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**ODOUR MANAGEMENT PLAN
for
BRYN PICA LANDFILL SITE**

**Amgen Cymru
Bryn Pica
Llwydcoed
Aberdare**

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ODOUR MANAGEMENT PLAN FOR BRYN PICA LANDFILL SITE

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SUMMARY

This document represents an updated Odour Management Plan for the operation of the Bryn Pica Landfill. The original report was provided in accordance with Item 5 of Table S1.3 in Schedule 1 to Environmental Permit DP3732SQ ("the Permit"), which authorises the operation of the Bryn Pica Landfill site ("the Installation"), wherein the following is stated:

'The operator shall submit to the Agency an odour management plan. The plan shall include, but not be limited to the following:

- *Control measures to prevent or control odour.*
- *A justification that there will not be an odour problem from emissions under normal conditions.*
- *Identification of the actions to be taken in the event of abnormal events or conditions which might lead to odour or potential odour problems.*
- *An understanding of the impact in the event of abnormal events or conditions, for example the failure of the landfill gas flare.*
- *Impact of any leachate recirculation;*
- *Monitoring undertaken.*
- *Notification of odour events.*
- *Odour control is not a once-off activity and requires constant re-evaluation of control techniques and this should form part of the odour management plan.*

The operator shall implement any improvements or measures as agreed in writing with the Environment Agency (now Natural Resources Wales-NRW).'

Odour Management Plan

1. INTRODUCTION

1.1 Terms of Reference and Context

- 1.1.1 The purpose of this Odour Management Plan (OMP) is to document actions taken by the Operator (Amgen Cymru) to mitigate the risk of odorous emissions resulting from landfill waste disposal activities at the Bryn Pica Site.
- 1.1.2 At the time of writing the Bryn Pica site has waste management activities governed by separate Environmental Permits including a waste transfer station and materials recycling facility. The provision set out within this OMP is only intended for application to the landfill waste disposal permit (DP3732SQ) and the associated activities. Other waste management operation at the site have separate OMPs.
- 1.1.3 Amgen Cymru (Amgen) is the trading name for Cynon Valley Waste Disposal Company Ltd., a small to medium waste management company owned and operated by Rhondda Cynon Taf County Borough Council (RCTCBC). Amgen is the holder of the environmental permit for landfill operations at the Bryn Pica site.
- 1.1.4 Implementation of this OMP will as far as practicably possible mitigate the risk associated with odorous emissions from the landfill site. It makes provision for the following:
- Control measures to prevent or control odour.
 - A justification that there will not be an odour problem from the emissions under normal conditions.
 - Identification of the actions to be taken in the event of abnormal events or conditions which might lead to odour or potential odour problems.
 - An understanding of the impact in the event of abnormal events or conditions, for example the failure of a landfill gas well.
 - Impact of any leachate recirculation;
 - Monitoring undertaken.
 - Notification of odour events.
 - Odour control is not a once-off activity and requires a constant re-evaluation of control techniques and this should form part of the odour management plan.

1.2 Background

- 1.2.1 The Bryn Pica Landfill Site is located approximately 4 km North of Aberdare at National Grid Reference (NGR) SO 010 047, at an elevation of between 260 – 350 mAOD, on the Northern slope of the Cynon Valley. The site's location in relation to its surroundings is illustrated in Dwg. No. AM5494/1/5/001 (Site Location Plan).

1.2.2 The landfill waste disposal facility at the Bryn Pica site has been established in former opencast coal workings, with some mined coal seams beneath. Activities associated with the landfill include the following:

- Landfill Gas Power Generation Scheme
- Biological Leachate Treatment Plant

1.2.3 The Bryn Pica site is the location of several additional waste management activities operated under separate environmental permits. Some of these facilities have the potential to generate odorous emissions as follows:

- Materials Recycling Facility
- Waste Transfer Station
- Food Waste Treatment Plant (Anaerobic Digestion)

1.2.4 The Bryn Pica Anaerobic Digestion Plant is not owned or operated by Amgen Cymru and is covered by a separate environmental permit.

1.3 Landfill Infrastructure

1.3.1 At the time of writing the landfilled at Bryn Pica extends to an area of 18.2 hectares. Waste deposition started in 1993 and in Jan-23 the site is estimated to contain 4.5 million Tonnes of non-hazardous municipal, commercial and industrial waste.

1.3.2 The final approved landform is planned to extend to 28 hectares with an estimated remaining void space of 2.8 million Tonnes. Currently the landfill consists of several completed landfill cells. At the time of writing landfill operations are ongoing within phase 5a.

1.3.3 The Company operates a policy of progressive remediation and restoration of completed landfill cells. At the time of writing the following observations are made regarding the extent of landfill capping:

- Permanent Engineered Landfill Cap - 11 hectares.
- Temporary Capping – 4 hectares.

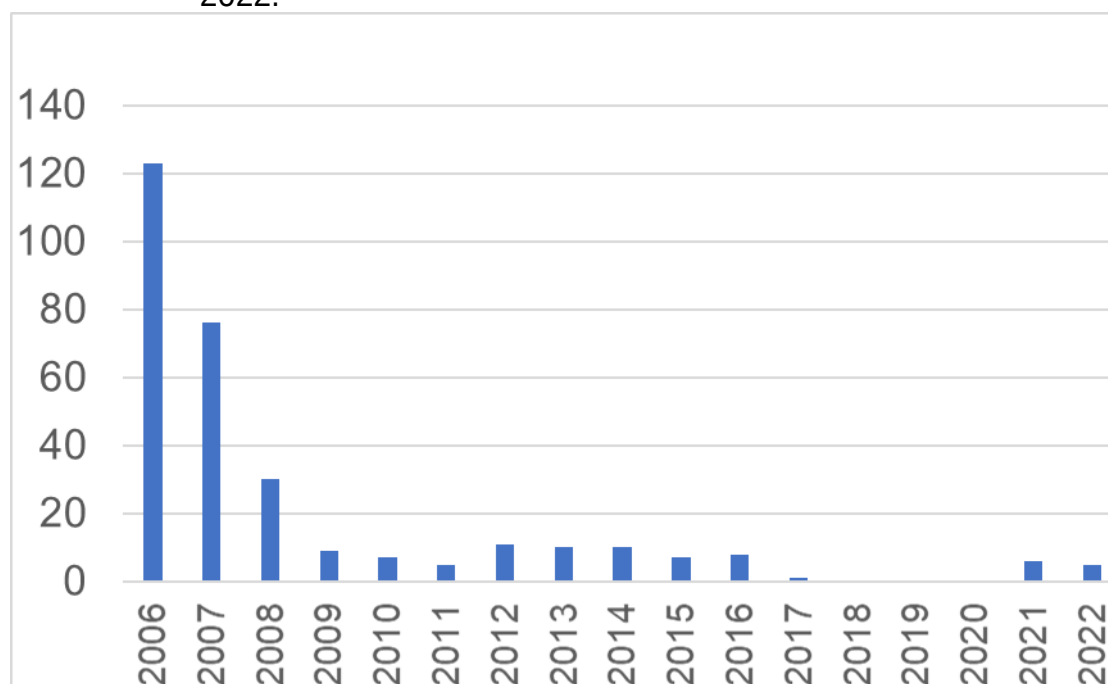
2. ASSESSMENT OF RISK

2.0.1 Experience of operating landfill disposal facilities indicate that they have the potential to generate odours with the ability to migrate beyond the site boundary. There are several documented examples of landfills resulting in odorous emissions which have been assessed to be causing 'nuisance' to neighbouring communities.

2.0.2 Historically the Bryn Pica site has not experienced excessive problems with air quality and odour complaints. This is evident when comparing the number of complaints generated in the communities surrounding Bryn Pica, to other similar waste management sites, throughout the UK. Nevertheless, there have been periods when complaint levels were elevated.

- 2.0.3 A review of odour complaints recorded in relation to the Bryn Pica landfill has been undertaken for the period Jan-06 to Dec-22. It is shown that odour related complaints have reduced significantly from their peak of 123 during 2006 to an average of less than 5 per year from 2017 onwards. Figure 1 provides an overview of complaints number during the review period.

Figure 1: Number of complaints recorded by Amgen Cymru in relation to the Bryn Pica Landfill Site. Annual total for the 17-year period 2006 to 2022.



2.1 Waste Types and Landfill Inputs

- 2.1.1 The landfill at Bryn Pica is permitted to accept inert and hazardous wastes from households, commercial and industrial sources. Annual thresholds for waste inputs are as follows:

Waste Category	Limit Tonne / Year
Non-hazardous Waste	189,000
Inert Waste	10,000
Asbestos Waste*	1,000

* Asbestos waste is not currently accepted at the site and this has been the case since 2008.

- 2.1.2 The list of wastes permitted for acceptance at the site is provided in Appendix B. Whilst this is an extensive list, historical records show that the site has mostly accepted mixed municipal waste with European Waste Catalogue (EWC) code 20 03 01. This type of waste has the potential to generate odour on deposition and will contain biodegradable material capable of generating landfill gas following burial.
- 2.1.3 Waste inputs into Bryn Pica have reduced significantly over the previous 10 years. During 2010 the site accepted a total of 100,00 Tonnes of non-hazardous waste for landfill disposal. During the 3-year period Jan-19 to Dec-22 the site

accepted on average around 28,000 Tonnes per annum. The key factor in this reduction was the diversion by RCT Council of biodegradable municipal waste from landfill to other forms of waste management (around 2015).

2.2 Source of Odours and Risk

- 2.2.1 With regards to the potential generation of odorous emission, landfill operations at Bryn Pica can be considered as follows:

Waste / Refuse derived odours generated at the tipping face.	
Description	The 'tipping face' is described as the immediate area of waste disposal. During operational hours, waste deposited at this location has the potential to generate rotting type odours and or other odours associated with the type of waste being deposited.
Risk of Impact	LOW
Justification	Whilst these types of odours are unavoidable during waste deposition, they are typically confined to the tipping area which is covered with a layer of soil following each working day. Amgen staff have rarely witnessed these odours migrating beyond the operational landfill area and or the site boundary. The reduced level of inputs now occurring at the site result in smaller working areas and less volumes of exposed waste. This reduces the risk of generating this type of odour.
Emissions of Landfill Gas	
Description	Landfill gas is a by-product of biodegradable waste deposited within the landfill environment. It's major constituents are Methane (CH₄, up to 65 % by Vol) and Carbon Dioxide (CO₂, up to 35 % by Vol). It can also contain low concentration of a range of organic gases and vapours (in excess of 150 identified to date). Experience indicates that Landfill gas can be a significant source of odour. It has the potential to migrate reasonable distances from the source and has been shown in various studies to impact on local air quality. Consistent with other landfills of this type, the Landfill Gas at Bryn Pica is known to contain high levels of Hydrogen Sulphide. This gas is very odours even down to low concentrations and give landfill gas

	its characteristic sulphurous or 'rotten egg' smell.
Risk of Impact	MEDIUM
Justification	Landfill sites are known to produce landfill gas for extended time periods, particularly during the operational acceptance of waste. The Company and its partners continue to collect treat and or utilise landfill gas at the site albeit at a lower capacity due to reduced inputs of biodegradable waste. The gas management system at Bryn Pica has a good record of availability over the previous 10 years of operation. In the case that gas management is not available then there is a potential risk of odorous emissions. In addition to active gas management, landfill gas is controlled at the Bryn Pica Landfill Site through the construction of low permeability liners. Under normal operating conditions these prevent accumulation of odours at the site and reduce the risk of potential odour migration. Extensive areas of the landfill are now covered by a some form of low permeability capping (see para 1.3.3).
Leachate Treatment Plant Storage Lagoons	
Description	Leachate generated at the site is collected within the leachate containment system, consisting of landfill cells with very low permeability basal liners and associated leachate drainage blanket and extraction points. Leachate levels at the site are maintained by active extraction of leachate which is stored in 2 large (3,500 m³) leachate lagoons. To part neutralise the leachate the site is equipped with a biological leachate treatment plant. This facility uses nitrifying bacteria to treat ammonia contained within the leachate.
Risk of Impact	LOW
Justification	Historically, landfill leachate at Bryn Pica has not been characterised as being odorous in nature. During winter months the leachate can be very dilute, due to the high levels of rainfall. During Summer months leachate generation is reduced and the requirement for storage of large volumes is minimal.

3. CONTROL MEASURES

3.1 Landfill Gas Management

- 3.1.1 Landfill disposal of waste containing biodegradable material results in the production of a biogas (Landfill Gas). Landfill Gas can be odourous in nature with a typical sulphurous smell, resulting from the presence of Hydrogen Sulphide. It can also contain other odorous constituent gases. Landfill gas is required to be controlled to prevent excessive surface emission and migration of odours to potential receptors.
- 3.1.2 Landfill Gas is controlled at Bryn Pica using a system of active extraction. This consists of a network of vertical gas extraction wells installed into the waste. Negative pressure (suction) is applied to the wells to encourage the flow of gas into the system. This reduces gas pressure within the landfill waste mass, reducing the risk of surface emissions.
- 3.1.3 The Landfill Gas is delivered to a treatment facility located at the site. Under normal operating conditions the gas is used to generate electrical energy by using a specialist biogas generation set. A high temperature flare is also maintained and provides a treatment back for use during periods of maintenance or breakdown.
- 3.1.4 Emissions testing is carried out annually on the biogas generation sets and on the flare if its percentage use is greater than 10%. Historical records show that the duration in which the backup flaring has been employed at the site has been consistently below the 10% threshold. Result of emissions testing are compared to limits specified within the Environmental Permit with and non-compliance reported to NRW in accordance with the terms outline therein.

3.2 Waste Containment

- 3.2.1 Encapsulation of the landfill waste is fundamental to preventing emissions of landfill gas and leachate. The use of very low permeability geosynthetic liners and soils prevent the escape of landfill gas and other potential sources of odour. The Company has a proactive policy of capping areas of landfilled waste that are completed to final levels of tipping or are to be untipped for extended period. At the time of writing the circa 18 hectares of the existing landfill footprint can be classified in terms of its capping status as follows:

Landfill Footprint	180,000 m ²
Permanent Cap	110,450 m ²
Temporary Cap	42,452 m ²

3.3 Operational Procedures

- 3.3.1 As outlined in the Working Plan (Section 4.15.1) for Bryn Pica, the following provisions for daily cover is provided:

“At the end of each working day, daily cover will be placed over exposed wastes. This will comprise imported inert material; surplus material excavated on-site or a suitable alternative and will be placed to a depth to ensure adequate covering of the waste whilst ensuring sufficient traction to delivering vehicles.

The minimum thickness of daily cover will be sufficient to prevent waste becoming airborne and to deter vermin, birds and other pests, whilst being thin enough to minimise the future risks of perching of leachate in the waste mass. A stockpile of cover material will be retained on site at all times.”

- 3.3.2 The provision of daily cover reduces the potential for odours to become airborne. By covering the recently deposited waste with a layer of inert material any odour that may emulate the waste will be suppressed.

4. PREVENTATIVE MEASURES

4.1 Meteorological Conditions

- 4.1.1 Experience of Company Officers is that prevailing weather conditions strongly influence the risk of odour complaints. Wind direction and strength is a key factor. Odorous emissions can be carried off-site in the direction of the wind.
- 4.1.2 With regards to the landfill gas emissions, barometric pressure and temperature are also influencing factors. It is thought that during period of calm cold weather, similar to those type associated with cyclonic conditions; landfill gas can build up in the air above the landfill. Contaminated air above the landfill could migrate off-site under the influence of light winds, with suspected influence from topography (i.e. air sinking down the valley side in cold conditions).
- 4.1.3 Periods of wet weather can result in increased moisture within the waste and can increase gas generation.
- 4.1.4 The Operator shall maintain a functioning weather station for the purpose of monitoring meteorological conditions at the site. Data will be recorded and held for a period of 5 years. The following parameters will be recorded as a minimum:

• Wind Direction • Wind Speed (mph) • Air Temperature (°C)	• Rainfall (mm) • Barometric Pressure (mbar)
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4.2 Routine Monitoring

- 4.2.1 The Company shall undertake walkover inspections of the landfill to determine if there are any odorous emissions. These shall be carried out monthly, except for the months of November, December, January and February when the frequency shall increase to weekly. Historic records show that the majority of odour complaints received in relation to Bryn Pica, occur during the winter months.

Methodology for Walkover Surveys

- 4.2.2 Technical Officers employed by the Company shall undertake walkover surveys in accordance with the frequency described above. They shall receive training on the detection and recording of odour and the operation of any machinery used to analyse components of air quality. Records of surveys shall be made and sent to the regulator in accordance with the reporting requirements specified within the permit.

4.2.3 Walkover survey shall consist of 2 parts:

- An olfactory assessment (i.e. can the operator detect an odour at the sampling point at the time of the visit).
- Analysis of air quality using a suitably calibrated analyser. At the time of writing the preferred target gas shall be Hydrogen Sulphide. The method of detection shall be the use of the handheld Jerome 631 Analyser.

4.2.4 At commencement of the survey the operator shall check any equipment and record prevailing weather conditions. The operator shall then visit each sample location and undertake the two observations explained above.

4.2.5 Air quality sampling shall be undertaken as follows:

- The operator shall turn the analyser to check for errors and thereafter follow any start-up procedures recommended by the manufacturer.
- Standing towards the direction of the wind the operator shall hold the equipment at 1m above the surface and take the samples.
- Two samples shall be taken at each sample point.
- In the case of a positive result above 5 parts per billion (ppb) then the operator shall take a further two samples.
- The duration between samples shall be at least 1 minute.

4.2.5 Any proposed changes to the above methodology shall be agreed with NRW in writing in advance of implementation.

Frequency and Location

4.2.6 The location of sample points is illustrated in Drawing No. AC23/02/001 (Appendix A). A total of 27 sample locations are provided in positions surrounding the active area of the landfill.

4.2.7 The frequency of walkover survey shall be monthly except for the months of November, December, January and February. These months present a greater risk of odour complaints due to prevailing weather conditions. The frequency of walkover surveys shall increase to weekly during these months, starting on 1st of November and reverting back to monthly on the 1st March.

4.3 Reactive Monitoring

4.3.1 In the case of any of the following outcomes the Company shall undertake additional odour monitoring:

- An extended period (in excess of 24 hours) of downtime associated with the site's gas management system.
- Ongoing engineering works with the potential to increase the risk of odorous emissions (e.g. installation of new or replacement landfill gas wells).
- The receipt of 2 or more odour complaints in a 5-day period.
- A positive identification of odorous emissions during routine operations or walkover surveys.

- 4.3.2 The Company shall write to inform NRW of any such outcome and provide a short-term plan for additional monitoring suitable to demonstrate the extent of any impact. This plan will consist of a selection of measures outlined below.

Continuous Site Boundary Air Quality Monitoring

- 4.3.3 The Jerome 631 Hydrogen Sulphide analyser has a facility to operate and record data autonomously at remote locations. The duration of the sample interval can be set to the required frequency. Historically the Company has used a 15-minute sample interval to provide sufficient data to assess any potential migration of landfill gas towards the site boundary.
- 4.3.4 Where required, a monitor shall be placed at a suitable location on the site boundary in the direction of off-site receptors, taking into consideration prevailing wind direction. Historic records demonstrate that a high percentage of complaints are sourced from the Abernant area, particularly the location of Richmond Garden, Moss Row and Little Row. In this respect the location of the monitor would either be to the south or south south west of the landfill.
- 4.3.4 Other locations shall be used in response to complaints from other communities neighbouring the site.

5. ABNORMAL CONDITIONS

- 5.0.1 The Company acknowledges that certain site conditions, programmed engineering works and breakdowns have the potential to increase the risk of odorous emissions. The following paragraphs identify reasonable worst-case scenarios that could impact on odour management at the site. Action to mitigate the impact on local receptors is provided for each.

5.1 Programmed Engineering Works.

- 5.1.1 The ongoing process of waste deposition creates new areas of landfill that require the installation of gas management and capping remediation. Often these activities result in excavation of the waste to an extent that may result in odorous emissions.
- 5.1.2 As part of the Construction Quality Assurance (CQA Plan) for infrastructure works, the company will submit a description of measures to be employed to reduce the likelihood of odorous emissions from the works.
- 5.1.3 In the case that the works are at high risk of generating odours then the Company will undertake additional monitoring described in section 4.3.

5.2 Emergency Conditions

- 5.2.1 The occurrence of an unforeseen outcome or emergency situation could result in an increased risk of odorous emissions at the site. An assessment of several outcomes is presented below along with outline actions to be taken to reduce as far as practicable any off-site impact.

Fire on landfill or within gas management system.	
Description	In the case of a fire on the landfill then it is likely that the gas management system would be shut down until it has been assessed as being safe to recommence. In addition to any burning odours, there is an increased risk of landfill gas emissions as gas pressure within the waste would increase in the absence of active extraction.
Likelihood	LOW
Impact	MEDIUM to HIGH (depending on prevailing weather conditions).
Mitigation Measures	The risk of fire occurring on the landfill site is controlled by the Company's Policy Rules and Procedures. Additional air quality monitoring to be undertaken in the case of a fire or any extended period of downtime associated with the landfill gas management system.
Breakdown / Failure of the Gas Management System.	
Description	Under normal operating conditions gas extraction and treatment is provided through the operation of a biogas powered generation set. In addition, the site is equipped with a high temperature landfill gas flare for use during period of maintenance or failure of the generating set. Together these provide a resilient system of gas management at the site. In the unlikely event that both these treatment facilities breakdown or require maintenance at the same time then this would result in a period during which landfill gas is not extracted from the waste. Over an extended period of time this would lead to an increase in gas pressures within the landfill. This in turn would increase the risk of fugitive emissions across the site.
Likelihood	LOW
Impact	MEDIUM to HIGH (depending on prevailing weather conditions).
Mitigation Measures	In the event of a failure of the existing gas management system at Bryn Pica, the company would source a mobile

	plant capable extracting and treating landfill gas to the standard required by the Environmental Permit. The likely response time would be between 5 – 10 working days. In the interim the Company would undertake additional odour / air quality monitoring as outline in section 4.3
Non-compliant odorous waste deposition.	
Description	Pre-acceptance checks are undertaken on waste destined for landfill disposal. Where a waste type is particularly malodorous then provision is made to bury the waste on deposition (example Council Dog Waste Collections). Where a waste consignment is not expected to be malodorous, and it is found to be so then the following actions will be taken: • Taken action to prevent deposition of the load and reject. • In the case that deposition has occurred, assess the acceptability of reloading the consignment on the delivery vehicle and reject. • In the case that either of the above actions are not achievable and providing the waste is compliant with the list of waste permitted at the site. Undertake burial and covering of the waste prior to the end of the day shift.
Likelihood	LOW
Impact	MEDIUM
Justification	Pre-acceptance measures employed for waste disposal at Bryn Pica reduces the risk of the receipt of malodorous waste. Furthermore, input rates are such that operational task have several opportunities to identify and stop any deposition of such waste. Procedures to reject unacceptable waste types are in place.

6. RECORDING AND NOTIFICATION OF ODOURS

6.1 Register of Odour Complaints / Events

- 6.1.1 A register of all odour complaints received is maintained on site, describing the complaint plus the details of any investigations that were carried out as a result of the complaint. Weather data for the time of the complaint is also recorded.
- 6.1.2 All records of odour complaints received on site are now being forwarded to Novera Energy Ltd (Infinis) as part of our ongoing partnership with the operators of the on-site landfill gas generation scheme.
- 6.1.3 Any complaints received directly by the Company shall be forwarded to NRW for information.

6.2 Recording and Reporting Monitoring.

- 6.2.1 A record of all air quality monitoring carried out in accordance with Section 4 of this report, shall be maintained. This record shall be made available to NRW if and when requested, as these results do not come under either of the Emissions & Monitoring or the Reporting requirements of the sites permit. Reporting of these results can be arranged in conjunction with the regular monitoring reporting if required by NRW.
- 6.2.2 Notification of an odour event / anticipated odour event will be carried out in accordance with Schedule 6 of the site's Environmental Permit. As soon as is practically possible following identification / expectation of an odour event a Schedule 6, Part A Notification will be completed and signed by an authorised member of Amgen Cymru staff and forwarded to the sites Regulatory Officer. Following an on-site investigation of the odour event Part B of the Schedule 6 Notification will also be completed and forwarded to the Regulatory Officer.

7. SUMMARY

- 7.0.1 It is concluded that there is the potential for odour production on site, not only from the waste mass but also from the landfill gas and leachate produced. Therefore, the management of these operations is essential to ensure that odour does not escape the site.
- 7.0.1 Measures undertaken on site such as the landfill gas collection system, high temperature flare and capping works are sufficient to mitigate any potential odour problems during normal operating conditions.
- 7.0.2 Action plans in place for emergency situations allow for safe, controlled handling of any odour event on site as well as providing for follow up investigation into these events. This will eventually lead to identification of potential improvements on site and changes to working practices.
- 7.0.3 It is proposed that this Odour Management Plan be reviewed every 4 years, or following any emergency on site that has the potential to change operational procedures.

APPENDIX A

Drawings

APPENDIX B

List of Wastes