr01,10/11/07
13: 2.25E-04 @Hr02,24/03/08	41: 4.26E-04 @Hr05,27/01/08
14: 9.00E-06 @Hr05,23/01/07	42: 4.22E-04 @Hr05,27/01/08
15: 1.20E-04 @Hr02,24/03/08	43: 4.16E-04 @Hr05,18/11/08
16: 4.15E-05 @Hr24,03/02/08	44: 4.32E-04 @Hr05,18/11/08
17: 6.06E-05 @Hr19,17/02/08	45: 4.44E-04 @Hr05,18/11/08
18: 8.40E-05 @Hr04,30/10/08	46: 4.48E-04 @Hr05,18/11/08
19: 3.11E-04 @Hr05,18/11/08	47: 4.39E-04 @Hr02,05/03/07
20: 2.67E-04 @Hr05,18/11/08	48: 4.52E-04 @Hr02,05/03/07
21: 2.43E-04 @Hr05,18/11/08	49: 4.53E-04 @Hr02,05/03/07
22: 1.97E-04 @Hr02,05/03/07	50: 4.39E-04 @Hr04,08/11/08
23: 1.71E-04 @Hr02,05/03/07	51: 4.55E-04 @Hr04,08/11/08
24: 1.25E-04 @Hr05,03/12/07	52: 4.55E-04 @Hr05,03/12/07
25: 1.23E-04 @Hr05,19/11/08	53: 4.56E-04 @Hr05,19/11/08
26: 1.14E-04 @Hr05,03/06/08	54: 4.55E-04 @Hr04,08/11/08
27: 1.41E-04 @Hr05,26/01/08	55: 4.55E-04 @Hr04,08/11/08
28: 1.48E-04 @Hr05,25/01/08	56: 4.56E-04 @Hr05,03/06/08

Zone 3 Nighttime Emissions

40913 Macdonaldtown Fugitive Stockpile Emissions Sources Zone 3 Daytim

Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	A	B	C	D	E	F
	Stability Class					
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

40913 Macdonaldtown Fugitive Stockpile Emissions Sources Zone 3 Daytim

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VFZ3AO

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332338	6247710	18m	45m	25m	-15deg	4m	20m

(Constant) emission rate = 1.00E+00 OUV/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Fugitive Stockpile Emissions Sources Zone 3 Daytim

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332279	6247616	17.5	1.5	29	332421	6247672	17.5	1.5
2	332277	6247625	17.5	1.5	30	332442	6247701	17.5	1.5
3	332276	6247638	17.5	1.5	31	332421	6247680	17.5	1.5
4	332274	6247650	17.5	1.5	32	332454	6247709	17.5	1.5
5	332275	6247664	17.5	1.5	33	332420	6247687	17.5	1.5
6	332273	6247674	17.5	1.5	34	332467	6247717	17.5	1.5
7	332272	6247688	17.5	1.5	35	332420	6247695	17.5	1.5
8	332269	6247701	17.5	1.5	36	332479	6247727	17.5	1.5
9	332343	6247692	17.5	1.5	37	332419	6247703	17.5	1.5
10	332343	6247707	17.5	1.5	38	332495	6247735	17.5	1.5
11	332263	6247726	17.5	1.5	39	332419	6247710	17.5	1.5
12	332271	6247726	17.5	1.5	40	332509	6247743	17.5	1.5
13	332279	6247731	17.5	1.5	41	332330	6247537	17.5	1.5
14	332342	6247715	17.5	1.5	42	332338	6247541	17.5	1.5
15	332295	6247740	17.5	1.5	43	332344	6247544	17.5	1.5
16	332432	6247743	17.5	1.5	44	332351	6247547	17.5	1.5
17	332435	6247735	17.5	1.5	45	332359	6247551	17.5	1.5
18	332439	6247729	17.5	1.5	46	332366	6247554	17.5	1.5
19	332358	6247641	17.5	1.5	47	332382	6247560	17.5	1.5
20	332366	6247651	17.5	1.5	48	332390	6247565	17.5	1.5
21	332374	6247654	17.5	1.5	49	332399	6247570	17.5	1.5
22	332381	6247662	17.5	1.5	50	332408	6247574	17.5	1.5
23	332386	6247667	17.5	1.5	51	332417	6247579	17.5	1.5
24	332396	6247677	17.5	1.5	52	332426	6247584	17.5	1.5
25	332405	6247681	17.5	1.5	53	332435	6247588	17.5	1.5
26	332412	6247687	17.5	1.5	54	332424	6247578	17.5	1.5
27	332422	6247688	17.5	1.5	55	332423	6247585	17.5	1.5
28	332428	6247692	17.5	1.5	56	332462	6247601	17.5	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\Odour Emmission Files PTM\Zone3NFu.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable,Emissions,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VFZ3AO

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR

X (km):	332.119	332.162
Y (km)		
6248.028	9.24E-04 04,06/02/07	8.82E-04 01,23/04/07
6247.977	9.19E-04 05,11/10/07	8.95E-04 05,29/11/08
6247.926	1.03E-03 05,06/02/07	1.14E-03 05,11/10/07
6247.875	1.14E-03 23,02/06/08	1.22E-03 05,06/02/07
6247.822	1.08E-03 23,02/06/08	1.32E-03 23,02/06/08
6247.768	1.29E-03 05,26/01/07	1.41E-03 05,26/01/07
6247.712	1.30E-03 05,26/12/08	1.42E-03 05,26/12/08
6247.660	1.21E-03 05,25/12/08	1.39E-03 05,25/12/08
6247.604	1.17E-03 02,04/02/08	1.32E-03 02,04/02/08
6247.550	1.09E-03 05,01/01/08	1.21E-03 24,25/10/07
6247.493	9.60E-04 24,25/10/07	1.05E-03 05,23/01/07

X (km):	332.202	332.243
Y (km)		
6248.028	9.34E-04 05,29/11/08	8.38E-04 05,29/11/08
6247.977	1.09E-03 05,29/11/08	1.09E-03 05,29/11/08
6247.926	1.10E-03 05,29/11/08	1.32E-03 05,29/11/08
6247.875	1.37E-03 05,11/10/07	1.26E-03 05,29/11/08
6247.822	1.42E-03 23,02/06/08	1.32E-03 05,06/02/07
6247.768	1.36E-03 05,26/01/07	9.41E-04 05,26/01/07
6247.712	1.38E-03 05,26/12/08	1.00E-03 02,24/03/08
6247.660	1.41E-03 05,25/12/08	1.23E-03 02,04/02/08
6247.604	1.40E-03 05,01/01/08	1.41E-03 05,23/01/07
6247.550	1.31E-03 05,23/01/07	1.37E-03 05,18/11/07
6247.493	1.14E-03 05,18/11/07	1.20E-03 05,11/01/07

X (km):	332.285	332.326
Y (km)		
6248.028	7.51E-04 03,09/09/07	7.25E-04 01,28/03/08
6247.977	8.14E-04 05,29/11/08	6.89E-04 21,21/03/07
6247.926	1.12E-03 05,29/11/08	7.67E-04 21,21/03/07
6247.875	1.35E-03 05,29/11/08	7.37E-04 05,04/01/07
6247.822	9.39E-04 05,29/11/08	5.41E-04 05,29/11/08
6247.768	3.98E-04 23,02/06/08	2.69E-05 05,11/10/07
6247.712	2.73E-04 02,24/03/08	4.23E-06 05,25/12/08
6247.660	7.24E-04 24,25/10/07	2.63E-04 05,11/01/07
6247.604	1.30E-03 05,11/01/07	1.16E-03 05,27/01/08
6247.550	1.41E-03 02,31/08/08	1.38E-03 05,27/01/08
6247.493	1.26E-03 03,20/07/08	1.22E-03 05,18/11/08

X (km):	332.370	332.411
Y (km)		
6248.028	9.54E-04 05,02/11/07	1.05E-03 05,02/11/07
6247.977	1.13E-03 05,02/11/07	1.23E-03 24,02/06/08
6247.926	1.29E-03 05,02/11/07	1.36E-03 24,02/06/08
6247.875	1.27E-03 05,02/11/07	1.38E-03 23,15/11/08
6247.822	6.34E-04 05,02/11/07	9.01E-04 01,05/03/07
6247.768	1.00E-05 01,05/03/07	1.95E-04 21,20/01/08
6247.712	3.20E-08 05,22/12/08	8.01E-05 21,27/04/07
6247.660	1.62E-04 02,05/03/07	4.75E-04 05,26/01/08
6247.604	1.12E-03 02,05/03/07	1.23E-03 05,19/11/08

6247.550	1.39E-03 02,05/03/07	1.40E-03 04,08/11/08
6247.493	1.26E-03 02,05/03/07	1.25E-03 04,08/11/08

X (km):	332.452	332.493
Y (km)		
6248.028	9.98E-04 23,15/11/08	9.53E-04 23,15/11/08
6247.977	1.19E-03 23,15/11/08	1.12E-03 01,05/03/07
6247.926	1.29E-03 23,15/11/08	1.28E-03 05,24/10/07
6247.875	1.42E-03 05,24/10/07	1.16E-03 05,24/10/07
6247.822	1.07E-03 05,28/12/07	1.42E-03 21,20/01/08
6247.768	8.25E-04 05,30/11/07	1.32E-03 05,19/12/08
6247.712	6.94E-04 24,03/02/08	1.28E-03 05,30/10/08
6247.660	1.03E-03 01,04/02/08	1.37E-03 05,15/12/07
6247.604	1.37E-03 05,19/10/08	1.42E-03 03,21/08/08
6247.550	1.38E-03 05,03/06/08	1.33E-03 05,19/10/08
6247.493	1.23E-03 05,19/11/08	1.17E-03 05,03/06/08

X (km):	332.533
Y (km)	
6248.028	9.20E-04 01,05/03/07
6247.977	1.05E-03 05,24/10/07
6247.926	1.03E-03 05,24/10/07
6247.875	1.29E-03 05,28/12/07
6247.822	1.41E-03 05,18/12/08
6247.768	1.43E-03 05,12/11/08
6247.712	1.43E-03 22,15/11/08
6247.660	1.42E-03 22,27/04/07
6247.604	1.36E-03 01,04/02/08
6247.550	1.25E-03 05,25/01/08
6247.493	1.09E-03 05,19/10/08

At the discrete receptors:

1: 1.28E-03 @Hr05,18/11/07	29: 5.02E-04 @Hr03,20/11/08
2: 1.23E-03 @Hr05,15/01/07	30: 6.00E-04 @Hr05,31/10/07
3: 1.13E-03 @Hr05,23/01/07	31: 4.10E-04 @Hr01,04/02/08
4: 1.04E-03 @Hr24,25/10/07	32: 7.93E-04 @Hr23,03/02/08
5: 8.78E-04 @Hr05,01/01/08	33: 3.33E-04 @Hr05,24/01/07
6: 7.92E-04 @Hr02,04/02/08	34: 9.91E-04 @Hr05,30/10/08
7: 6.73E-04 @Hr05,25/12/08	35: 2.70E-04 @Hr02,10/11/07
8: 6.32E-04 @Hr05,25/12/08	36: 1.15E-03 @Hr05,27/11/08
9: 8.02E-06 @Hr05,11/01/07	37: 2.20E-04 @Hr04,30/10/08
10: 6.66E-07 @Hr05,23/01/07	38: 1.32E-03 @Hr04,31/08/08
11: 6.96E-04 @Hr05,29/01/08	39: 1.87E-04 @Hr21,27/04/07
12: 5.28E-04 @Hr05,29/01/08	40: 1.40E-03 @Hr20,20/01/08
13: 3.84E-04 @Hr05,29/01/08	41: 1.34E-03 @Hr05,27/01/08
14: 1.56E-07 @Hr05,01/01/08	42: 1.38E-03 @Hr05,18/11/08
15: 1.66E-04 @Hr05,26/01/07	43: 1.41E-03 @Hr05,18/11/08
16: 3.78E-04 @Hr05,12/11/08	44: 1.42E-03 @Hr05,18/11/08
17: 4.19E-04 @Hr20,20/01/08	45: 1.40E-03 @Hr05,18/11/08
18: 4.66E-04 @Hr04,31/08/08	46: 1.38E-03 @Hr02,05/03/07
19: 5.19E-04 @Hr05,18/11/08	47: 1.41E-03 @Hr02,05/03/07
20: 3.46E-04 @Hr02,05/03/07	48: 1.36E-03 @Hr04,08/11/08
21: 3.10E-04 @Hr04,08/11/08	49: 1.40E-03 @Hr04,08/11/08
22: 2.15E-04 @Hr05,19/11/08	50: 1.40E-03 @Hr05,03/12/07
23: 1.88E-04 @Hr05,03/06/08	51: 1.40E-03 @Hr05,19/11/08
24: 1.48E-04 @Hr05,26/01/08	52: 1.36E-03 @Hr05,19/11/08
25: 1.99E-04 @Hr01,31/08/08	53: 1.40E-03 @Hr05,03/06/08
26: 2.31E-04 @Hr01,04/02/08	54: 1.39E-03 @Hr05,19/11/08
27: 3.46E-04 @Hr05,22/12/08	55: 1.36E-03 @Hr05,19/11/08
28: 4.14E-04 @Hr02,10/11/07	56: 1.41E-03 @Hr05,26/01/08

Zoom 4 Nighttime Emissions

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 4 Night

Concentration or deposition	Concentration
Emission rate units	OUV/second
Concentration units	Odour_Units
Units conversion factor	1.00E+00
Constant background concentration	0.00E+00
Terrain effects	Egan method
Smooth stability class changes?	No
Other stability class adjustments ("urban modes")	None
Ignore building wake effects?	No
Decay coefficient (unless overridden by met. file)	0.000
Anemometer height	10 m
Roughness height at the wind vane site	0.300 m

DISPERSION CURVES

Horizontal dispersion curves for sources <100m high	Pasquill-Gifford
Vertical dispersion curves for sources <100m high	Pasquill-Gifford
Horizontal dispersion curves for sources >100m high	Briggs Rural
Vertical dispersion curves for sources >100m high	Briggs Rural
Enhance horizontal plume spreads for buoyancy?	Yes
Enhance vertical plume spreads for buoyancy?	Yes
Adjust horizontal P-G formulae for roughness height?	Yes
Adjust vertical P-G formulae for roughness height?	Yes
Roughness height	0.800m
Adjustment for wind directional shear	None

PLUME RISE OPTIONS

Gradual plume rise?	Yes
Stack-tip downwash included?	Yes
Building downwash algorithm:	PRIME method.
Entrainment coeff. for neutral & stable lapse rates	0.60,0.60
Partial penetration of elevated inversions?	No
Disregard temp. gradients in the hourly met. file?	No

and in the absence of boundary-layer potential temperature gradients given by the hourly met. file, a value from the following table (in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 4 Night

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VFZ4AO

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332294	6247673	18m	45m	25m	-25deg	4m	20m

(Constant) emission rate = 1.00E+00 OUV/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 4 Night

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332279	6247616	17.5	1.5	29	332421	6247672	17.5	1.5
2	332277	6247625	17.5	1.5	30	332442	6247701	17.5	1.5
3	332276	6247638	17.5	1.5	31	332421	6247680	17.5	1.5
4	332274	6247650	17.5	1.5	32	332454	6247709	17.5	1.5
5	332275	6247664	17.5	1.5	33	332420	6247687	17.5	1.5
6	332273	6247674	17.5	1.5	34	332467	6247717	17.5	1.5
7	332272	6247688	17.5	1.5	35	332420	6247695	17.5	1.5
8	332269	6247701	17.5	1.5	36	332479	6247727	17.5	1.5
9	332343	6247692	17.5	1.5	37	332419	6247703	17.5	1.5
10	332343	6247707	17.5	1.5	38	332495	6247735	17.5	1.5
11	332263	6247726	17.5	1.5	39	332419	6247710	17.5	1.5
12	332271	6247726	17.5	1.5	40	332509	6247743	17.5	1.5
13	332279	6247731	17.5	1.5	41	332330	6247537	17.5	1.5
14	332342	6247715	17.5	1.5	42	332338	6247541	17.5	1.5
15	332295	6247740	17.5	1.5	43	332344	6247544	17.5	1.5
16	332432	6247743	17.5	1.5	44	332351	6247547	17.5	1.5
17	332435	6247735	17.5	1.5	45	332359	6247551	17.5	1.5
18	332439	6247729	17.5	1.5	46	332366	6247554	17.5	1.5
19	332358	6247641	17.5	1.5	47	332382	6247560	17.5	1.5
20	332366	6247651	17.5	1.5	48	332390	6247565	17.5	1.5
21	332374	6247654	17.5	1.5	49	332399	6247570	17.5	1.5
22	332381	6247662	17.5	1.5	50	332408	6247574	17.5	1.5
23	332386	6247667	17.5	1.5	51	332417	6247579	17.5	1.5
24	332396	6247677	17.5	1.5	52	332426	6247584	17.5	1.5
25	332405	6247681	17.5	1.5	53	332435	6247588	17.5	1.5
26	332412	6247687	17.5	1.5	54	332424	6247578	17.5	1.5
27	332422	6247688	17.5	1.5	55	332423	6247585	17.5	1.5
28	332428	6247692	17.5	1.5	56	332462	6247601	17.5	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\Odour Emmission Files PTM\Zone4NFu.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable,Emissions Zone 4 Night,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VFZ4AO

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR

X (km):	332.119	332.162
Y (km)		
6248.028	9.21E-04 19,17/06/08	8.94E-04 24,17/10/08
6247.977	9.11E-04 05,29/11/08	9.93E-04 05,29/11/08
6247.926	9.76E-04 05,11/10/07	1.14E-03 05,29/11/08
6247.875	1.20E-03 05,11/10/07	1.18E-03 05,11/10/07
6247.822	1.28E-03 23,02/06/08	1.40E-03 05,06/02/07
6247.768	1.21E-03 23,02/06/08	1.38E-03 23,02/06/08
6247.712	1.34E-03 05,26/01/07	1.31E-03 05,26/01/07
6247.660	1.42E-03 02,24/03/08	1.35E-03 02,24/03/08
6247.604	1.34E-03 05,25/12/08	1.43E-03 02,04/02/08
6247.550	1.30E-03 05,01/01/08	1.39E-03 24,25/10/07
6247.493	1.15E-03 05,23/01/07	1.26E-03 05,31/10/08

X (km):	332.202	332.243
Y (km)		
6248.028	8.44E-04 23,01/09/08	8.40E-04 01,22/03/07
6247.977	8.91E-04 05,29/11/08	6.89E-04 03,09/09/07
6247.926	1.16E-03 05,29/11/08	8.55E-04 05,29/11/08
6247.875	1.37E-03 05,29/11/08	1.16E-03 05,29/11/08
6247.822	1.30E-03 05,11/10/07	1.29E-03 05,29/11/08
6247.768	1.14E-03 23,02/06/08	6.95E-04 05,11/10/07
6247.712	9.00E-04 05,26/01/07	1.92E-04 05,26/01/07
6247.660	9.52E-04 05,25/12/08	2.82E-04 02,04/02/08
6247.604	1.30E-03 05,26/10/07	9.54E-04 05,15/01/07
6247.550	1.43E-03 05,15/01/07	1.36E-03 05,11/01/07
6247.493	1.33E-03 05,11/01/07	1.38E-03 03,20/07/08

X (km):	332.285	332.326
Y (km)		
6248.028	8.27E-04 01,28/03/08	8.64E-04 05,02/11/07
6247.977	7.11E-04 05,02/11/07	1.03E-03 05,02/11/07
6247.926	7.76E-04 05,02/11/07	1.22E-03 05,02/11/07
6247.875	7.84E-04 21,21/03/07	1.36E-03 05,02/11/07
6247.822	6.46E-04 05,04/01/07	1.17E-03 05,02/11/07
6247.768	2.33E-04 05,29/11/08	2.88E-04 24,02/06/08
6247.712	6.22E-07 23,02/06/08	3.42E-07 05,28/12/07
6247.660	1.33E-05 05,23/01/07	1.57E-06 05,26/01/08
6247.604	5.98E-04 03,20/07/08	5.47E-04 02,05/03/07
6247.550	1.29E-03 05,27/01/08	1.31E-03 02,05/03/07
6247.493	1.33E-03 05,18/11/08	1.38E-03 02,05/03/07

X (km):	332.370	332.411
Y (km)		
6248.028	9.45E-04 05,02/11/07	8.87E-04 23,15/11/08
6247.977	1.11E-03 24,02/06/08	1.07E-03 23,15/11/08
6247.926	1.27E-03 24,02/06/08	1.22E-03 23,15/11/08
6247.875	1.40E-03 23,15/11/08	1.38E-03 01,05/03/07
6247.822	1.26E-03 23,15/11/08	1.34E-03 05,24/10/07
6247.768	6.17E-04 05,24/10/07	1.17E-03 05,28/12/07
6247.712	1.49E-04 05,19/12/08	8.21E-04 02,26/06/07
6247.660	1.94E-04 05,25/11/07	8.77E-04 04,30/10/08
6247.604	8.77E-04 05,07/12/08	1.24E-03 01,31/08/08

6247.550	1.36E-03 05,19/11/08	1.41E-03 05,07/12/08
6247.493	1.37E-03 04,08/11/08	1.30E-03 05,03/06/08

X (km):	332.452	332.493
Y (km)		
6248.028	8.76E-04 03,10/01/07	8.70E-04 21,16/03/07
6247.977	9.81E-04 01,05/03/07	9.54E-04 05,24/10/07
6247.926	1.17E-03 01,05/03/07	1.03E-03 05,24/10/07
6247.875	1.26E-03 05,24/10/07	1.06E-03 05,28/12/07
6247.822	1.33E-03 05,28/12/07	1.35E-03 21,20/01/08
6247.768	1.41E-03 05,18/12/08	1.41E-03 05,30/11/07
6247.712	1.33E-03 20,20/01/08	1.43E-03 20,20/01/08
6247.660	1.33E-03 21,27/04/07	1.42E-03 23,03/02/08
6247.604	1.41E-03 05,24/01/07	1.39E-03 05,25/11/07
6247.550	1.39E-03 05,25/01/08	1.31E-03 05,12/11/07
6247.493	1.26E-03 05,07/12/08	1.15E-03 05,25/01/08

X (km):	332.533
Y (km)	
6248.028	7.80E-04 05,24/10/07
6247.977	9.01E-04 20,29/07/07
6247.926	8.12E-04 05,28/12/07
6247.875	1.10E-03 05,28/12/07
6247.822	1.23E-03 05,18/12/08
6247.768	1.28E-03 05,19/12/08
6247.712	1.34E-03 04,31/08/08
6247.660	1.34E-03 24,03/02/08
6247.604	1.28E-03 22,27/04/07
6247.550	1.19E-03 05,24/01/07
6247.493	1.07E-03 03,21/08/08

At the discrete receptors:

1: 4.74E-04 @Hr02,31/08/08	29: 1.03E-03 @Hr23,03/02/08
2: 3.46E-04 @Hr05,11/01/07	30: 1.27E-03 @Hr04,31/08/08
3: 1.92E-04 @Hr05,18/11/07	31: 1.01E-03 @Hr05,30/10/08
4: 1.04E-04 @Hr05,23/01/07	32: 1.36E-03 @Hr20,20/01/08
5: 3.79E-05 @Hr05,01/01/08	33: 9.97E-04 @Hr01,10/11/07
6: 2.16E-05 @Hr02,04/02/08	34: 1.42E-03 @Hr02,26/06/07
7: 1.33E-05 @Hr02,24/03/08	35: 9.77E-04 @Hr05,27/11/08
8: 1.55E-05 @Hr05,29/01/08	36: 1.44E-03 @Hr05,12/11/08
9: 6.51E-06 @Hr04,31/08/08	37: 9.89E-04 @Hr04,31/08/08
10: 9.93E-06 @Hr05,30/11/07	38: 1.43E-03 @Hr05,12/11/08
11: 7.87E-05 @Hr23,02/06/08	39: 9.97E-04 @Hr02,26/06/07
12: 3.41E-05 @Hr23,02/06/08	40: 1.40E-03 @Hr05,19/12/08
13: 2.49E-05 @Hr05,16/01/07	41: 1.39E-03 @Hr02,05/03/07
14: 1.58E-05 @Hr04,26/06/07	42: 1.34E-03 @Hr02,05/03/07
15: 1.75E-05 @Hr05,29/11/08	43: 1.36E-03 @Hr04,08/11/08
16: 1.25E-03 @Hr05,30/11/07	44: 1.37E-03 @Hr04,08/11/08
17: 1.25E-03 @Hr05,19/12/08	45: 1.36E-03 @Hr05,03/12/07
18: 1.28E-03 @Hr05,19/12/08	46: 1.36E-03 @Hr05,19/11/08
19: 2.61E-04 @Hr05,25/01/08	47: 1.36E-03 @Hr05,03/06/08
20: 2.57E-04 @Hr01,04/02/08	48: 1.36E-03 @Hr05,03/06/08
21: 3.30E-04 @Hr05,24/01/07	49: 1.37E-03 @Hr05,07/12/08
22: 3.74E-04 @Hr22,27/04/07	50: 1.38E-03 @Hr05,26/01/08
23: 4.45E-04 @Hr04,30/10/08	51: 1.38E-03 @Hr05,25/01/08
24: 5.79E-04 @Hr04,05/03/07	52: 1.40E-03 @Hr05,28/01/07
25: 7.37E-04 @Hr05,30/10/08	53: 1.41E-03 @Hr01,31/08/08
26: 8.67E-04 @Hr01,10/11/07	54: 1.41E-03 @Hr05,25/01/08
27: 1.02E-03 @Hr05,27/11/08	55: 1.39E-03 @Hr05,28/01/07
28: 1.11E-03 @Hr05,27/11/08	56: 1.43E-03 @Hr05,24/01/07

Zone 5 Nighttime Emissions

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 5 Night

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Concentration or deposition Concentration
Emission rate units OUV/second
Concentration units Odour_Units
Units conversion factor 1.00E+00
Constant background concentration 0.00E+00
Terrain effects Egan method
Smooth stability class changes? No
Other stability class adjustments ("urban modes") None
Ignore building wake effects? No
Decay coefficient (unless overridden by met. file) 0.000
Anemometer height 10 m
Roughness height at the wind vane site 0.300 m

DISPERSION CURVES
Horizontal dispersion curves for sources <100m high Pasquill-Gifford
Vertical dispersion curves for sources <100m high Pasquill-Gifford
Horizontal dispersion curves for sources >100m high Briggs Rural
Vertical dispersion curves for sources >100m high Briggs Rural
Enhance horizontal plume spreads for buoyancy? Yes
Enhance vertical plume spreads for buoyancy? Yes
Adjust horizontal P-G formulae for roughness height? Yes
Adjust vertical P-G formulae for roughness height? Yes
Roughness height 0.800m
Adjustment for wind directional shear None

PLUME RISE OPTIONS
Gradual plume rise? Yes
Stack-tip downwash included? Yes
Building downwash algorithm: PRIME method.
Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
Partial penetration of elevated inversions? No
Disregard temp. gradients in the hourly met. file? No

and in the absence of boundary-layer potential temperature gradients
given by the hourly met. file, a value from the following table
(in K/m) is used:

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

WIND SPEED CATEGORIES
Boundaries between categories (in m/s) are: 1.54, 3.09, 5.14, 8.23, 10.80

WIND PROFILE EXPONENTS: "Irwin Urban" values (unless overridden by met. file)

AVERAGING TIMES
1 hour

1

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 5 Night

SOURCE CHARACTERISTICS

INTEGRATED AREA SOURCE: VFZ5AO

X0(m)	Y0(m)	Ground El	Length X	Length Y	Or. Angle	Ver. spread	Height
332294	6247673	18m	45m	25m	-25deg	4m	20m

(Constant) emission rate = 1.00E+00 OUV/second per square metre

Hourly multiplicative factors will be used with
this emission factor.
No gravitational settling or scavenging.

1

40913 Macdonaldtown Fugitive Emissions Stockpiles Zone 5 Night

RECEPTOR LOCATIONS

The Cartesian receptor grid has the following x-values (or eastings):
332119.m 332162.m 332202.m 332243.m 332285.m 332326.m 332370.m
332411.m 332452.m 332493.m 332533.m

and these y-values (or northings):
6247493.m 6247550.m 6247604.m 6247660.m 6247712.m 6247768.m 6247822.m
6247875.m 6247926.m 6247977.m 6248028.m

DISCRETE RECEPTOR LOCATIONS (in metres)

No.	X	Y	ELEVN	HEIGHT	No.	X	Y	ELEVN	HEIGHT
1	332279	6247616	17.5	1.5	29	332421	6247672	17.5	1.5
2	332277	6247625	17.5	1.5	30	332442	6247701	17.5	1.5
3	332276	6247638	17.5	1.5	31	332421	6247680	17.5	1.5
4	332274	6247650	17.5	1.5	32	332454	6247709	17.5	1.5
5	332275	6247664	17.5	1.5	33	332420	6247687	17.5	1.5
6	332273	6247674	17.5	1.5	34	332467	6247717	17.5	1.5
7	332272	6247688	17.5	1.5	35	332420	6247695	17.5	1.5
8	332269	6247701	17.5	1.5	36	332479	6247727	17.5	1.5
9	332343	6247692	17.5	1.5	37	332419	6247703	17.5	1.5
10	332343	6247707	17.5	1.5	38	332495	6247735	17.5	1.5
11	332263	6247726	17.5	1.5	39	332419	6247710	17.5	1.5
12	332271	6247726	17.5	1.5	40	332509	6247743	17.5	1.5
13	332279	6247731	17.5	1.5	41	332330	6247537	17.5	1.5
14	332342	6247715	17.5	1.5	42	332338	6247541	17.5	1.5
15	332295	6247740	17.5	1.5	43	332344	6247544	17.5	1.5
16	332432	6247743	17.5	1.5	44	332351	6247547	17.5	1.5
17	332435	6247735	17.5	1.5	45	332359	6247551	17.5	1.5
18	332439	6247729	17.5	1.5	46	332366	6247554	17.5	1.5
19	332358	6247641	17.5	1.5	47	332382	6247560	17.5	1.5
20	332366	6247651	17.5	1.5	48	332390	6247565	17.5	1.5
21	332374	6247654	17.5	1.5	49	332399	6247570	17.5	1.5
22	332381	6247662	17.5	1.5	50	332408	6247574	17.5	1.5
23	332386	6247667	17.5	1.5	51	332417	6247579	17.5	1.5
24	332396	6247677	17.5	1.5	52	332426	6247584	17.5	1.5
25	332405	6247681	17.5	1.5	53	332435	6247588	17.5	1.5
26	332412	6247687	17.5	1.5	54	332424	6247578	17.5	1.5
27	332422	6247688	17.5	1.5	55	332423	6247585	17.5	1.5
28	332428	6247692	17.5	1.5	56	332462	6247601	17.5	1.5

METEOROLOGICAL DATA : DECCW Randwick AWS Data BoM SydneyAP Clouds SydneyAP

HOURLY VARIABLE EMISSION FACTOR INFORMATION

The input emission rates specfied above will be multiplied by hourly varying
factors entered via the input file:
C:\Users\sdorairaj\Ausplume\Odour Emmission Files PTM\Zone5NFu.csv
For each stack source, hourly values within this file will be added to each
declared exit velocity (m/sec) and temperature (K).

Title of input hourly emission factor file is:
Variable,Emissions Zone 5 Night,

HOURLY EMISSION FACTOR SOURCE TYPE ALLOCATION

Prefix V allocated: VFZ5AO

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1 HIGHEST RECORDINGS FOR EACH RECEPTOR (in Odour_Units)
AVERAGING TIME = 1 HOUR

X (km):	332.119	332.162
Y (km)		
6248.028	1.15E-03 19,17/06/08	1.12E-03 24,17/10/08
6247.977	1.14E-03 05,29/11/08	1.24E-03 05,29/11/08
6247.926	1.22E-03 05,11/10/07	1.43E-03 05,29/11/08
6247.875	1.50E-03 05,11/10/07	1.48E-03 05,11/10/07
6247.822	1.60E-03 23,02/06/08	1.75E-03 05,06/02/07
6247.768	1.51E-03 23,02/06/08	1.72E-03 23,02/06/08
6247.712	1.68E-03 05,26/01/07	1.64E-03 05,26/01/07
6247.660	1.78E-03 02,24/03/08	1.69E-03 02,24/03/08
6247.604	1.68E-03 05,25/12/08	1.79E-03 02,04/02/08
6247.550	1.63E-03 05,01/01/08	1.74E-03 24,25/10/07
6247.493	1.44E-03 05,23/01/07	1.58E-03 05,31/10/08

X (km):	332.202	332.243
Y (km)		
6248.028	1.05E-03 23,01/09/08	1.05E-03 01,22/03/07
6247.977	1.11E-03 05,29/11/08	8.61E-04 03,09/09/07
6247.926	1.45E-03 05,29/11/08	1.07E-03 05,29/11/08
6247.875	1.71E-03 05,29/11/08	1.45E-03 05,29/11/08
6247.822	1.63E-03 05,11/10/07	1.61E-03 05,29/11/08
6247.768	1.43E-03 23,02/06/08	8.68E-04 05,11/10/07
6247.712	1.13E-03 05,26/01/07	2.40E-04 05,26/01/07
6247.660	1.19E-03 05,25/12/08	3.52E-04 02,04/02/08
6247.604	1.62E-03 05,26/10/07	1.19E-03 05,15/01/07
6247.550	1.79E-03 05,15/01/07	1.70E-03 05,11/01/07
6247.493	1.66E-03 05,11/01/07	1.72E-03 03,20/07/08

X (km):	332.285	332.326
Y (km)		
6248.028	1.03E-03 01,28/03/08	1.08E-03 05,02/11/07
6247.977	8.89E-04 05,02/11/07	1.29E-03 05,02/11/07
6247.926	9.69E-04 05,02/11/07	1.53E-03 05,02/11/07
6247.875	9.80E-04 21,21/03/07	1.69E-03 05,02/11/07
6247.822	8.07E-04 05,04/01/07	1.46E-03 05,02/11/07
6247.768	2.91E-04 05,29/11/08	3.60E-04 24,02/06/08
6247.712	7.78E-07 23,02/06/08	4.28E-07 05,28/12/07
6247.660	1.66E-05 05,23/01/07	1.96E-06 05,26/01/08
6247.604	7.48E-04 03,20/07/08	6.83E-04 02,05/03/07
6247.550	1.61E-03 05,27/01/08	1.64E-03 02,05/03/07
6247.493	1.67E-03 05,18/11/08	1.72E-03 02,05/03/07

X (km):	332.370	332.411
Y (km)		
6248.028	1.18E-03 05,02/11/07	1.11E-03 23,15/11/08
6247.977	1.39E-03 24,02/06/08	1.33E-03 23,15/11/08
6247.926	1.59E-03 24,02/06/08	1.53E-03 23,15/11/08
6247.875	1.75E-03 23,15/11/08	1.73E-03 01,05/03/07
6247.822	1.57E-03 23,15/11/08	1.67E-03 05,24/10/07
6247.768	7.71E-04 05,24/10/07	1.46E-03 05,28/12/07
6247.712	1.86E-04 05,19/12/08	1.03E-03 02,26/06/07
6247.660	2.43E-04 05,25/11/07	1.10E-03 04,30/10/08
6247.604	1.10E-03 05,07/12/08	1.55E-03 01,31/08/08

6247.550	1.71E-03 05,19/11/08	1.76E-03 05,07/12/08
6247.493	1.71E-03 04,08/11/08	1.63E-03 05,03/06/08

X (km):	332.452	332.493
Y (km)		
6248.028	1.10E-03 03,10/01/07	1.09E-03 21,16/03/07
6247.977	1.23E-03 01,05/03/07	1.19E-03 05,24/10/07
6247.926	1.47E-03 01,05/03/07	1.29E-03 05,24/10/07
6247.875	1.57E-03 05,24/10/07	1.32E-03 05,28/12/07
6247.822	1.66E-03 05,28/12/07	1.68E-03 21,20/01/08
6247.768	1.76E-03 05,18/12/08	1.76E-03 05,30/11/07
6247.712	1.66E-03 20,20/01/08	1.79E-03 20,20/01/08
6247.660	1.67E-03 21,27/04/07	1.78E-03 23,03/02/08
6247.604	1.76E-03 05,24/01/07	1.74E-03 05,25/11/07
6247.550	1.73E-03 05,25/01/08	1.63E-03 05,12/11/07
6247.493	1.57E-03 05,07/12/08	1.44E-03 05,25/01/08

X (km):	332.533
Y (km)	
6248.028	9.75E-04 05,24/10/07
6247.977	1.13E-03 20,29/07/07
6247.926	1.01E-03 05,28/12/07
6247.875	1.38E-03 05,28/12/07
6247.822	1.54E-03 05,18/12/08
6247.768	1.60E-03 05,19/12/08
6247.712	1.68E-03 04,31/08/08
6247.660	1.67E-03 24,03/02/08
6247.604	1.60E-03 22,27/04/07
6247.550	1.48E-03 05,24/01/07
6247.493	1.34E-03 03,21/08/08

At the discrete receptors:

1: 5.92E-04 @Hr02,31/08/08	29: 1.29E-03 @Hr23,03/02/08
2: 4.32E-04 @Hr05,11/01/07	30: 1.58E-03 @Hr04,31/08/08
3: 2.40E-04 @Hr05,18/11/07	31: 1.26E-03 @Hr05,30/10/08
4: 1.30E-04 @Hr05,23/01/07	32: 1.70E-03 @Hr20,20/01/08
5: 4.74E-05 @Hr05,01/01/08	33: 1.25E-03 @Hr01,10/11/07
6: 2.70E-05 @Hr02,04/02/08	34: 1.77E-03 @Hr02,26/06/07
7: 1.66E-05 @Hr02,24/03/08	35: 1.22E-03 @Hr05,27/11/08
8: 1.93E-05 @Hr05,29/01/08	36: 1.80E-03 @Hr05,12/11/08
9: 8.14E-06 @Hr04,31/08/08	37: 1.24E-03 @Hr04,31/08/08
10: 1.24E-05 @Hr05,30/11/07	38: 1.79E-03 @Hr05,12/11/08
11: 9.84E-05 @Hr23,02/06/08	39: 1.25E-03 @Hr02,26/06/07
12: 4.26E-05 @Hr23,02/06/08	40: 1.75E-03 @Hr05,19/12/08
13: 3.11E-05 @Hr05,16/01/07	41: 1.74E-03 @Hr02,05/03/07
14: 1.98E-05 @Hr04,26/06/07	42: 1.68E-03 @Hr02,05/03/07
15: 2.19E-05 @Hr05,29/11/08	43: 1.70E-03 @Hr04,08/11/08
16: 1.56E-03 @Hr05,30/11/07	44: 1.71E-03 @Hr04,08/11/08
17: 1.56E-03 @Hr05,19/12/08	45: 1.70E-03 @Hr05,03/12/07
18: 1.61E-03 @Hr05,19/12/08	46: 1.70E-03 @Hr05,19/11/08
19: 3.26E-04 @Hr05,25/01/08	47: 1.71E-03 @Hr05,03/06/08
20: 3.21E-04 @Hr01,04/02/08	48: 1.70E-03 @Hr05,03/06/08
21: 4.12E-04 @Hr05,24/01/07	49: 1.72E-03 @Hr05,07/12/08
22: 4.67E-04 @Hr22,27/04/07	50: 1.73E-03 @Hr05,26/01/08
23: 5.56E-04 @Hr04,30/10/08	51: 1.73E-03 @Hr05,25/01/08
24: 7.24E-04 @Hr04,05/03/07	52: 1.75E-03 @Hr05,28/01/07
25: 9.22E-04 @Hr05,30/10/08	53: 1.76E-03 @Hr01,31/08/08
26: 1.08E-03 @Hr01,10/11/07	54: 1.76E-03 @Hr05,25/01/08
27: 1.27E-03 @Hr05,27/11/08	55: 1.74E-03 @Hr05,28/01/07
28: 1.38E-03 @Hr05,27/11/08	56: 1.78E-03 @Hr05,24/01/07

Appendix H

Greenhouse Gas Emissions Calculations

Project No. 40913
Project: Former Macdonaldtown Gasworks

Greenhouse and Exhaust Emissions Assessment **Scope 1 Emissions Macdonaldtown Site**

1	List of Plant / Machinery Consuming Fuel		
	excavator	40	L/hour
	truck and dog	0.5	L/km
	air compressor	30	L/hour
	water cart	0.5	L/km

2	Estimate of Fuel Consumption During Material Removal			
	Contaminated soil for Treatment	16215	m3	
		22701	tonnes	EPA (2006) 1m3 material = 1.4 tonnes
	Contaminated soil for Landfill Disposal	3765	m3	
		5271	tonnes	EPA (2006) 1m3 material = 1.4 tonnes
	Number of trips required to disposal of soil to treatment site	756.7	trips	assumes on average one truck + dog trailer trip transports 30 tonnes
	Number of trips required to transfer of soil to landfill	175.7	trips	assumes on average one truck + dog trailer trip transports 30 tonnes
	Distance travelled to dispose soil to landfill	21084	km	(assume 120 km per trip)
	Distance travelled to transfer soil to treatment location	19674.2	km	(assume 26 km per trip)
	Fuel consumed disposing soil to landfill	10542	L	using 0.5L/km consumed by truck + dog trailer
	Fuel consumed transfering soil to treatment site and back	9837.1	L	using 0.5L/km consumed by truck + dog trailer

3	Estimate of Fuel Consumption by On-site Equipment		
	Number of site work days (assumes 6 months of 6 days/week)	154	days
	Number works hours (assumes 9 hours/day)	1386	hours
	Fuel used by 2 Excavators (for project duration)	110880	Litres
	Fuel used by air compressor (x 1 for project duration)	41580	Litres
	Fuel used by water cart (assume 30 km of travel per day)	2310	Litres

4	Estimate of Total fuel Consumed by Project		
	Estimated Volume of Fuel used (site equipment + material removal)	175149	Litres

5	**Predicted Scope 1 Emissions**			
	Estimated CO2 emission	472.90	(tonnes CO_2-e)	2.7 tonnes CO2 equivalent per kL of diesel fuel consumed (NECC 2009)

Estimated Exhaust Emissions			
Constituent	**Fuel Used**	**Emission Factor**	**Emission (kg)**
VOCs	175149	0.0018	315.27
NOx	175149	0.023	4028.43
CO	175149	0.0068	1191.01
PM10	175149	0.0018	315.27
SO2	175149	0.000017	2.98

Appendix I

Risk Assessment Calculations

Human Health Risk Assessment Calculation

Calculation of Chemical Concentration in Air

(AUSPLUME highest value based on 24h Averaging time)

Assumes all controls in places as per AQMP

Assumes Stage 1 remediation works to be undertaken over 6 month period

Benzene

	Receptor Location					
AUSPLUME SOURCE ID	**1**	**2**	**3**	**4**	**5**	**6**
V1EX	1.27E-03	3.35E-03	2.63E-03	5.32E-04	1.80E-03	2.21E-03
F1	7.67E-08	3.86E-07	6.12E-07	1.49E-07	4.93E-07	4.71E-07
V2EX	4.02E-04	4.15E-03	1.18E-03	1.12E-04	6.13E-04	2.29E-03
F2	1.53E-05	1.43E-04	2.09E-04	3.31E-05	1.38E-04	2.37E-04
WTBE	4.50E-01	3.74E+00	1.76E+00	2.60E-01	1.08E+00	2.67E+00
Highest concentration from any one area						
SUM (micro-g/m3)	4.52E-01	3.74E+00	1.76E+00	2.61E-01	1.09E+00	2.67E+00
SUM (milli-g/m3)	0.000451687	0.003742643	0.00175902	0.000260977	0.001085551	0.002673737

Benzo(a)pyrene

V1EX	9.61E-04	2.42E-03	1.90E-03	3.85E-04	1.30E-03	1.60E-03
F1	4.76E-06	2.39E-05	3.80E-05	4.93E-05	3.06E-05	2.92E-05
V2EX	4.02E-03	4.15E-02	1.18E-02	1.12E-03	6.13E-03	2.29E-02
F2	1.03E-04	1.25E-03	5.77E-04	1.02E-04	3.83E-04	5.77E-04
WTBP	3.77E-04	2.70E-03	2.30E-03	8.13E-04	2.04E-03	3.15E-03
Highest concentration from any one area						
SUM (micro-g/m3)	5.09E-03	4.52E-02	1.43E-02	1.66E-03	7.84E-03	2.51E-02
SUM (milli-g/m3)	5.08876E-06	4.51939E-05	0.000014315	1.6563E-06	7.8436E-06	2.51062E-05

Calculation of Health Risk - Receptor Location 1

CDI = (C * IR * ET * EF * ED) / (365 * AT * BW)

Benzene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	0.000451687	0.000451687	0.000451687		0.000451687	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		10	
EF	156	156	156		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	3.29062E-07	1.55879E-07	1.18194E-07		8.06143E-07	
CDI threshold	2.30344E-05	1.09115E-05	8.27357E-06		5.643E-05	
SF benzene	0.021	0.021	0.021		0.021	
risk	6.91031E-09	3.27346E-09	2.48207E-09	**1.26658E-08**	1.6929E-08	
RfD benzene	0.0029	0.0029	0.0029		0.0029	
Hazard Index	0.007942886	0.003762593	0.002852955	**0.007942886**	0.019458615	

Benzo(a)pyrene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	5.08876E-06	5.08876E-06	5.08876E-06		5.08876E-06	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		8	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	1.85363E-09	8.78074E-10	6.65792E-10		7.26567E-09	
CDI threshold	1.29754E-07	6.14652E-08	4.66055E-08		5.08597E-07	
SF benzo(a)pyrene	304	304	304		304	
risk	5.63503E-07	2.66935E-07	2.02401E-07	**5.63503E-07**	2.20876E-06	

Calculation of Health Risk - Receptor Location 2

CDI = (C * IR * ET * EF * ED) / (365 * AT * BW)

Benzene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	0.003742643	0.003742643	0.003742643		0.003742643	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		10	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	1.36329E-06	6.45799E-07	4.89672E-07		6.67963E-06	
CDI threshold	9.54304E-05	4.5206E-05	3.4277E-05		0.000467574	
SF benzene	0.021	0.021	0.021		0.021	
risk	2.86291E-08	1.35618E-08	1.02831E-08	**5.2474E-08**	1.40272E-07	
RfD benzene	0.0029	0.0029	0.0029		0.0029	
Hazard Index	0.03290704	0.015588262	0.011819671	**0.03290704**	0.161232441	

Benzo(a)pyrene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	4.51939E-05	4.51939E-05	4.51939E-05		4.51939E-05	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		8	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	1.64623E-08	7.79828E-09	5.91298E-09		6.45273E-08	
CDI threshold	1.15236E-06	5.4588E-07	4.13909E-07		4.51691E-06	
SF benzo(a)pyrene	304	304	304		304	
risk	5.00453E-06	2.37068E-06	1.79755E-06	**9.17276E-06**	1.96163E-05	

Calculation of Health Risk - Receptor Location 3

CDI = (C * IR * ET * EF * ED) / (365 * AT * BW)

Benzene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	0.00175902	0.00175902	0.00175902		0.00175902	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		8	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	6.40739E-07	3.03522E-07	2.30143E-07		2.51151E-06	
CDI threshold	4.48517E-05	2.12465E-05	1.611E-05		0.000175806	
SF benzene	0.021	0.021	0.021		0.021	
risk	1.34555E-08	6.37396E-09	4.833E-09	**2.46625E-08**	5.27417E-08	
RfD benzene	0.0029	0.0029	0.0029		0.0029	
Hazard Index	0.015466108	0.007326388	0.005555174	**0.015466108**	0.060622613	

Benzo(a)pyrene						
	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	0.000014315	0.000014315	0.000014315		0.000014315	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		8	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	5.21437E-09	2.47008E-09	1.87292E-09		2.04388E-08	
CDI threshold	3.65006E-07	1.72905E-07	1.31104E-07		1.43072E-06	
SF benzo(a)pyrene	304	304	304		304	
risk	1.58517E-06	7.50904E-07	5.69366E-07	**2.90544E-06**	6.21339E-06	

Calculation of Health Risk - Receptor Location 4

CDI = (C * IR * ET * EF * ED) / (365 * AT * BW)

Benzene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	0.000260977	0.00175902	0.00175902		0.00175902	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		8	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	9.50633E-08	3.03522E-07	2.30143E-07		2.51151E-06	
CDI threshold	6.65443E-06	2.12465E-05	1.611E-05		0.000175806	
SF benzene	0.021	0.021	0.021		0.021	
risk	1.99633E-09	6.37396E-09	4.833E-09	**1.32033E-08**	5.27417E-08	
RfD benzene	0.0029	0.0029	0.0029		0.0029	
Hazard Index	0.002294632	0.007326388	0.005555174	**0.007326388**	0.060622613	

Benzo(a)pyrene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	1.6563E-06	1.6563E-06	1.6563E-06		1.6563E-06	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		8	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	6.03322E-10	2.85797E-10	2.16703E-10		2.36485E-09	
CDI threshold	4.22326E-08	2.00058E-08	1.51692E-08		1.65539E-07	
SF benzo(a)pyrene	304	304	304		304	
risk	1.8341E-07	8.68824E-08	6.58779E-08	**3.3617E-07**	7.18913E-07	

Calculation of Health Risk - Receptor Location 5

CDI = (C * IR * ET * EF * ED) / (365 * AT * BW)

Benzene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	0.001085551	0.001085551	0.001085551		0.001085551	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		8	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	3.95422E-07	1.87314E-07	1.42029E-07		1.54994E-06	
CDI threshold	2.76795E-05	1.3112E-05	9.94204E-06		0.000108496	
SF benzene	0.021	0.021	0.021		0.021	
risk	8.30386E-09	3.93359E-09	2.98261E-09	**1.52201E-08**	3.25487E-08	
RfD benzene	0.0029	0.0029	0.0029		0.0029	
Hazard Index	0.009544667	0.004521366	0.003428289	**0.009544667**	0.037412299	

Benzo(a)pyrene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	7.8436E-06	7.8436E-06	7.8436E-06		7.8436E-06	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		8	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	2.8571E-09	1.35343E-09	1.02622E-09		1.1199E-08	
CDI threshold	1.99997E-07	9.47398E-08	7.18357E-08		7.8393E-07	
SF benzo(a)pyrene	304	304	304		304	
risk	8.68559E-07	4.11442E-07	3.11972E-07	**1.59E-06**	3.4045E-06	

Calculation of Health Risk - Receptor Location 6

CDI = (C * IR * ET * EF * ED) / (365 * AT * BW)

Benzene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	0.002673737	0.002673737	0.002673737		0.002673737	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		8	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	9.73933E-07	4.61358E-07	3.49821E-07		3.81753E-06	
CDI threshold	6.81753E-05	3.22951E-05	2.44875E-05		0.000267227	
SF benzene	0.021	0.021	0.021		0.021	
risk	2.04526E-08	9.68852E-09	7.34624E-09	**3.74873E-08**	8.01682E-08	
RfD benzene	0.0029	0.0029	0.0029		0.0029	
Hazard Index	0.023508728	0.011136226	0.008443951	**0.023508728**	0.092147324	

Benzo(a)pyrene

	Child 0-5	**Child 6-15**	**Adult 16 - 70**		**Construction Worker**	
C	2.51062E-05	2.51062E-05	2.51062E-05		2.51062E-05	
IR	0.63	0.78	1.2		1.33	
ET	10	10	10		8	
EF	78	78	78		240	
ED	0.25	0.25	0.25		1	
AT non threshold	70	70	70		70	
AT threshold	1	1	1		1	
BW	13.2	34.5	70		70	
CDI non threshold	9.14516E-09	4.33212E-09	3.28479E-09		3.58463E-08	
CDI threshold	6.40161E-07	3.03248E-07	2.29935E-07		2.50924E-06	
SF benzo(a)pyrene	304	304	304		304	
risk	2.78013E-06	1.31696E-06	9.98577E-07	**5.09567E-06**	1.08973E-05	

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