Project No. 44280 EMS
June 2011

ENVIRONMENTAL MANAGEMENT STRATEGY (EMS)
AIR QUALITY ODOUR AND GREENHOUSE GAS MANAGEMENT PLAN

Former QUARRY SITE AT OLD WALLGROVE ROAD EASTERN CREEK
MATERIALS PROCESSING CENTRE (MPC)
WASTE TRANSFER FACILITY associated with an adjacent
PROPOSED SOLID WASTE LANDFILL
Document Control

Reference Documents
22 December 2009 Air Quality Management Plan by PAE Holmes - Consultant Aleks Todoroski (**PAE Holmes**)
1 July 2010 Noise and Air Quality Monitoring Report by PAE Holmes – Consultant Aleks Todoroski (**PAE Holmes Report**)

For controlled copies of this EMS the copy number is shown below and initialled in Red by the Light Horse Business Centre and the The Quarry Unit Trust Project Manager.

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1 AIR QUALITY, ODOUR AND GREENHOUSE GAS MANAGEMENT PLAN

PROJECT APPROVAL CONDITIONS

An Air Quality, Odour and Greenhouse Gas Management Plan is required to be prepared and implemented in accordance with Condition 37 of Schedule 3 of the Project Approval. Condition 37 is as follows.

*The Proponent shall prepare and implement an **Air Quality, Odour and Greenhouse Gas Management Plan** for the project to the satisfaction of the Director-General. This plan must:*

a) Be prepared in consultation with DECCW by a suitably qualified, experienced, and independent expert whose appointment has been endorsed by the Director-General, and submitted to the Director-General for approval within three months of the date of this approval;

b) Describe in detail the measures that would be implemented on site to control the odour and air quality impacts of the project, and to ensure that these controls remain effective over time;

c) Identify triggers for remedial action;

d) Include a program for monitoring the air quality and odour impacts of the project including a real-time dust monitor to measure dust emissions during operation.

e) Identify the number and location of continuous monitoring points for fine particulates (PM10) during each stage of works, ensuring sufficient representation of the relevant sensitive receptors at each stage of the proposed works;

f) Include development and identification of PM10 concentration trigger levels at which:

- *Dust management actions must be taken, and specification of the relevant actions; and*
- *Works at the site must cease.*

g) Include a program for monitoring subsurface gas, surface gas emission, and gas accumulation in general accordance with the guidance in sections 15-18 of Appendix A of the DECCW's Environmental Guidelines for Solid Waste Landfills, and

h) Include a protocol for remediating uncontrolled landfill gas emissions.

ACHIEVEMENT OF REQUIREMENTS

Table 1.1 lists the consent conditions for the preparation of an Air Quality Odour and Greenhouse Gas Management Plan, provides a summary of the current compliance status and provides recommendations to achieve compliance and to improve the presentation of the Program.

Table 1.1. Air Quality Odour and Greenhouse Gas Management Plan Compliance Review (Condition 37 of Schedule 3).

CONSENT REQUIREMENTS	COMPLIANCE STATUS
a) Be prepared in consultation with DECCW by a suitably qualified, experienced, and independent expert whose appointment has been endorsed by the Director-General, and submitted to the Director-General for approval within three months of the date of this approval;	Complies Plan prepared by PAE Holmes in consultation with DECCW Refer: Section 2 of this Management Plan; Section 1 of PAE Holmes; and PAE Holmes 9 August 2010 email included herewith.
b) Describe in detail the measures that would be implemented on site to control the odour and air quality impacts of the project, and to ensure that these controls remain effective over time;	Complies Refer: Sections 2 & 5 of this Management Plan; and Section 3 of PAE Holmes
c) Identify triggers for remedial action;	Complies Refer: Sections 2.1 & 4.4 of this Management Plan; and Section 4.1.4.1 of PAE Holmes
d) Include a program for monitoring the air quality and odour impacts of the project including a real-time dust monitor to measure dust emissions during operation.	Complies Refer: Sections 2.4, 3, 4 & 6 of this Management Plan; and Section 4 of PAE Holmes

e) Identify the number and location of continuous monitoring points for fine particulates (PM10) during each stage of works, ensuring sufficient representation of the relevant sensitive receptors at each stage of the proposed works;	Complies Refer: Section 2.4 of this Management Plan; and Section 4.1.3 of PAE Holmes Section 2.2 of PAE Holmes Report
f) Include development and identification of PM10 concentration trigger levels at which: • *Dust management actions must be taken, and specification of the relevant actions; and* • *Works at the site must cease.*	Complies Refer: Section 2.1 of this Management Plan; and Section 4.1.4.1 of PAE Holmes
g) Include a program for monitoring subsurface gas, surface gas emission, and gas accumulation in general accordance with the guidance in sections 15-18 of Appendix A of the DECCW's Environmental Guidelines for Solid Waste Landfills, and	Complies Refer Section 4.4 of PAE Holmes
h) Include a protocol for remediating uncontrolled landfill gas emissions.	Complies Refer: Section 4.4 of this Management Plan; and Section 3.2 of PAE Holmes

Table 1.2 reviews whether the preparation of the Air Quality, Odour and Greenhouse Gas Management Plan, has been consistent with the requirements of Condition 2 of Schedule 5 of the Project Approval. It provides a summary of the current compliance status

Table 1.2. Air Quality Odour and Greenhouse Gas Management Plan Compliance Review (Condition 2 of Schedule 5).

CONSENT REQUIREMENTS	COMPLIANCE STATUS
prepared in accordance with any relevant guidelines.	Complies The Plan was prepared in accordance with the Benchmark Techniques outlined in DECCW's Waste Classification Guidelines

CONSENT REQUIREMENTS	COMPLIANCE STATUS
	and in accordance with DECCW's *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (DECC 2005a) Chapter 11 of the NSW Government Industrial Noise Policy and s8.2 Interim Construction Guide. as referred to in several parts of this Management Plan and PAE Holmes
a) Detailed baseline data;	Refer Appendix E of Environmental Assessment Report lodged in support of Proponent's Development Application No. 06-0239
b) A description of; • *The relevant statutory requirements (including any relevant approval, licence or lease conditions);* • *Any relevant limits or performance measures/criteria;* • *The specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;*	Complies Refer: Sections 1.1, 2.4, 3, 4 & 6.4 of this Management Plan; and Sections 1, 2, 3.2, 3.4.2, 4.1.1, 4.1.2, 4.1.3 & 4.1.4 of PAE Holmes
c) A description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Complies Refer: Sections 2.4, 3, 4 & 6.4 of this Management Report; and Sections 1, 2, 3.2, 3.4.2, 4.1.1, 4.1.2, 4.1.3 & 4.1.4 of PAE Holmes
d) A program to monitor and report any; • *Incidents;* • *Complaints;* • *Non-compliances with statutory requirements; and* • *Exceedances of the impact assessment criteria and/or performance criteria; and*	Complies Refer: Sections 2.1, 2.4, 3, 4.1, 4.4, 6.1, 6.2 & 6.5 of this Management Report; and Sections 4, 5.2, 6.1 & 6.2 of PAE Holmes

CONSENT REQUIREMENTS	COMPLIANCE STATUS
e) A protocol for periodic review of the plan.	Complies Refer: Sections 6.2, 6.3, 6.4, 6.6 and 7.1 of this Management Plan; and Sections 6.3 & 6.4 of PAE Holmes

2 AIR QUALITY MANAGEMENT CONTROL OF PARTICULATE EMISSIONS (Benchmark Table BM 34)

AIRBORNE IMPURITIES AND TOXINS (Benchmark Table BM 34)

MANAGEMENT OF DUST (Benchmark Tables BM 24, 33, 34 & 36)

DUSTY WASTES (Benchmark Tables BM 21-23 & 34)

AN AIR QUALITY, ODOUR AND GREENHOUSE GAS MANAGEMENT PLAN is required to be prepared and implemented in accordance with condition 37 of schedule 3 of the project approval.

The Report must be *prepared in consultation with DECCW by a suitably qualified, experienced, and independent expert whose appointment has been endorsed by the Director-General, and submitted to the Director-General for approval within three months of the date of this approval;*

The Director General has endorsed the use of PAE Holmes Pty Ltd for the preparation of the Air Quality, Odour and Greenhouse Gas Management Plan

PAE Holmes records
a) Detailed baseline data; and
b) A description of;

- The relevant statutory requirements (including any relevant approval, licence or lease conditions);
- Any relevant limits or performance measures/criteria;
- The specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;

2.1 CRITERIA

PAE Holmes identifies triggers for remedial action as follows,

The relevant criteria are set out in condition 37 of Development Consent MP 06_0239 dated 22 November 2009. Air Quality Potential for Adverse impacts

Particulate Matter less than 10 Microns (PM_{10})

Emissions of PM_{10} and $PM_{2.5}$ are considered important pollutants in terms of impact due to their ability to penetrate into the respiratory system.

In the case of the $PM_{2.5}$ category, recent health research has shown that this penetration can occur deep into the lungs.

Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

One of the difficulties in dealing with air quality goals governing fine particles such as PM_{10} is that the medical community has not been able to establish a threshold value below which there are no adverse health impacts.

The NSW Department of Environment and Conservation (DEC) PM_{10} impact assessment goals, as expressed in their document, "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*", (AMMAAP) (Dec. 2005) are:

- 24-hour maximum of 50 $\mu g/m^3$.
- Annual average of 30 $\mu g/m^3$.

The 24-hour PM_{10} reporting standard of 50 $\mu g/m^3$ is numerically identical to the equivalent National Environment Protection Measure (or NEPM) reporting standard except that the NEPM reporting standard allows for five exceedances per year.

These NEPM goals were developed by the National Environmental Protection Council (NEPC) in 1998 to be achieved within 10 years of commencement.

The NSW Department of Planning (DoP) in setting development consent conditions for extractive industries under Section 80 of the Environmental Planning and Assessment Act 1979, additionally reference Land Acquisition Criteria, which when exceeded, require the developer to acquire the land.

The DoP short term land acquisition criteria for particulate matter are given in 1.

Table11 Short Term Land Acquisition Criteria

	Pollutant	Averaging Period	Criterion	Percentile	Basis
PM_{10}		24-hour	150 µg/m^3	99	Total[1]
PM_{10}		24-hour	50 µg/m^3	98.6	Incremental[2]

Note[1] Background PM_{10} concentrations due to all other sources plus incremental increase in PM_{10} due to development alone.

Note[2] Incremental increase in PM_{10} concentration due to development alone.

The DoP land acquisition criterion thus states that the total PM_{10} concentration (background plus increment) should not exceed 150 µg/m^3 on more than three occasions in any one year. The incremental PM_{10} concentration, due to the development alone should not exceed 50 µg/m^3 on more than five occasions annually.

The US EPA has developed an Air Quality Index (AQI) for reporting to the community on daily air quality. The AQI is designed to tell the community how clean the air is and focuses on the health effects that may be experienced from breathing polluted air for periods ranging between a few hours to days. The US EPA AQI for particulate pollution is given in **Table** .

Table 2 US EPA AQI for Particulate Pollution

QI	ir Quality	Health Advisory	Equivalent PM_{10} Concentration
0-50	Good	None.	0 µg/m^3 - 54 µg/m^3

51-100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.	5 $\mu g/m^3$ – 154 $\mu g/m^3$
101-150	Unhealthy for sensitive groups	People with health or lung disease, the elderly and children should reduce prolonged or heavy exertion.	155 $\mu g/m^3$ – 254 $\mu g/m^3$
a. 151-200	Unhealthy	People with health or lung disease, the elderly and children should avoid prolonged or heavy exercise. Everyone should reduce prolonged or heavy exertion.	255 $\mu g/m^3$ – 354 $\mu g/m^3$
b. 201-300	Very Unhealthy (Alert)	People with health or lung disease, the elderly and children should avoid all outdoor activity. Everyone should avoid prolonged or heavy exertion.	355 $\mu g/m^3$ – 424 $\mu g/m^3$

The US EPA AQI indicates that at 24-hour PM_{10} concentrations in the region of 55 $\mu g/m^3$ to 154 $\mu g/m^3$ may have moderate health implications for unusually sensitive people. 24-hour PM_{10} concentrations in excess of 155 $\mu g/m^3$ are considered unhealthy.

Criteria Applicable to Particulate Matter less than 2.5 Microns ($PM_{2.5}$)

In December 2000, NEPC initiated a review to determine whether a new ambient air quality standard for particulates 2.5 microns or less in aerodynamic diameter ($PM_{2.5}$) was needed in Australia, and the feasibility of developing such a standard. The review found that:

- there are health effects associated with fine particles,
- the health effects observed overseas are supported by Australian studies,
- fine particle standards have been set in Canada and the USA, and an interim guideline proposed for New Zealand.

The review concluded that there was sufficient community concern regarding $PM_{2.5}$ to consider it an entity separate from PM_{10}. As such, in July 2003 a variation to the Ambient Air Quality National Environment Protection Measure (NEPM) was made to extend its coverage to $PM_{2.5}$. The NEPM reporting standards for $PM_{2.5}$ are:

- 24-hour maximum of 25 $\mu g/m^3$.
- Annual Average of 8 $\mu g/m^3$.

As there is little data available regarding $PM_{2.5}$ emission factors, $PM_{2.5}$ has not been quantitatively assessed within the report. In addition, given the nature of activities being undertaken at the Eastern Creek site, Criteria Applicable to Total Suspended Particulate

The annual goal for Total Suspended Particulate (or TSP) is given as 90 $\mu g/m^3$ as recommended by the National Health and Medical Research Council (NHMRC) at their 92nd session in October 1981. It was developed before the more recent results of epidemiological studies suggested a relationship between health impacts and exposure to PM_{10} concentrations.

It is noted that the PM_{10} sub-set is typically 50% of total suspended particulate (TSP) mass in regions where road traffic is not the dominant particulate source (USEPA, 2001). This would be consistent with an annual average PM_{10} goal of approximately 45 $\mu g/m^3$ (derived from 50% of the annual NHMRC goal of 90 $\mu g/m^3$). Thus, the historical NHMRC goal may be regarded as not as stringent as the newer PM_{10} goal of 30 $\mu g/m^3$ expressed as an annual average.

The Eastern Creek Quarry is bounded on the northern side by the M4 Motorway which is a six lane highway and the M7 Motorway lies 1.3 km to the east.

These routes are major traffic arteries and include heavy vehicle traffic.

Where road traffic is the dominant source of particulate pollution, the PM_{10} subset of TSP from heavy vehicle exhaust emissions (diesel emissions) can be as high as 96% (Watson et al, 2000). The annual TSP goal is seen to be achieved if the annual PM_{10} goal is satisfied, Nuisance Impacts of Fugitive Emissions

The preceding sections are concerned in large part with the health impacts of particulate matter. Nuisance impacts need also to be considered, mainly in relation to dust. In NSW, it is accepted practice that dust becomes a nuisance in relation to its impact on residential areas when annual average dust deposition levels exceed 4 g/m^2/month (inclusive of background dust levels).

3 presents the NSW DECCW impact assessment goals for dust fallout, showing the allowable increase in dust deposition level over the ambient (background) level which would be acceptable so that dust nuisance could be avoided and the maximum allowable total dust level before loss of amenity is experienced.

Table 32 DECCW Goals for Allowable Dust Deposition

Averaging Period	**Maximum Increase in Deposited Dust Level**	**Maximum Total Deposited Dust Level**
Annual	$2g/m^2$/month	$4g/m^2$/month

Source: AMMAAP, DEC 2005.

As the ambient dust deposition level has been assumed to be $2g/m^2$/month the maximum increase in deposited dust level will be the governing goal for the project).

Trigger Levels for Activity Control

There are two PM10 concentration trigger levels required for the site, as follows:

- Trigger Level 1 – elevated 1-hour average PM10 concentrations indicate that additional dust control measures are required; and

- Trigger Level 2 – sustained elevated 1-hour and 24-hour average PM10 concentrations indicate that site activities should cease.

Trigger values are presented for two averaging periods and explained as follows.

- ***Trigger Level 1***: Remedial action is required under Trigger Level 1 when peak 1-hour concentrations are above 100 µg/m3 for three (3) consecutive hours and the wind is blowing from the site to the monitoring location.

- ***Trigger Level 2***: Under extreme cases, open air crushing or screening site operations would be required to cease under Trigger Level 2. This applies when the rolling 24-hour concentration is above 50 µg/m3 for 24 consecutive hours and the peak 1-hour concentrations above 100 µg/m3 are also sustained.

- The additional conditions for when this applies that the wind is blowing from the site to the monitoring location and that the elevated PM10 concentrations are not caused by an external regional pollution event such as a bushfire or dust storm. This is tested by examining the 24-hour PM10 concentrations at the DECCW's monitoring sites at Prospect and St Marys.

The Plan Includes development and identification of PM10 concentration trigger levels at which:

- Dust management actions must be taken, and specification of the relevant actions; and
- Works at the site must cease.

2.2 MITIGATION AND CONTROL MEASURES

- PAE Holmes Report in Section 3 describes in detail the measures that would be implemented on site to control the odour and air quality impacts of the project, and to ensure that these controls remain effective over time;

These include that Site Operator must minimise the amount of dust emitted from the premises. The following measures must be followed:

WIND MEASUREMENT- General

An anemometer shall be maintained on the Site at all times and shall be installed and operated in accordance with its manufacturer's instructions.

The anemometer shall be maintained and checked regularly to ensure it is in good working order during the hours of operation of the Site.

AUTOMATED WATER SPRAYS

The anemometer shall be linked to a device that issues a warning and which activates mist sprays along the perimeter escarpment of the Pit Area in the north and north east of the site and appropriate sprays in areas where processing is carried out in the open air when wind speeds exceed 30 km/h and it is not raining.

Locations and zones of influence of sprays and misters are shown on the diagram which is Annexure 1 to this EMS.

HIGH WINDS

When:

(a) the wind speed is measured above 30 kms per hour and,

(b) when it is not raining

then in addition to those other mitigation measures referred to in this DMP those parts of the Site with a potential for dust generation must be continuously kept damp or high pressure mist sprays shall be activated along that perimeter of the Site Area opposite to the direction of wind or any area used for processing.

The installed suppression system shall be designed such that it will automatically operate to spray a sufficient amount of water to suppress dust and to prevent fugitive emissions whenever wind speeds as measured by the anemometer installed on the Site exceed 30 km/hour and when it is not raining, even when the Site is not open.

Dust sprays and/or dust collection systems must be installed and operating on all crushing, grinding and screening equipment at the Site.

FURTHER DUST SUPPRESSION MEASURES

Since the lodgement and public exhibition of the EA the proponent has further refined the proposed materials handling techniques which affect the previous modelling in the following ways,

The proposed installation of a chute to transfer materials from the upper ground surface to the Quarry floor removes the need for Dump truck vehicles to traverse the perimeter road of the Quarry.

Airborne particulate emissions (dust) generated by the journeying of Dump trucks from the quarry surface via the perimeter road to the quarry base was modelled in the manner set out in the EAR.

The use of an electrically driven conveyor fed chute directly from the MPC building to the chute feed point removes from the model dust generated by CAT 740 Dump Trucks transporting waste from the surface to the Quarry floor and returning unladen.
Minimum criteria are established in the Project Modification Approval.

In addition,There are a number of dust control techniques available to reduce dust emission at an outdoor materials recovery facility.
These specific controls and approaches arising from the project specific dust sources are outlined in this DMP.
It is proposed that the following dust suppression measures be applied **as a minimum.**

Roads
Paved site roads and unpaved areas will be watered regularly by the water cart spray to suppress dust.

- Water sprays will be applied to all unsealed haul roads. Level 1 watering (2 litres/m3/hr) can reduce emissions by up to 50%.
- Increasing this to Level 2 watering (>2 litres/m3/hr) can reduce emissions by up to 75%.
- An additive could also be applied to the water sprays which reduces the surface tension of water allowing it to penetrate deeper into the road and further reduce dust emissions.
- Sealed or gravel road must be constructed and maintained from the public roadway to the gatehouse (weighbridge) reception area of the landfill;
- Dust suppression methods must be used as frequently as necessary for any unsealed on unvegetated areas at the landfill including the use of water sprays and water carts; and

- A water cart must always be available on the site for the purpose of dust suppression.
- The operator will also ensure that the access road is adequately drained or dewatered and ensure that the access roads, platforms and tipping face areas are maintained in a conditioned state to prevent or substantially reduce dust emissions.
- Site roads and access roads must be maintained and be subjected to dust suppression measures in dry periods or in periods of windy conditions.
- Paved site approach roads shall be swept once daily to remove dust and debris which may accumulate.
- Litter pick up patrols will be mounted at least on alternate days or in the event of public complaints regarding the presence of litter. Litter will be picked up and taken to the site for disposal.
- The operator shall make use of a water tanker with suitable spray bar to condition surfaces and roads to damp down dust and suppress emissions from the passage of vehicles.

Site/Traffic Management

- Trucks must be immediately covered after being loaded with fines and aggregates and tailgates should be effectively sealed prior to leaving site.
- All vehicles on site will be confined to designated roads with a speed limit of 15 km/h strictly enforced.
- Vehicle speeds have approximately a linear relationship to dust emissions, that is, a 50% reduction in speed can achieve a 50% reduction in dust generation.
- All trucks leaving the site should be required to pass through a truck wheel wash before returning to sealed roads within the Facility..
- Pre-notification/booking of the arrival of dusty loads by the waste producer will be required by the operator and notices regarding procedures to be adopted will be displayed at prominent locations on the approaches to the tipping face and at the gatehouse/weighbridge complex as well as distributed to all site staff and to waste transporters if required..
- Incoming Vehicles will be required to pass through an automated load wetting process before their loads are tipped.

Barriers

- Impermeable landscaped earthen bunds will be constructed and maintained along the site boundary to protect neighbouring premises where appropriate.
- These walls or barriers would be supplemented by landscape plantings of mature screen trees probably cupressus Lleylandii (Leighton Green).
- These plantings would operate to screen and mask the operation from surrounding landholders. Tree heights of mature plants will rapidly achieve 5-6metres

Stockpile management

- Water sprays, or a suitable alternative dust control measure, will operate on any above ground uncovered or unsheltered stockpiles to reduce wind erosion by up to 50%.
- Wind erosion from stockpiles of fines (sands), with a higher potential for dust emissions, will be minimised by sheltering stockpiles using wind shields or breaks. During periods of high winds these stockpiles will be subject to water sprays to further reduce dust emissions.
- When critical wind speeds and directions are reached, fugitive dust emissions can be further reduced by increasing the frequency of water sprays.
- Wind speeds would be measured by an onsite anemometer.
- A possible alternative to water sprays is to use a stabilisation or crusting agent. This forms a fast drying, thick crust on the surface of the stockpile. The sealing agent is an acrylic polymer formulated to penetrate and bind soil, coal, limestone and other particles to prevent fugitive dust emissions.
- The number of work faces on stockpiles must be limited to one where practical.
- Wetting down of stockpiles should occur before transfer within or removal off site.
- Wetting down of raw materials stockpiles should occur before all crushing and screening.

Tipping in Quarry

- Tipping on site will occur within the Quarry void and this will be expected initially to be approximately 150 metres below surrounding landforms. This can reduce dust emissions by up to 95%.
- Prompt compaction of wastes will occur after dumping followed by covering with suitable material to sufficient depth.

- All earthmoving activities will occur within the reach of the water spray system.
- Waste disposal above natural contours will not occur for many decades.
- When it eventually occurs it will ultimately require that cells walls are constructed to contain the wastes and drop-out dust emissions. In addition, the cell wall construction will ensure that runoff is directed away from the waste materials (or contained within the cell and treated as leachate) and is collected by surface drains.
- The working face shall be limited in dimension to prevent or substantially reduce nuisance from litter, dust and visual impact.
- The working area shall be large enough to facilitate manoeuvring and redistribution of material delivered by chute.
- The tipping face shall not be more than 500 mm in height and shall be oriented such that the placement of refuse is facilitated and such that compactors can move from the base upwards to facilitate maximum compaction of the wastes.
- Working at the tipping face will be controlled by tip face operative who will also direct traffic (if any) and ensure dust emissions are minimised.
- A water mist spray will be available at the tipping face to damp down any dusty wastes that are disposed. Drop heights should be minimised or dusty wastes rejected for disposal unless prior arrangement has been made.
- Operatives supervising receipt of materials will wear suitable face masks to prevent dust inhalation during the disposal of dusty wastes.

Drop Heights

- Drop heights from conveyors should be kept to a minimum, and chutes socks and cowlings should be used. The use of a variable height stacker to load stockpiles can reduce emissions by up to 25%.
- Fugitive dust emissions from the operation of the crusher will be achieved through a number of control measures such as windbreaks, water sprays, or hooding with fabric filters. The combination of using wind breaks and applying water sprays has been shown to result in an 80% reduction in dust emissions from crushing activities in mines.
- Fine mist sprays will operate on all crushing and screening equipment to keep materials moist during processing. Dust suppressant foams are also effective in combating dust by expanding water by up to 100 times thereby increasing the effectiveness of water sprays.

- Fugitive dust emissions from the operation of the crusher will be reduced through a number of control measures such as windbreaks, water sprays, or hooding . The combination of using wind breaks and applying water sprays has been shown to result in an 80% reduction in dust emissions from crushing activities in mines.
- Dusty wastes must be wetted or arrive in sealed bags which will have been organised by prior arrangement.
- The dust suppression programme will be carried out in such a manner as to prevent excess water ponding or running over exposed surfaces. Vehicle speeds within the site must be restricted by the operator to 15 km/hour.

2.3 CONTINGENCY MEASURES

Specific responsibilities of the Site Project Manager that seek to address any unpredicted impacts and to improve the environmental performance in terms of dust/air quality issues includeLogging of weather conditions on a daily basis, including wind speed and direction and also by reference to the nearest BOM monitoring site.

Dust control measures to be implemented under Trigger 1 will depend on the activities occurring on-site at the time and will involve:

- Increasing the frequency of watering for exposed areas and stockpiles.
- Increasing the frequency of watering on paved and unpaved roads.
- Modifying site activities such as ceasing all open air processing (i.e. crushing).
    - Removing mud from wheels and bodies of haulage equipment before they enter public roads and ensure loads are fully covered.
    - Remove mud spilt on public roads by construction equipment.
    - Service and maintain all plant and equipment powered by internal combustion engines to ensure exhaust emissions comply with regulations.
    - Visually monitor and record dust emissions to ensure emission comply with regulatory requirements.
    - Define trafficked areas.

- Impose site vehicle speed limits.
- Stabilise exposed areas as quickly as possible.
- Install perimeter dust fences around the main area of operations to provide a barrier for dust emissions.
- Immediately clean spills of potentially dusty materials.

- In the event there is an exceedance of the trigger values at sensitive receivers then the control measures outlined in this section must be enhanced with greater use of water on site for dust suppression. If enhanced measures are unsuccessful, then all on site earthmoving and dust generating works outside of the perimeter berms works must cease until there is a variation in climatic conditions.
- The Site Project Manager shall monitor the site daily and report weekly to the Landowner on the following:
  - The impacts and environmental performance of the Cut and Fill Bulk Earthworks.
  - Effectiveness of the management measures in relation to cut and fill works and compaction.
  - Any recommendations of ways to improve the environmental performance of the works over time.

2.4 MONITORING AND COMPLIANCE REPORTING

The Plan includes a program for monitoring the air quality and odour impacts of the project including a real-time dust monitor to measure dust emissions during operation.

Routine dust monitoring will continue on a monthly basis as prescribed in the *Environmental Guidelines: Solid Waste Landfills* (1996) and according to AS3580.10.1-1991 (Method 10.1).

To ensure adjacent sensitive receivers are not impacted by on-site operations, an ongoing air quality monitoring program will be established to assess the performance of on-site mitigation measures.

Non-compliance with the air quality trigger levels would be reported promptly and corrective action taken to mitigate any impacts.

Should monitoring reveal exceedances of air quality trigger levels at adjacent sensitive receivers, additional dust mitigation would be instigated through processes defined within this EMS.

Results of monitoring would be reported to Management so that dust control and operational procedures can be reviewed and modified, if required. Results of monitoring would be reported through an Annual Environmental Monitoring Report.

An effective complaint investigation shall be undertaken to determine the nature of the complaint and then determine whether an exceedance has occurred or an aesthetic issue is present.

A review of work procedures and/or dust control procedures shall be undertaken in response to complaints and supplementary monitoring undertaken if deemed necessary.

The Plan identifies the number and location of continuous monitoring points for fine particulates (PM10) during each stage of works, ensuring sufficient representation of the relevant sensitive receptors at each stage of the proposed works;

- A meteorological monitoring station will be established on site with sensors to measure wind speed and wind direction.
- The real- time dust monitoring will be conducted in accordance with the NSW DECCW "*Approved methods for the sampling and analysis of air pollutants in NSW*" **(DECC 2005a)**.

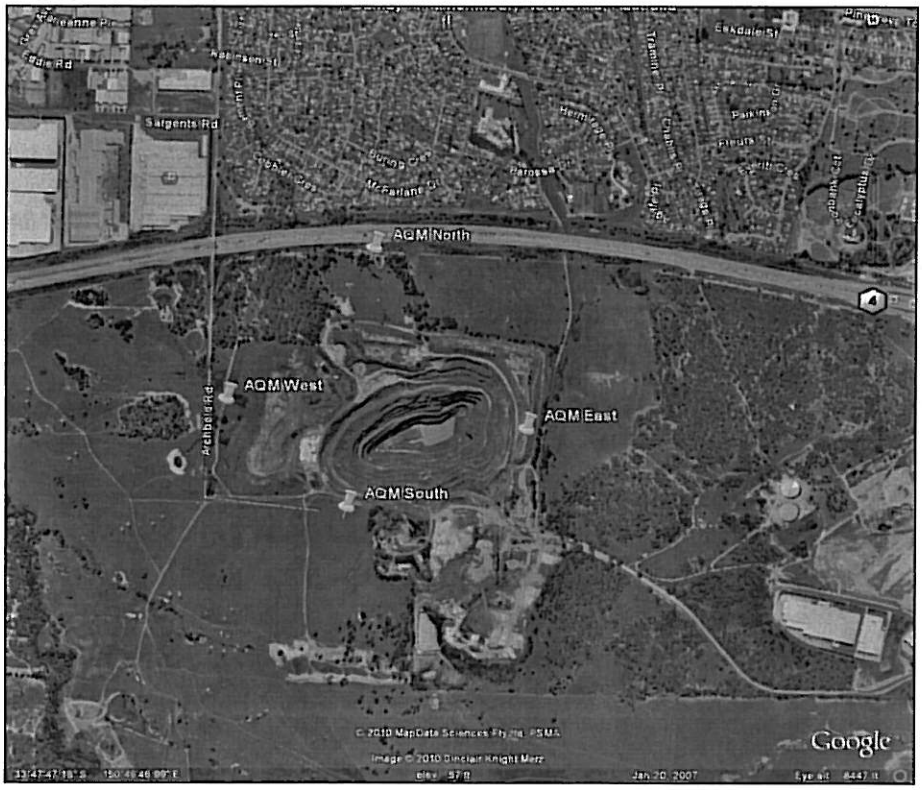
Real time PM10 monitoring will be to assess the potential for off-site air quality impacts and will commence by 15th April and for a representative period during Bulk earthworks. TAPM Generated Meteorology

TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), is a prognostic model which may be used to predict three-dimensional meteorological data, with no local data inputs required.

The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations. TAPM is often used where insufficient on-site meteorological data is available, and as such is considered suitable to predict indirect meteorological parameters in this assessment.

A TAPM generated meteorological input file has been provided by Holmes Air Sciences. Direct measurements obtained at Eastern Creek Corporation Limited (SACL) meteorological monitoring site (hourly average wind speed, wind direction and temperature) were used in creating the meteorological input file for modelling purposes. Parameters not recorded by the AWS (atmospheric stability class, mixing height and sigma theta) but required by the meteorological input file have been synthetically generated using TAPM.

Dust deposition monitoring at four locations around the site as shown on the plan below, or as specified by DECCW.



3 LANDFILL GAS EMISSIONS QUALITY AND DISTRIBUTION

(Benchmark Tables 15-19)

The Plan includes a program for monitoring subsurface gas, surface gas emission, and gas accumulation in general accordance with the guidance in sections 15-18 of Appendix A of the DECCW's Environmental Guidelines for Solid Waste Landfills.

Landfill gas (LFG) emissions from the site can be expected to develop as filling proceeds. Benchmark Technique No. 11 suggests that a positive gas extraction system should be installed where there is a risk of explosion, fire or excessive greenhouse gas emissions.

The DECCW recommends gas extraction where methane levels in buildings, or beyond the site boundary exceeds 1.25% methane or 25% of the lower explosive limit (LEL) for methane in air of 5% by volume.

The *Environmental Guidelines: Solid Waste Landfills* (1996) indicates a guideline trigger value of 1.25% methane (i.e. 25% of the lower explosive limit – LEL) at which point increased monitoring and DECCW notification should occur.

In accordance with the Benchmark requirements (Benchmarks 15, 16, 17 and 18) annual gas monitoring survey of the landfilled surface will be conducted for LFG emissions.

A summary of the proposed methodology is provided in Tables BM 15-19. The actual methodology to be employed will be provided in annual reports prepared by external consultants engaged to monitor, report and manage environmental issues in accordance with DECCW licence and landfilling guidelines, however this will broadly include:-

- LFG monitoring in four perimeter wells and at low pressure points;
- Monitoring within capping on a grid basis;
- Monitoring in air at 50 mm above capping on a grid basis (walkover); and
- Monitoring in structures and dead air spaces within the landfill and within 25 m of the landfill boundary.

4 GREENHOUSE GAS EMISSIONS (Benchmark Technique Table BM 17)

The Plan also includes a protocol for remediating uncontrolled landfill gas emissions.

The method of waste emplacement involving daily cover will inevitably lead to anaerobic conditions and decompositional processes. Accordingly, some potential for methane and carbon dioxide gas emissions exists, particularly whilst daily or intermediate cover is in place.

Placement of interim (temporary) cover will alleviate such emissions and completion of final capping over the finished areas of the site should further reduce the potential for LFG emission to the atmosphere.

Methane generation is an inevitable consequence of anaerobic waste decomposition and the amount of methane generated is generally finite (a function of the nature of wastes disposed and the active environment within the site).

The main control available in terms of minimising greenhouse gas emissions is to minimise the organic content of material to be landfilled and thereafter to reduce the rate of gas losses to the atmosphere by capping or the conversion of the gas to a less reactive form i.e. via combustion.

Complete containment of gas beneath the cover can, however, have negative effects by creating gas gradients which lead to lateral migration and off-site impacts. The general topography of the site and the surrounding landform would suggest that potential gas migration would be limited. Zones of potential gas impact are, in any case, fairly remote from the site. Accordingly, no provisions to further reduce risk from gas emission or migration are proposed at this stage.

The rate of methane losses measured at the surface by the walkover survey will determine the nature of potential greenhouse gas losses to atmosphere and the need to consider remedial actions such as additional capping and gas collection and oxidation.

4.1 CONCENTRATIONS OF LFG (Benchmark Technique Tables BM 15 - 19)

The potential for significant landfill gas emissions from the site is considered fairly remote at present.

Noting that the waste characteristics of the landfilled waste are non-putrescible, it is expected that landfill gas will not represent a major issue. However, since a small proportion of waste will be of

organic nature (but not necessarily putrescible) gas emissions in the future cannot be entirely ruled out.

Accordingly gas monitoring as outlined in this section is recommended until a body of suitable data has been accumulated.

No trace gas analysis data are presently available for the site. However, if methane emissions are observed at the surface during routine soil gas and walkover surveys then provision will be made to undertake trace gas sampling and analysis with results to be presented in the monthly and annual reports.

Proposed trace gas analytes are shown in Table 4.1 with corresponding trigger levels.

Table 4.1 - Trace Gas Analysis and Trigger Levels

Chemical	Trigger Level (TWA) (ppb/v)	Action Level (IDLH) (ppb/v)	Reference
Hydrogen sulphide	1.5×10^6	3.0×10^8	1
Chloromethane	50000	1.0×10^7	1 & 2
Vinyl Chloride	5000	ND	1 & 2
Methylene chloride	50000	5.0×10^6	1 & 2
Chloroform	10000	1.0×10^6	1 & 2
1,1,1-Trichloroethane	125000	ND	1
Benzene	5000	3.0×10^6	1 & 2
Toluene	100000	2.0×10^6	1 & 2
Total Xylene	80000	1.0×10^6	1 & 2

Notes

TWA Time Weighted Average exposure standard

IDLH Immediately Dangerous to Life or Health Concentration

ND Not Defined

1 National Occupational Health and Safety Commission (NOHSC), Exposure Standards for Atmospheric Contaminants in the Occupational Environment, 1991.

2 U.S. Department of Health and Human Services, NIOSH Pocket Guide to Chemical Hazards, 1990.

4.2 LFG UTILIZATION (Benchmark Table BM 19)

No landfill gas utilisation is proposed to be undertaken on the site and gas utilisation is not planned by the Site Owner. If for any reason gas was to be collected it would simply be burnt-off, as the economics of installing any type of gas utilisation plant are not considered viable. Due to the types of waste being landfilled the anticipated gas generated is not expected to be capable of sustaining an economic yield.

Further, the intention to remove the greater portion of organic material from the landfilled waste stream the potential to produce viable volumes of methane for reuse is not considered high and would not justify the considerable expenditure on active extraction and control systems which do not appear justified on environmental or health and safety grounds.

4.3 DETECTION OF LANDFILL GAS EMISSIONS (Benchmark Technique 17)

Quarterly surveys of landfill gas emissions will be undertaken in order to detect any future emissions through the cap and also at selected locations within the landfill i.e. at and beneath permanent structures (buildings) and enclosed spaces.

Monitoring will comprise a walk over gas probe survey utilising an infra-red scanning instrument (GA94A). Gas detection is to occur at 25 selected representative locations at the site, concentrating on areas where gas build up or egress may have, or may be occurring.

Concentrations of methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) are to be recorded as soon as the soil gas begins to pass through the instrument and maximum levels recorded for the three constituent gases. Upon stabilisation a further reading is to be taken to obtain residual gas concentrations.

Results will be forwarded to the DECCW as required. If the elevated soil or void space gases are confirmed then remediation measures will be immediately considered and a proposal for remediation reported to the DECCW.

4.4 REMEDIATING LANDFILL GAS (Benchmark Technique Table BM 19)

Landfill gas emissions to the atmosphere are most likely to be associated with breaches in the cover caused by erosion or slippage on sloping surfaces, or by slumping or cavitation on platforms which cause stress cracks in the capping.

Under such circumstances additional cover will be placed and compacted to rectify the problem and regular monitoring undertaken at an increased frequency to ensure that the gas hot spot has been rectified.

It should be noted however that the tighter the seal on the landfill the higher the gas pressure build-up beneath the cap will be. Any weak spots may be exploited under such a scenario.

Depending on the scale of the problem remediation may involve additional capping, the construction of a local cut-off on interceptor trench to enable venting to the atmosphere, installation of passive (or active) gas venting structures beneath buildings, installation of methane and carbon dioxide alarm systems, or the installation of positive gas abstraction in the area of the landfill considered to be causing the gas migration problem.

Based on the observed monitoring results to date and the physiographic features of the landfill and its environments it is not anticipated that gas remediation measures will be required. The exception may be the rectification of localised emissions through the cover and capping.

Trace gases analysis proposed in the Action Plan if methane trigger levels outside the landfill boundary are breached include:-

- total methane concentration;
- hydrogen sulphide;
- vinyl chloride;
- monoaromatic hydrocarbons (BTEX - compounds); and
- volatile chlorinated hydrocarbon compounds (VCHs).

Environmental trigger levels for a range of trace gases have been established and are shown in Table 4.1. Exceedance of these trigger levels will invoke the Action Plan for LFG. However, further remediation measures may be required if exceedances of trace gases are determined. The nature of the remediation required will depend on the circumstances observed

5 ODOUR MANAGEMENT (Benchmark Technique Table BM 36)

Odour management at the Site will be undertaken in the form of the following operational practices:-

- daily cover of the active tipping face;
- immediate burial of odourous or offensive wastes (normally an excluded waste);
- dust suppression by spraying and conditioning of wastes loads and haul roads;
- intermediate covering with 300 mm of VENM or other approved alternative cover;
- interim capping as agreed by DECCW;
- banning of all waste burning on site;
- ensuring that emission controls on operational vehicles are acceptable;
- ensuring that waste loads are covered when vehicles enter the site;
- provision of vehicle wash down facilities;
- inspection of waste loads to ensure that unacceptable/excluded wastes do not enter the site, and that any special wastes have been pre-notified and that a trench has been prepared for disposal; and
- response to complaints from the general public regarding odour - resulting in attempts to identify the source of the odour and immediate removal, or undertaking air monitoring if the source of odour is not readily discernible.

The above practices will continue as routine and will be reported on an annual basis.

6 ENVIRONMENTAL MONITORING, CORRECTIVE ACTION AND AUDITS

6.1 ENVIRONMENTAL MONITORING

Environmental monitoring to determine conformance of the LHBC Operations with the EMS will be managed by the Site Operations Manager.

Monitoring is undertaken in accordance with the Environmental Monitoring Program and individual Management plans and programs prepared in accordance with the Development Consent Conditions.

A schedule of environmental monitoring undertaken is also contained within the EMS along with an environmental monitoring site location plan.

The purpose of this monitoring is to provide a measure of the performance of the operation, which can be compared against the objectives, targets and performance criteria specified in the Environment Protection Licences, Consent Conditions and EMS.

All monitoring is undertaken using standard monitoring techniques and calibrated equipment operated by trained personnel.

Analysis of samples is to be undertaken in accordance with the Development Consent and DECCW licence conditions.

All monitoring results are to be filed by the Site Operations Manager for LHBC and maintained on site for at least four years.

Monitoring results are to be compared against development consent, licence and permit conditions and any non-conformance recorded against the monitoring result.

In the event of a non-conformance the Site Manager and the Divisional General Manager are to investigate the cause of the non-conformance and recommend corrective and/or preventative action.

The effectiveness of the corrective and/or preventative action is to be assessed by analysis of the next available monitoring results and during the next monthly site inspection.

Any changes to work procedures as a result of the corrective or preventative action are to be documented and communicated as per the sites change management procedure.

Calibration records are kept of the monitoring equipment used.

Calibration will be undertaken in accordance with the equipment manufacturer's recommendations. Where monitoring is outsourced, the consulting body is responsible for maintaining calibration and supplying the relevant documentation.

6.2 INSPECTIONS

Regular environmental inspections of the LHBC Facility Site operations are conducted.

These inspections are to determine, in conjunction with the environmental monitoring and incident/complaint reporting procedures, on-site compliance with the EMSs.

Site inspections are to be conducted by the Site Operations Manager or his/her delegate and the inspection results recorded on the inspection form.

Any non-conformances are to be recorded on the inspection form and the cause of the non-conformance investigated by the Site Operations Manager.

Corrective and/or preventative action is to be recommended by the person undertaking the inspection and the effectiveness of the corrective and/or preventative action assessed at the next monthly site inspection.

The Site Operations Manager will report any significant non-conformances arising from site inspections to the Operations Manager and General Manager.

6.3 INTERNAL AUDITS

Internal EMS audits will be undertaken annually to assess whether the EMS has been properly implemented and maintained and conforms to the environmental policy, objectives and targets of LHBC Executive Management Committee.

The results are communicated to senior management and employees in accordance with the EMS Communication Procedures.

Actions and recommendations from internal audits undertaken on site will also be entered into the site's reporting database.

Internal auditors are to be selected on the basis of their understanding of environmental management principles of Waste Processing and landfill operations.

Internal auditors shall be suitably qualified and experienced and be capable of impartially and objectively auditing the EMSs.

A schedule of Environmental Audits will be maintained within the EMS.

6.4 EXTERNAL AUDITS

Independent environmental audits of the operation are to be conducted within six months of commencement of Operations in accordance with Condition 7 of the Schedule 5 of the Development Consent.

Thereafter external audits shall be conducted every 2 years unless the Director General of Planning NSW directs otherwise.

External auditors are to be selected on the basis of their understanding of environmental management principles waste processing and landfill operations.

The selection of external auditors will be the responsibility of the LHBC Executive Management Committee Manager and the appointment duties and tasks of the auditors must satisfy the criteria and requirements set out in set out Condition 7 of the Schedule 5 of the Development Consent.

Actions and recommendations from external audits will be communicated to senior management and employees in accordance with relevant EMS communication procedures.

6.5 NON CONFORMITY, CORRECTIVE ACTION AND PREVENTATIVE ACTION

On receipt of an incident/complaint reporting form, site inspection form, hazard report or monitoring result that indicates a potential or actual non-conformance of the LHBC Waste Facility with the relevant EMSs, the Divisional General Manager or Site Operations Manager is to undertake an investigation and recommend corrective or preventative action.

Details of the required action(s) are to be communicated to the relevant supervisor of the specific operations area and a copy of the communications kept with the investigation report.

The effectiveness of the requested action is to be assessed within one month of the non-conformance.

Corrective and preventative actions relating to environmental aspects specifically identified within the Development Consents are addressed within the dedicated Environmental Management Plans and Programs as required by the Consents.

6.6 EMS RECORDS AND INFORMATION MANAGEMENT

A master copy of the EMSs including the Strategy, plans, procedures and supporting information is held in the office of the Managing Director and/Group General Counsel.

All EMS records are to be maintained in the appropriate location, as detailed throughout this document, in a legible form for a minimum period of four years.

The EMS is to be reviewed at least every two years and updated, as required.

7 REVIEW AND IMPROVEMENT

7.1 MANAGEMENT REVIEW

The review and revision of the EMS are to be undertaken by senior management not less than every two years.

The EMS review will include:

- review of audit findings;
- results of monitoring programs;
- achievement of objectives and targets;
- relevance of the Policy, objectives and targets to current and future conditions; and information and concerns of stakeholders.