Llantrisant Recycling Centre Limited

Pantybrad Lane
Castellau Fach
Llantrisant
CF72 8LP

Site Specific Bioaerosol Risk Assessment

February 2017

Cardiff Metropolitan University | Prifysgol Metropolitan Caerdydd

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Summary

The Centre for Health Safety and Environment at the Cardiff Metropolitan University has been requested by Llantrisant Recycling Centre Limited to undertake a Site Specific Bioaerosol Risk Assessment for their green waste composting operations.

In the absence of specific guidance published by Natural Resources Wales (NRW) on bioaerosols at waste facilities and the preparation of Site Specific Bioaerosol Risk Assessments (SSBRA), the analysis and report has been prepared with reference to Environment Agency appropriate levels and guidance. References to policy and guidance from the Environment Agency within the text therefore also refer to NRW.

The assessment undertaken uses the principles of a staged risk assessment and is in line with current guidance published by the Environment Agency and Department for Environment, Food and Rural Affairs. As the facility is not currently operating, operational bioaerosol monitoring data is not available for a quantitative SSBRA. As a result, a qualitative SSBRA has been prepared.

Data from background bioaerosol monitoring carried out at the facility has been used to inform the development of the Site Specific Bioaerosol Risk Assessment. The level of activity required to process up to 10,000 tonnes per annum of green waste has been forecast. This includes specific tasks such as shredding, turning and screening of the waste.

The risk assessment has been prepared following current guidance and good practice for the preparation of environmental risk assessments. This has taken the form of problem definition, by defining the sources, pathways and receptors, risk screening and the development of a conceptual model.

The intensity of work forecast for the site is deemed to be low and 'active' composting work, i.e. shredding, turning or screening, will be periodic and of short duration. The level of work processed would not require more than one active composting activity to take place at any one time. Due to the proximity of sensitive receptors, presumption against active composting activities when the wind blows from the north west to north east directions has been proposed. It is anticipated that this will not be overly restrictive due to the small scale nature of the site and the low intensity of the activity. It will therefore be easily practicable to implement.

The assessment determined that providing that control measures are adopted and employed, the risk to receptors from bioaerosols from composting activities at the Castellau Fach facility are deemed to be low.

1.0 Introduction

At the request of Llantrisant Recycling Centre Limited, the Centre for Health, Safety and Environment (CHSE) at Cardiff Metropolitan University have undertaken a Site Specific Bioaerosol Risk Assessment (SSBRA) at the facility. The SSBRA has been undertaken to accompany the Environmental Permit application, submitted by Environmental Focus on behalf of Llantrisant Recycling Centre Limited.

The site currently receives top soil, aggregates, glass, wood waste, nappies and a small volume of green waste (Environmental Permit: AB3092FR). The current permit application is for a variation of the existing Environmental Permit, to allow the composting of up to 6,000 tonnes of green waste per annum in a defined area of the facility.

The Environment Agency (EA) Position Statement on composting and the potential health effects from bioaerosols (Position Statement 031, v1.0) (EA, 2010) requires that a site specific bioaerosol risk assessment be submitted in support of applications for new composting sites within 250m of workplaces or dwellings, with similar considerations being applied to applications for variations at existing sites.

The CHSE are a research and consultancy centre based at Cardiff Metropolitan University. The Centre has been involved in research into occupational and environmental exposures to bioaerosol since 2005. CHSE have been involved in numerous research and consultancy projects related to the risk posed by bioaerosol emissions from waste treatment facilities. As part of the consultancy work, the Centre provides routine bioaerosol monitoring for Permit compliance for a number of facilities and has prepared SSBRA's for several facilities throughout the UK. Dr Peter Sykes, the Associate Dean (Enterprise) for the School of Health Sciences and head of the Centre has published several research papers on bioaerosols including *Managing the potential public health risks from bioaerosol liberation at commercial composting sites in the UK: an analysis of the evidence base* (Sykes et al, 2007).

On the 01st April 2013, Natural Resources Wales (NRW) was formed as the regulatory authority in Wales by combination of the functions of the Environment Agency, Countryside Council for Wales and the Forestry Commission in Wales. At present, NRW has not issued specific guidance relating to bioaerosols at waste facilities. The SSBRA has therefore been prepared with reference to Environment Agency

appropriate levels and guidance. References to policy and guidance from the Environment Agency within the text therefore also refer to NRW.

This SSBRA has been prepared following guidelines published by both the EA (Drew et al, 2009, Pollard et al, 2000) and the Department for Environment, Food and Rural Affairs (DEFRA) (DEFRA, 2011) and its predecessors (DETR, 2000), and incorporating current research findings.

1.1 Environmental Risk Assessment

Environmental Risk Assessment is a method used to characterise and appraise complex problems and communicate them in such a way that transparent and equitable decisions can be made (DEFRA, 2011).

In order to ensure a consistency of approach to risk assessments, DEFRA and the EA have produced several guidance documents on the process, techniques and practice of environmental risk assessments. Specific guidance on the preparation of risk assessment in relation to the waste management industry has been produced by the Environment Agency - A Practical Guide to Environmental Risk Assessment for Waste Management Facilities Environmental Policy - Risk and Forecasting Guidance Note No: 25 (Pollard et al, 2000).

Guidance on environmental risk assessment proposes a staged approach to risk assessment (DEFRA, 2011). The staged approach to risk assessment is based on the 'source-pathway-receptor' concept and relies on the development of a comprehensive conceptual model.

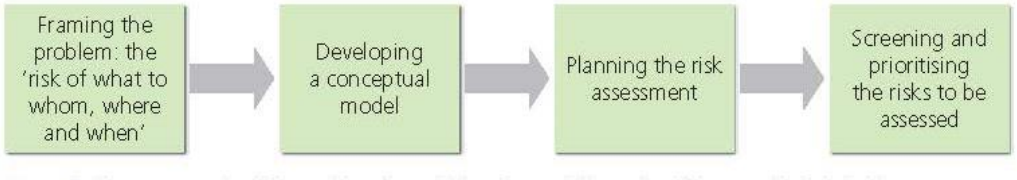


Figure 1 Components of problem formation. [Source: DEFRA, 2011]

Effective risk assessment and risk management should determine:

- the hazards present and their properties
- the method by which receptors may become exposed to a hazard and the probability and scale of the exposure
- the probability and scale of harm from an exposure

- the significance of the risk and any uncertainties that may exist, and
- methods required to prevent, control or minimise the risk. (Pollard et al, 2000)

In order to comprehensively categorise risks an environmental risk assessment should follow the stages of: Hazard Identification, Identification of consequences, Estimation of Magnitude of Consequences, Estimation of the Probability of Consequences and Evaluating the significance of the risk (DEFRA, 2011).

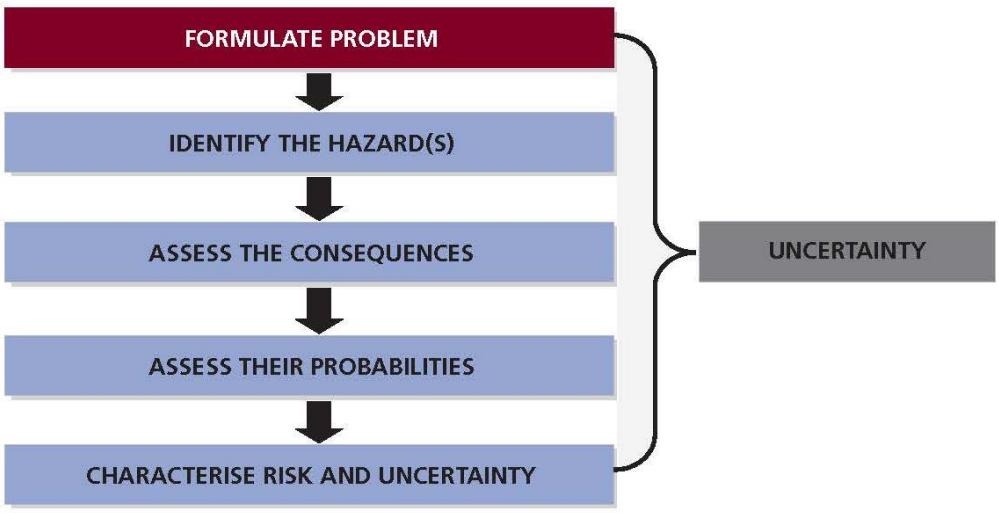


Figure 2: Staged approach to environmental risk assessment and management [Source: DEFRA, 2011]

Although targeted in its scope, these principles of good practice in preparation of an environmental risk assessment have been applied in the preparation of this Site Specific Bioaerosol Risk Assessment.

2.0 Problem Formation

2.1 Bioaerosols.

The term bioaerosol refers to biological particles that have become aerosolised. Bioaerosols may contain a wide variety of micro-organism, their components and metabolites, for example: bacteria, actinomycetes, fungal spores, endotoxin, mycotoxins and glucans (Millner et al 1994; Millner, 1995; Gilbert & Ward, 1998; Fischer et al, 1999; Fischer 2000; Swan et al, 2003). Bioaerosols are endemic in the environment and may be formed in varying concentrations in almost all environments where micro-organisms exist. The natural decomposition of vegetation and certain industries, such as agriculture, waste management, waste water treatment, forestry and textile manufacture may all act as sources of bioaerosols.

Bioaerosols from composting activities may contain varying quantities of actinomycetes, thermophilic bacteria, fungal spores, gram-positive bacteria, gram negative bacteria, endotoxin, mycotoxins and glucans (Swan et al, 2003). In addition to biological particles, volatile organic compounds (VOCs), methane and hydrogen sulphide may also be present in emissions from composting activities (Swan et al 2003; Fischer et al, 2000). The effect of VOCs, Methane and Hydrogen Sulphide are not within the scope of this risk assessment.

There are very few studies of background levels of bioaerosols. Concentrations of bacteria and fungi are typically below 1000 cfu/m^3 in urban areas (Searl, 2008). Bovallius (1978) in a study of airborne bacteria at four different locations in Sweden, reported ranges of total viable bacteria of 2 to 3400 cfu/m^3 for an agricultural area, 0 to 560 cfu/m^3 at a coastal area and 100 to 4000 cfu/m^3 at two urban locations.

2.2 Source-Term Variation

The concentration of bioaerosols in the vicinity of waste treatment facilities is highly variable and dependant on a number of factors including waste composition, the operational cycles of the process, meteorological fluctuations, such as temperature, humidity, wind turbulence, atmospheric pressure and phase changes in contaminant behaviour (Taha *et al*., 2006). Background or typical ambient bioaerosol levels may differ by orders of magnitude depending on location, weather and season, which hinder the risk assessment process and interpretation of results.

The agitation of green compost windrows may result in airborne fungi and bacteria levels averaging 10^4 - 10^7 cfu/m^3 (Lacey, 1997; Wheeler *et al*., 2001; Recer *et al*., 2001). In contrast, static compost windrows typically emit bioaerosols at rates of 10^3 cfu/m^3 for both actinomycetes and *A. fumigatus* (Taha *et al*., 2005). These estimates however are subject to considerable temporal variation and reliable quantitative data that characterise the emissions of compost organisms, both viable and non-viable, does not currently exist. Between-day variations in bioaerosol concentrations have been observed at source and at distances greater than 250m from the source (DEFRA, 2013).

In general, the release of bioaerosols from waste management facilities is episodic due to a number of factors, which include the stage of the process, work activity and meteorological considerations (Taha et al, 2006). In addition, there may be more than one source of bioaerosols at a waste facility. The various stages of composting, shredding, turning windrows, screening and soil turning may all act as sources of bioaerosols.

2.3 Dispersal

Once liberated, bioaerosols may be transported by prevailing winds and air currents and have the potential to impact on third parties. The distance that the micro-organisms are transported will be dependent on a wide variety of factors, such as the weather conditions, i.e. wind speed, turbulence and precipitation, the weight of the particle, integrity of the micro-organism, surrounding topography, etc. Reviews of bioaerosol dispersion studies from composting sites has noted that concentrations generally return to background levels between 100m and 500m and the majority of surveys included, tend to reach background within 250m (DEFRA, 2013; Wheeler *et al*., 2001; Millner *et al*., 1994). Particle dispersion in relation to emissions from composting facilities are problematical to predict however as bioaerosol emissions do not exhibit typical particulate behaviour in part, due to the ‘clumping’ of organisms in air. Consequently traditional modelling techniques have yet to be verified for assessing bioaerosol dispersion.

2.4 Potential Health Effects

Bacteria, actinomycetes and fungi are fundamental to the composting process. The concern regarding bioaerosols from composting activities arises because of their potential to cause adverse health effects in employees and the public living in close proximity to such facilities. These adverse effects can potentially occur in susceptible

individuals from exposure to the micro-organisms associated with the composting process and can elicit an adverse response by infection, allergy or an adverse response to toxins (EA, 2005). According to Swan *et al.* (2003) the effects of exposure to organic dust on respiratory health may lead to or exacerbate a number of distinct identifiable conditions including Aspergillosis in immuno-compromised individuals (Millner *et al*,1994, Millner 1995), Allergic Rhinitis and Asthma (Zuskin *et al*, 1994), Extrinsic allergic alveolitis (Farmers Lung) (Flannigan *et al* 1991) where prolonged (usually occupational) exposure occurs, Chronic Obstructive Pulmonary Disease (COPD) (Lacey and Crook, 1988, Matheson et al, 2005); Toxic Pneumonitis (Lacey and Crook,1988) and upper airway irritation/mucous membrane irritation (Dutkiewicz,1997).

The potential hazards following exposure to the agents contained in compost bioaerosols have been described. However, the risk to people exposed is difficult to characterise as, at this present time, no reliable dose-response data exists for compost bioaerosols or any of the agents likely to be present.

2.5 Risk to the public

Whilst many measurements of airborne concentrations of organisms have been made within and in the vicinity of composting plants (Wheeler et al., 2001), which give ample evidence for a hazard especially to composting workers, there have been very few studies of health effects from which any quantitative indication of risk can be derived for members of the public. (DEFRA, 2004; Searl, 2008)

Even though, the organisms that predominate throughout the composting process have been identified, it is extremely difficult to obtain a concise definition of bioaerosol emissions from composting activities. The existence and concentration of individual species associated with the composting process is highly variable and heavily dependent on a number of factors including the nature of the material being composted, individual bioaerosol properties, the temperature and moisture content of the compost and whether the process is enclosed or carried out in the open air, process design, site operations and geographical, topographical and meteorological conditions. (Swan *et al*, 2002, Taha et al, 2006). Consequently establishing the toxic potential of bioaerosol emissions from commercial composting facilities is extremely difficult.

Concern has been raised by residents in the vicinity of composting sites that composting activities could increase levels of bioaerosols, such as airborne *Aspergillus*

fumigatus spores. Few published studies exist where the health of residents near composting sites has been investigated, but where such work has been done there is little evidence of ill health compared to controls (Millner, 1995). The responses to bioaerosols are host and dose dependent; that is some individuals may respond to a dose that does not affect others (Searl, 2008). However based on the current knowledge, the risk is impossible to quantify due to the lack of accepted dose-response relationships for bioaerosol exposure (Wheeler et al, 2001; Searl, 2008; Drew et al, 2009; EA, 2009). Bioaerosols are endemic in the environment from decomposing leaves in gardens and woods, wheat fields etc. and the body has many natural defences against them. However individual susceptibilities vary considerably and even natural levels of bioaerosols can be harmful to certain individuals. The EA has established conservative *'acceptable levels'* for micro-organisms in air as shown in Table 1 (Source: Drew et al, 2009). The EA concede that other activities may lead to higher background bioaerosol levels than would normally be expected (EA, 2008).

Table: 1

Environment Agency Reference for Bioaerosol (Drew et al, 2009)	
Reference Pollutant	CFU m^{-3}
Total Bacteria	1000
Aspergillus fumigatus	500
Gram-negative Bacteria	300

3.0 Site Details and Process

3.1 Site Description

The Llantrisant Recycling Centre Limited facility lies on the edge of the Llantrisant Business Park, near Llantrisant, Rhondda Cynon Taf. The site covers approximately 2.1 ha and is made up of two sections, a civic amenity site operated by Amgen Cymru, adjacent to the road (approx. 0.9 ha) and the Llantrisant Recycling Centre Limited facility at the rear of the site (approx. 1.2 ha).

Current

The site currently receives topsoil, aggregates, wood waste, glass, nappies and a small amount of green waste. The surface of the site is currently compacted type 1 Sub-Base aggregate. A two bay open fronted building is used for the reception and storage of nappy waste and top soil. Crushed glass waste is stored in an open bay on the north west side of the side and in the northern corner of the site. Wood waste is received in the southern corner of the site, adjacent to the open fronted building. Mounds of stored top soil are located in the south east corner and north east edge of the site.

A small amount of green waste is currently received at the site. Deliveries are made by street collection type refuse vehicles and from the adjacent CA site in high sided skips. The green waste from street collection vehicles is delivered in compostable bags. A small conveyor and picking station are location on the east side of the facility and is used infrequently to remove contaminants from deposited green waste.

The site currently operates under Environmental Permit number AB3092FR.

Proposed

The current proposal consists of the construction of a concrete pad, approximately 3000m^2 in area, located in the north east corner of the existing site. This will be used for all composting activities at the facility, including the delivery of green waste, sorting, shredding, formation and maturation of windrows, screening and storage of final product. Copies of the proposed site layout drawings are contained in Figures 3 and 4 below.

The existing earth bund to the north east of the proposed composting area will be retained. A new 4.2m bund will be constructed on the south west side of the working area, around the settling pond.

3.2 Site Layout

The Llantrisant Recycling Limited facility lies to the north east of the Llantrisant Community Recycling Centre. An entrance road, with weighbridge, follows the western boundary of the Community Recycling Centre, to access the working area. The working area contains:

- The composting area. A 3000m^2 concrete pad, housing all green waste composting activities, including waste reception, shredding area, windrows, screening area and final product storage area.
- Wood Waste area. To include wood reception area, sorting area, wood storage and biomass boiler.
- Glass area. To include storage bays for crushed glass and sorting area.
- Nappy disposal area. Storage area for bagged waste nappies prior to collection for processing at a separate facility. Housed in a bay of a two bay, open fronted building.
- Aggregate sorting and storage area.

<u>Composting Area - Proposed Operation</u>

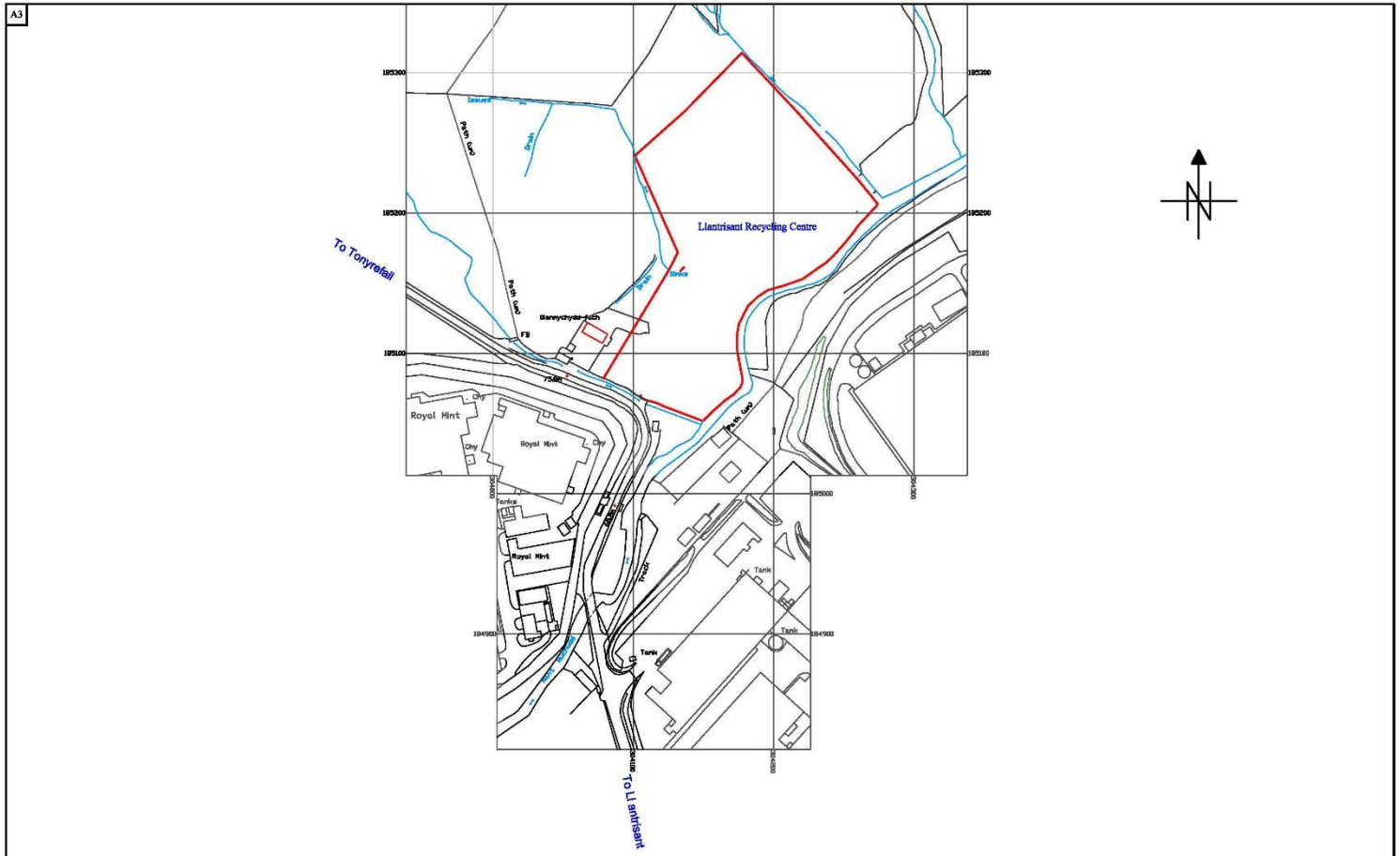
Delivery of material will be made by refuse collection vehicles and high sided skip vehicles to the north east end of the concrete yard. Green waste from refuse collection vehicles will be by Rhondda Cynon Taff council, who operate a weekly green waste collection in clear plastic recycling bags. Deposited green waste material will be shredded and formed in to windrows on the middle portion of the concrete yard. Windrows will be turned every one to two weeks over a twelve to twenty four week period, dependant on temperature readings, etc. After sanitisation, the material will be screened. Following screening, oversize material (>40mm) will be formed back in to windrows for further composting, while screened material (<40mm) will be formed in to maturation windrows.

Material in maturation windrows will be left for approximately 2½ to 3 months and turned every one to two weeks. The composting area will house up to four windrows measuring 45m x 2.4m x 4m. It is anticipated that the site will house 2 windrows at a standard operating capacity. All shredding, turning and screening work will take place

within the designated composting area of the concrete yard. The Risk Assessment has been based on this level of activity.

A settlement pond will be constructed between the composting area and the community recycling site. The settlement pond will be used to hold run-off from the concrete yard, prior to treatment by the water treatment plant.

Figure 3 – Proposed location plan.



REV.	DESCRIPTION	DATE
D	Renumbered	12/02/2017
C	Site Area Defined	02/02/2017
B	Site Area	01/06/2011

NOTES

Ordnance Survey Licence: 100047474

Scale	1:2500
Date	04/08/2009
Drawn	J.W.

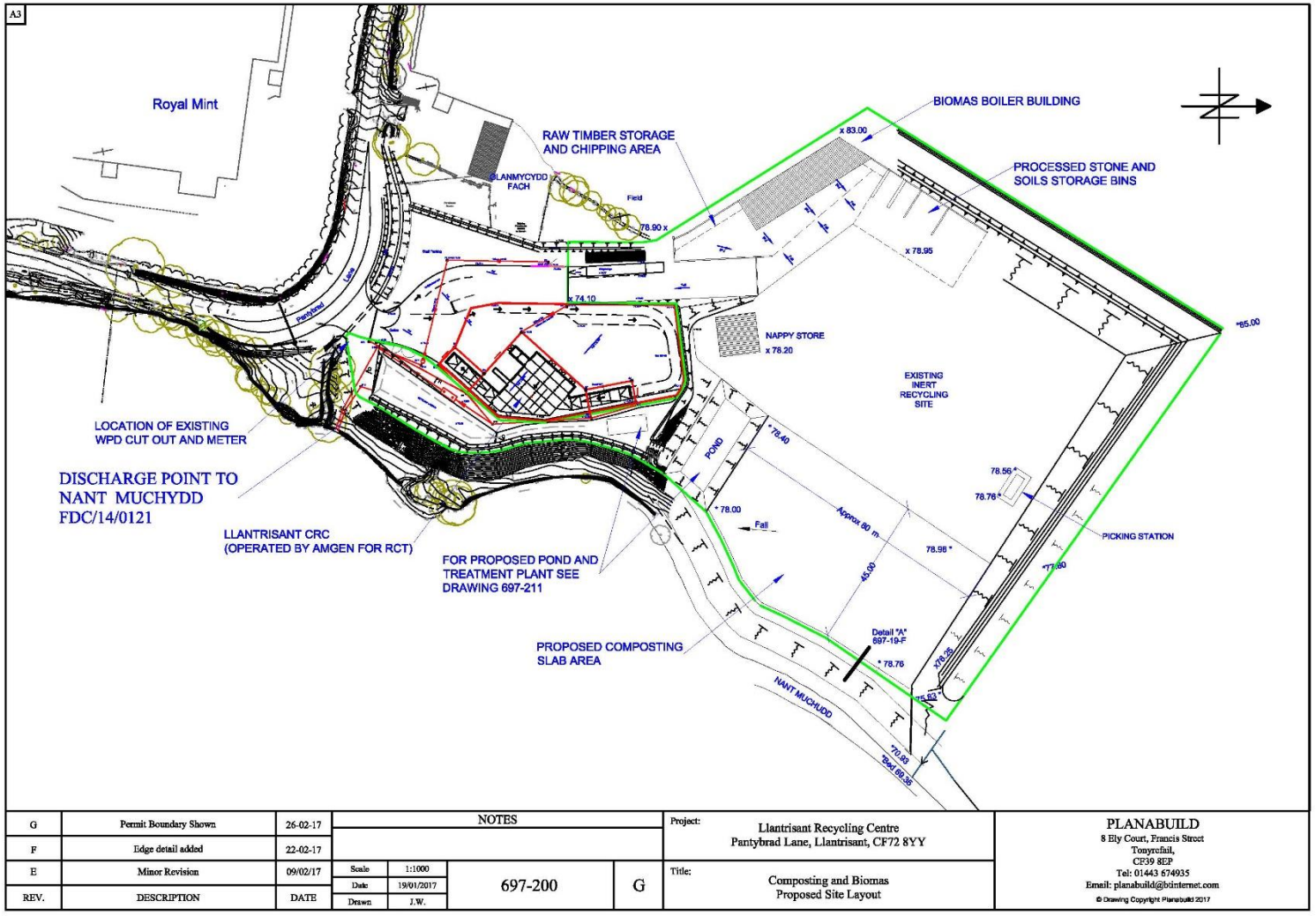
697/02 D

Project: Llantrisant Recycling Centre
Panybrad Lane, llantrisant, Pontyclun, CF72 8YY

Title: Location Plan

PLANABUILD
8 Ely Court, Francis Street
Tonyrefail,
CF39 8EP
Tel: 01443 674935
Email: planabuild@btinternet.com

Figure 4 – Proposed site plan.



3.3 Process Stages

The following timings and frequencies have been used to form the basis of the risk assessment:

Stage 1 - Green waste delivery and storage:

Green waste delivered to the site will be deposited and stored in a temporary green waste storage area on the concrete working area. Material will be stored until sufficient material has been deposited to be shredded. Bagged green waste from household green waste collections will be broken open and sorted by hand, using the picking cabin, approximately once per week.

It is forecast that at full capacity, between 2 and 3 deliveries of green waste would be made per day.

Stage 2 - Shredding

Shredding will be undertaken towards the north east end of the composting pad using a Forus HB 171 slow speed shredder. The shredder is portable and will be located adjacent to the green waste delivery area to minimise transport. Once shredded, material will be formed in to windrows towards the centre of the composting area for sanitisation.

Intervals between shredding will be variable and dependant on when sufficient material has been deposited. It is anticipated that shredding will take place once per week. Shredding will be carried out in sessions approximately 1 to 2 hours in length. It is forecast that at full capacity, shredding would take place up to twice a week at peak times, lasting approximately 2 hrs per session.

Stage 3 - Sanitisation and turning

Once shredded, material will be formed in to windrows towards the centre of the concrete pad. Material will be left to compost for between 12 and 24 weeks and is turned every one to two weeks. Windrows will be turned using a wheeled loader shovel, progressively turning the windrows. Windrows will be no greater than 2.5m in height. Turning windrows will be carried out approximately once every one to two weeks and last for approximately 3 hours per session. i.e. relatively small volumes, moved relatively small distances.

Stage 4 - Screening

After the initial 'sanitisation' phase, windrows will be screened. Screening will take place using a Terex Finlay 883 reclaimer screen positioned adjacent to the windrow being screened. Finished product is moved to an adjacent stockpile, while oversized material is returned to the system for further composting. Screening will be carried out approximately once per week and last approximately 2 hours per session.

Stage 5 – Turning maturation windrows

Material in maturation windrows will be turned once a week and take approximately 2 – 3 hours per session.

3.4 Surrounding Topography and land use

The Llantrisant Recycling Ltd facility is located on open farm land on the edge of the Llantrisant Business Park. Generally, land to the north, east and west of the site are open rough grazing farmland, while the Business Park lies to the south of the site.

The land to the north of the facility slopes gently from north west to south east, lying at approximately 75 m above Ordnance Datum (AOD). To the south west of the site, the Nant Muchudd stream flow, north east to south west, in a steep sided valley. The southern bank of the valley is wooded.

The working area cuts in to the uphill slope on the north west side. As a result, the building under construction on the west side of the site is partly sunk in to the hillside. To the north, the site is bordered by a 4m high earth bund. The bund has been planted with trees and scrub landscaping. The site is bordered on the south side by a concrete and steel building, approximately 4m in height, and the settlement pond. An earth bund, 2m in height, will be constructed around the settlement pond. To the south east, the site is bordered by landscape planning and a steep grass covered slope down to the Nant Muchudd stream.

The land immediately surrounding the site to the north, east and north west is farmland, predominantly used for rough grazing livestock. To the south east, south and south west, lie various units on the Llantrisant Business Park, which include manufacturing, warehousing and healthcare units. To the west of the site lies a residential property and civic amenity site, with the Royal Mint, manufacturing premises further to the west. A detailed description of receptors in the vicinity of the facility is given in Table 3.

3.5 Prevailing Wind

Annual meteorological data is not currently available for the Llantrisant Recycling Ltd site, therefore it is not possible to produce wind rose data for the prevailing wind direction in the immediate area in this report. A weather station has now been installed at the facility.

In order to provide an approximation of the prevailing wind direction for the site, the table below summaries wind direction data from RAF St Athan, 16km to the south of the facility, from 2000 to 2010.

Table 2 – Summarised wind direction data – RAF St Athan 2000 - 2010.

Wind Direction	Percentage
N	1.03
NNE	2.15
NE	6.56
ENE	6.48
E	3.63
ESE	1.51
SE	1.31
SSE	1.67
S	1.71
SSW	3.99
SW	9.91
WSW	26.08
W	28.97
WNW	3.9
NW	0.78
NNW	0.33

A graphical representation of the wind direction data is included in Appendix 1.

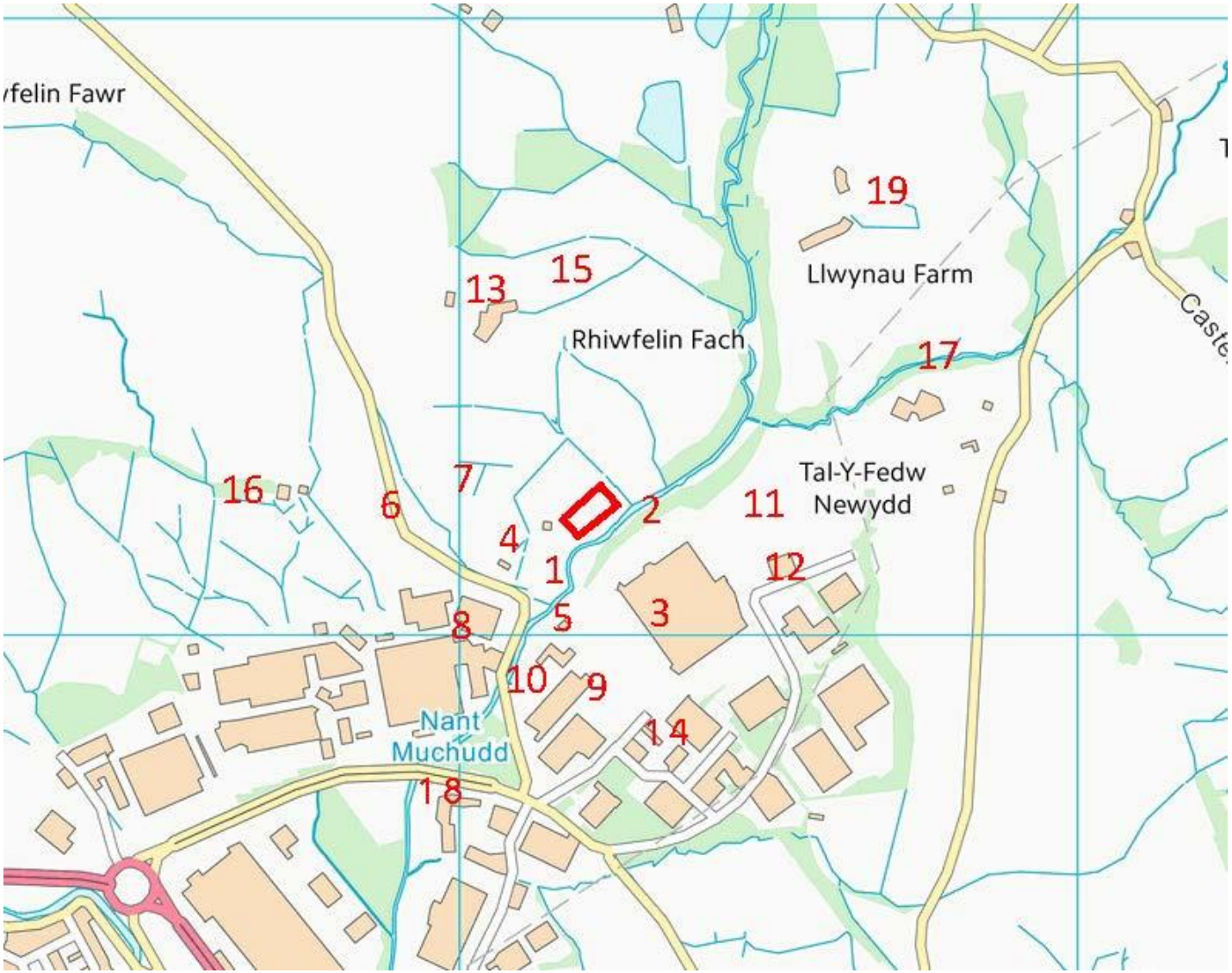
3.6 Receptors

The Environment Agency interim position statement on Composting and the health effects from Bioaerosols (EA, 2010), defines a sensitive receptor as:

"Sensitive receptor refers to people likely to be within 250 metres of the composting operation for prolonged or frequent periods. This term would therefore apply to dwellings (including any associated gardens) and to workplaces where workers would frequently be present."

Table 3 lists the receptors closest to the site, along with the distance and bearing from the working area and a description of the topography between the site and receptor, the 'pathway'. The nearest receptors to the facility are illustrated in the Nearest Receptor Plans, Figures 5 and 6.

Figure 5: Nearest Receptor Plan



Contains Ordnance Survey data © Crown copyright and database right 2011

Figure 6 – Nearest Receptor Plan 2

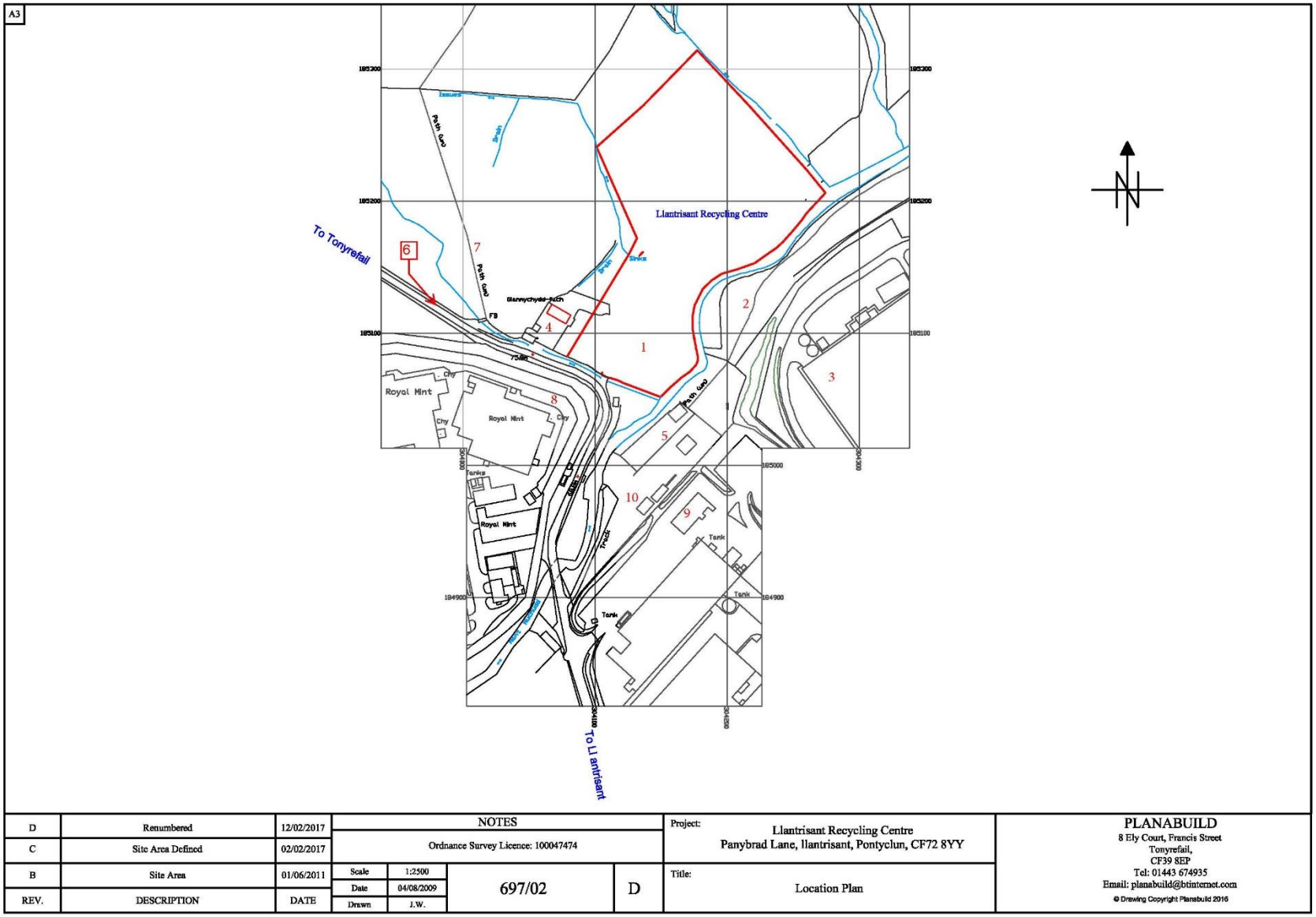


Table 3 – Receptors

Ref.	Receptor	Type	Single/Linear/Multiple	Distance	Direction	Pathway' topography
1	Llantrisant Community Recycling Centre	Workplace	Single	27m +	SW	Partially obscured by building, 4.2m earth bund.
2	Public footpath	Public Right of Way	Linear – South West/North East	50m +	S - E	Newly planted screening, stream in steep sided valley, woodland.
3	Former Universal Engineering factory	Workplace	Single	60m +	SE	Newly planted screening, stream in steep sided valley, woodland.
4	Glanmychydd-fach	Residential	Single	87m	SW	Partially obscured by building, 4.2m earth bind, CA site, site access road.
5	Country Timber (Timber Yard)	Workplace	Multiple	100m +	S	4.2m earth bund, incline down to stream.
6	Pantybrad Lane	Minor Highway	Linear	140m	S - NNW	Partially obscured by building, 4.2m earth bind, CA site, site access road.
7	Public footpath	Public Right of Way	Linear	140m +	SW - NW	Partially obscured by building, tree screen, open field.
8	Royal Mint	Workplace	Multiple	160m +	SW	Partially obscured by building, CA site, site access road, minor highway.
9	GeesinkNorba Ltd	Workplace	Multiple	160m +	S	4.2m earth bund, stream, partial woodland.
10	Potting Shed	Retail/Catering (Workplace/Public)	Multiple	205m +	ESE	4.2m earth bund, incline down to stream.

Table 3 (Continued)

Ref.	Receptor	Type	Single/Linear/Multiple	Distance	Direction	Pathway' topography
11	Tom Pritchard Contractors Ltd	Workplace	Multiple	230m +	E	Newly planted screening, stream in steep sided valley, woodland.
12	Llantrisant Dialysis Centre	Healthcare (Workplace/Public)	Single	255m +	E	Newly planted screening, stream in steep sided valley, woodland.
13	Rhiw Felin Fach Farm	Residential/Workplace	Single	300m	NNW	Building, open field.
14	Minor road, Llantrisant Business Park	Minor Highway	Linear	300m +	SE	Newly planted screening, stream in steep sided valley, woodland.
15	Public footpath	Public Right of Way	Linear	300m +	NNW - NNE	Building, open field.
16	Rhiw Felin, agricultural buildings	Workplace	Single	430m	W	Partially obscured by building, CA site, site access road, minor highway.
17	Tal-y-Fedw Newydd	Residential	Single	430m	ENE	Earth bund, stream in steep sided valley, woodland, open field.
18	Heol Y Sarn	Minor Highway	Linear	450m +	SW	Partially obscured by building, CA site, site access road, minor highway, factory buildings.
19	Llwynau Farm	Residential	Single	510m	NE	Earth bund, open field.

Note:

The Llantrisant Community Recycling Centre is operated by staff from Amgen Cymru and is visited by members of the public to dispose of waste. It is therefore treated as a separate receptor for the SSBRA.

The facility is bordered to the west, north and north east by agricultural land. This agricultural land is used for the grazing of livestock. As a result, it would not be occupied frequently as part of the land use. It has therefore not been marked on the Receptor Plans (Figure 5 and 6) but has been included in the Qualitative Source – Receptor analysis (Table 5). For the purpose of the assessment, the agricultural land falls within the 'Commercial/Industrial workplace within 250m' and 'Commercial/ Industrial workplace 250m – 500m' categories.

There are no Sites of Special Scientific Interest (SSSI) within 500m of the facility. The closest SSSI's to the facility are the Llantrisant Common and Pastures and Rhos Tonyrefail SSSI's which are 550m and 660m from the facility, respectively. These are greater than 500m from the facility. As a result, SSSI's have not been included in the assessment.

3.7 Sources of Bioaerosol

Composting Activities

There are several possible sources of bioaerosol within the site (Table 4), both directly related to the composting process and in relation to agricultural operations. These sources are the result of both passive (windrows, stockpiles) and dynamic activities (shredding, turning, screening).

Table 4 – On-site Bioaerosol Sources

Source	**Details**	**Frequency**	**Duration (hrs.)**	**Emission Potential**
Green waste delivery	Unloading green waste from vehicles in delivery area.	Daily (Infrequent)	Short	Low
Green waste stockpile	Deposited green waste.	Daily	Constant	Low
Hand sorting of green waste.	Breaking open bagged green waste and sorting by hand.	Weekly, once a week	2	Low
Shredding green waste	Green waste shredding and formation of windrows	Weekly, approx. once a week	1	High
Static windrows	'Pasteurisation' and maturation windrows	Daily	Constant	Low
Turning 'Pasteurisation' Windrows	Turning	Once every 1-2 weeks	3	High
Screening	Screening 'pasteurisation' windrows, moving screened material to maturation windrows on upper pad, returning oversize material back in to system.	Weekly, once a week	3	High
Turning maturation windrows	Turning	Weekly	2 - 3	High
Compost product stockpiles	Screened material that has completed composting and maturation.	Daily	Constant	Low
Settlement pond	Settlement pond to store run-off from hard standing before treatment in enclosed system.	Daily	Constant	Low

N.B. – Frequency and duration details contained in Table 4, are based on forecasts of maximum frequency and duration at full capacity of 10,000 tonnes per annum.

Other waste activities at the facility.

Storage of nappy waste

Nappy waste is deposited in the two bay, open fronted building adjacent to the composting pad. The nappy waste, which is delivered twice per week is deposited by refuse collection vehicles and is contained in sealed plastic bags. Nappy waste is aggregated for collection by a disposal contractor, weekly. As the waste is contained in sealed bags and only stays on the facility for a short length of time, it would not provide a significant addition to bioaerosol concentrations.

Wood waste

Wood waste will be in two forms, wood that can be used in the biomass boiler, under construction and unsuitable wood waste. The unsuitable wood waste consists of painted wood and board made from reconstituted wood. Wood, used for the biomass boiler will be stockpiled close to the composting area. The wood stock pile does not contain 'green' material and the stockpile will be undercover. The wood that is unsuitable for the biomass boiler will be removed from site weekly for processing at another facility. Bioaerosol emissions from the wood stockpile is considered to be insignificant.

Glass waste

Pre-screened glass waste will be received by the facility for further processing. Processing takes the form of the removal of plastic fragments from the glass waste. This will be carried out by a purpose made screen. The screened glass and plastic are then removed from the site for recycling or disposal. It is not envisaged that processing of glass waste at the site will provide a significant addition to bioaerosol concentrations.

Aggregates

The storage and processing of aggregates at the facility will not contribute to the bioaerosol emissions of the facility.

4.0 Risk Screening

The aim of the Risk Screening exercise is to provide a qualitative assessment to identify where a source-pathway-receptor relationship may exist. In order that the risk assessment is site specific, the risk screening must include sources and receptors identified during the Problem Formation stage.

Table 5 provides a qualitative analysis of bioaerosol sources and receptors at Llantrisant Recycling Centre Ltd. The table demonstrates that several 'source-pathway-receptor' linkages exist.

Table 5: Qualitative Source-Receptor Analysis – Potential for completed pathways of exposure

	Site Specific Bioaerosol Sources							
Typical Receptor	Green waste delivery	Green waste stockpile	Shredding green waste	Static windrows	Turning 'Pasteurisation' Windrows	Screening	Turning maturation windrows	Compost product stockpiles
Footpath/Bridleway	✓	✓	✓	✓	✓	✓	✓	✓
Private driveway	-	-	-	-	-	-	-	-
Minor Public Highway within 250m	✓	✓	✓	✓	✓	✓	✓	✓
Minor Public Highway 250m - 500m	✓	✓	✓	✓	✓	✓	✓	✓
Main Public Highway within 250m	-	-	-	-	-	-	-	-
Main Public Highway 250m – 500m	-	-	-	-	-	-	-	-
Residential Property within 250m	✓	✓	✓	✓	✓	✓	✓	✓
Residential property 250m - 500m	✓	✓	✓	✓	✓	✓	✓	✓
Offices within 250m	-	-	-	-	-	-	-	-
Offices 250m - 500m	-	-	-	-	-	-	-	-
Healthcare within 250m	-	-	-	-	-	-	-	-
Healthcare 250 - 500m	✓	✓	✓	✓	✓	✓	✓	✓
Commercial/Industrial workplace within 250m	✓	✓	✓	✓	✓	✓	✓	✓
Commercial/Industrial workplace 250m - 500m	✓	✓	✓	✓	✓	✓	✓	✓
Recreational within 250m	-	-	-	-	-	-	-	-
Recreational 250m - 500m	✓	✓	✓	✓	✓	✓	✓	✓
Designated Conservation site (SAC, SPA, SSSI, etc.) within 500m	-	-	-	-	-	-	-	-
Spring, well or borehole used to supply water within 250m	-	-	-	-	-	-	-	-
Agricultural land within 250m	✓	✓	✓	✓	✓	✓	✓	✓

NB: Table 5 does not include working areas related to Llantrisant Recycling Centre Limited. Exposure to bioaerosols of workers and visitors to the facility fall within Health & Safety legislation.

5.0 Risk Assessment Methodology

As the Risk Screening assessment indicated the presence of at least one 'source-pathway-receptor' linkage that could not be simply ranked and prioritised a Risk Assessment is required.

The risk arising from the 'source-pathway-receptor' linkages identified in the risk screening are difficult to predict using quantitative risk assessment techniques because of the complexities surrounding accurate characterisation of the hazard, knowledge gaps in relation to dose-related effects following exposure and limitations that currently exist in the modelling of exposures of bioaerosols. These can be summarised as:

- A concise characterisation of bioaerosol emissions is difficult due to the highly variable nature of bioaerosols and limitations of monitoring techniques
- Dose-response relationships have not been characterised and may not be possible due to the variation in the population
- Exposure-response relationships have only been described for a few agents within a typical bioaerosol
- Theoretical models used to model exposures are hindered by a number of key limitations, including variability in the source-term, particles not exhibiting gaseous behaviour due to aggregation and the reduction in viability of micro-organisms over distance and time.

For a new facility, bioaerosol data from monitoring of operational activities is not available. This combined with uncertainties in the interpretation of the data mean that a quantitative risk assessment on a new facility is not possible. Therefore a tailored qualitative assessment is required, incorporating site specific data to apply the general risk control measures on a site specific basis.

5.1 Conceptual Model

The development of a conceptual model helps to gain a clear picture of the site and its interactions with its environment. The development of a conceptual model aids the stages of the risk assessment process: hazard identification, identification of consequences, magnitude of consequences, probability of consequences and the significance of the risk.

Table 6: Conceptual model for exposure to bioaerosols from the Llantrisant Recycling Centre Facility.

Source	Hazards	Outcome	Transport Mechanism	Pathway	Medium of exposure	Receptor
Composting activities at Llantrisant Recycling Centre Ltd.	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites)	Chronic Respiratory disease/condition	Airborne micro-organisms.	Inhalation	Air	Humans
		Acute Respiratory disease/condition	Airborne micro-organisms.	Inhalation	Air	
		Intestinal illnesses.	Deposition of airborne micro-organisms.	Ingestion	Air and deposition	

Based on DETR, 2000

Irritation of mucus membranes from inhalation of bioaerosols has been considered under Acute Respiratory Disease/Illness outcomes for the Assessment.

Exposure to bioaerosols from absorption through the eye is considered to be very low and so has not been included in the Assessment.

5.2 Identification of Consequences

In order to compile the risk assessment, the level of consequences must be defined. The table below (Table 7) details the severity criteria used in the assessment.

Table 7: Identification of Consequences - Severity

Severity	Description of Consequences
High	Severe consequences, evidence that exposure may result in serious damage.
Medium	Significant consequences, evidence that exposure may result in damage that is not severe and is reversible.
Low	Minor consequences, damage not apparent, reversible adverse changes possible.
Very Low	Negligible consequences, no evidence for adverse changes.

Based on Drew et al, 2009

5.3 Probability of exposure

In order to compile the risk assessment, the probability of exposure must be defined. The table below (Table 8) details the probability criteria used in the assessment.

Table 8: Probability of Exposure - Probability

Probability	Description of Probability
High	Exposure is probable, direct exposure likely with no/few barriers between source and receptor
Medium	Exposure is fairly probable, barriers less controllable
Low	Exposure unlikely, barriers exist to mitigate
Very Low	Exposure very unlikely, effective and multiple barriers

Based on Drew et al, 2009

5.4 Magnitude of the risk

In order to compile the risk assessment, the magnitude of the risk must be defined. The figure below (Figure 7) details the criteria used to combine the severity of the risk and probability of exposure in the assessment.

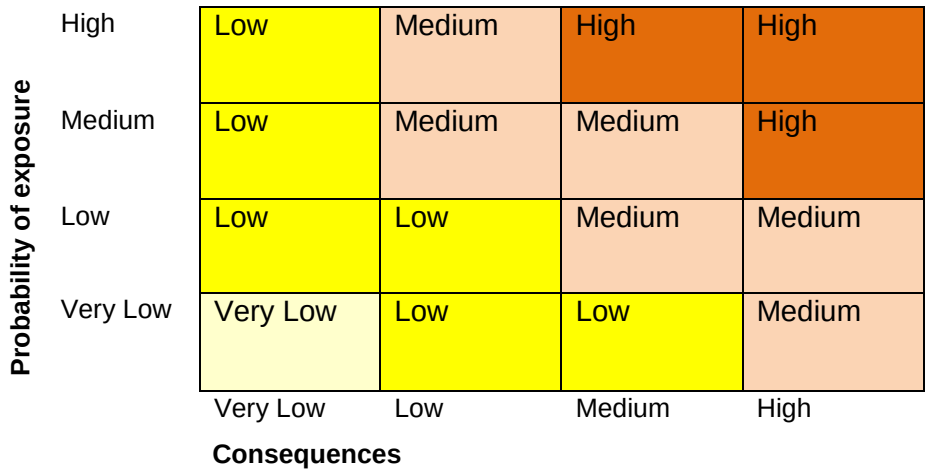


Figure 7: Magnitude of the Risk

5.5 Qualitative Risk Assessment

The Qualitative Risk Assessment structure used is based on the Environment Agency's generic risk assessment format for standard rules permits.

As the site is not currently operating as a green waste compost facility, site specific bioaerosol data under operating conditions is not available. As site specific data is not available, the assessment has been based on the findings of research that found that in the majority of cases bioaerosol concentrations returned to background levels within 250m of a green waste composting facility (Millner, 1994; Wheeler et al, 2001; Swan et al, 2003, EA, 2008).

Due to the close proximity of receptors to the facility, risk management and risk control measures have been proposed for operation of the facility. The risk management and control measures indicated in the tabulated risk assessment below, should be in addition to risk control measures contained within the Site Management Plan. General risk control measures are summarised in the following Section – 7.0 Recommendations.

Assumptions in the Qualitative Risk Assessment

Irritation of mucus membranes from inhalation of bioaerosols has been considered under Acute Respiratory Disease/Illness outcomes for the Assessment.

Intestinal illnesses have been omitted from the SSBRA Risk Assessment table. The risk associated with intestinal illnesses for receptors resulting from exposure to bioaerosols is extremely small. Intestinal illnesses may be relevant if receptors come in to contact with the waste but this is outside the remit of this assessment. The risk to waste workers following contact with the waste would be covered by Health & Safety legislation.

Assumed Control Measures

The following tailored generic Risk Assessments have been compiled with the following risk control measures adopted and enforced during the operation of composting activities:

- Only one composting activity that involves vigorous agitation, i.e. shredding, turning or screening of biodegradable waste should be undertaken at any time.

This may be reviewed where bioaerosol monitoring data illustrates that emissions from shredding, turning or screening activities are routinely well below acceptable levels recommended by the Environment Agency, i.e. below 1000 cfu/m3 for mesophilic bacteria, 500 cfu/m3 for the fungi *Aspergillus fumigatus* and 300 cfu/m3 for gram negative bacteria, at full capacity.

- Activities that agitate waste, i.e. shredding, turning and screening, should not be carried out when the wind blows from north westerly to north easterly directions, i.e. NW, NNW, N, NNE, NE. This may be reviewed if sufficient evidence suggests that bioaerosol concentrations downwind of the facility at a distance equivalent as that to the nearest receptor are within acceptable levels proposed by the Environment Agency/Natural Resources Wales. The installation of a wind sock in a prominent location has been recommended, as a visual aid if wind conditions change.

- All shredding, turning and screening activities should only be carried out in the designated composting area, outlined in the site layout plan, Figure 4.

- The maximum number of windrows present on the site will be 4, with maximum dimensions of 45m x 4m x 2.5m (LxWxH).

- The planted landscaping and tree screen on the south east boundary of the composting pad should be retained.

- An aggregate filled gabion and earth bund should be constructed on the south west boundary of the composting area, bordering the settlement pond, as indicated in planning drawings 697-200-E and 697-212-A.

The assumed control measures above should be in addition to controls recommended by the Environment Agency's Technical Guidance on Composting Operations (EA, 2001) and are to include:

- The moisture content within all stages of the composting process should be monitored to avoid the waste and materials drying out and potentially forming dusts.
- The formation or turning of windrows or piles should be avoided if possible on windy days. Screening and shredding should also be undertaken when wind speeds are calm or wind direction is away from sensitive receptors.

- Site surfaces such as roads and tracks and the piles or windrows themselves should be regularly dampened down and/or regularly swept to suppress dust.
- Plant and machinery should be well maintained to avoid dust generation. The use of enclosures for screens and hoppers can be useful.
- Physical barriers such as mounds or walls can prevent dust leaving a site. Site construction and specific landscaping techniques can contain dusts that are generated on site.
- Drop heights should be minimised.
- Vehicle speeds limits should be strictly observed and enforced.

Site management should be undertaken in line with the Organics Recycling Group's, The Compost Industry Code of Practice (published as Composting Association) (Composting Association, 2005).

Bracketed numbers in the table below refer to receptor references designated in Table 3, pages 25 & 26.

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Table 9: - Site Specific Bioaerosol Risk Assessment

Chronic respiratory disease/condition from waste agitation.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Footpath/ Bridleway within 250m. **Receptor:** Public footpath (2, 7). Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Very Low	Low	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly direction (2). Shredding, turning and screening activities not carried out when prevailing wind is in a north easterly direction (6).	Very Low
Footpath/ Bridleway 250m – 500m. **Receptor:** Public footpath (15).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Chronic respiratory disease/condition.	Air transport then inhalation.	Very Low	Very Low	Very Low	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Very Low	Low	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north easterly direction (6).	Very Low
Minor public highway 250m – 500m **Receptor:** Llantrisant Business Park access road (14), Heol y Sarn (18)	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Very Low	Low	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly direction (14). Shredding, turning and screening activities not carried out when prevailing wind is in north easterly direction (18).	Very Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Residential - within 250m **Receptor:** Glanmychydd -Fach (4)	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Screening effect of building and bund.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north easterly direction.	Low
Residential - 250m – 500m. **Receptor:** Rhiw Felin Fach Farm (13), Tal-y-fedw Newydd (17).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Healthcare - 250m – 500m **Receptor:** Llantrisant Dialysis Centre.	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Greater than 250m, therefore lies outside limit of significant influence of the site. Emissions from static windrows only, due to control measures. Screening effect of woodland. Patients - Potentially susceptible population but short term exposure duration. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly direction.	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Commercial/ Industrial - within 250m **Receptor:** Llantrisant Community Recycling Centre (1), Universal Engineering (3), Country Timber (5), Royal Mint (8), GeesinkNorba Ltd (9), Potting Shed (10), Tom Pritchard Contractors (11).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Emissions from static windrows only, due to control measures. Screening effect of building and bund / woodland. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly to north easterly direction.	Low
Commercial/ Industrial - 250m – 500m. **Receptor:** Rhiw Felin agricultural buildings (16).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Low	Low	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Emissions from static windrows only, due to control measures. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly to north easterly direction.	Very Low

Acute respiratory disease/condition from waste agitation.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Footpath/ Bridleway within 250m. **Receptor:** Public footpath (2, 7). Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport then inhalation.	Medium	Medium	Medium	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly direction (2). Shredding, turning and screening activities not carried out when prevailing wind is in a north easterly direction (6).	Low
Footpath/ Bridleway 250m – 500m. **Receptor:** Public footpath (15).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport then inhalation.	Medium	Medium	Medium	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north easterly direction (6).	Low
Minor public highway 250m – 500m **Receptor:** Llantrisant Business Park access road (14), Heol y Sarn (18)	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly direction (14). Shredding, turning and screening activities not carried out when prevailing wind is in north easterly direction (18).	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Residential - within 250m **Receptor:** Glanmychydd -Fach (4)	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport then inhalation.	Medium	Medium	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Screening effect of building and bund.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north easterly direction.	Low
Residential - 250m – 500m. **Receptor:** Rhiw Felin Fach Farm (13), Tal-y-fedw Newydd (17).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low
Healthcare - 250m – 500m **Receptor:** Llantrisant Dialysis Centre.	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Greater than 250m, therefore lies outside limit of significant influence of the site. Emissions from static windrows only, due to control measures. Screening effect of woodland. Patients - Potentially susceptible population but short term exposure duration. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly direction.	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Commercial/ Industrial - within 250m **Receptor:** Llantrisant Community Recycling Centre (1), Universal Engineering (3), Country Timber (5), Royal Mint (8), GeesinkNorba Ltd (9), Potting Shed (10), Tom Pritchard Contractors (11).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport then inhalation.	Medium	Medium	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Emissions from static windrows only, due to control measures. Screening effect of building and bund woodland. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly to north easterly direction.	Low
Commercial/ Industrial - 250m – 500m. **Receptor:** Rhiw Felin agricultural buildings (16).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Emissions from static windrows only, due to control measures. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly to north easterly direction.	Low

Chronic respiratory disease/condition from operation of the picking station.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Footpath/ Bridleway within 250m. **Receptor:** Public footpath (2, 7). Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Very Low	Low	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Footpath/ Bridleway 250m – 500m. **Receptor:** Public footpath (15).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Chronic respiratory disease/condition.	Air transport then inhalation.	Very Low	Very Low	Very Low	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Very Low	Low	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Minor public highway 250m – 500m **Receptor:** Llantrisant Business Park access road (14), Heol y Sarn (18)	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Very Low	Low	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Residential - within 250m **Receptor:** Glanmychydd -Fach (4)	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Screening effect of building and bund.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north easterly direction.	Very Low
Residential - 250m – 500m. **Receptor:** Rhiw Felin Fach Farm (13), Tal-y-fedw Newydd (17).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Infrequent and short duration of activity. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Healthcare - 250m – 500m **Receptor:** Llantrisant Dialysis Centre.	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Greater than 250m, therefore lies outside limit of significant influence of the site. Infrequent and short duration of activity. Screening effect of woodland. Patients - Potentially susceptible population but short term exposure duration. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Commercial/ Industrial - within 250m **Receptor:** Llantrisant Community Recycling Centre (1), Universal Engineering (3), Country Timber (5), Royal Mint (8), GeesinkNorba Ltd (9), Potting Shed (10), Tom Pritchard Contractors (11).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Infrequent and short duration of activity. Screening effect of building and bund / woodland. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly to north easterly direction.	Very Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Commercial/ Industrial - 250m – 500m. **Receptor:** Rhiw Felin agricultural buildings (16).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Low	Low	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Infrequent and short duration of activity. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Acute respiratory disease/condition from operation of the picking station.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Footpath/ Bridleway within 250m. **Receptor:** Public footpath (2, 7). Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low
Footpath/ Bridleway 250m – 500m. **Receptor:** Public footpath (15).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low
Minor public highway 250m – 500m **Receptor:** Llantrisant Business Park access road (14), Heol y Sarn (18)	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low
Residential - within 250m **Receptor:** Glanmychydd -Fach (4)	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Screening effect of building and bund.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low
Residential - 250m – 500m. **Receptor:** Rhiw Felin Fach Farm (13), Tal-y-fedw Newydd (17).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Healthcare - 250m – 500m **Receptor:** Llantrisant Dialysis Centre.	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Greater than 250m, therefore lies outside limit of significant influence of the site. Screening effect of woodland. Patients - Potentially susceptible population but short term exposure duration. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low
Commercial/ Industrial - within 250m **Receptor:** Llantrisant Community Recycling Centre (1), Universal Engineering (3), Country Timber (5), Royal Mint (8), GeesinkNorba Ltd (9), Potting Shed (10), Tom Pritchard Contractors (11).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Screening effect of building and bund woodland. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Commercial/ Industrial - 250m – 500m. **Receptor:** Rhiw Felin agricultural buildings (16).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from passive windrows and hand sorting.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Emissions from static windrows only, due to control measures. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low

Chronic respiratory disease/condition from passive windrows and stockpiles.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Footpath/ Bridleway within 250m. **Receptor:** Public footpath (2, 7). Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Chronic respiratory disease/condition.	Air transport then inhalation.	Very Low	Low	Low	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly direction (2). Shredding, turning and screening activities not carried out when prevailing wind is in a north easterly direction (6).	Very Low
Footpath/ Bridleway 250m – 500m. **Receptor:** Public footpath (15).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Chronic respiratory disease/condition.	Air transport then inhalation.	Very Low	Low	Low	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Chronic respiratory disease/condition.	Air transport then inhalation.	Very Low	Low	Low	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north easterly direction (6).	Very Low
Minor public highway 250m – 500m **Receptor:** Llantrisant Business Park access road (14), Heol y Sarn (18)	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Chronic respiratory disease/condition.	Air transport then inhalation.	Very Low	Low	Low	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly direction (14). Shredding, turning and screening activities not carried out when prevailing wind is in north easterly direction (18).	Very Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Residential - within 250m **Receptor:** Glanmychydd -Fach (4)	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Screening effect of building and bund.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north easterly direction.	Low
Residential - 250m – 500m. **Receptor:** Rhiw Felin Fach Farm (13), Tal-y-fedw Newydd (17).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Healthcare - 250m – 500m **Receptor:** Llantrisant Dialysis Centre.	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Greater than 250m, therefore lies outside limit of significant influence of the site. Emissions from static windrows only, due to control measures. Screening effect of woodland. Patients - Potentially susceptible population but short term exposure duration. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly direction.	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Commercial/ Industrial - within 250m **Receptor:** Llantrisant Community Recycling Centre (1), Universal Engineering (3), Country Timber (5), Royal Mint (8), GeesinkNorba Ltd (9), Potting Shed (10), Tom Pritchard Contractors (11).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Emissions from static windrows only, due to control measures. Screening effect of building and bund woodland. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly to north easterly direction.	Low
Commercial/ Industrial - 250m – 500m. **Receptor:** Rhiw Felin agricultural buildings (16).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Low	Low	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Emissions from static windrows only, due to control measures. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Shredding, turning and screening activities not carried out when prevailing wind is in a north westerly to north easterly direction.	Very Low

Acute respiratory disease/condition from passive windrows and stockpiles.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Footpath/ Bridleway within 250m. **Receptor:** Public footpath (2, 7). Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Footpath/ Bridleway 250m – 500m. **Receptor:** Public footpath (15).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Minor public highway within 250m. **Receptor:** Pantybrad Lane (6).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. Close proximity but short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Minor public highway 250m – 500m **Receptor:** Llantrisant Business Park access road (14), Heol y Sarn (18)	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Residential - within 250m **Receptor:** Glanmychydd -Fach (4)	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Screening effect of building and bund.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Residential - 250m – 500m. **Receptor:** Rhiw Felin Fach Farm (13), Tal-y-fedw Newydd (17).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Short transient duration of exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Healthcare - 250m – 500m **Receptor:** Llantrisant Dialysis Centre.	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Greater than 250m, therefore lies outside limit of significant influence of the site. Screening effect of woodland. Patients - Potentially susceptible population but short term exposure duration. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Commercial/ Industrial - within 250m **Receptor:** Llantrisant Community Recycling Centre (1), Universal Engineering (3), Country Timber (5), Royal Mint (8), GeesinkNorba Ltd (9), Potting Shed (10), Tom Pritchard Contractors (11).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Close proximity to the working area. Infrequent and short duration of activity. Screening effect of building and bund woodland. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low
Commercial/ Industrial - 250m – 500m. **Receptor:** Rhiw Felin agricultural buildings (16).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and settlement pond.	Acute respiratory disease/condition.	Air transport then inhalation.	Low	Medium	Medium	Volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence of the site. Workplace – exposure during working shift only.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Chronic respiratory disease/condition from fugitive green waste and final product on concrete yard and hard standing areas.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Commercial/ Industrial - within 250m **Receptor:** Llantrisant Community Recycling Centre (1).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) from fugitive green waste and final product on highways, concrete yards and hard standing.	Chronic respiratory disease/condition.	Air transport and inhalation	Very Low	Very Low	Very Low	Very small amounts of material, short exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Residential - within 250m **Receptor:** Glanmychydd -fach (4).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) from fugitive green waste and final product on highways, concrete yards and hard standing.	Chronic respiratory disease/condition.	Air transport and inhalation	Very Low	Very Low	Very Low	Very small amounts of material, short exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Acute respiratory disease/condition from fugitive green waste and final product on concrete yards and hard standings.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Commercial/ Industrial - within 250m **Receptor:** Llantrisant Community Recycling Centre (1).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) from fugitive green waste and final product on highways, concrete yards and hard standing.	Acute respiratory disease/condition.	Air transport and inhalation	Very Low	Very Low	Very Low	Very small amounts of material, short exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Residential - within 250m **Receptor:** Glanmychydd -fach (4).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) from fugitive green waste and final product on highways, concrete yards and hard standing.	Acute respiratory disease/condition.	Air transport and inhalation	Very Low	Very Low	Very Low	Very small amounts of material, short exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Chronic respiratory disease/condition from vehicles on weigh bridge and vehicles using site.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Commercial/ Industrial - within 250m **Receptor:** Llantrisant Community Recycling Centre (1).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) from vehicles using site.	Chronic respiratory disease/condition.	Air transport and inhalation	Very Low	Very Low	Very Low	Very short, low level exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Residential - within 250m **Receptor:** Glanmychydd -fach (4).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) from vehicles using site.	Chronic respiratory disease/condition.	Air transport and inhalation	Very Low	Very Low	Very Low	Very short, low level exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Acute respiratory disease/condition from vehicles on weigh bridge and vehicles using site.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Commercial/ Industrial - within 250m **Receptor:** Llantrisant Community Recycling Centre (1).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) from vehicles using site.	Acute respiratory disease/condition.	Air transport and inhalation	Very Low	Very Low	Very Low	Very short, low level exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Residential - within 250m **Receptor:** Glanmychydd -fach (4).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) from vehicles using site.	Acute respiratory disease/condition.	Air transport and inhalation	Very Low	Very Low	Very Low	Very short, low level exposure.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

6.0 Conclusions

The Centre for Health Safety and Environment at the Cardiff Metropolitan University was requested by Llantrisant Recycling Centre Limited to undertake a Site Specific Bioaerosol Risk Assessment for their green waste composting activities.

The assessment undertaken uses the principles of a staged risk assessment and is in line with current guidance published by the Environment Agency and Department for Food and Rural Affairs.

As the site is not currently operating as a green waste compost facility, site specific bioaerosol data under operating conditions is not available. As site specific data is not available, the assessment has been based on the findings of research that found that in the majority of cases bioaerosol concentrations returned to background levels within 250m of a green waste composting facility (Millner, 1994; Wheeler et al, 2001; Swan et al, 2003, EA, 2008).

Due to the proximity of receptors within 250m of the facility, control measures must be adopted in order to ensure that concentrations of bioaerosols at those receptors can be maintained below appropriate levels proposed by the EA/NRW. This takes the form of a presumption against activities that involve the agitation of waste (i.e. shredding, turning and screening) when the wind is from the north west to north east. It is recommended that a suitable weather station, with terminal and data logging facility, be established at Llantrisant Recycling Centre Limited. The weather station terminal should be consulted prior to commencing agitation of waste. It is also recommended that a wind sock be erected in a prominent location on the bund around the perimeter of the site, to act as a visual aid if wind conditions change. Wind Rose data from RAF St Athan, 16km (approx. 10 miles) from the facility, records wind cumulatively from directions between north west and north east on approximately 11% of the time between 2000 and 2010 (currently available data). The low intensity of the forecast site activity suggests that this restriction on site operation will not affect the operation of the site adversely. Where site specific monitoring data can confirm that other control measures such as bunding and screening can be shown to control concentrations to below appropriate levels then an application to review the restriction of working may be possible.

The site activity required in order to process the volume of material proposed for the facility, i.e. up to 10,000 tonnes of green waste per annum, are forecast to be of low intensity. There should be no requirement to undertake more than one active composting activity, i.e. shredding, turning and screening, at any one time. Therefore it is proposed that only one composting activity that involves vigorous agitation, i.e. shredding, turning or screening of biodegradable waste should be undertaken at any time.

The assessment determined that, with the implementation of effective risk control measures, the risk to receptors from bioaerosols at Llantrisant Recycling Centre Ltd are deemed to be low.

7.0 Recommendations

In order to control and manage the liberation of bioaerosols from the site, it is recommended that practical risk mitigation measures are continued to be employed at the site, particularly during processes such as turning, shredding and screening. The Environment Agency Technical Guidance on Composting Operations (October 2001 – Draft for External Consultation) (EA, 2001) recommends the following;

- The moisture content within all stages of the composting process should be monitored to avoid the waste and materials drying out and potentially forming dusts.
- The formation or turning of windrows or piles should be avoided if possible on windy days. Screening and shredding should also be undertaken when wind speeds are calm or wind direction is away from sensitive receptors.
- Site surfaces such as roads and tracks and the piles or windrows themselves should be regularly dampened down and/or regularly swept to suppress dust.
- Plant and machinery should be well maintained to avoid dust generation. The use of enclosures for screens and hoppers can be useful.
- Physical barriers such as mounds or walls can prevent dust leaving a site. Site construction and specific landscaping techniques can contain dusts that are generated on site.
- Drop heights should be minimised.
- Vehicle speeds limits should be strictly observed and enforced.

In addition to the recommendations in the Technical Guidance note, it is recommended that:

- Only one composting activity that involves vigorous agitation, i.e. shredding, turning or screening of biodegradable waste should be undertaken at any time. This may be reviewed where bioaerosol monitoring data illustrates that emissions from shredding, turning or screening activities are routinely below acceptable levels recommended by the Environment Agency, i.e. below 1000 cfu/m3 for mesophilic bacteria, 500 cfu/m3 for the fungi *Aspergillus fumigatus* and 300 cfu/m3 for gram negative bacteria.
- Shredding green waste material and placing it in windrows should be carried out within as short as operationally feasible time frame from receipt.
- Continue use of the purpose built shredder and screen for green waste and replace with similar when the equipment reaches the end of its serviceable life.
- Export finished compost product off site as soon as possible alternatively bag ready for sale/transport.

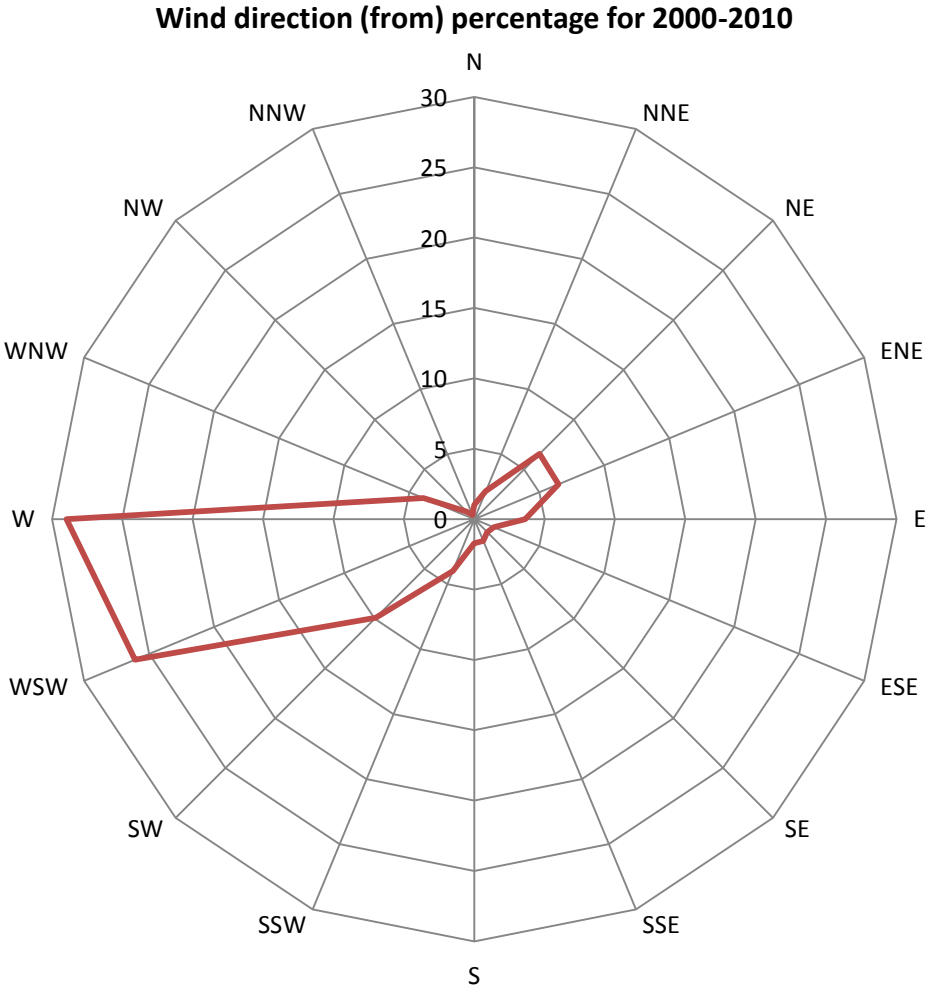
The recommendations made, above, should be incorporated in to the operation of the site. In addition, specific risk management measures developed from the SSBRA should be used to minimise the generation of bioaerosols and the transport of bioaerosols to receptors. These are:

- Activities that agitate waste, i.e. shredding, turning and screening, should not be carried out when the wind blows from north westerly to north easterly directions.
- All shredding, turning and screening activities should only be carried out in the designated composting area, outlined in the site layout plan
- No more than four windrows measuring a maximum of 45m x 4m x 2.5m should be present at the facility.

It is recommended that a bio-aerosol monitoring program is introduced at quarterly intervals in the first year, which could then be reduced in frequency to twice a year thereafter if the monitoring does not highlight any issues.

Appendices

Appendix 1 – Graphical representation of summary wind data


Wind direction (from) percentage for 2000-2010
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
30
25
20
15
10
5
0

Appendix 2 – Background Bioaerosol Monitoring Report – February 2017

Bioaerosol Monitoring Report – February 2017 included under separate cover.

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