Odour Management Plan

Issue 07

Produced for **Biowise**

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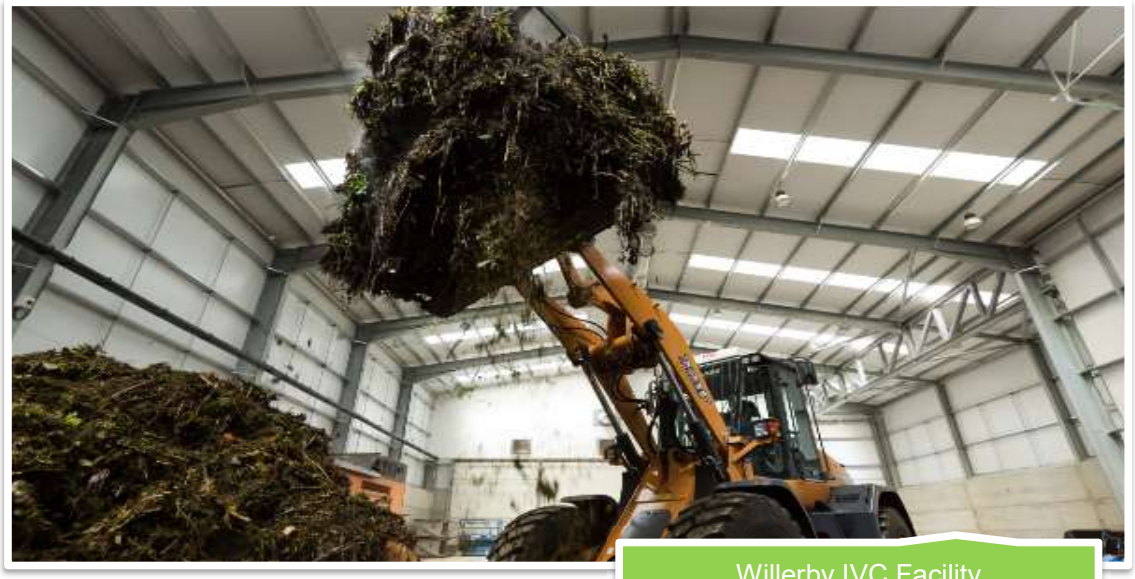

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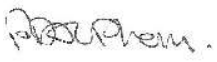
Author	Peter Upham	
Reviewer	Ben Brown	

Issue No.	Date	Description of change
01	07/05/2015	Initial OMP submitted for permit application
02	10/02/2016	Amended following review of controls post IVC commissioning
03	14/07/2016	Updated to include ASP stabilisation phase
04	25/11/2016	Amended following review of controls post ASP commissioning
05	08/11/2019	Updated following management review of full OMP
06	03/11/2020	Amended for submission of permit variation to increase capacity
06.1	13/09/2021	Amendments following Schedule 5 Notice
07	13/09/2021	Second Issue

CONTENTS

1.0 INTRODUCTION

This Odour Management Plan (OMP) has been produced in accordance with Environment Agency (EA) guidance on OMPs[1] and EPR H4 Odour Management[2] and follows the general monitoring procedures detailed in Environment Agency guidance document *Internal Guidance for the Regulation of Odour at Waste Management Facilities*[3]. Reference has been made to the Association for Organics Recycling *Industry guide for the prevention and control of odours at biowaste processing facilities*[4] and the Agency document *Technical Guidance on composting operations*[5].

This OMP is aimed at assisting the operator in effectively managing potential odour releases associated with the operations at the site and minimisation of the risk of abnormal operational conditions, which could result in increased risk of odour generation at the site.

1.1 Current Permitted Activity

Biowise is currently permitted to treat a variety of materials at the Willerby recycling facility under a bespoke environmental waste operation permit (EPR/PP3096ZA). Permitted activities are as stated below:

- Composting in closed systems of biodegradable wastes (<90,000 tonnes per annum (tpa)).
- Composting in open systems of biodegradable wastes (<90,000tpa, no more than 30,000 tonnes at any one time);
- Soil manufacture (<50,000 tpa, no more than 20,000 tonnes at any one time); and
- Wood recycling (<75,000 tpa, no more than 10,000 tonnes at any one time).

1.2 Structure of the Odour Management Plan

The structure of the OMP is laid out in accordance with the EA guidance and considers:

- Feedstock Inventory;
- Process Management;
- Evaporation;
- Containment and abatement;
- Dispersion;
- Sensitive Receptors; and
- Incidents and Emergencies.

[1] Appendix 8 of Application for an environmental permit - Guidance notes on part B3 new bespoke installation permit. EPB3 Version 1, January 2010. Environment Agency.
[2] Environment Agency Technical Guidance Note H4 – Odour management. March 2011.
[3] Environment Agency. Odour Guidance, Internal Guidance for the Regulation of Odour at Waste Management Facilities VERSION 3.0. (July 2002).
[4] The Compost Association. An industry guide for the prevention and control of odours at biowastes processing facilities. Jeremy Jacobs, Nick Sauer and E. Jane Gilbert (2007).
[5] Environment Agency. Technical Guidance on composting operations, Draft for Internal Consultation Version 3.0. October 2001.

1.3 Material Recovery Operations

Biowise Ltd (Biowise) are recovering biodegradable waste materials through in-vessel composting (IVC), open windrow composting (OWC), and aerated static pile (ASP) composting operations.

The recovery of organic waste has the potential to generate malodours from site operations. This odour management plan makes an assessment of likely sources of odour generation and sets out the good site practice and mitigation that is employed to minimise where reasonably practicable any odour emitted from site.

The likelihood and frequency of exposure to odour arising from the facility is determined by a combination of the magnitude of release, the prevailing meteorological conditions, and the distance and direction of receptors in relation to the facility. Each of these factors are discussed in the following sections.

1.4 Conceptual Model

The conceptual model for pollutant linkages identified for the release of odours from the composting facility is identified in Figure 1 below.

SOURCE	PATHWAY	RECEPTOR
		
→	→	→
Release of odours during waste reception, processing and movements.	Airborne transportation.	Nearby sensitive receptors identified in section 7.
HAZARD	Nuisance to local population.	

Figure 1 - Conceptual Model for Pollutant Linkages

1.5 Dispersion Modelling

Modelling can be a useful source of predictive information to assess the likely impact of odour. However, there may be much greater uncertainties associated with odour modelling than with the modelling of other pollutants for the following reasons[6]:

- The human nose responds to odour exposure over a 1 to 5 second interval. Average exposure levels may very well be below the detection threshold but still expose people to short term concentrations which are much higher.
- UK odour benchmark levels are based on research at one particular type of site under distinct dispersion conditions (e.g. ground level emissions in generally flat terrain).

[6] Environment Agency (2011) Technical Guidance Note H4 – Odour management. Appendix 3.

Further uncertainty is added to the modelling process through the determination of appropriate odour concentrations based upon several factors[7] including:

- The state and type of raw materials used on site and how they are delivered and stored;
- The process e.g. the control of moisture, temperature and oxygen content; and
- The scale of the operation, e.g. the surface area of the composting process, the quantity and quality of (intermediate) products.

In this instance it is not deemed appropriate to undertake modelling where there has been no site specific baseline data collected for the exact waste streams to be treated for the technology to be deployed within the site specific topographical context.

[7] DEFRA (2009) Good Practice and Regulatory Guidance on Composting and Odour Control for Local Authorities. Defra: London.

2.0 FEEDSTOCK INVENTORY

The site operates a waste recovery operation through the composting of source-segregated biodegradable waste to produce quality compost that is quality assured to PAS100[8] and the Compost Quality Protocol[9]. The composting processes treat biodegradable materials which have the potential to produce odour.

In order to understand the odour potential of the different waste streams that enter these processes, a feedstock inventory has been provided for the various waste types. Table 1 below provides an assessment of each waste type by source of material, identifying the typical and abnormal compositions of those waste types and providing an overall odour potential of that feedstock based upon the likelihood of abnormal compositions being encountered at site. The table will also include the food waste fraction that the site accepts.

Table 1 - Assessment of Odour Potential from Feedstock Inventory

Waste Type	Waste Source	Typical Composition	Abnormal Composition	Likelihood	Odour Potential
Green Waste	Kerbside collected.	Mixture of grass clippings and woody plant material. Typically up to 14 days old.	Mixture of grass clippings and woody plant material that has been stagnant for weeks.	Material is often received from these sources which is several days old.	**Med** – Material may be wet and already started to degrade given the potential age of cut material.
	Civic amenity sites e.g. HWRC.	Mixture of grass clippings and woody plant material. Typically up to 14 days old.	Mixture of grass clippings and woody plant material that has been stagnant for a few weeks. Seasonal exceptions e.g. Christmas trees.	Material is often received from these sources which is several days old.	**Med** – Material may be wet and already started to degrade given the potential age of cut material but is typically fresher than kerbside materials.
	Commercial e.g. landscapers.	Fresh woody plant material and grass clippings / turf.	Large bulky tree stumps/logs. Large load of grass/turf.	Material usually delivered shortly after being collected.	**Med** – Material is typically fresh and mainly dry woody plant material.
Food Waste	Kerbside collected.	Mixture of all food types associated with kerbside collections which is several days old.	Mixture of food waste with a high moisture content that is several days old and has started to degrade.	Material is often received from these sources which is several days old.	**High** – Material is often wet and may have already started to degrade given the potential age of material.
	Commercial e.g. food production wastes.	Mixture of different types of food waste in singular form and mixed type.	Mixture of food waste with a high moisture content that is several days old and has started to degrade.	Material is sometimes received from these sources which is several days old.	**High** – Material is often wet and may have already started to degrade given the potential age of material.
Co-mingled	Kerbside collected.	Mixture of food waste and green waste. Typical ratio is 95%	Mixture of food and green waste with a high moisture content that is	Material is often received from these sources which is	**Med** – Material can often be several days old, but has a

[8] BSi (2011) *PAS 100: Specification for Composted Materials*. British Standards Institution: London.
[9] WRAP (2008) *The quality protocol for the production and use of quality compost from source-segregated biodegradable waste*. Waste and Resources Action Programme: Oxon.

Waste Type	Waste Source	Typical Composition	Abnormal Composition	Likelihood	Odour Potential
		green waste to 5% food waste in spring-autumn, with 90% green waste to 10% food waste in winter.	several days old and has started to degrade.	several days old. However, consistent ratio of green to food waste results in a more balanced feedstock.	high green to food waste ratio and good C:N balance.

Biowise are treating predominantly comingled green and food wastes at the IVC, servicing contracts with East Riding of Yorkshire Council and Hull City Council. The contract is for an anticipated 60,000 tonnes per annum (tpa), which equates to 80% of all feedstock going into the IVC. Waste compositional analysis provided by both councils indicates that the anticipated split between food and green waste will be 95% green waste and 5% food waste. The remaining capacity (30,000tpa) will consist of green and food waste as yet unsourced from spot market opportunities or commercial ventures.

Therefore, the minimum and maximum splits of green waste to food waste will be dependent upon other feedstock opportunities as detailed below:

Max Food Waste Scenario: Food in comingled contracts: 3,600tpa
Food from commercial sources: 18,000tpa
Green from commercial sources: 0
Total food to green waste: 21,600tpa (food) to 68,400tpa (green)
Percentage split: 24% food waste to 76% green waste

Max Green Waste Scenario: Food in comingled contracts: 3,000tpa
Food from commercial sources: 0
Green from commercial sources: 15,000tpa
Total food to green waste: 3,600tpa (food) to 86,400tpa (green)
Percentage split: 4% food waste to 96% green waste

It should be noted that food to green waste ratios will be tempered by the actual constituents of each waste type by C:N ratio. It is therefore unlikely that 24% food waste will be treated, given the Nitrogenous material within the green waste fraction will imbalance the C:N ratio. This will depend on seasonality as identified in Table 1. In reality, should commercial food waste be treated on site the typical maximum food waste (total) input to the IVC will be 10-15%.

2.1 C:N Ratios

Nutrient content (typically the C:N ratio) is a critical factor as the micro-organisms require a range of nutrients to flourish. Nitrogen is used for protein manufacture and reproduction whereas carbon is used for energy and growth. Typically, biological organisms require 25 times more carbon than nitrogen and ratios of between 20:1 and 40:1 are generally accepted as capable of achieving good composting results.

Low C:N ratios (<20:1) allow the carbon to be fully utilised without stabilising the nitrogen, which may be lost as ammonia. Such conditions also lead to rapid composting process resulting in elevated temperatures and the need for frequent (possibly daily) turning to cool the composting mass. High C:N ratios (>40:1) require longer composting periods whilst the extra carbon is used.

Typical C:N ratios of between 20:1 and 35:1 are optimal for the composting process. The site is adopting an optimal range of 25:1 to 30:1, given the inclusion of food waste, which equates to approximately 1 part green (nitrogenous) waste to 3/4 parts brown (carbonous) waste. It should be noted that the IVC will be mainly processing co-mingled food and green waste which should reduce the requirement for additional balance materials.

C:N ratios of green wastes such as grass clippings and vegetable wastes are approximately 10:1, whereas the C:N ratio of brown wastes such as woody branches and oversize are approximately 35:1. Therefore at a ratio of 1 part green waste to 3 parts brown waste an overall C:N ratio for the feedstock mix will be approximately 28:1, at 4 parts brown to 1 part green the overall mix will be 30:1.

Parts will be measured by volume based on a simple approach that allows consistency in batch creation. This will be achieved via a simple loading of feedstock via a loading shovel, where one bucket will equate to 1 part. As a guide, the following wastes anticipated to be processed on site will require mixing based on C:N ratio as a general classification as brown or green. The table below identifies how the different waste types will be mixed by operatives on site. This volumetric C:N ratio procedure is validated on biannually (considering seasonal variance in feedstock), by obtaining a sample of the feedstock blend and sending for laboratory analysis to confirm the C:N ratio is being achieved. If the test result is outside of the target ratio, then alterations will be made to the blend mix and re-testing undertaken to ensure the appropriate feedstock blend is achieved. The records of this validation testing are held on the Biowise IMS system.

Table 2 – C:N Ratio Mixing Guide for Operators

Material	Typical C:N Ratios[10]	General Classification	Mix Requirement	Seasonal Variation
Yard Waste	35	Brown	3:1 with Green	Drop off in winter months. Source additional Carbon as required.
Oversize	35-50	Brown	3:1 with Green	Available all year round as Carbon balance.
Shrub trimmings	35-50	Brown	3:1 with Green	Increase in autumn and winter months, balance with Nitrogenous materials.
Grass clippings	10-15	Green	1:3 with Brown	Surge in spring time at “first cut”. Balance with additional Carbon.
Leaves	35-50	Brown	3:1 with Green	Surge in autumn months. Balance with Nitrogenous materials.
Food Wastes	10-15	Green	1:3 with Brown	Steady with festive spikes (e.g. Christmas). Blend with Carbon materials.
Vegetable waste	10-15	Green	1:3 with Brown	Steady with festive spikes (e.g. Christmas). Blend with Carbon materials.

[10] Aggregated typical values from range of sources including: NRAES (1992) On farm composting handbook (1992); Defra (2009) Good Practice and Regulatory Guidance on Composting and Odour Control for Local Authorities; Lens *et al.,* (2004) Resource Recovery and Reuse in Organic Solid Waste Management.

2.2 Feedstock Management

As identified in Table 1 there are various potential compositions for the waste types accepted onto site which have a med-high odour potential. In order to manage the feedstock inputs an assessment of the variation by waste source by season is provided, the implication on odour generation and the management controls to mitigate odours. Table 3 outlines the controls required at the waste feedstock stage.

Table 3 - Feedstock Variation and Management Controls

Waste Source	Seasonal Variation	Odour Implication	Management Controls	Age and Source
Kerbside collected comingled green and food wastes 72,000tpa (80%)	Comingled green waste fraction ~ 95%			Local Authority collections undertaken on a bi-weekly basis. Material up to 14 days old. Material also delivered to site via a transfer loading stations where material is bulked up prior to receipt. Material is transferred within 72 hours of reception. Material up to 17 days old.
	April – September: Increasing grass clippings content (typically peaking at 40%+ in May-June from experience). Short, sharp, tonnage surges possible (e.g. collections around bank holiday weekends) Accordingly, loads increasingly compacted due to material density.	Degradation could begin rapidly. Excess nitrogen will form ammonia and odorous compounds.	Source additional "woody" / carbonaceous material in anticipation of warm, wet, weather when possible. In the event of sudden summer green waste "surge" overwhelming treatment capacity, broker material to other local compost facility.	
	October – March: Increase in "woody" type materials (branches etc), resulting in higher C:N ratios.	Material unlikely to compost rapidly, so odour potential is decreased, but still present if stored too long.	Green waste loads from October to March containing large amounts of "woody" type materials (branches etc) may need to be blended together to improve C:N ratio.	
	Comingled food waste fraction ~5%			
	Seasonal variation is minimal. Waste produced over public holidays could be greater in amount and older / more compacted due to collection round disruptions.	The low C:N ratio of this waste (approx 15) means it is highly susceptible to degradation with age. Treatment as soon as possible is crucial to prevent / minimise nitrogen volatilisation in the form of ammonia and other odours.	Ensure food waste is processed immediately after it is accepted on site. Food waste blended with less odorous \ carbonaceous prior to treatment. If material significantly odorous consider rejection or disposal.	

Waste Source	Seasonal Variation	Odour Implication	Management Controls	Age and Source
Civic amenity (HWRC) green waste. <18,000tpa (<20%)	**April – September:** Increasing grass clippings content (peaking at 40%+ in May – June). Short, sharp, tonnage surges possible over bank holiday weekends. Accordingly, loads increasingly compacted due to material density, and contractors desire to maximise bin weights / payloads. Potential for waste to be kept in warm conditions prior to delivery (waste exposed to direct sunlight in site bins).	Degradation could begin rapidly. Excess nitrogen will form ammonia and odorous compounds. Increased risk of evaporation.	Source additional "woody" / carbonaceous material in anticipation of warm, wet, weather when possible. In the event of sudden summer green waste "surge" overwhelming treatment capacity, leading to green stockpile in reception building longer than 2 days, broker material to other local compost facility.	Local CA sites where material is stored between 1 and 2 weeks before arriving on site. Material up to 14 days old.
	October – March: Increase in "woody" type materials (branches etc.), resulting in higher C:N ratios. Potential for significant "spike" post-Christmas (disposal of Christmas trees).	Material unlikely to compost rapidly, so odour potential is decreased, but still present if stored too long.	Adjust green to "woody" green waste ratios during October – March to meet desired C:N ratio. Green wastes loads may need to be blended together to improve C:N ratio.	

Waste Source	Seasonal Variation	Odour Implication	Management Controls	Age and Source
Commercial green waste. <18,000tpa (<20%)	**April – September:** Increasing grass clippings content (typically peaking at 40%+ in May – June from experience). Accordingly, loads increasingly compacted due to material density. Potential for waste to be kept in warm conditions prior to delivery (waste exposed to direct sunlight prior to delivery).	Degradation could begin rapidly. Excess nitrogen will form ammonia and odorous compounds. Increased risk of evaporation.	Source additional "woody" / carbonaceous material in anticipation of warm, wet, weather when possible. In the event of sudden summer green waste "surge" overwhelming treatment capacity, leading to green stockpile in reception building longer than 2 days, broker material to other local compost facility.	Sourced from a variety of local landscape contractors typically within a day of cutting, but potentially up to a week. Material up to 7 days old.
	October to March: Increase in "woody" type materials (branches etc.), resulting in higher C:N ratios.	Material unlikely to compost rapidly, so odour potential is decreased, but still present if stored too long.	Adjust green waste to "woody" green waste ratios during October – March to meet desired C:N ratio. Green wastes loads may need to be blended together to improve C:N ratio.	
Commercial food waste <18,000tpa (20%)	**N/A:** Commercial food waste not affected by seasonality in type or quantity.	**N/A:** No seasonal variation. However, the high nitrogen content of the waste could generate ammonia and odorous compounds, depending on age and type of commercial food waste.	Ensure food waste is processed immediately after it is accepted on site. Food waste blended with less odorous \ carbonaceous material prior to treatment. Limit waste reception storage period at the acceptance stage. Contractual arrangements will limit waste acceptance storage to a maximum of 7 days. If material significantly odorous consider rejection or disposal.	Sourced from a variety of food manufacture, retailers of single or mixed food type. Typically delivered directly to site and within a week. Material up to 7 days old.

2.3 Contractual Arrangements

The majority of waste to be delivered to the site will be from contracted local authority collection rounds. This will consist of two main sources of waste as received at the site.

1. Approximately 50% of the waste input will be delivered directly to the site from council refuse collection vehicles (RCVs). These vehicles are fully enclosed and material is delivered directly following waste collection. Collections are fortnightly so will be up to 2 weeks old at point of receipt on site.
2. The other 50% will be collected from 3 transfer loading stations (TLS) within the local area. Waste is transferred to the site within 72 hours of reception at the TLS and is delivered on fully enclosed articulated lorries.

Where waste is contracted, agreements with suppliers as to material type and expected quality with appropriate limits will be set both quantitative and qualitative as appropriate. Any load containing 5% or more non-targeted waste materials by weight shall be considered above the acceptable contamination threshold. The quality of material delivered to the site will be constantly reviewed and fed back to suppliers in order to minimise odour potential at point of receipt. This quality feedback process will include contamination levels, odorous loads and load rejections.

A Daily Load Inspection Sheet (F03b-02) will be filled by the site operatives and held on record. Where received loads do not meet the agreed requirements, they will be rejected. Rejected loads will be recorded and the waste provider contacted immediately upon the rejection of a load by email. The Sheet will include details of the reason for rejection and photographic evidence as required.

Waste will be initially inspected by the site operative working on the reception area. Prior to formal rejection of a load the Site Manager will be informed to undertake the inspection and sign off any rejections. If the material is rejected for odour, a member of the administration team situated within the Site Office (south of the OWC site) will be utilised for odour assessment to prevent odour adaption of site operatives providing erroneous judgements.

2.4 Material Treatment by Technology

The facility utilises in-vessel, aerated static pile and open windrow composting techniques. Material is processed primarily by in-vessel sanitisation and ASP stabilisation.

Material that requires in-vessel sanitisation will be undertaken by the IVC process, treating materials itemised in Table S2.2 in the Environmental Permit. Once sanitised by the IVC process, this material is then either stabilised in ASP (default) or IVC or open windrows (back up), or alternatively exported to a separate site for stabilisation.

Materials that do not require sanitisation in enclosed vessels will be treated by the ASP process, treating materials itemised in Table S2.3 in the Environmental Permit. Once sanitised by the ASP process, the material is then either matured in ASP (default) or open windrows (back up).

3.0 ODOUR RELEASE POINTS

In order to determine the points that require odour assessment and management, a review of the composting process has been undertaken. The assessment identifies at which physical locations odours may be released from the site to identify where management controls are required to mitigate such release events. The following section breaks down these release points by stage within the composting process and identifies where on site they are situated. A plan of the odour release points on site is provided in Appendix A.

3.1 IVC Reception Hall

The reception hall is utilised for the receipt of comingled food and green waste materials. Inspection of waste, storage of physical contaminants and shredding/mixing will take place in the reception hall. Waste materials enter the IVC facility though the fast action roller shutter doors (ORP1). There are two odour release points located at the exit points where material is moved from the IVC tunnels to the open windrow pad (ORP2).

3.2 IVC Biofilter

The IVC treatment of biodegradable wastes takes place in the northern portion of the site and consists of eight enclosed composting tunnels. All composting activities take place within the IVC building and air is extracted through the air treatment system, a wet scrubber prior to release at one of the four biofilters (ORP3).

The IVC is fully sealed and doors are only opened during the receipt of wastes and during the movement of compost out of the tunnels to the open windrow pad.

3.3 OWC Reception Bays

The green waste reception area will consist of two bays on the external pad (ORP4), which will be used alternately to deposit, shred and store the material for a maximum of 5 days prior to composting.

3.4 OWC Pad

The OWC active processing occurs on the external pad which includes operational activities of waste shredding, active composting in open windrows, windrow turning, screening and material movements (ORP5).

3.5 ASP Bays

The active composting process takes place on the northern pad within purpose built aerated static pile bays. Material is processed through forced aeration and the material is only moved during the loading and unloading of each bay (ORP8).

3.6 Product Storage

The product storage area (ORP6) is utilised for PAS100/QP compliant composts only, prior to removal from the site. Material is stored in open conditions with an odour release potential that requires management procedures to be implemented.

3.7 Leachate Storage Tanks

Leachate is captured both at the IVC and on the external composting pad (ORP7) to prevent pollution to the ground/groundwater. Leachate has the potential to be odorous given the organic component within the water. Management is required to prevent release of odours from these storage tanks.

3.8 Odour Release Point Inventory

All identified odour release points have been collated into the table below for quick reference. The inventory assists in identifying the physical locations that require management.

Table 4 – Odour Release Point Inventory

Odour Release Point	Description	Location and Process
ORP1	IVC Roller Shutter Doors	IVC Facility: Material reception
ORP2	IVC Material Exit Doors	IVC Facility: Post sanitisation/stabilisation material exit
ORP3	IVC Biofilters	IVC Facility: Constant air treatment system, final exit to atmosphere
ORP4	Reception Bays	OWC Pad: Material reception
OPR5	OWC Pad	OWC Pad: Material shredding, movement, active composting, windrow turning and screening
ORP6	Product Storage Area	Product Storage Area: storage of PAS100/QP compliant composts
ORP7	Leachate Storage Tanks	Tanks at both the IVC facility and at the OWC facility.
ORP8	ASP Bays	ASP Bays: composting in static forced aeration bays.

4.0 ODOUR INVENTORY

In order to determine the points that require odour assessment and management, a review of the composting process and odour potential for materials at each stage of the process is provided. The assessment identifies at which physical locations on site potentially odorous materials are stored, upper limits for storage amounts and the potential odour impact of those materials to inform management procedures.

Storage limits have been provided in both tonnes and cubic metres. A standard waste density factor has been applied for all materials of 0.5t/m^3.

4.1 Waste Reception

There are two separate waste reception areas on site; one located within the IVC building and one on the open windrow concrete pad in bays. Green only waste is stored at the waste reception bays; food and green wastes are stored at the reception area within the IVC building. Storage limits have been defined by processing space and time to process all material in storage at any one time. Management of storage limits is linked to batch formation records which identify all loads by weight and time of reception that form the batch to be processed. Therefore, for materials awaiting processing, the records sheets provide an age and weight of material within the reception stage.

Location	Storage Limits	Odour Potential	Management
OWC Reception Area	<1,500t <3,000m^3 <5 days from receipt to next process phase	Medium – High Material could be up to 2 weeks old and started to biodegrade. Depending upon the nature of the material, high nitrogen wastes e.g. cut grass, will have a higher odour potential.	Section 5.4.1
IVC Building Reception Hall	<1,000t <2,000m^3 <48hrs from receipt to the next process phase	Medium – High Material could be up to 2 weeks old and started to biodegrade when delivered to site. Food waste has a higher odour potential.	Section 5.3.1

4.2 Rejected Loads

In the abnormal incidents of loads requiring rejection there will be a requirement for holding material for a period of time prior to leaving the site. Depending on the contractual arrangements for the waste, the material may be immediately loaded back onto the delivery vehicle thereby not requiring on site storage.

Material can be rejected for different reasons, such as not being as described on the waste transfer note, being elevated in level of physical contamination, or being unsuitable for the composting process such as being too wet or too odorous. Storage limits will usually be set by the amount of waste to be rejected which is not expected to be above that of a usual delivery.

A rejected load record sheet will be compiled for all rejected loads awaiting removal from site. The record sheet will link to weighbridge tickets allowing full traceability including time and tonnages to comply with the proposed limits.

Location	Storage Limits	Odour Potential	Management
OWC Reception Area	<50t <100m^3 <24hrs of receipt for abnormally odorous loads	High Material could be rejected due to being abnormally odorous.	Section 5.4.1
IVC Building Reception Hall	<50t <100m^3 <24hrs of receipt for abnormally odorous loads	High Material could be rejected due to being abnormally odorous.	Section 5.3.1

4.3 Shredding (Pre-Sanitisation)

Material can be shredded on receipt (pre-sanitisation) within the IVC reception hall or at the OWC reception area (green wastes only). Material is batch shredded within 5 days of receipt for green only wastes and within 48hrs (72hrs on a Friday) of receipt for food and co-mingled wastes. Each accepted load at the IVC shall be assessed for size. Material must be less than 150mm in one plane only, prior to the waste being loaded into the IVC tunnel. For example, a branch may be 300mm long, but if it is less than 150mm thick it will meet the required standard. This can be achieved in one of two ways: through shredding; or through the removal of non-conforming oversized materials. Site operatives in the IVC inspect the waste on receipt and remove any non-conforming waste into the receptacles provided for further processing (i.e. liberating waste in black bin liners or shredding any oversized items). Accordingly, in the latter case, material can then be shredded after the active composting phase, post-stabilisation (see Section 4.6).

The odour potential of the material is elevated at this stage as material is agitated and the surface area is increased. In both systems material is continually moved from the shredding area into the active composting area to limit incidental storage. For the IVC, material is moved into tunnels to form a new batch and on the OWC pad shredded material is formed into windrows or ASP batches.

Batch record sheets detail when shredding has taken place by batch and therefore the age and tonnage of material that comply with the proposed storage limit.

Location	Storage Limits for Shredded Material	Odour Potential	Management
OW Concrete Pad Shredding Area	<500t <1,000m^3 <5 days of receipt	Medium – High Material processed within 5 days of receipt and agitation could release odour.	Section 5.4.2
IVC Building Reception Hall	<500t <1,000m^3 <48hrs of receipt (72hrs on Friday)	High Odour potential as per reception as material shred within 48hrs, increased release of odour due to agitation.	Section 5.3.2

4.4 Sanitisation

Material is processed through three separate systems on site. Material is formed into 400t/1,560t batches and processed through an open windrow turned system or ASP system respectively, on the external composting pad for green only wastes. Within the IVC, material is formed into batches up to 315t which are processed through the enclosed tunnel for food only and commingled wastes.

Batch record sheets detail each batch under process including the age and tonnage of material that comply with the proposed storage limit.

Location	Storage Limits	Odour Potential	Management
OW Concrete Pad	<10,000t <20,000m^3 (including stabilisation) <2 weeks	Medium – High Active phase has the potential for odour which diminishes as material ages.	Section 5.4.4
IVC tunnels	<2,520t <5,040m^3 <10 days	Medium – High Active phase has the potential for odour which diminishes as material ages.	Section 5.3.3
ASP Bays	<7,000t <14,000m^3 (including stabilisation) <2 weeks	Medium – High Active phase has the potential for odour which diminishes as material ages.	Section 5.5.2

4.5 Stabilisation

A period of stabilisation of post sanitised material takes place in IVC or open windrows or aerated static piles on the open systems concrete pad. Material is processed for a typical 4-6 week process period to mature the compost and meet the quality requirements of PAS100/QP.

Batch record sheets detail each batch under process including the age and tonnage of material that comply with the proposed storage limit.

Location	Storage Limits	Odour Potential	Management
OWC Concrete Pad	<10,000t <20,000m^3 (including sanitisation) <6 weeks	Medium The material has completed the most active composting phase and the odour potential of the material is reduced.	Section 5.4.5
IVC tunnels	<2,520t <5,040m^3 <4 weeks	Medium – High Active phase has the potential for odour which diminishes as material ages.	Section 5.3.4
ASP Bays	<7,000t <14,000m^3 (including sanitisation) <4 weeks	Medium The material has completed the most active sanitisation phase and the odour potential is reduced.	Section 5.5.3

4.6 Shredding & Screening (Post-Stabilisation)

Following the completion of each composted batch, material is shredded and screened to remove contaminants and to a grade suitable for the end market. Material at this stage has

completed the active composting phase and is mature with a lower odour potential. Material is batch processed between completion of the composting process and moving into product storage.

Given the losses during the composting process, the amount in transitional storage prior to shredding and screening is approximately half that of the batch at the point of formation. Materials from both processes are screened at the dedicated Product Manufacture Line and at a maximum of two batches at any one time.

Batch record sheets detail each batch that is being shredded and screened including the age and tonnage of material that comply with the proposed storage limit. Mass loss following the stabilisation phase can be accounted for by applying a 50% loss in mass from the original input tonnage. Approximately 30% of the shredded material is lost as oversize and contamination with the oversize used as amendment material which is stored on the OWC pad or in IVC reception hall.

Location	Storage Limits	Odour Potential	Management
Product Manufacture Line	<800m^3 <5 days	Low – Medium The material has completed the active composting phase and the odour potential of the material is reduced. Agitation of the material may release odours.	Section 5.6

4.7 Product Storage

Following the completion of product grading, material will have completed the PAS100 requirements and reaches end of waste status. Material at this stage has completed the active composting phase and is mature with a low odour potential. Material is often stored in combined batches, separated by grade, prior to dispatch to end markets.

Batch record sheets detail each batch being stored prior to dispatch including the age and tonnage of material that comply with the proposed storage limit.

Location	Storage Limits	Odour Potential	Management
Product Storage Area	<20,000m^3 <12 months (PAS100 compliant)	Low The material has completed the active composting phase and the odour potential of the material is greatly reduced.	Section 5.7

4.8 Amendment Materials

In order to provide a suitable mix of carbonous and nitrogenous materials, a stock of amendment carbon based materials are held on site for blending purposes. This material is mainly used as an amendment for the IVC but can also be utilised for abnormal green waste loads such as large volumes of spring cut grass. The amendment material is a mix of compost oversize and large woody fresh materials, e.g. large branches and logs that are odour stable. These are specially selected by the operator to be held on site for addition as necessary to the IVC and abnormal green loads.

Batch record sheets detail screened oversize being stored including the age and tonnage of material that comply with the proposed storage limit and from which compost batch it was sourced.

Location	Storage Limits	Odour Potential	Management
Amendment Materials Storage Area	<1,000m^3 <6 months	Low The material is specially selected for low odour potential and is high in carbon for addition to the more unstable nitrogenous wastes.	Section 5.3.2 & Section 5.4.1

4.9 Leachate

All leachate resulting from composting operations on site is captured through the integral drainage and storage systems. All external composting activities (OWC and ASP) take place on concrete hard-standing and leachate drains to one of two underground sumps which then pump to a dedicated leachate storage tank. Leachate arising within the IVC is retained within the integral drainage system and pumped to a central leachate storage tank.

Location	Storage Limits	Odour Potential	Management
IVC Leachate Storage Tank	<90% capacity	High Leachate generation is elevated with high liquid content food wastes and with no dilution from rainwater has a high odour potential.	Section 5.8.3
OWC External Leachate Tank	<90% capacity	Low – Medium Leachate within the tank is heavily diluted with rainwater falling on the pad, greatly reducing the odour potential.	

5.0 PROCESS MANAGEMENT

The following sections outline the waste recovery processes operated for the production of PAS100 compost through separate processes in combination: IVC, ASP and OWC. The monitoring parameters, critical limits, process controls and records at each stage within the recovery process for the minimisation of the production of odours are provided herein. Reference is made throughout to the sites Standard Operating Procedure (SOP) for the production of PAS100 compost.

The facility deploys a number of different composting techniques which can be utilised in parallel or series depending upon operational requirements. The flow diagram below outlines the different process routes depending upon material treated and technique employed. The default treatment technology for sanitisation is the IVC and for stabilisation is the ASP bays (highlighted in red below). The use of open windrow composting will be as a back up to the ASP system for any down time during routine or abnormal outage.

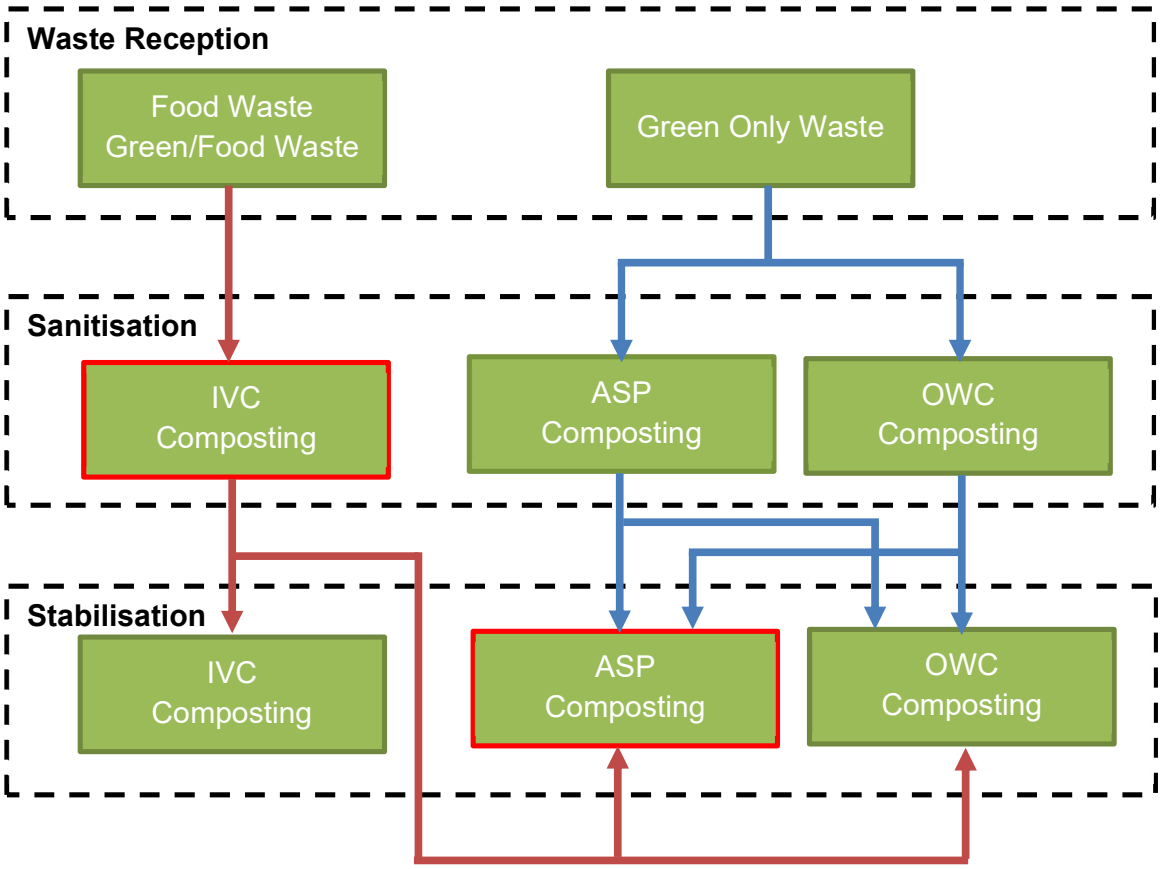


Figure 2 – Process Technique Material Flow Diagram

5.1 Pre-Acceptance

The Site Manager or Senior Operations Manager shall ensure that the site has the required number of qualified staff on site prior to the waste acceptance and rejection procedures (four qualified members of staff). In this instance, qualified means someone who has been trained via a toolbox talk in the correct procedures for assessing waste and making appropriate adjustments. Records of the members of staff who have been trained are stored on site. The

Site Manager or Senior Operations Manager shall ensure that the site has capacity to store and treat any incoming waste. The Site Manager or Senior Operations Manager l shall ensure that the site will not exceed Permit conditions by accepting any incoming wastes.

Prior to the acceptance of wastes on site, Biowise will obtain baseline information in writing relating to:

- the type of process producing the waste
- the specific process from which the waste derives
- the quantity of waste;
- the form the waste takes (solid, liquid, sludge etc)
- presence, strength and description of odour assessment
- physical appearance and colour
- hazards associated with the waste (e.g. low pH)

Hazards will be fully detailed according to the potential for presence within the material and accompanied by laboratory analysis. Hazards will be assessed against the framework for waste material acceptance[11] and decisions taken for acceptance based against threshold values and operational controls for mitigation.

On a risk based approach as recommended in the EC BREF for Waste Treatment Industries, analysis will be undertaken to determine the properties of the waste material where specific hazards are identified at the baseline reporting stage. The analysis will aim to identify the suitability for the proposed treatment method, and any special treatment requirements. Analysis will include the following parameters:

- check on constituents declared by waste producer/holder to ensure Permit compliance, treatment plant specification and final disposal
- all hazardous characteristics
- moisture content
- pH
- C:N ratio
- Alkalinity
- Ammonia and Kjeldahl Nitrogen
- Heavy Metals
- Potentially Toxic Elements (PTE)
- Total organic carbon (TOC)
- Particle size distribution
- Physical contaminants

Sampling will be representative of the type of load that is expected to be received on site and sampling will be obtained from a batch in line with British Standard EN 12579. Sample frequency will be in line with anticipated variation in feedstock, e.g. seasonal variation between summer and winter months.

Verification of the written information provided by the producer may be required, and this will require a visit to the producer (at least annually) specifically where a third party is involved, e.g. waste broker. Following characterisation of the waste, a technical assessment will be

[11] EA (2013) Framework for assessing suitability of wastes going to anaerobic digestion, composting and biological treatment. Framework Guidance Note.

made by technical staff of its suitability for treatment or storage to ensure Permit conditions are being met. The assessment will include:

- suitability for process by confirmation of waste classification and physico-chemical properties;
- suitability for treatment in line with operational parameters e.g. C:N ratio allows appropriate blending to target ratio with other waste materials available; and
- suitability for acceptance based on risk to pollution, e.g. odour level.

5.2 Waste Rejection

Non-targeted waste materials for recovery through the proposed composting facility shall include:

- Dog, cat and horse waste;
- Wood and paper ash;
- Non-organic materials;
- Cardboard;
- Liquid wastes;
- Powders or dusts;
- Highly decomposed wastes e.g. non-stackable;
- Highly odorous wastes, as determined by experienced site operatives.

Any load containing 7% or more non-targeted materials by weight shall be considered above the acceptable contamination threshold and would result in rejection, based on existing contractual arrangements at this percentage level. Percentage contamination will be obtained by visual inspection of the load by a trained operative in line with industry best practice techniques[12]. This includes spreading the load out to about 0.5m deep to enable a visual inspection to take place. The following table provides guidance on how to carry out a visual assessment and how to identify whether a load requires rejections.

Number of plastic bags / per 10 tonnes of material delivered	Action
<5 bags	No action required
5-7 bags	No action required
8-13 bags	Minimal picking of contaminants required before waste is shredded.
>13 bags i.e. >7%	Considerable picking of contaminants before waste is shredded or rejection of load.

Any rejected load will be placed in quarantine, clearly segregated from all other materials and removed from site as soon as possible, and in any case within 24 hours of receipt. A waste rejection form will be completed for any such load and the waste producer informed immediately.

[12] ORG (2014) Guidance on visual assessment of light plastics in input materials. Organics Recycling Group.

5.3 In-Vessel Composting

5.3.1 Waste Reception

On arrival, vehicles are weighed on the site weighbridge and directed to the reception building where they unload into the specified tipping area. As vehicles arrive to unload they enter the site through fast action roller shutter doors, negative pressure within the reception hall draws air out of the hall preventing the release of odours out of the doors. The doors are immediately closed once the vehicle exits the reception hall.

Once offloaded, materials are inspected by site staff for conformity with the waste rejection criteria. Loads are tipped into batches prior to treatment allowing traceability of materials and records to be held on batch tonnages and times. Each Batch Record Sheet will record each individual load received within each batch by linking weighbridge tickets with a date and weight in tonnes.

Once accepted, the operator undertakes a visual assessment of the likely carbon to nitrogen balance and the likely moisture content to identify the need for the incorporation of other materials i.e. woody material, oversize, water. Sufficient stocks of oversize and woody materials will be kept onsite to adjust the feedstock. Should the stock of amendments run low the site will either screen some compost to replenish the supply or shred some appropriate clean wood waste.

Waste materials awaiting shredding following acceptance are stored under normal operations against the far wall of the reception hall (opposite the entrance doors). The total space available for storage prior to shredding is 52m (l) x 15m (w) x 6m (h). Material can be stored with breaks denoting batches with associated batch record sheets. Under normal operating conditions there will be two batches in the waste reception hall at any one time (630t).

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Delivery of moist highly nitrogenous material consisting mainly of grass or food.	Visual Inspection by Volume.	>50% grass >25% food	Isolate feedstock from remaining material immediately, add amendment such as woody green waste, woodchip or oversize material and mix thoroughly to open up and aerate the material. On completion, the blended material can be covered with woodchip or moistened screened compost which will aid in reducing any odorous emissions to the air. Material is then processed in line with standard controls (i.e. <48hrs of receipt, 72 hrs on a Friday).	Duty of Care Transfer Note.
Delivery of odorous material that is highly degraded which is not recoverable through mitigation measures.	Visual Inspection.	Present in load.	Reject load and inform waste supplier for removal from site within 24hrs of receipt.	Duty of Care Transfer Note.
Feedstock material becoming odorous from storage prior to treatment.	Batch record sheets.	Feedstock processed within 48 hours of receipt or 72 hrs on a Friday and not stored over 2,000m^3.	Material will be processed within 48 hours of receipt or 72 hrs on a Friday. Stockpiled waste material shall not exceed 2,000m^3. Stockpiles will be "batch processed" which will ensure that all the material available is processed, or failing that, the site will process using a first in, first out system. If limits are exceeded, then the emergency response Section 10.5 will be actioned.	Batch record sheet.
Reception building not operating under negative pressure allowing odorous air to release when doors are open.	Pressure within tunnels monitored via SCADA system.	<-20 Pa & >-50Pa	Fast acting roller shutter doors are deigned to prevent loss of odorous air out of the building. Should there be a fault with the fast acting roller shutter doors, a contractor shall be called to site to fix the problem within 24 hours. The building also operates under negative pressure with 4 air changes per hour. Should the pressure in the tunnels be outside the normal working range of -20PA to -50Pa, a contractor shall be called to site to fix the problem within 24 hours.	SCADA system
ORP	1 & 3			

5.3.2 Pre-Treatment

Following receipt of conforming waste at the IVC reception hall, each accepted load shall be assessed for size; material must be less than 150mm in one plane only, prior to the waste being loaded into the IVC tunnel. For example, a branch may be 300mm long, but if it is less than 150mm thick it will meet the required standard. This can be achieved in one of two ways: through shredding; or through the removal of non-conforming oversized materials. Site operatives in the IVC inspect the waste on receipt and remove any non-conforming waste into the receptacles provided for further processing (i.e. liberating waste in black bin liners or shredding any oversized items). Accordingly, in the latter case, material can then be shredded after the active composting phase, post-stabilisation (see Section 4.6).

Following this a second assessment is made of C:N ratio and of material structure. Additional coarse or woody materials will be introduced if a greater carbon balance is required or additional coarse material is needed to add structure.

Typical C:N ratios of between 20:1 and 35:1 are optimal for the composting process. The site is adopting an optimal range of 25:1 to 30:1, given the inclusion of food waste, which equates

to approximately 1 part green (nitrogenous) waste to 3/4 parts brown (carbonous) waste. It should be noted that the IVC will be mainly processing co-mingled food and green waste which should reduce the requirement for additional balance materials.

C:N ratios of green wastes such as grass clippings and vegetable wastes are approximately 10:1, whereas the C:N ratio of brown wastes such as woody branches and oversize are approximately 35:1. Therefore at a ratio of 1 part green waste to 3 parts brown waste an overall C:N ratio for the feedstock mix will be approximately 28:1, at 4 parts brown to 1 part green the overall mix will be 30:1.

Parts will be measured by volume based on a simple approach that allows consistency in batch creation. This will be achieved via a simple loading of feedstock via a loading shovel, where one bucket will equate to 1 part.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Release of odours to the environment during pre-treatment.	Moisture Assessment	Moisture Index: 5	All pre-treatment takes place within the sealed, negatively aerated waste reception hall. Should material be assessed to be dry, clean water will be added to limit aerial dispersion immediately.	Batch record sheet.
Odours released due to poor mix of feedstock materials.	Volumetric Assessment	1:3/4 (green:brown) waste mix.	Waste selected for batch processing is carried out by volumetric assessment of green:brown waste ratios (Section 2.1). Where there are excessive green waste amounts, clean source-segregated wood is added to obtain the desired C:N ratio immediately.	Batch record sheet.
Odours released from storage of feedstocks prior to tunnel loading.	Physical measurement.	<450m^3 <4m high <20m long/wide	Waste awaiting to be loaded into the tunnels after pre-treatment, shall not exceed 450m^3 and be loaded within 24 hours of material being blended. If limits are exceeded, then the emergency response Section 10.5 will be actioned.	Batch record sheet.
ORP	1 & 3			

5.3.3 In-Vessel Sanitisation

After pre-processing, the feedstock is transferred to the composting tunnels using a front loader. The IVC building consists of 8 tunnels, each with a maximum capacity of 315t/600m^3. Each vessel is 6m high, 5.2m wide and 35m long. Prior to loading, a grip test is undertaken to ensure that the material is at the correct moisture content. Material is then loaded into the tunnel and the monitoring probes are inserted, doors shut, and automated air and water handling system engaged.

The IVC tunnels are actively aerated via pipes incorporated into the floor of the tunnels. A proportion of the air flow is re-circulated through the tunnels and the temperature (in the compost) and oxygen concentration (in the airflow) continuously monitored to ensure aerobic conditions and compliance with the requirements of the ABPR. Once the ABPR temperature (and retention time) requirements have been achieved, if temperatures rise to 75°C or oxygen depletes to less than 5% additional fresh air is introduced. During processing, the level of total evaporation is reviewed, alongside airflow rates, and an assessment is made as to whether additional moisture or airflow is required to wet or dry the material respectively.

Any air which is not recirculated is directed to the dedicated odour abatement system prior to release to atmosphere. After typically 7-10 days the waste will have been turned a minimum

of 2 times (once going into the tunnel and once when leaving) and having met the requirements of ABPR and critical composting limits, the sanitisation phase is complete.

To minimise the potential for odours and to maintain air quality for operatives inside, the doors of the IVC can be completely sealed, extractor fans create negative pressure in the building and the exhaust air from the fans are directed through the air treatment system. The airflow through the tunnels is a maximum of $100m^3/m^2/h$. The overpressure air from the tunnels is exhausted through aluminium ($AlMg_3$) ducting into an aluminium constructed wet scrubber (1 per 4 tunnels). From there on, air is sucked out and blown through the biofilters by 2 individual GICOM fans. Fans are stainless steel and built upon a galvanised frame with shock absorbers. The 30 kW fans blow the air into an aluminium plenum which is connected to the spigot pipes of the biofilter.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Tunnel too dry leading to slow process and material backlog.	Moisture Monitoring.	Moisture Index: 5	Additions of water to compost should be done on a little and often basis. If additional moisture is required by monitoring moisture content less than the critical limit, process water (sanitisation only) is applied immediately directly to the tunnel.	Batch Record Sheet.
Tunnel too wet leading to anaerobic conditions.	Moisture Monitoring.	Moisture Index: 1-2	The compost tunnels are free draining onto an enclosed drainage system to enable runoff from excessive moisture content. Aeration of tunnels will aid the drying of material to prevent high moisture levels occurring. If elevated moisture levels are encountered, additional air is introduced immediately to fully aerate.	Batch Record Sheet.
Tunnel not in optimal temperature range for composting.	Temperature Monitoring.	>75^{0}C	Compost is formed into tunnels of adequate size in order to generate required temperatures during active composting phases. Should temperature become elevated above critical limits, tunnels will be flushed with fresh air as immediately to fully aerate.	Process Computer Records.
Tunnel becoming anaerobic due to lack of oxygen within the material.	Oxygen Monitoring	<8%	Compost is fully aerated to ensure adequate levels of oxygen within the tunnels. Oxygen levels are directly monitored in the airflow. Where these are elevated above critical limits, tunnels will be flushed with fresh air immediately to fully aerate.	Process Computer Records.
ORP	3			

5.3.4 In-Vessel Stabilisation

Following IVC tunnel sanitisation, one of the process options is to undertake stabilisation within the tunnels. Throughout the 4-week stabilisation phase tunnels are actively monitored for temperature, moisture and oxygen. The controls outlined in Section 5.3.3 apply to the stabilisation phase with a cooler upper temperature limit as the material has met the sanitisation pathogen kill phase.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Tunnel too dry leading to slow process and material backlog.	Moisture Monitoring.	Moisture Index: 5	Additions of water to compost should be done on a little and often basis. If additional moisture is required by monitoring moisture content less than the critical limit, process water (sanitisation only) is applied immediately directly to the tunnel.	Batch Record Sheet.
Tunnel too wet leading to anaerobic conditions.	Moisture Monitoring.	Moisture Index: 1-2	The compost tunnels are free draining onto an enclosed drainage system to enable runoff from excessive moisture content. Aeration of tunnels will aid the drying of material to prevent high moisture levels occurring. If elevated moisture levels are encountered, additional air is introduced immediately to fully aerate.	Batch Record Sheet.
Tunnel not in optimal temperature range for composting.	Temperature Monitoring.	>55^{0}C	Compost is formed into tunnels of adequate size in order to generate required temperatures during active composting phases. Should temperature become elevated above critical limits, tunnels will be flushed with fresh air as immediately to fully aerate.	Process Computer Records.
Tunnel becoming anaerobic due to lack of oxygen within the material.	Oxygen Monitoring	<8%	Compost is fully aerated to ensure adequate levels of oxygen within the tunnels. Oxygen levels are directly monitored in the airflow. Where these are elevated above critical limits, tunnels will be flushed with fresh air immediately to fully aerate.	Process Computer Records.
ORP	3			

5.3.5 Tunnel Unloading

Following completion of the active composting sanitisation phase material is unloaded from the compost tunnels. For biosecurity following the sanitisation phase, material is unloaded from the tunnels externally to the reception hall, i.e. the opposite end to loading which takes place from the side that faces the reception building. Material can then be reloaded externally for tunnel stabilisastion or transferred to the outdoor composting pad.

After sanitisation and prior to tunnel unloading, the material is taken through a conditioning and cool down phase in the process control system. During this period the batches in the tunnel are actively cooled and stabilised by introducing more air into the tunnels to ensure prior to unloading the material is cooled to below 35^{0}C and fully aerated. This is a typical 72hr process period that ensures material is stable and cool ready for unloading.

Material is unloaded directly into dumper trucks or tractor and trailer during the unloading of each tunnel to minimise handling movements. Only one tunnel is unloaded at any one time to minimise exposure to the atmosphere of sanitised waste materials.

To minimise impact from any potential odour release towards the local sensitive receptor, where operationally practicable, tunnel unloading will not take place when the wind is blowing in a northerly direction. This is discussed further in Section 9.1.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Release of odorous compounds to the atmosphere.	Monitoring records.	Composting process complete.	Compost that is to be unloaded from the tunnels shall only take place if the material has completed the sanitisation phase and met the critical limits throughout this period. If it fails this process, the batch remains in the tunnel and reprocessed from point zero.	Batch record sheet.
Release of odours dispersed towards sensitive receptor.	Monitoring Records.	Completion of cool down process. <35^{0}C	Compost that is to be unloaded from the tunnels shall only take place if the material has completed the cool down phase ensuring that the material is fully aerobic and cool prior to opening of tunnel doors. Material will not exit the tunnels until the cool down phase has been completed.	Batch record sheet.
ORP	2			

5.3.6 Material Transportation

Once material has been loaded into the transportation vehicles from the tunnel system, it is transported to the stabilisation pad via the site access routes and crossing Westfield Road. There will be a single approved route for transportation which all vehicles will strictly adhere to. Each tunnel will hold approximately 200 tonnes of material after the IVC stage (i.e. allowing for 30% mass reduction). If a tractor and trailer carries an average of 15 tonnes of compost, then there will be approximately 13 loads per tunnel. If 1 tunnel is emptied per day in the peak period, then this equates to 65 movements per week.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Release of dust and odour during open transportation to the atmosphere.	Moisture Assessment.	Moisture Index: 5	As material is loaded for transportation a moisture assessment is undertaken to ensure materials are not too dry that could lead to elevated dust generation during transportation. If material is too dry, then it is damped down using clean water only.	Site Diary.
Release of odorous compounds to the wider atmosphere.	Visual observations of vehicle movements.	Transport Route.	Compost that is to be transferred to the stabilisation pad shall be done so via the appropriate transportation route. The route is entirely within the permitted site boundary and cross Westfield Road. No other routes shall be taken to prevent transportation close to residential areas.	Site Diary.
Release of odours from open top transport to the atmosphere.	Visual observations of vehicle movements.	10mph	At all times vehicles within the site are restricted to the site speed limit of 10mph. Any exceedances are recorded and staff retrained as appropriate on site rules.	Site Diary.
ORP	Not static – along route between the IVC and OWC facilities			

5.4 Open Windrow Composting

5.4.1 Waste Reception

On arrival, vehicles are weighed on the site weighbridge and directed to the reception area on the southern portion of the site where they unload into the specified tipping area. Once offloaded, materials are inspected by site staff for contamination and any gross contamination removed by hand (i.e. large objects, plastics etc.).

At the same time the operator undertakes a visual assessment of the likely carbon to nitrogen balance and the likely moisture content to identify the need for the incorporation of other materials i.e. woody material, water. Sufficient stocks of oversize and woody materials will be kept onsite to adjust the feedstock. As per Section 4.8 above, amendment material is stored on the Open Windrow Composting pad for up to 6 months, in a maximum pile size of 1,000m^3. Should the stock of amendments run low the site will either screen some compost to replenish the supply or shred some appropriate clean wood waste. Should the site exhaust all supplies of amendment materials, and not be able to obtain any further supplies, deliveries of feed stocks needing amendment materials will cease.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Delivery of moist highly nitrogenous material consisting mainly of grass.	Visual Inspection.	>50% grass	Isolate feedstock from remaining material, add amendment such as woodchip or oversize material and mix thoroughly to open up and aerate the material. On completion the blended material can be covered with woodchip or moistened screened compost which will aid in reducing any odorous emissions to the air. Should the stock of amendment material run out and site is unable to source any additional stock, deliveries of feedstocks requiring amendment material i.e. highly nitrogenous material consisting mainly of grass, shall cease.	Duty of Care Transfer Note.
Delivery of odorous material that is highly degraded which is not recoverable through mitigation measures.	Visual Inspection.	Present.	Reject load and inform waste supplier.	Waste rejection form.
Feedstock material becoming odorous from storage prior to treatment.	Visual assessment and record sheets.	Feedstock shred within 5 days of receipt.	Material will be shredded within 5 days of receipt. Stockpiles will be "batch shredded" which will ensure that all the material available to be shred is processed, or failing that, the site will shred using a first in, first out system. If limits are exceeded, then the emergency response Section 10.5 will be actioned.	Batch record sheet.
ORP	4			

5.4.2 Shredding

Following waste acceptance, a loading shovel or 360^0 excavator is used to deposit the raw material into the hopper of the shredder. The operator can select different loads to achieve the required mix; additionally, the moisture content of the shredded material can be increased. This is done using a sprinkler with the water sourced from leachate storage tank serving the OWC pad. The shredder is located on the OWC processing pad as part of the existing

activities, material is shredded into holding batches prior to windrows being formed, where it is mixed to achieve the appropriate feedstock blend.

Material is batch shredded before being formed into windrows, so obtaining the right carbon:nitrogen ratio during the shredding process is an important factor in reducing odour potential during the shredding and composting process. Typical C:N ratios of between 20:1 and 30:1 are optimal for the composting process. The site is adopting an optimal range of 25:1 to 30:1 which equates to approximately 1 part green (nitrogenous) waste to 3/4 parts brown (carbonous) waste.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Release of odours to the environment during shredding.	Visual Assessment.	Dry material by visual assessment.	Should material entering the shredder be observed to be dry, water will be added to limit aerial dispersion.	Batch record sheet.
Odours released due to poor mix of feedstock materials.	Visual Assessment.	1:3/4 (green:brown) waste mix.	Waste selected for batch shredding is carried out by visual assessment of green:brown waste ratios. Where there is excessive green waste amounts, clean source-segregated woody fraction is added to obtain the desired C:N ratio.	Batch record sheet.
Odours released from storage of feedstocks prior to windrow formation.	Physical measurement.	<450m^3 <4m high <20m long/wide	Waste awaiting to be formed into the windrows shall be limited to 450m^3 and will be loaded within 5 days of material being blended. If limits are exceeded, then the emergency response Section 10.5 will be actioned.	Batch record sheet.
ORP	5			

5.4.3 Windrow Formation

Green waste is formed into windrows on the OWC concrete pad with dimensions of each windrow approximately 4 metres high, 8 metres wide and 40 metres long (in a trapezoidal shape) to a maximum of 400t/850m^3 per batch. Gaps of suitable width to enable turning/monitoring and litter picking will be left between the windrows. A larger windrow will have a smaller surface area to volume ratio and will therefore reduce the surface area of an odorous material; this will cut the rate of evaporation.

When a windrow is small, the core zone of the pile may not reach ambient temperatures and will therefore lose its heat very rapidly. As a result, this can lead to moisture being retained in the windrow meaning it is a cooler windrow. High temperatures are required to ensure pathogens and weed seeds are killed off. Oxygen consumption by microbes ensures the compost is biodegraded, however when there is a lack of oxygen the composting process slows down and odours may result. The readings from the monitoring will determine when the windrows should be turned and when moisture needs to be added.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Oversize windrow leading to anaerobic conditions.	Physical measurement.	Windrow dimension: 4m (h) x 8m (w) x 40m (l) <850m^3	Material is formed into windrows not exceeding 850m^3 by way of physical measurement of volume and windrow dimension. Composting process is actively managed to PAS100 to ensure that material is progressing through the system to allow adequate space on the pad.	Batch record sheet.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
ORP	5			

5.4.4 OWC Sanitisation

The sanitisation phase is a minimum 7-day process, but typically lasts 2 weeks, during which time monitoring equipment will be used for temperature and oxygen readings, and moisture levels will be assessed by grip test to ensure critical limits for composting are being met. During this period a minimum of 1 turn is made to fully incorporate the compost by loading shovel.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Windrow too dry leading to slow process and pad backlog.	Moisture Monitoring.	Moisture Index: 5	Additions of water to compost should be done on a little and often basis. If additional moisture is required by monitoring moisture content less than the critical limit, process water is applied directly to the windrow. Too much water should not be added as it will generate excessive runoff onto the composting pad.	Batch record sheet.
Windrow too wet leading to anaerobic conditions.	Moisture Monitoring.	Moisture Index: 1-2	The compost windows are free draining onto a concrete pad to enable runoff from excessive moisture content. If elevated moisture levels are encountered, windrow is turned as soon as possible to fully aerate.	Batch record sheet.
Windrow not in optimal temperature range for composting.	Temperature Monitoring.	>75^{0}C.	Compost is formed into windrows of adequate size in order to generate required temperatures during active composting phases. Should temperature become elevated above critical limits, windrows will be turned as soon as possible to fully aerate.	Batch record sheet.
Windrow becomes anaerobic due to a lack of oxygen.	Oxygen monitoring.	<5%	Windrows are formed of a suitable structure to enable air to enter the windrow core. Should oxygen levels fall below critical limits, then the windrow is turned to fully aerate the pile. Oversize material is also introduced in order to improve windrow structure.	Batch record sheet.
Evaporation from windrow surface.	Visual Assessment.	Large amounts of steam from windrow by visual assessment.	Should there be large amounts of steam visible from a composting windrow, the windrow will be temperature monitored to ensure the windrow is within critical limits. If not the windrow is turned as soon as possible in order to fully aerate.	Batch record sheet.
Release of odour during windrow turning.	Visual assessment and record sheets.	Minimum 1 turn and as required	A regular turning regime is implemented in line with PAS100 that ensures aerobic conditions within the windrow. Turning is carried out once in this phase and again as required by monitoring parameters.	Batch record sheet.
	Local Time.	Outside of core hours.	Where outside of core hours, turning of compost windrows shall not take place.	N/A

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
	Weather Station	Wind direction SW-SE	If the wind is blowing towards the SW-SE, then consideration will be given to delaying windrow turning. Should this not be possible sniff testing will take place during the turning period.	Site Diary.
ORP	5			

5.4.5 OWC Stabilisation

Following completion of the sanitisation phase in either IVC, ASP or OWC processes, materials are further processed to mature. Stabilisation of these materials is undertaken in open windrows on the external composting pad. There is no mixing of wastes at stabilisation, all windrows are kept in discrete batches from formation to completion of stabilisation.

The stabilisation phase is a minimum 6 week process during which time monitoring equipment will be used for temperature monitoring and moisture levels will be assessed by grip test to ensure critical limits for composting are being met. During this period a minimum of 2 turns are made to fully incorporate the compost by loading shovel.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Windrow too dry leading to slow process and material backlog.	Moisture Monitoring.	Moisture Index: 5	Additions of water to compost should be done on a little and often basis. If additional moisture is required by monitoring moisture content less than the critical limit, clean water only is applied directly to the windrow.	Batch record sheet.
Windrow too wet leading to anaerobic conditions.	Moisture Monitoring.	Moisture Index: 1-2	The compost windrows are free draining onto a drainage system to enable runoff from excessive moisture content. Aeration of windrows will aid the drying of material to prevent high moisture levels occurring. If elevated moisture levels are encountered, additional air is introduced as soon as possible to fully aerate via turning.	Batch record sheet.
Windrow not in optimal temperature range for composting.	Temperature Monitoring.	>55^{0}C.	Compost is formed into windrows of adequate size in order to generate required temperatures during active composting phases. Should temperature become elevated above critical limits, windrows will be turned to introduce fresh air as soon as possible to fully aerate.	Batch record sheet.
Windrow becomes anaerobic due to a lack of oxygen.	Oxygen monitoring.	<5%	Windrows are formed of a suitable structure to enable air to enter the windrow core. Should oxygen levels fall below critical limits, then the windrow is turned to fully aerate the pile. Oversize material is also introduced in order to improve windrow structure.	Batch record sheet.
Evaporation from windrow surface.	Visual Assessment.	Large amounts of steam from windrow by visual assessment.	Should there be large amounts of steam visible from a composting windrow, the windrow will be temperature monitored to ensure the windrow is within critical limits. If not the windrow is turned as soon as possible in order to fully aerate.	Batch record sheet.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Release of odour during turning.	Visual assessment and record sheets.	Minimum of 2 turns and as required.	A regular turning regime is implemented in line with PAS100 that ensures aerobic conditions within the windrow. Turning is carried out twice in this phase and again as required by monitoring parameters.	Batch record sheet.
	Local Time.	Outside of core hours.	Where outside of core operational hours, turning of compost windrows shall not take place.	Site Diary.
	Weather Station	Wind direction SW-SE	If the wind is blowing towards the SW-SE, then consideration will be given to delaying windrow turning. Should this not be possible sniff testing will take place during the turning period.	Site Diary.
ORP	5			

5.5 Aerated Static Pile Composting

5.5.1 Pile Formation

Shredded green waste or sanitised green waste, or sanitised green/food waste from the IVC is formed into piles within an ASP bay. The dimensions of each pile will be approximately 4 metres high, 30 metres wide and 20 metres long to a maximum of 2,400m^3 per batch. Solid concrete walls divide each bay. A larger pile will have a smaller surface area to volume ratio and will therefore reduce the surface area of any odorous material; this will cut the rate of evaporation.

When a pile is small, the core zone of the pile may not reach ambient temperatures and will therefore lose its heat very rapidly. As a result, this can lead to moisture being retained in the pile resulting in stalling of the composting process. High temperatures are required to ensure pathogens and weed seeds are killed off. Oxygen consumption by microbes ensures the compost is biodegraded, however when there is a lack of oxygen the composting process slows down and odours may result. The readings from the monitoring will determine if any changes to the airflow rate are required or when moisture needs to be added.

Should the optimal airflow not be achieved, the structure of the batch will be investigated and amended as appropriate. This can include the addition of oversize material to increase the pore space within the media, or the reduction in batch height. The dimension limits will be maintained throughout the composting period, although there will be mass loss during the process so the overall height of the pile in each bay will reduce during the composting process.

It is considered that remixing will not be required. The ASP bay design has been specified against the target material arising from the IVC tunnels. The system is therefore specifically designed with the anticipated structure of the target material. In addition, the ASP bays are provided by Gicom who also provide the IVC technology which both work on the same principle of design. Since the commissioning of the IVC tunnels, there has not been a single instance where the tunnels have required remixing in order to aid airflow. This gives confidence that the same level of performance can be anticipated for the ASP system.

A 300mm layer of biofilter media (e.g. mulch/finished compost) is added to all batches (within 24hrs of formation) as a cover layer to aid the reduction of odour emissions.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Oversized pile leading to anaerobic conditions.	Physical measurement.	2,400m^3	Material is formed into piles not exceeding 2,400m^3 by way of physical measurement of pile dimension. The composting process is actively managed to PAS100 to ensure that material is progressing through the system to allow adequate space. Each bay is physically restricted in dimension by concrete walls 4m in height providing a simple visual reference point.	Batch record sheet.
Loading of highly active odorous material from the IVC.	Temperature probe.	<35^{0}C	Post sanitised material from the IVC is sent to the ASP bays for stabilisation. Prior to unloading from the tunnels and transfer to the ASP the material is cooled to <35^{0}C to ensure the material is not highly active/odorous during batch formation at the ASP bays. No material leaves the IVC until the cool down temperature limit is met.	Computer Records.
Airflow through the pile is not sufficient, indicating poor structure.	Backpressure monitoring.	>4.5kPa	Backpressure is constantly monitored so that should airflow through the pile not be sufficient, above the critical limit, then a lack of oxygen is received by the pile potentially leading to anaerobic conditions. Should backpressure be a repeated issue during treatment, a layer of compost oversize (150-300mm) will be added to the base of existing batches experiencing insufficient airflow to aid dispersion.	Computer system records.
Odours generated from the ASP process causing pollution beyond the site boundary.	Internal/EA inspection forms.	Elevated odour concentrations during sniff checks.	A layer (~300mm) of biofilter media (e.g. mulch/finished compost) is added to all batches (within 24hrs of formation) as a cover layer to aid the reduction of odour emissions. Should concentrations continue to be elevated then the emergency action plan will be implemented (Section 10).	Sniff check reports.
ORP	8			

5.5.2 ASP Sanitisation

The ASP bays are actively aerated via pipes laid on top of the concrete bay floor and connected to a plenum chamber. Air is forced through these pipes up into the compost pile and the temperature (in the compost) and oxygen concentration are continuously monitored to ensure aerobic conditions and compliance with the requirements of PAS100. The Gicom computer control system automatically varies the air delivery to the pile to ensure that the critical limits for oxygen content and temperature are not exceeded, thereby preventing anaerobic or other unfavourable conditions forming. The sanitisation phase is a minimum 48hr period in which critical limits are constantly met.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Pile oxygen levels low leading to anaerobic conditions	Oxygen Monitoring.	<8%	Compost is fully aerated to ensure adequate levels of oxygen within the bays. Oxygen levels are directly monitored in the media. Where these	Computer system records.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
			are below critical limits, bays will be flushed with fresh air immediately to fully aerate.	
Pile too dry leading to slow process and pad backlog.	Moisture Monitoring.	Moisture Index: 5	Additions of water to compost should be done on a little and often basis. If additional moisture is required by monitoring moisture content less than the critical limit, process water is applied directly to the pile. Too much water should not be added as it will generate excessive runoff onto the composting pad.	Computer system records.
Pile too wet leading to anaerobic conditions.	Moisture Monitoring.	Moisture Index: 1-2	The compost piles are free draining onto a concrete pad to enable runoff from excessive moisture content. If elevated moisture levels are encountered, the airflow system is increased to introduce more air to dry the pile.	Computer system records.
Pile not in optimal temperature range for composting.	Temperature Monitoring.	>75^{0}C.	Compost is formed into piles of adequate size in order to generate required temperatures during active composting phases. Should temperature become elevated above critical limits, airflow to the pile will be increased automatically to fully aerate.	Computer system records.
Airflow through the pile is not sufficient, indicating poor structure.	Backpressure monitoring.	>4.5kPa	Backpressure is constantly monitored so that should airflow through the pile not be sufficient, above the critical limit, then a lack of oxygen is received by the pile potentially leading to anaerobic conditions. If the critical limit is exceeded, then the process computer alarm is activated. If the limit is exceeded for more than 72hrs, then the pile is fully remixed, with additional oversize material as required to improve the structure, enabling optimal airflow through the pile. Remixing will not occur when the wind is in the direction of sensitive receptors. All piles are routinely covered with a 300mm biofilter layer. All remedial actions will be implemented until monitored levels are within the critical limits.	Computer system records.
Airflow through the pile is too rapid, indicating perched flow.	Backpressure monitoring.	<1.0kPa	Backpressure is constantly monitored so that should airflow through the pile be below the critical limit, then it is indicative of preferential flow. If the critical limit is exceeded, then the process computer alarm is activated. If the limit is exceeded for more than 72hrs, then the pile is fully remixed, with additional oversize material as required to improve the structure, enabling optimal airflow through the pile. Remixing will not occur when the wind is in the direction of sensitive receptors. All piles are routinely covered with a 300mm biofilter layer. All remedial actions will be implemented until monitored levels are within the critical limits.	Computer system records.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Odours generated from the ASP process causing pollution beyond the site boundary.	Internal/EA inspection forms.	Elevated odour during sniff checks.	Should it be identified during routine monitoring that the ASP is producing elevated odours (3+), then a layer (~300mm) of biofilter media (e.g. mulch/finished compost) will be added to all batches as a cover layer to aid the reduction of odour emissions.	Sniff check reports.
ORP	8			

5.5.3 ASP Stabilisation

Following completion of the sanitisation phase in either IVC, ASP or OWC processes, materials are further processed through a stabilisation phase. Stabilisation of these materials is undertaken within the ASP bays. Where material is sanitised in ASP and then stabilised in ASP, between each phase the batch is physically moved from one bay to another to segregate the distinct process phases. There is no mixing of wastes at stabilisation, all piles are kept in discrete batches from formation to completion of stabilisation.

The stabilisation phase is a minimum 4-week process during which time monitoring equipment will be used for temperature monitoring and moisture levels will be assessed by grip test to ensure critical limits for composting are being met. Air is forced through these pipes up into the compost pile and the temperature (in the compost) and oxygen concentration are continuously monitored to ensure aerobic conditions and compliance with the requirements of PAS100. The Gicom computer control system automatically varies the air delivery to the pile to ensure that the critical limits for oxygen content and temperature are not exceeded, thereby preventing anaerobic conditions forming.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Pile oxygen levels low leading to anaerobic conditions	Oxygen Monitoring.	<8%	Compost is fully aerated to ensure adequate levels of oxygen within the bays. Oxygen levels are directly monitored in the media. Where these are below critical limits, bays will be flushed with fresh air immediately and automatically to fully aerate.	Computer system records.
Pile too dry leading to slow process and material backlog.	Moisture Monitoring.	Moisture Index: 5	Additions of water to compost should be done on a little and often basis. If additional moisture is required by monitoring moisture content less than the critical limit, clean water only is applied directly to the pile.	Computer system records.
Pile too wet leading to anaerobic conditions.	Moisture Monitoring.	Moisture Index: 1-2	The compost piles are free draining onto a concrete pad to enable runoff from excessive moisture content. Aeration of piles will aid the drying of material to prevent high moisture levels occurring. If elevated moisture levels are encountered, additional air is automatically introduced as soon as possible to fully aerate.	Computer system records.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Pile not in optimal temperature range for composting.	Temperature Monitoring.	>55^{0}C.	Compost is formed into piles of adequate size in order to generate required temperatures during active composting phases. Should temperature become elevated above critical limits, airflow to the pile will be increased automatically to fully aerate.	Computer system records.
Airflow through the pile is not sufficient, indicating poor structure.	Backpressure monitoring.	>4.5kPa	Backpressure is constantly monitored so that should airflow through the pile not be sufficient, above the critical limit, then a lack of oxygen is received by the pile potentially leading to anaerobic conditions. If the critical limit is exceeded, then the process computer alarm is activated. If the limit is exceeded for more than 72hrs, then the pile is fully remixed, with additional oversize material as required to improve the structure, enabling optimal airflow through the pile. Remixing will not occur when the wind is in the direction of sensitive receptors. If the wind is in the direction of sensitive receptors for more than 48hrs then the material will be covered with a 300mm biofilter layer. All remedial actions will be implemented until monitored levels are within the critical limits.	Computer system records.
Airflow through the pile is too rapid, indicating perched flow.	Backpressure monitoring.	<1.0kPa	Backpressure is constantly monitored so that should airflow through the pile be below the critical limit, then it is indicative of preferential flow. If the critical limit is exceeded, then the process computer alarm is activated. If the limit is exceeded for more than 72hrs, then the pile is fully remixed, with additional oversize material as required to improve the structure, enabling optimal airflow through the pile. Remixing will not occur when the wind is in the direction of sensitive receptors. If the wind is in the direction of sensitive receptors for more than 48hrs then the material will be covered with a 300mm biofilter layer. All remedial actions will be implemented until monitored levels are within the critical limits.	Computer system records.
Odours generated from the ASP process causing pollution beyond the site boundary.	Internal/EA inspection forms.	Elevated odour concentrations during sniff checks.	Should it be identified during routine monitoring that the ASP is producing elevated odours (3+), then a layer (~300mm) of biofilter media (e.g. mulch/finished compost) will be added to all batches as a cover layer to aid the reduction of odour emissions.	Sniff check reports.
ORP	8			

5.5.4 ASP Bay Unloading

Following completion of the stabilisation phase material is unloaded from the ASP bays. Prior to bay unloading the material is taken through a cool down phase in the process control system. During this period the batches in the bay are actively cooled by introducing more air

into the ASP bay to ensure prior to unloading the material is cooled to below 35°C and fully aerated.

Material is unloaded by loading shovel to reduce fall heights during transfer and storage prior to grading at the adjacent pad. This reduces the likelihood of material becoming entrained in the air, thus reducing the likelihood of a release of odour. Only one bay is unloaded at any one time to minimise exposure to the atmosphere of finished material.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Release of odorous compounds to the atmosphere.	Monitoring records.	Composting process complete.	Compost that is to be unloaded from the bays shall only take place if the material has completed the stabilisation phase and met the critical limits throughout this period. If it fails this process, the batch remains in the bay and reprocessed from point zero. The reason for failure is considered and amended e.g. reduction in batch height or amendment of structure by adding oversize material.	Batch record sheet.
Release of odours dispersed towards sensitive receptor.	Monitoring records.	Completion of cool down process. <35°C	Compost that is to be unloaded from the bays shall only take place if the material has completed the cool down phase ensuring that the material is fully aerobic and cool prior to unloading. Material will not exit the bays until the cool down phase has been completed.	Batch record sheet.
Release of odour from forced cool down of material.	Monitoring records.	1°C/hr	The cool down process cools material from ~55°C to <35°C over a typical 48hr period. The process control automates the air delivery system to ensure that cooling is not too rapid. The system will reduce temperature by 1°C over a maximum hourly period. Once the temperature drop has been achieved, the system stops the cooling process. This means the maximum temperature drop is 1°C/hr or 30hrs, although typically this takes 48hrs to achieve.	Process computer records.
ORP	8			

5.6 Compost Grading (inc. Shredding & Screening)

Shredding and screening of the compost following the active composting phase shall be carried out to create different grades of soil improver, certified to PAS 100 & CQP. The date(s) on which each batch is shredded and screened, and its batch code shall be recorded on the batch record sheet. Oversize material coming off the screener shall only be re-composted if visual assessment confirms that physical contaminants will not adversely affect the composting process or prevent effective control of compost quality (as stated in the quality policy). Addition of oversize material to a batch of composting material shall only be carried out when it is being formed. If the oversize material is too heavily contaminated for re-composting, it shall be rejected and disposed of or used for onsite restoration works.

Processing of matured material can result in increased emissions due to agitation. However, shredding and screening is typically not a significant odour source unless the material has become anaerobic or is still actively composting. The latter is prevented through robust monitoring and management as identified in the table below.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Release of odorous compounds to the atmosphere.	Monitoring records.	Composting process complete.	Finished compost that is to be shredded and screened shall only take place if the material has completed the active composting phase and met the critical limits throughout this period. Material will only be moved from the ASP once the cool down phase is completed (i.e. <35°C).	Computer system records and/or Batch record sheet.
Release of odorous compounds to the atmosphere due to elevated temperatures in piles of material awaiting shredding/screening.	Visual Assessment	>400t >5 days	Material that is awaiting shredding is held in piles not exceeding 400t at any one time. Material is held for a maximum of 5 days. Should for any reason material not be processed within 5 days, the material is formed into an active windrow and monitored in line with Section 5.4.5.	Batch record sheet.
Release of odours to the environment during shredding.	Visual Assessment.	Dry material by visual assessment.	Should material entering the shredder be observed to be dry, water will be added to limit aerial dispersion.	Batch record sheet.
Release of odours during shredding/screening due to agitation.	Odour sniff checks	Odour intensity scale: 2	During routine odour sniff checks, should the odour intensity be scored at a level 2 or above then shredding/screening will be stopped where reasonably practicable and there would be no knock-on effect to the management of odours on site. Where this is not possible, water will be added to limit aerial dispersion.	Site Diary
ORP	5			

5.7 Product Storage

Products are stored on the storage area to the north of the OWC site, following grading ready for dispatch to the end markets. Each product batch is identifiable in its storage location by a marker that displays its unique product batch code. Each product batch contains compost from no greater than 6 batches and may be stored for a maximum of 12 months before dispatch to the customer.

During product storage there is not a significant source of odour generation given the age of material at this point following a typical 6-8-week minimum composting process. However, if oxygen, moisture and temperature are not controlled the biological processes can re-accelerate and result in the onset of anaerobic conditions. The process control is outlined below.

Products will be stored no higher than 5m to ensure that the centre of the pile does not become too high in temperature with minimal levels of oxygen. Daily temperature monitoring is carried from three locations across the product storage pile and if a temperature of 45°C or above is detected then this indicates that the biological process could be re-accelerating and the pile is turned to fully aerate.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Release of odours from anaerobic product storage conditions.	Visual Assessment. Temperature probe.	Steaming from product storage piles. Temperature: >45^{0}C	Compost that is to be stored shall only be material that has completed the active composting phase and met the critical limits throughout this period. Daily monitoring of the product storage pile is carried out. 3 temperature readings are taken across the pile and if temperatures exceed the critical limit, stockpiles are turned to fully aerate.	Site Diary.
ORP	6			

5.8 Site Infrastructure

The composting facility has infrastructure to control emissions from site at various stages of the process, namely leachate management, forced aeration ASP bays and odour treatment units.

5.8.1 Odour Treatment Units

The IVC incorporates two wet scrubbers and four biofilters to abate odour generated during the most active stage of the compositing. The units work in series with process air passing through the wet scrubber to strip ammonia prior to biofiltration at point of emission. The biofilters will contain suitable biofiltration media (e.g. untreated woodchip); the dimensions of the biofilters are 2.5m x 15m x 11m and receive an air load of 150m^3/m^2/h. Fresh air intake from the reception hall is integrated with compost tunnel air prior to treatment. This acts to dilute the odorous air from the tunnels prior to treatment.

The biofilters are open systems with the final discharge point to the atmosphere at the top of the biofilter unit. In order to improve aerial dispersion, the biofilter units have been sited on the roof of the IVC building (6.5m high). The total height at point of release is therefore 9m above ground level.

Management of the bio-filter includes moisture and temperature monitoring, performance monitoring and the establishment of a maintenance schedule. The biofilter system will require regular inspection, monitoring and maintenance to ensure optimal performance and therefore the following monitoring will be conducted.

A monthly visual inspection of the condition of the biofilter media of all biofilters shall be conducted by a trained operative, to identify areas of drying, weed growth, shrinkage of the bed, cracks and fissures, etc. The results will be recorded on the Site Diary and any remedial action taken as necessary. There is constant monitoring of temperature and moisture levels of the biofilters on the SCADA system.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Biofilter not in optimal moisture content.	Air humidity within plenum chamber.	<75% >125%	Air entering the biofilter is constantly measured within the plenum chamber beneath the biofilter for humidity. The humidity level is constantly monitored to ensure that the correct moisture content is delivered to the biofilter to keep consistently within operation critical limits. This is backed up with visual inspections of the media every week to ensure humidity critical limits are still appropriate. In the event that the humidity of the plenum air is too low, then clean water from the borehole tank would be applied to the biofilter using the sprinkler system.	Process Computer Records.
Biofilter not in optimal temperature range for performance.	Temperature Monitoring.	>45^{0}C for more than 48hrs	Elevated temperature readings indicate that biodegradation of biofilter media is occurring. Should temperature become elevated above critical limits the system alarm will trigger and water will be added to the biofilter media. The media will also be inspected and replaced if required, as soon as reasonably practicable.	Process Computer Records.
Biofilter degraded closing structure preventing airflow through biofilter.	Back pressure at inlet to biofilters.	>2.5kPa	Should backpressures be elevated above critical limits then process air will be diverted from the degraded biofilter immediately to the remaining 3 biofilters. The biofilter media will be inspected and replaced as appropriate with clean woodchip as soon as practicably possible.	Process Computer Records.
Wet scrubber not processing airflow leading to elevated concentrations of ammonia to the biofilter.	Pressure of water entering the wet scrubbing chamber.	>2.25Bar <1.75Bar	Pressure of water entering the scrubbing chamber is monitored to ensure optimum conditions within the scrubber prior to the biofilter. If pressure is outside of critical limits, then alarms trigger in the computer system and the air extraction system is shut down for inspection and repair as soon as practicably possible. If the system cannot be repaired/replaced within 24hrs then waste materials are removed from the affected tunnels and taken off site to an alternative facility for processing within 24hrs.	Process Computer Records.
Wet scrubber not effectively stripping ammonia from the air leading to poisoning of the biofilter media.	Ammonia monitoring at outlet of the scrubber.	>45mg NH_3/m^{-3}	If ammonia is not effectively stripped by the scrubber then the biofilter can get poisoned, preventing effective abatement. Ammonia monitoring is undertaken at the outlet of the scrubber on a quarterly basis to ensure ammonia levels in the air is within the critical limit. If the critical limits are breached, then the system will be investigated and appropriate action taken for replacement/repairs as soon as practicably possible. If the system cannot be repaired/replaced within 24hrs then waste materials are removed from the affected tunnels and taken off site to an alternative facility for processing within 24hrs.	Site Diary or Computer records.
ORP	3			

5.8.2 ASP Forced Aeration System

The aerated static pile array integrates a forced aeration system for the delivery of fresh ambient air to the compost pile to maintain aerobic composting conditions. The system is detailed further in Section 7.3. In addition to the critical limits for maintaining optimum composting conditions, system parameters are monitored to ensure the effective operation of the aeration system. Backpressure is monitored at the fan delivering fresh air to the bays. If the backpressure exceeds 4.5kPa then an alarm is triggered to indicate a blockage in the air delivery system. Call off engineering support is provided by GICOM for the ASP system with 24/7/365 support provided. GICOM can also remotely access the computer system to provide quick troubleshoot advice and action.

Air flow is delivered to the media at a rate required to ensure the critical limits of oxygen, temperature and moisture are maintained as itemised in Section 5.5. These critical limits determine the flow rate as controlled at the fan, ensuring that the compost media is maintained within the critical limits for effective treatment.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Air delivery system is blocked preventing the delivery of oxygen to the static piles.	Back pressure at fans.	>4.5kPa	Should backpressures be elevated above critical limits then the system will be shut down and the piles removed from the bay to the open windrow composting pad (within 72hrs), during pipework inspection. Any replacement works will be undertaken as soon as practicably possible. The compost media will be checked and amended as required to increase airflow through the pile e.g. the addition of coarse oversize material. Consideration will also be given to the routine addition of a base layer over the pipes of 150-300mm woodchip/oversize material.	Process Computer Records.
ORP	8			

5.8.3 Drainage System

The waste reception hall and in-vessel tunnels are connected to an integral drainage system which drains all sanitisation phase leachate and runoff waters. Process water from each of the composting tunnels will drain to a series of collection sumps, which in turn will have an overflow leading to the leachate collection tank (50m^3). In addition, the process water coming from the wet scrubber is directed back to the leachate collection tank.

The whole system is constantly circulated back through the process, i.e. leachate water is constantly pumped through the piping system and mixed with treatment water (see technical drawing PFD3-02 in Appendix B). Leachate held within the tank is replenished from the freshwater tank as leachate is consumed within the composting process, ensuring that the leachate is highly diluted within the tank due to evaporation rates within the tunnels.

The open windrow composting pad is laid to a 1 in 50 fall to a central drainage channel that directs leachate to a sump pit (8m³ capacity). The ASP bays are situated on top of a concrete pad which is laid to a 1 in 50 fall to a central drainage channel that directs leachate to a sump pit (24m³ capacity). Both sumps are fitted with pumps that direct leachate via sealed pipework to a large Boythorpe storage tank (398m³ capacity). Routine monitoring is carried out to ensure

all tanks are operating below maximum capacity. A diagram of the drainage area can be seen in Appendix C.

Potential Odour Issue	Monitoring	Critical Limits	Process Controls	Records
Release of odours from overflowing leachate storage tanks.	Electronic alarm.	<90% Capacity.	In order to prevent the overflowing of leachate storage tanks and constantly monitored by the SCADA system with an alarm triggered when levels are within 90% of tank capacity. When this critical limit is met, leachate is pumped out within 48hrs and disposed of to a suitably licensed facility.	Process Computer Records.
Blocking of drains leading to pooling of leachate on concrete surfacing.	Visual Assessment.	Particulate blockages.	Daily site inspections are made to ensure that no drains are blocked by loose compost. Where identified, material is swept up immediately and re-processed as soon as practicably possible.	Site Diary.
Release of odours from leachate storage conditions on OWC.	Daily sniff test at surface of leachate tank	Odour intensity 3 – distinct odour	Odour losses due to wind blow should be minimised in a tank where capacity is kept <90%. Should odour be detected during sniff test, the Site Manager will arrange for the leachate in the tank to be removed from the site and sent to a suitably licenced facility for onward treatment. During the time between the leachate being arranged to be removed and actually being removed from site, the tank will be temporarily covered and the leachate will be prohibited from being used on the windrows or ASP piles.	Site Diary.
ORP	7			

5.9 Housekeeping

Section 6.2 (page 27) of the Management System (document reference *BIO02 – Management System (Issue 07*), September 2021) includes details of maintenance and housekeeping schedules. Housekeeping and cleaning schedules ensure organic material does not adhere or aggregate in any areas of the site to produce an odour. Each IVC tunnel shall be thoroughly cleaned after each batch to ensure odour control and prevent cross-contamination.

Available floor space within the IVC reception will also be cleaned at the end of each working day to prevent odour and/or attraction of pests. This includes full scrape down and pressure wash of the concrete hardstanding. Loading shovels and the shredder are wash-down on a weekly basis.

Site operatives will undertake daily site checks and will scrape up any loose materials to minimise, where reasonably practicable, any materials that are left on edges or corners of the site.

5.10 Process Monitoring

Additional information regarding the specific monitoring regimes for the waste treatment processes are presented within the sites Standard Operating Procedures. The table below identifies the monitoring frequency for the various parameters as identified throughout section 5, as well as the calibration schedule for monitoring equipment.

Table 5 - Process Monitoring Frequency

Parameter	Process Stage	Frequency	Calibration
Temperature	IVC Tunnels	Four probes per tunnel (continuous). Records kept on computer.	12 monthly.
	OW Sanitisation	Daily. 1m below surface, 4 readings per windrow by hand held probe.	
	OW Stabilisation	Weekly. 1m below surface, 4 readings per windrow by hand held probe.	
	ASP Sanitisation	Eight probes per bay (continuous), 1m below surface. Records kept on computer.	
	ASP Stabilisation	Eight probes per bay (continuous), 1m below surface. Records kept on computer.	
	Biofilter	Continuous 0.5m below surface, 2 readings per biofilter by probe.	
	Oversize Storage	Weekly. 0.5-1.5m below surface, 2 readings per stockpile by hand held probe.	
Moisture	IVC Tunnels	Grip test prior to tunnel loading. Records kept on batch record sheet.	Calibrated to dry oven and balance 12 monthly.
	OW Sanitisation	Daily. 1m below surface, 4 readings per windrow by grip test.	
	OW Stabilisation	Weekly. 1m below surface, 4 readings per windrow by grip test.	
	ASP Sanitisation	Daily. 1m below surface, 8 readings per pile by grip test.	
	ASP Stabilisation	Weekly. 1m below surface, 8 readings per pile by grip test.	
	Biofilter.	Monthly. Visual assessment 0.5m below the surface, 2 readings per biofilter.	
Oxygen	IVC Sanitisation	1 point per tunnel at air exit vent (continuous). Records kept on computer.	12 monthly
	OW Sanitisation	Daily. 1m below surface, 4 readings per windrow by hand held probe.	
	OW Stabilisation	Weekly. 1m below surface, 4 readings per windrow by hand held probe.	
	ASP Sanitisation	1 point per bay inlet (continuous). Records kept on computer.	
	ASP Stabilisation	1 point per bay inlet (continuous). Records kept on computer.	

5.11 Temperature

Temperature monitoring is carried out during the active composting period. Although the probes will reach the core zone, the temperatures at the edge of the windrow will be lower. However, the turning schedule or forced aeration will ensure that whole batch will reach the temperatures required during sanitisation and stabilisation.

5.12 Moisture

A 'squeeze' test, for open composting monitoring, of materials will be conducted using procedures in accordance with BS EN 12579 by a suitably trained site operative to check moisture content as follows:

The sample of the material is selected in accordance with the standard then grasped and clenched in a gloved hand for approximately ten seconds, then the hand is opened and the moisture content assessed using the information below.

Table 6 - Moisture Assessment Index

Index number	Sample Moisture Behaviour	Interpretation
1	Water seeps out	Too wet
2	More than one droplet appears	Too wet
3	One droplet appears	OK
4	Compost particles remain packed together and no droplets appear	OK
5	Compost particles fall away from each other	Too dry

Figure 3 below shows the core area of the compost windrow. As the temperature and oxygen probes will be inserted to a depth of 1.0m the readings will indicate core zone readings as the core area is large. A 1.0m probe will be more than effective at taking a core zone reading. For moisture the readings will be taken using the method stated in section 5.11 and by a suitably trained employee. The moisture can be read at a greater depth by collecting compost from within the core zone. The compost can be dug out of the windrow to ensure the reading is taken from the core zone.

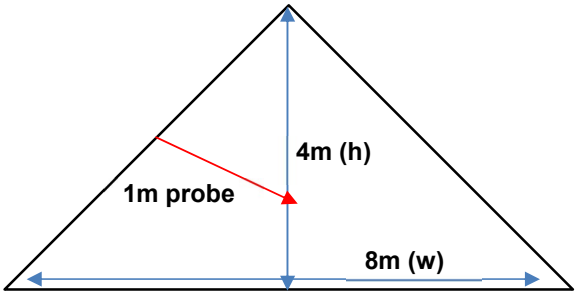


Figure 3 – Typical Batch Size and Probe Reach (scale 1:100)

5.13 Oxygen Monitoring

Oxygen monitoring is undertaken with an automated system controlled as part of the IVC and ASP aeration systems and manual oxygen monitoring is undertaken for the OWC process. The airflow into each vessel/bay is controlled by an air handling system and have individual aeration arrangements. Optimum oxygen levels can be maintained within each vessel/bay by adjusting the airflow by increasing the fan speed. The system automatically adjusts the airflow to ensure the critical limits for temperature and oxygen are maintained. Fresh air is introduced

into the vessel/bay via the adjustable aeration fans. Oxygen is continually monitored to ensure that the aerobic conditions are maintained. The system automatically increases airflow where oxygen levels drop below the set point critical limits.

In order to ensure aerobic conditions are being met, management processes will be employed at all stages of the composting process including:

- Feedstock blending to appropriate structure and ratio;
- Moisture and temperature monitoring to ensure active biodegradation can take place;
- Turning as required by monitoring parameters to fully aerate each open air windrow.

Biowise actively manage the composting process to ensure the correct structure and ratio is maintained. Moisture readings are undertaken regularly by a trained site operative and calibrated temperature probes take readings of the windrows. Turning is undertaken to ensure the windrows are fully aerated.

5.14 Contingency Planning

Should the above process controls fail at any point within the processing of wastes through either of the operational processes, an investigation will be carried out to determine the cause of failure. A full review of this Odour Management Plan will be conducted and process controls (including critical limits) amended as required. The EA will be informed of the process failure and proposed investigation period and contingency measures. Should contingency be required then a record of actions taken will be maintained using an Action Required Report (F05a-01, version 1, 07/09/17). As part of the investigation process, Biowise will discuss with the EA the cessation of waste acceptance and the removal of odorous material from the site for disposal at a suitably licensed waste management facility.

5.15 Internal Odour Assessment and Monitoring

Odour monitoring is undertaken utilising the Safe System of Work for odour monitoring (SSOW03I-02, version 6, 30/10/20).

5.16 Daily Checks

A Daily Checklist (F03i-02, version 1, 08/10/17) has been produced which is to be carried out daily and available to the EA on inspection. The checklist will be filled in daily by the site manager in order to monitor the site cleanliness and weather conditions which may affect odour controls. The monitoring will take place on a daily basis and is designed to reduce the potential for odour. This checklist will be kept in the site office and will be produced upon the request of the EA.

5.16.1 ASP System Maintenance

The ASP infrastructure (i.e. concrete pads, wall systems, fans, pipework, leachate collection chamber etc.) is included in the Site Inspection schedule and checked on a daily basis. Any maintenance or cleaning works will be carried out as required.

The leachate collection chamber will be given a formal visual inspection on a regular basis when it is empty. The time between inspections will not exceed 6 months. Any defects will be marked on a drawing of the chamber and a decision taken on the need for remedial works and an appropriate timescale. The maximum time period that will be allowed to elapse before defects with leachate collection chamber will be remedied after identification is 48 hours.

The following maintenance activities will take place following the emptying of each bay:

- The airflow system is flushed out for a period of 5 minutes following emptying of the bays to remove any particulates within the pipework.
- Pipes are inspected to identify any cracking or otherwise damage to the pipe work delivering the airflow. Should cracking or damage be identified, they are repaired via an external contractor within 48 hours and the valve is closed to prevent pollution.
- Each fan is inspected during the flush sequence to ensure backpressure is within normal working parameters and the fans are operational.
- Leachate channels are inspected to ensure there is no blockage of flow to the collection chamber.

6.0 EVAPORATION

Evaporation from the open composting processes are likely to be prevalent given the nature of the process and external location. Over the 4-8 weeks of active composting, compost moisture levels can drop from 65% to 40% representing a loss (predominantly of moisture) of the total weight of the windrow/pile. The moisture within the compost is lost to the atmosphere through evaporation from the surface of the windrow/pile, and may be the vector for odorous chemicals to enter the atmosphere. As detailed within Section 5 there are several process controls in place to minimise the evaporation potential of the composting processes.

In summary, the process controls include the moisture monitoring of PAS100 compost to ensure that the composting process is in line with industry guidelines. This will prevent an overly wet windrow being formed on the composting pad which could lead to elevated levels of evaporation from the site. In addition, the PAS100 compost is regularly turned, or connected to a forced aeration system, in order to fully aerate and incorporate material from the windrow surface, core and basal zones. This aeration, in addition to other process controls, will prevent the creation of anaerobic conditions which enable the production of odorous compounds which could then be lost to the atmosphere through evaporation.

Additionally, windrows/piles are formed of adequate size to reduce the overall surface area of compost exposed to the wind driving evaporation. Smaller windrows increase the surface area and thus increase the amount of evaporation encountered.

6.1 Leachate Tanks

The leachate tank at the IVC is fully covered to prevent evaporation from the surface of the tank. Levels within tanks are automatically monitored to ensure they are <90% of full capacity. The tank integrity is regularly investigated to ensure no leaks are present which could lead to evaporation. The level of leachate within the tank is regulated by the computer controlled automated system to ensure enough freshwater is drawn in to replenish the supply of water for the composting process.

The leachate tank at the open composting area is covered with expanding clay granules to mitigate evaporation from the surface of the tank. Levels within tanks are automatically monitored to ensure they are <90% of full capacity. The tank integrity is regularly investigated to ensure no leaks are present which could lead to evaporation. The level of leachate within the tank is regulated by the computer controlled automated system to ensure that there is no over spilling of the tank.

7.0 CONTAINMENT AND ABATEMENT

The site will employ containment with air treatment at the IVC facility. Details of both systems are outlined below. The system is provided by GICOM which has been designed by a team of process engineers and have installed over 400 systems globally with 6 IVC installations within the UK.

A basic airflow block diagram is provided below to demonstrate simply how air is captured from each process area and treated prior to release to atmosphere.

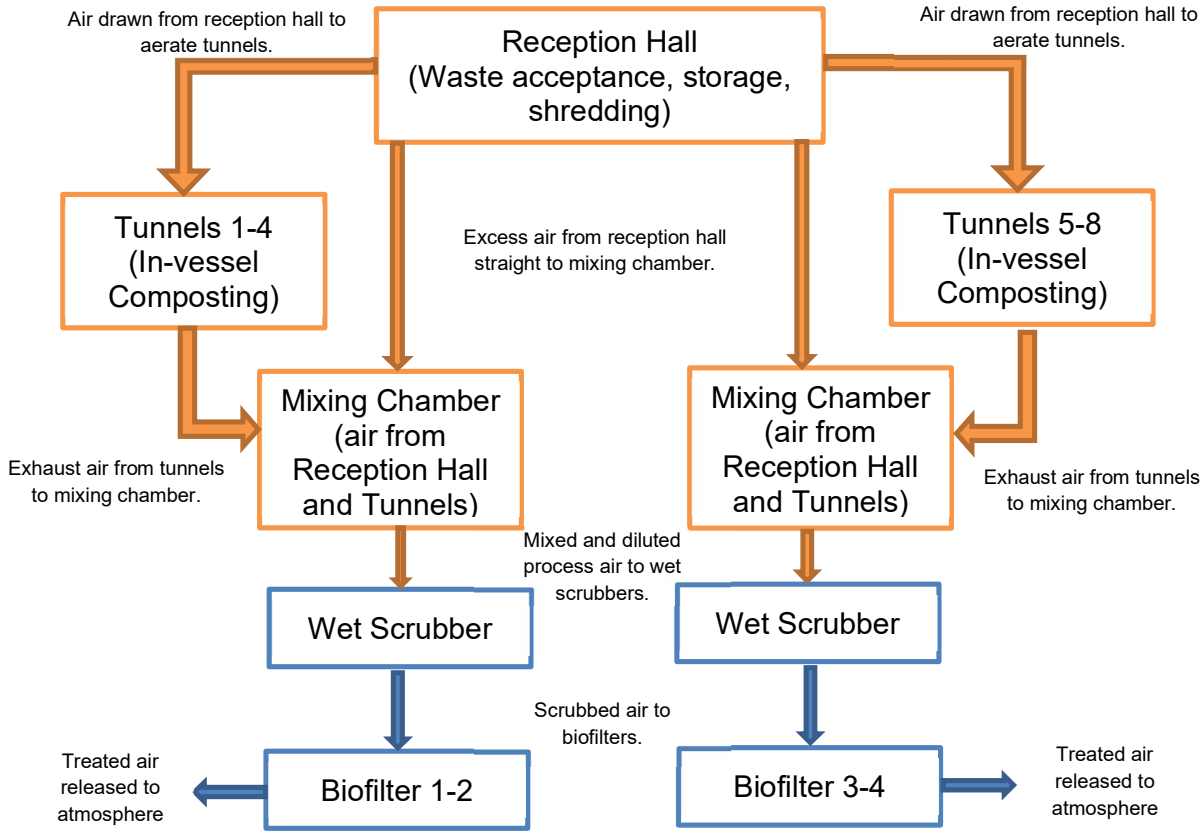


Figure 4 – Block Diagram of Airflow Treatment System

7.1 IVC Containment System

The GICOM tunnel composting system is a fully enclosed system incorporating waste reception and preparation and enclosed tunnel composting process. In addition, there is an aeration system for the forced aeration of process tunnels and capture of treatment air within the tunnels and reception hall for treatment prior to release. The air treatment system includes wet scrubbing and biofiltration. An overview of the layout of the air treatment system is provided below.

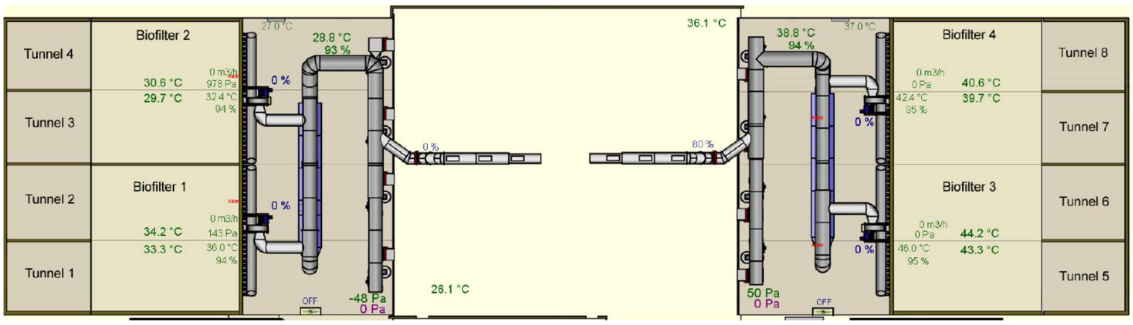


Figure 5 – Schematical Layout of Air Extraction and Abatement System.

The ventilation system is operated under a negative pressure principle that draws air through the process building via inlet louvres maintaining a negative pressure of -20Pa to -50Pa as monitored at the process tunnels. The negative pressure systems enable changing of the air space within the waste reception hall of over 4 air exchanges per hour under normal operating conditions.

7.1.1 Waste Reception Hall

The waste reception hall is an enclosed system for the reception and pre-treatment of waste to be processed within the composting tunnels and operated under negative pressure. The reception hall includes fast action roller shutter doors, operated during waste delivery. The reception hall includes waste storage prior to pre-treatment and pre-processing operations prior to tunnel loading. Pre-processing includes screening, hand picking and shredding.

The waste reception hall is one open space but for the calculation of air volume is split into two rectangular sections as per the layout plan (BIO12).

- 32.5m x 24.7m x 11.7m (l * w * h) = 9,400m^3
- 19.5m x 29.9m x 11.7m (l * w * h) = 6,800m^3
- Total air space volume of 16,200m^3

The waste reception hall is continually vented as the source of air for aerating the compost tunnels. During normal composting operations (including cool-down) on average a tunnel will consume 50m^3 of air per m^2 of tunnel per hour. This means an average air consumption of 8,580m^3/h/tunnel, or a total air demand of 68,640m^3/h. Therefore, the reception hall is ventilated by 4.2$_{ae}$/h (air exchanges per hour).

In case the biofilter becomes too warm, or in case additional ventilation is required within the composting tunnels, the biofilters can receive up to a maximum airflow of 99,000m^3 of air per hour, resulting in a maximum designed air exchange rate of 6.1$_{ae}$/h.

7.1.2 Process Tunnels

There are 8 tunnels in total with an internal dimension of each tunnel of 35m x 5,2m x 6m (l * w * h). All tunnels are executed with outlet openings in the floors according to the GICOM “spigot” principle. Air is supplied to the tunnels via PVC pipes of Ø 200mm and directed vertically into the compost batch through spigots. When the tunnel is filled with organic material the process air is blown from the aeration plenum into the composting tunnel. The process air is circulated via ducts into the tunnel. When needed, fresh air can be directed to the tunnel and water can be added via overhead sprinkler.

By circulating the process air it is possible to control parameters that are important to the composting process, such as temperature, humidity and oxygen concentration. The composting conditions can be optimised through the automated system delivering a maximum airflow to the tunnels of 100$m^3/m^2/h$.

7.1.3 Air Treatment

After the tunnel has been filled with compost feedstock the door is closed and the tunnel climate control program is initialised. The composting tunnels will be managed with respect to temperature and moisture to optimise the process, attain pathogen reduction requirements, and meet process objectives. All exhaust process and ventilation air is led to the odour control system via a valve system, a motor and a pressure-controlled blower via enclosed seaworthy ductwork. This system contains a water scrubber and a biofilter.

The water scrubber, fed with the effluent from the process water buffer tank – and if necessary fresh water, humidifies and scrubs the process air throughout the residence time of the air. The water stream coming from the scrubber is lead back to the buffer tank.

The fresh air stream to the tunnels is drawn from the reception hall and the tunnels via an overhead ductwork system with managed controls. The process air exhausted from the tunnels, directly links into the above described odour control system. Additional ventilation air can by-pass the tunnels. This means the air going into the scrubber and biofilter system is a mixture of process air and additional ventilation air. The total maximum air flow is designed at 99,000m^3/h. Under normal operational conditions the total process airflow will be 68,640m^3/h is treated by the scrubbers and biofilters.

7.1.4 Wet Scrubbing

Air (both ventilation air and process air) is treated in 2 scrubbers, each 12.25m x 1.91m diameter. The volume of each scrubber is 35m^3 with a maximum airflow per scrubber of 50,000m^3/hr or 100,000m^3/hr total system flow. Scrubbers are made from seaworthy aluminium ($AlMg_3$). Under normal operating conditions the air velocity in the scrubber is 3.36m/s and residence time is 3.6 seconds. At maximum airflow the air velocity in the scrubber is 4.85m/s and residence time is 2.54 seconds.

Scrubbers are designed to humidify the exhaust air, buffer ammonia, evaporate water, aerate the water and cool down the air to a maximum of 37^0C, which is the operational maximum temperature of the biofilter. The scrubber is designed to scrub the air within 2.5 seconds at maximum throughput. The velocity during maximum exhaust is less than 5m/s in the scrubber. In this period ammonia is quickly dissolved in the water and turned into nitrite, nitrate and eventually to nitrogen, similar to 80% of the ambient air. This process takes place in the scrubber. Part of the ammonia stays dissolved in the humidity of the air. This remaining ammonia is blown through biofilter material where another part of the ammonia is turned into nitrite, nitrate and eventually nitrogen.

The scrubber is controlled by temperature. If the temperature exceeds 37^0C more air from the reception hall is ventilated into the scrubber, so more water can be evaporated into this air, actively cooling the scrubber. Ammonia samples are obtained quarterly at the inlet and outlet of the scrubber to ensure that the wet scrubber is working effectively.

7.1.5 Biofiltration

There are 4 biofilters for the treatment of air from the reception hall and 8 compost tunnels. The internal dimensions of each biofilter is 15m x 11m (l * w) with a maximum airload of

150m^3/h/m^2. The biofilter fans blow the process air through the scrubber followed by the biofilter. The biofilter is built with a spigot floor, for an optimal air distribution. In total 4 biofilter fans are installed. The capacity of these fans is 24,750m^3/h each. Fan power is 30kW. At maximum capacity the biofilter fans supply 150m^3/h/m^2 of the biofilter. The maximum airflow through each set of 4 tunnels during normal operation is 34,000m^3/hr. Each biofilter can handle 49,500m^3/hr of process air per set of tunnels. This means there is additional capacity of 15,500m^3/hr of airflow that can be utilised for cooling or extraction.

The biofilter will be constructed of coarse shredded untreated wood. The biofilters will be filled to 2.5m^3 of media per m^2 of biofilter resulting in scrubbed air exiting the biofilter at a velocity of 0.04 meters per second at maximum capacity, with a residency time of 61 seconds. At nominal operational conditions the velocity is 0.03 meters per second and residence time is 86 seconds.

Over time biofilter material loses its coarseness. This is identified by visual inspection of the biofilter media (the operator looks for areas of drying, weed growth, shrinkage of the bed, cracks and fissures) and backpressure (critical limit of 6,000Pa constantly for 1 week). Once the media has been identified as requiring replacement, fresh wood chip material is brought in and the spent biofilter media composted. When media is being replaced, extracted air is diverted to the other biofilter during the 24hr period in which the media is replaced. Each biofilter can treat up to 34,000m^3/hr and at maximum capacity the air diverted to an individual biofilter from 4 tunnels would be 49,500m^3/hr. However, this is at maximum throughput during peak summer months, the likely rate during other times of the year will be within the 34,000m^3/hr capacity of an individual biofilter. During peak periods air flow can be turned down during the 24hr period of media replenishment to reduce the load on the single biofilter.

Temperature monitoring is undertaken within the biofilter media and any temperature above 45^{o}C triggers the system to ventilate the biofilters to cool them down. In the plenum chamber, pressure and energy uptake are measured. These parameters help running the facility at its maximum efficiency.

7.1.6 Automated System

The GICOM process computer (G-2000) controls the entire process. The computer is equipped with custom designed, patented software which allows dynamic control and pre-programming of critical limits for each composting activity. As the air exits the composting tunnels, several parameters are continuously measured in the airstream. The software is programmed to control certain variables at certain pre-determined times or points in the composting process cycle. The speed of the blower and the circulation rate is controlled to maintain the desired conditions in the waste.

All monitored results are recorded and displayed by the computer on a continuous basis. As results are recorded, they are simultaneously compared with critical limits. Based on this comparison the computer adjusts air and water flows and conditions affecting the tunnels, the building area, the scrubbers and the biofilters.

7.2 Localised Abatement System

Localised odour abatement systems, including aerial neutralisers and deodorisers could be employed on site at strategic locations on site. The efficacy of such systems will vary according to the meteorological conditions and are normally used as a back-up to the operational techniques to minimise odour generation as considered necessary by the operator.

Given the questionable performance of such systems, the operator had chosen not to employ localised abatement systems. Odour control will be maintained through operational best practice procedures. Should there be advances in technology, the operator will re-assess the option to include localised abatement systems to site practices.

7.3 ASP System

In addition to the containment system deployed within the IVC facility, additional technical information is provided for the ASP system. This system utilises forced aeration for the biological treatment of organic wastes in a static open system. The system comprises of five individual bays segregated by concrete walls. Each floor within each bay has a dedicated air handling and dispersion system detailed below.

7.3.1 Air Handling System

Each floor is equipped with a stainless steel fan installed with a 22kW capacity that can reach up to 5kPa pressure. The fans nominally provide an airflow for half of each section for $50m^3/h/m^2$. Each bay floor section is 30m x 20m, equalling $600m^2$. Each fan can therefore supply $50m^3/h/m^2$ x $600m^2$ x 50% = $15,000m^3/h$.

The fan is connected to an aluminium plenum. The plenum is connected with a servo-controlled valve and a pressure box (4 per floor). Each pressure box is connected (with a machete, so it can be disconnected during emptying the floor) to 7 thick walled polyethylene (PE) pipes. There are 4 pressure boxes per bay, therefore 28 pipes per ASP bay.

7.3.2 Aeration Piping

Each floor has 28, 20.5mm thick walled PE pipes with drilled holes for delivery of air up into the compost media. The pipes are laid down 1,050mm apart. The 28 pipes per floor (individual bay) are divided into 4 groups of 7 pipes. Each group has a valve system which allows air into this specific group of pipes, and hence into the compost that is laid on top of it. This enables individual control of air flow within each bay, split into 4 quarter segments.

The floor is designed so up to $50m^3/h/m^2$ of fresh ambient air can be delivered. These floors are controlled by an on/off regime of the specific section. It is calculated to work with 2 out of 4 sections at any given moment.

The control of preferential airflow though the composting piles is achieved by good feedstock preparation at the beginning of the IVC/ASP process. Compost oversize is mixed with fresh waste in the IVC/ASP reception areas prior to loading the tunnels/bays in order to ensure the right structure for effective and uniform airflow through the material. Additional compost oversize can be added to the material prior to loading the ASP bays if necessary.

The holes in the ASP pipework are designed to point downwards which, when combined with the amount of air pressure generated within the system, means that no material can fall into the pipes and cause blockages. This enables the air to flow over a larger area as it is deflected off the concrete base and upwards through the pile. As a result, there is no normal requirement to lay an oversize layer over the pipework prior to loading the ASP bays.

7.3.3 Process Control System

Each ASP bay is supplied with sensors that partially automate the composting process in line with defined critical limits. The aerated stabilisation floors are supplied with measurement of:

- Pile temperature: 8 temperature probes per bay.
- Air temperatures: 2 sensors for the whole ASP array, for the supplied fresh air (dry and wet bulb).
- Backpressure: 1 pressure sensor per plenum, or 1 sensor per ASP bay.
- Pile oxygen: 1 oxygen sensor per bay.
- Power uptake.

In principal the process is controlling the compost temperatures. This means that once a certain temperature is reached, as set by the operator as the critical limit, the system will try and control the temperature in order to keep it as close as possible to this temperature. Several phases of the process can be set in the computer i.e. sanitisation and stabilisation phases.

The oxygen measurement checks the oxygen level in the material. Oxygen is monitored by aerating the floor with fresh air for a set period of time, after which the fan either switches off or starts blowing on other sections. During this period oxygen levels are monitored with the sensor. After a set time the fan switches back on to this particular section. If, during the off interval, oxygen levels drop below the critical limit, the system is re-calibrated to ensure fresh air is delivered to the media at more regular intervals. The system therefore does not only monitor oxygen and provide a reading, it automatically re-calibrates the air delivery rate to constantly maintain aerobic conditions within the pile.

The backpressure is used for volume measurement of the air delivery (along with power uptake). Also it can provide an alarm, as set by the operator as a critical limit, in case a certain pressure is or is not reached. The dry and wet bulb measurement enables to measure the enthalpy of the fresh air. Along with air volume it provides the amount of enthalpy intake. In this system there is no measurement of exhaust air, so it is assumed that the air that goes out of the compost has a saturated character.

7.3.4 Automated System

The GICOM process computer (G-2000) controls the entire process, similarly to the IVC control system. The computer is equipped with custom designed, patented software which allows dynamic control and pre-programming of critical limits for each composting activity. The software is programmed to control certain variables at certain pre-determined times or points in the composting process cycle. All monitored results are recorded and displayed by the computer on a continuous basis. As results are recorded, they are simultaneously compared with critical limits. This system connects both the IVC and ASP bays to enable batch traceability across both processes within the computer software.

The system deploys alarms upon detection of parameters outside of critical limits. All alarms can be changed by the operator to meet with site specific critical limits. When an alarm is triggered a flag is displayed on the computer software and sent to an individual or multiple mobile phones. For temperature, an additional emergency alarm is triggered when temperatures exceed 80^{o}C to indicate a risk of fire requiring immediate response.

8.0 DISPERSION

The following section identifies the prevailing weather conditions on site, in particular the wind direction in order to predict the path of likely aerial dispersion of odours generated on site. By constant monitoring and even forecasting of poor dispersion conditions, Biowise can trigger contingency measures to temporarily enhance other odour controls.

Information on wind direction has been derived from the wind.willyweather.co.uk website which takes its information from the Leconfield weather statin located approximately 12km north of the site. The data presented is from the years 2015-2020. This data is illustrated by the wind rose in Figure 6. Wind data is collected daily as part of the routine monitoring on site. 8-point wind directions are provided below, note that calm days are also included to provide a complete data record.

Table 7 – Wind Direction Data

Wind Direction (from)	N	NE	E	SE	S	SW	W	NW	Calm
% Occurrence	4	8	7	19	23	30	7	2	<1

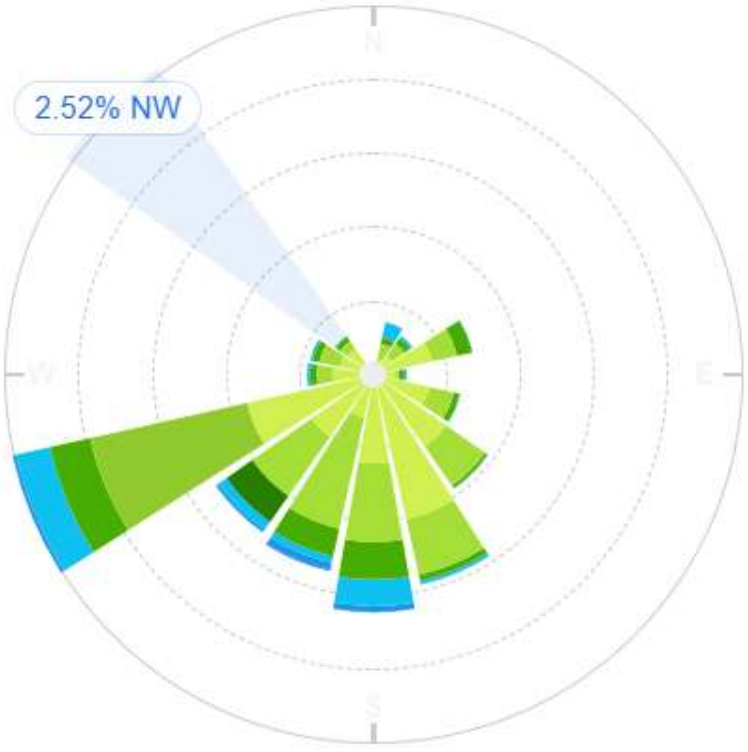


Figure 6 - Windrose

Biowise operate a weather station on site. The station records wind speed and direction, temperature, relative humidity, and rainfall at 5m above ground at the weighbridge, and enables the site management team to monitor site specific weather conditions. In addition to

the site weather monitoring station, the site has erected a wind sock to provide an instant visual guide as to the wind strength and direction to assist site operatives carrying out daily operations on site. The weather stations is serviced annually.

8.1 Enhancing Dispersion

Dispersion of air from the facility is managed through the positioning of the biofilters and the design of the airflow system through the biofilter media.

Treated air from the scrubbers is blown under pressure to the biofilters. Beneath each biofilter is a plenum chamber which distributes air across the profile of the biofilter. Additionally, the plenum chamber is linked to a spigot floor system which directs air vertically into the biofilter media via PVC pipes of Ø 200mm and through spigots. The pressure within the pipe delivering air to the plenum chamber is always greater than the pressure within any individual spigot, ensuring that equal air pressure is maintained and dispersion of air through the biofilter is even. The flow rate of air to the plenum is constantly monitored and at typical operational levels will be 25,000m^3/hr.

The biofilters are located on top of the process tunnels and the point of exit at the top of the biofilter will be approximately 9m above ground level. This elevated position enhances dispersion similar to a stack and aids dispersion preferably to typical positions close to ground level.

9.0 SENSITIVE RECEPTORS

There are potential sensitive receptors within 1,000m of the IVC and open composting (OC) sites. These are identified in the table below with distance from the site (closest operation), wind direction and percentage occurrence of wind direction. A map of receptors locations is provided in Appendix D.

Table 8 – Distance to Nearest Identified Sensitive Receptors

Ref:	General Wind Direction (To)	Occurrence (%)	Nearest Sensitive Receptor	Approximate Distance From Site (m)	Grid Reference
SR01	N	13	Eppleworth Wood Farm	150 (IVC)	500365, 432137
SR02	N-NE	11	Bungalow Cottage	580 (OC)	501362, 431919
SR03	NE	10	Green Lane Farm	700 (OC)	501885, 431737
SR04	N-E	11	White House Farm	980 (IVC)	501324, 432021
SR05	SE	3	Albion Mill	260 (OC)	501779, 430941
SR06	S	1	Church Farm	360 (OC)	501359, 430813
SR07	S-SW	3	Rawdales Farm	550 (OC)	500829, 430813
SR08	SW-W	3	Hessle Golf Course	210 (IVC)	500165, 431539
N/A	W	2	None within 1km	N/A	N/A
N/A	NW	7	None within 1km	N/A	N/A

9.1 Dispersal Control

There are residential sensitive receptors within close proximity of the site, Eppleworth Wood Farm ~150m to the North West and other sparsely populated residential areas, consisting mainly of farms within 1km of the site.

Given the frequency of winds blowing towards the closest sensitive receptors to the site, it is not considered appropriate to restrict movements by wind direction. However, where wind is blowing towards the SW through SE consideration will be given to delaying windrow turning and when the wind is blowing to the N at the IVC consideration will be given to delaying tunnel unloading and transportation. Given that material leaving the IVC will be fully aerated by the forced aeration system there is unlikely to be odour issues with this material having completed the process requirements detailing in Section 5.

9.2 Community Engagement

Biowise will strive to educate the local community through the use of site tours both for schools and local resident groups including businesses.

The Environment Agency will be contacted to advise them of any operation being undertaken that may increase in odour generation. All complaints will be recorded and actioned in accordance to the complaints procedure. Feedback will be given to any complainants on the findings of odour investigations when/if they are known. A summary will be provided of any remedial measures taken to rectify odour problems and ensure that the problem has been suitably resolved.

9.3 Responsibilities

The overall responsibility for the site shall remain with the Company's Operations Director, Bob Wilkes. Day to day operational responsibility is maintained by the site's competent persons or COTC holders (Certificate Of Technical Competence holders).

In the event of an odour incident the odour accident plan will come into force which will initially deal with the accident, the causes and consequences of the accident, and then look to mitigate any potential odour issues which may have resulted from the accident.

9.4 Procedures when Odours Arise

There is an internal Safe System of Work for Odour Monitoring (SSOW03-02) and an external complaints procedure to ensure any odour issues are dealt with quickly and effectively.

9.4.1 External Complaints Procedure

Any complaints relating to the odour from the site will be taken seriously and channelled through a senior member of staff. Staff taking note of the complaint will use the appropriate Odour Complaint Form (F05a-03, version 2, 2019). Once the complaint is taken, a senior member of staff will investigate the complaint and the site activities, and respond to the complainant (or intermediary regulator) in writing outlining any findings and actions taken to mitigate the source of odours. All complaints will be fully investigated within 24hrs of receipt of a complaint during the working week. The follow up actions and any remedial works required will be agreed in an action plan, including timescales, with the EA.

The complaints procedure, including a survey of the complaints to date will be re-assessed by the Operations Director and the Site Manager on a yearly basis, unless the number of complaints warrants additional reviews.

9.4.2 Response to Complaints

The receipt of a single odour complaint during normal composting operations is treated as an exceedance of control levels. The primary response will be as detailed in accordance with the site's complaints procedure. An investigation shall be initiated into the cause of the complaint; this will involve as necessary:

- An olfactory survey as outlined below;
- An examination of the site activities at the time of the complaint;
- An examination of the meteorological conditions at the time of the complaint; and
- A review of the effectiveness of operational and odour control procedures.

If the complaint is validated it will be treated as an exceedance of the control level. The outcome of the investigation will determine the corrective actions to be implemented.

9.4.3 Detection of Distinct Odour during Olfactory Survey

Detection of a "distinct odour" or stronger (3-6 on odour scale) will initiate a more extensive olfactory survey to determine the extent of the odour plume. The composting facility Manager (or Deputy) will be notified immediately, and a member of site from the office who has not been on the composting site that day will join the surveyor in undertaking the olfactory survey, and the survey will continue to attempt to determine the scope and extent of the odour plume, as follows:

- A suitable location downwind of the site and potentially sensitive receptor at which the odour plume is unlikely to extend will be selected for assessment;
- Survey will continue toward the composting facility until a composting odour is perceived; and
- Assessment points perpendicular to the plume axis and equidistant from the composting site will then be monitored, subject to access requirements.

An investigation will be initiated into the cause of the odour. This shall involve as necessary:

- A review of the site activities at site and other nearby potential sources at the time of the olfactory survey;
- A review of the meteorological conditions at the time of the olfactory survey; and
- A review of the effectiveness of process operations and odour control procedures.

9.4.4 Corrective Actions

The outcome of an investigation will determine the corrective actions to be implemented, they will consider, but not be limited to:

- Alteration to waste reception procedures and odour control measures employed;
- Effectiveness of methods used to mix waste to achieve a compost of suitable structure and moisture for composting and to avoid formation of anaerobic conditions;
- Review of compost process monitoring results;
- Turning frequencies and meteorological conditions under which turning should be carried out;
- Consider removal of material from site responsible for unacceptable offsite impacts;
- Consider ceasing the reception of further material from site until issue resolved;
- Activities that are necessary to bring the process back under control shall not be suspended without detailed consideration of risks; and
- Update of OMP if new procedures are created.

9.4.5 Reporting

Exceedance of the offsite odour control level will be investigated (as described above) and recorded in accordance with current procedures. This includes recording the following:

- Nature of the incident;
- Date of occurrence/s;
- Results of the investigation;
- Details of responses/ action plans implemented; and
- The event will be marked within the site's incident log.

The report will be made available to the Environment Agency upon request.

9.4.6 Review of Control Mechanisms.

A full review of the Odour Management Plan, taking note of all the internal odour report forms and external complaints will be made on a yearly basis, or as necessary after an odour incident in order to assess the site's operational procedure and odour control management plan.

Findings from the review will then be incorporated into an updated plan which will replace the original OMP.

Additionally, the OMP will be reviewed including a Risk Assessment of impact on odour pollution following any operational changes to those identified in Section 4 and 5 or changes to site containment and abatement systems identified in Section 7.

10.0 INCIDENTS AND EMERGENCIES

In accordance with the requirements of Environment Agency's Technical Guidance Note H4, types of failure or abnormal events considered to have the potential to result in an odour impact have been considered. These have been identified as abnormal meteorological conditions and failure of aspects of the composting process during any of the process stages previously described. Failure and abnormal event scenarios with response requirements are summarised below. The Site Manager will be responsible for enacting the emergency responses outlined within this section.

10.1 Machinery Breakdown

Breakdown of processing or aeration equipment, which may result in a delay in processing the material received or turning of windrows. Magnitude of impacts will depend on the length of the breakdown, the type and volume of waste received and the prevailing meteorological conditions but could potentially result in elevated odour concentrations at receptor locations.

The potential failure would be minimised through routine maintenance of equipment, servicing in accordance with manufacturers guidelines, provision of adequate spares, and a service level agreement to replace plant (or source hire plant) within 48 hours.

In the event of machinery breakdown, the service provider will be immediately informed and called in to repair as required. All repairs or replacement machinery will be made within 48hrs as per the service agreement. This does not affect operations as no stage within the process requires a maximum holding period less than the 48hrs within the agreement.

Spare components are stored on site for the IVC abatement system including fans which are immediately replaced as required. An overview of machinery and equipment employed is itemised below with impact on odour release and contingency plans for replacement.

Table 9 – Machinery Breakdown Contingency Actions

Equipment	Location	Odour Impact	Contingency Plan
Shredder	IVC and Compost Pad	**Low** Prevention of shredding does not in itself lead to increased odour generation.	Service arrangement for plant repair or replacement within 48hrs. Does not affect holding times for material prior to shredding. **Emergency Action** However, if breakdown prevents processing stockpiles within limits identified in Section 5 then material reception will cease (see 10.5).
Loading Shovel	IVC and Compost Pad	**Low** Prevention of material movement does not itself lead to increased odour generation.	Service arrangement for plant repair or replacement within 48hrs. Prevention of material movement at the OWC site are not adversely affected at this timescale. Prevention of material movement at the IVC site are not adversely affected at this timescale, all material held within contained infrastructure. **Emergency Action** However, if breakdown prevents processing stockpiles within limits identified in Section 5 then material reception will cease (see 10.5).

Equipment	Location	Odour Impact	Contingency Plan
Screener	OWC Pad	**Low** Prevention of screening material does not in itself lead to increased odour generation.	Service arrangement for plant repair or replacement within 48hrs. Does not affect holding times for material awaiting screening. **Emergency Action** However, if breakdown prevents processing materials within limits identified in Section 5 then material reception will cease (see 10.5).
Air Handling System (fans, pumps, ducting).	IVC	**Med** Failure of air handling system can prevent air being extracted from the tunnels and reception shed leading to build up of odours within the contained system.	System alarms for parts failure within the system/ 24/7/365 service for remote diagnosis for repair requirements. Spare components stored on site for immediate replacement as required. Flow rate within the system is constantly monitored to ensure that the air system is drawing air through the ducting, scrubbers and biofilters. This is monitored at entry to the biofilter and a flow rate <10,000m^3/hr under operational conditions indicates a failure in the system. Individual components also have alarms such as fans and pumps that are triggered on failures. Pressure within the system is constantly monitored to ensure air extraction from the reception hall prevents the release of odours. This is monitored within the entry to the tunnels from air drawn in from the reception hall. The system automatically adjusts air flow rates to ensure pressure is maintained at the target rate of -20Pa. Engineers are called to repair/replace fault. If fault cannot be fixed within 48hrs from identification, then the emergency action plan is implemented. **Emergency Action** If breakdown prevents effective air extraction within limits identified above, then the air handling system will be switched off, material reception will cease (see 10.5) and material will be exported from the site to a suitably licensed facility within 48hrs. The time period is from point of fault alarm. The alarm is automatically triggered by the process computer with a message sent to the Site Managers phone.

Equipment	Location	Odour Impact	Contingency Plan
Abatement System (water scrubber, biofilter).	IVC	**High** Failure of abatement system can result in air exiting the system at elevated odorous concentrations.	System alarms for parts failure within the system/ 24/7/365 service for remote diagnosis for repair requirements. Spare components stored on site for immediate replacement as required. Upon detection of fault the air handling system is switched off to prevent air forced through the system which could release odorous compounds. Engineers are called to repair/replace fault. If fault cannot be fixed within 48hrs from identification, then the emergency action plan is implemented. **Emergency Action** If breakdown prevents processing materials within limits identified in Section 5, then the air handling system will be switched off, material reception will cease (see 10.5) and material will be exported from the site to a suitably licensed facility within 48hrs. The time period is from point of fault alarm. The alarm is automatically triggered by the process computer with a message sent to the Site Managers phone.
Air Handling System (fans, pumps, piping)	ASP	**Low - Med** Failure of air handling system can prevent air from being forced through the static piles, potentially leading to the generation of anaerobic conditions within the pile. Indicated by backpressure >4.5kPa, following remedial actions identified in Section 5.8.2.	System alarms for parts failure within the system/ 24/7/365 service for remote diagnosis for repair requirements. Spare components stored on site for immediate replacement as required. Backpressure within the system is constantly monitored to ensure that the air system is drawing air through the piping. This is monitored at entry to the pipework. Individual components also have alarms such as fans and pumps that are triggered on failures. Engineers are called to repair/replace fault. If fault cannot be fixed within 48hrs from identification, then the emergency action plan is implemented. **Emergency Action** If breakdown occurs, or critical limits are exceeded following remedial actions (remixing/basal layer of oversize), then material will default to treatment as open windrows and be turned in accordance with these operational procedures to ensure anaerobic conditions do not occur. If odorous conditions form during the shutdown period, the material will be moved to the IVC (within 48hrs) to be held in the tunnels until brought under control by being fully aerated. If breakdown prevents effective treatment due to the site logistics preventing adequate space for treatment, material reception will cease (see 10.5) and material will be exported from the site to a suitably licensed facility within 48hrs. The time is from point of fault alarm. The alarm is automatically triggered by the process computer with a message sent to the Site Managers phone.

10.2 Staff Absence

Short-term staff shortages (such as a few days illness) will not affect the ability of the site to operate effectively as other staff members can be reassigned to critical operations. Magnitude of impacts will depend on the length of the absence, the number of staff absent at any one time, and the seniority of the staff member, but could potentially result in elevated odour concentrations at receptor locations, should process controls not be managed effectively.

In the event of prolonged absence of staff members (>5 working days), temporary staff will be recruited and appropriately trained to fulfil non critical roles whilst other more experienced staff members are reassigned.

If widespread illness occurs (<4 operational staff available) amongst staff members (such as food poisoning), the delivery of waste to the site will be suspended until sufficient staff are present to operate the site. The stabilisation area does not require daily turning, so for a limited period of time the odour risk would not be significant.

If prolonged, widespread absence occurs, the operators would contact alternative operators, such as other composting site operators for emergency assistance.

10.3 Flooding

If the site becomes flooded, this will inhibit effective aeration of the composting material and therefore increase the risk of anaerobic conditions. The composting pad is elevated from the surrounding area, so would not flood under any circumstances. Widespread flooding might prevent access to site, although this is very unlikely given the close proximity of the operators to the site.

In a flooding situation no further waste would be able to access the site and priority would be given to ensuring the on-going effective processing of waste.

Where waste is saturated and cannot be processed due to flood waters, waste will be disposed of from site to a suitably licensed waste management facility.

10.4 Fire

Fire at a composting site can spontaneously occur if the composting material is allowed to become too dry, equally it could be as a result of accident or mechanical failures, arson or even lightning strike. Fire response is itemised within the Fire Prevention Plan.

Any waterlogged material present on site would with be remixed with dry feedstock and reprocessed. Where waste is saturated and cannot be processed due to flood waters, waste will be disposed of from site to a suitably licensed waste management facility.

Any burnt compost material will be deemed not suitable for re-composting and will be disposed of from the site to a suitably licensed waste management facility. Depending on the severity of the fire, site critical equipment may have been damaged and no further reception or processing of waste would be undertaken until agreed with the EA. If equipment will be inoperable for extended periods of time, consideration will be given to the removal of material from site until repairs are effectuated.

10.5 Site at Full Capacity

The site will not accept more waste that it can process effectively at any one time and not above the permitted tonnage per annum.

In the event that any of the three treatment options reaches its maximum capacity, the Site Manager first seeks to utilise spare capacity in one of the other treatment options where appropriate. If this is not possible, the Site Manager will divert any further incoming waste from the sites to neighbouring facilities that are able to process the same types of waste until such a time when the site can resume operations within its normal operating capacity. Full capacity applies to any stage of the process where a storage limit is met (Section 4).

10.6 Odour Accident Management Plan

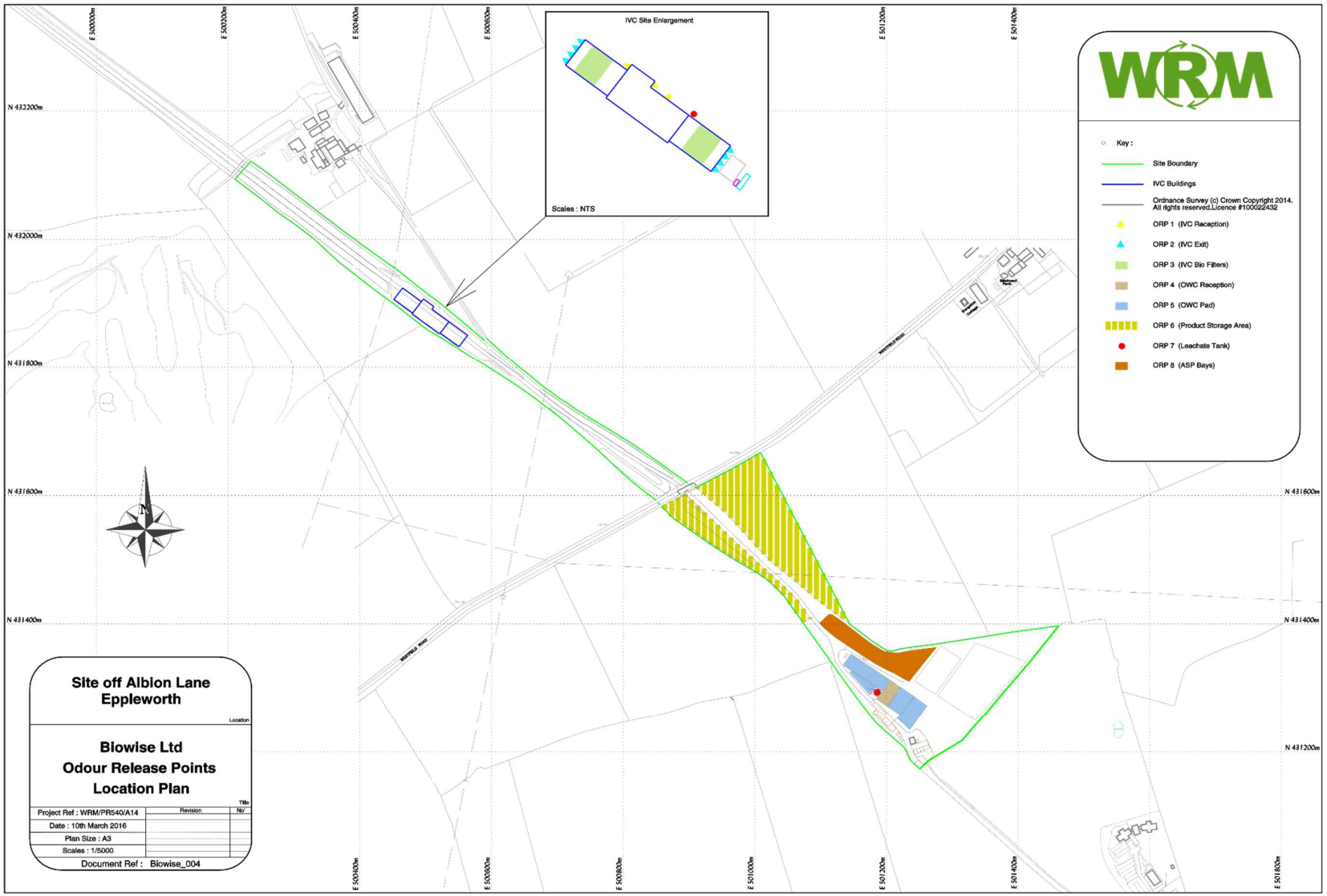
Procedures are in place, as identified in the table below, for the management of odour accidents. The identified accident, potential for occurrence and anticipated consequences has been discussed. A set of actions to be taken in order to priority is presented to be carried out by the site operatives and management.

Table 10 - Odour Accident Management Plan

Accident Type	Potential Occurrence	Consequences	Actions
Plant or Equipment failure	Seldom. Stringent preventative maintenance procedures in place to ensure all machinery remains functioning	• If waste is not processed for a long period compaction reduces the available oxygen which will lead to odours once the machinery is fixed.	• Inform management • Implement contingency plan in Section 10.1 • Establish time frame for repairs to be undertaken • Hire or source an alternative piece of equipment. • If no replacements are available divert waste to another site. • If diversion is not available cease accepting waste • Inform the EA if necessary • Record and review the incident
Fire - contaminated water and polluting smoke	Extremely rarely. Moisture content of delivered materials and temperature profile of process restricts excessive heat generation.	• Potentially polluting liquids flowing onto hard standing and leachate collection area where they will have the potential to generate odours. • Polluting smoke. • Exploding of fuel containers. • Wind dispersal of pollutants.	• Raise alarm on-site • Ensure personnel evacuated and accounted for from danger area. • Ensure all staff are alerted. • Call fire service and other emergency services as required. • Inform site management. • Inform the EA. • Post member of staff at entrance to site to direct emergency services. • Liaise and follow instructions of emergency team making them aware of any hazards on-site. • Consult site register for COSHH if appropriate.

Accident Type	Potential Occurrence	Consequences	Actions
			• Prevent fire waters causing pollution on-site. • Excess water should be removed from site to prevent odours • Address potential odour issue in waterlogged compost by spreading the compost thinly on the pad and adding additional course material (screened oversize) to it in order to aid the drainage of water and retention of airspaces. • Record and review incident.

APPENDIX A: ODOUR RELEASE POINTS PLAN


IVC Site Enlargement
Scales : NTS
WRM
Key :
Site Boundary
IVC Buildings
Ordnance Survey (c) Crown Copyright 2014. All rights reserved.Licence #100022432
ORP 1 (IVC Reception)
ORP 2 (IVC Exit)
ORP 3 (IVC Bio Filters)
ORP 4 (OWC Reception)
ORP 5 (OWC Pad)
ORP 6 (Product Storage Area)
ORP 7 (Leachate Tank)
ORP 8 (ASP Bays)
Site off Albion Lane
Eppleworth
Location
Biowise Ltd
Odour Release Points
Location Plan
Title
Project Ref : WRM/PR540/A14
Date : 10th March 2016
Plan Size : A3
Scales : 1/5000
Revision
No
Document Ref : Biowise_004
N 432200m
N 432000m
N 431800m
N 431600m
N 431400m
N 431200m
E 500000m
E 500200m
E 500400m
E 500600m
E 501200m
E 501400m
E 500200m
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E 500800m
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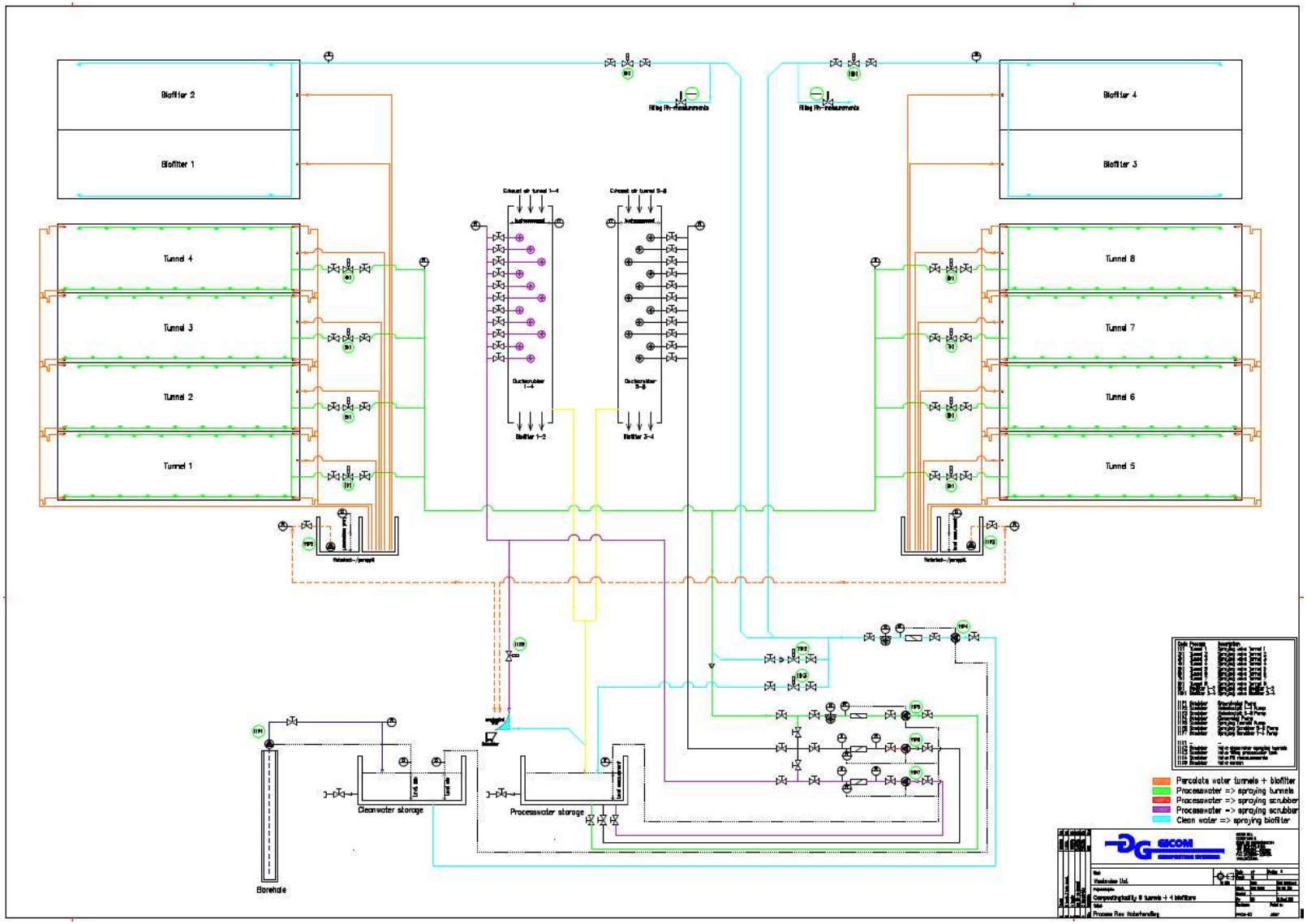
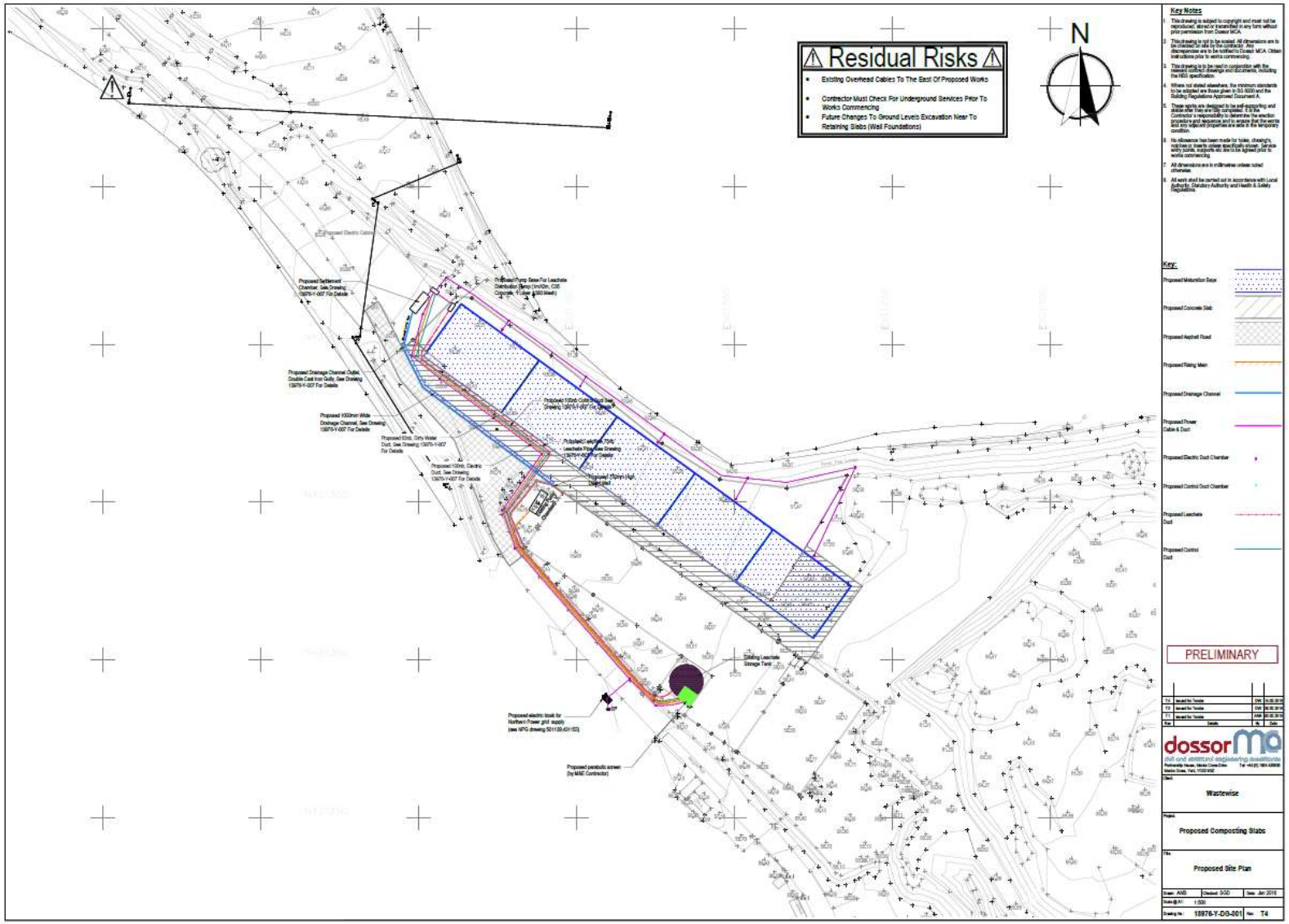
E 501200m
E 501400m
E 501600m

APPENDIX B: PFD3-02 TECHNICAL DRAWING


Biofilter 2
Biofilter 1
Biofilter 4
Biofilter 3
Tunnel 4
Tunnel 3
Tunnel 2
Tunnel 1
Tunnel 8
Tunnel 7
Tunnel 6
Tunnel 5
Cleanwater storage
Processwater storage
Borehole
Percolate water tunnels + biofilter
Processwater => spraying tunnels
Processwater => spraying scrubber
Clean water => spraying biofilter

APPENDIX C – OWC AND ASP DRAINAGE AREA


Residual Risks
Existing Overhead Cables To The East Of Proposed Works
Contractor Must Check For Underground Services Prior To Works Commencing
Future Changes To Ground Levels Excavation Near To Retaining Slabs (Wall Foundations)
N
Key Notes
Key:
PRELIMINARY
dossor
Wastewise
Proposed Composting Slabs
Proposed Site Plan
18976-Y-D0-001

APPENDIX D – SENSITIVE RECEPTORS


1
2
3
4
5
6
7
8
Eppleworth
Raywell
Castle Hill Hospital
Castle Rd
A164
A164
A164
A164
B1232
Google

Ref:	General Wind Direction (To)	Occurrence (%)	Nearest Sensitive Receptor	Approximate Distance From Site (m)	Grid Reference
SR01	N	16	Eppleworth Wood Farm	150 (IVC)	500365, 432137
SR02	N-NE	16	Bungalow Cottage	580 (OC)	501362, 431919
SR03	NE	6	Green Lane Farm	700 (OC)	501885, 431737
SR04	N-E	21	White House Farm	980 (IVC)	501324, 432021
SR05	SE	6	Albion Mill	260 (OC)	501779, 430941
SR06	S	16	Church Farm	360 (OC)	501359, 430813
SR07	S-SW	38	Rawdales Farm	550 (OC)	500829, 430813
SR08	SW-W	47	Hessle Golf Course	210 (IVC)	500165, 431539
N/A	W	5	None within 1km	N/A	N/A
N/A	NW	10	None within 1km	N/A	N/A

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