

Maindiff Court Farm

**Llantilio Pertholey
Abergavenny
NP7 8AY**

Site Specific Bioaerosol Risk Assessment

May 2014



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Metropolitan
University

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Summary

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

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 and the preparation of Site Specific Bioaerosol Risk Assessments. The analysis and report 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.

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

Data from bioaerosol monitoring carried out at Maindiff Court Farm for the previous year has been used to inform the development of the Site Specific Bioaerosol Risk Assessment. Data from four rounds of monitoring, April, July & November 2013 and March 2014, were used to provide data for seasonal variation. The seasonal bioaerosol assessments suggest that bioaerosol levels at the closest sensitive receptor, Maindiff Court cottages 65m from the working area, can be maintained below appropriate levels suggested by the Environment Agency, at the current working capacity of 6,000 tonnes per annum. The data also suggest that bioaerosol levels return to levels of the same order of magnitude to those witnessed at background levels within 250m of the working area.

As the proposal is to increase the licensed capacity of the site from 6,000 tonnes per annum to 15,000 tonnes per annum, additional control measures are recommended to ensure that appropriate levels proposed by the Environment Agency can be maintained at receptors. The proposal also includes the creation of a new hard standing area to the east of the existing working area. Working restrictions have been suggested to reduce the potential influence of this area on receptors. Proposed control measures are detailed in section 7.0 – Recommendations, page 62.

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

1.0 Introduction

At the request of Maindiff Court Farm, the Centre for Health, Safety and Environment (CHSE) at Cardiff Metropolitan University have undertaken a Site Specific Bioaerosol Risk Assessment (SSBRA) at the farm. The SSBRA has been undertaken to accompany the Environmental Permit variation application, submitted by Enviresource on behalf of Mr Andrew Lewis.

Composting of green waste at the site is currently carried out under Environment Permit: BP3392LC/A001, which allows the composting of up to 6,000 tonnes per annum. The permit variation is to amend the working area and increase the capacity of the composting operation from 6,000 tonnes to 15,000 tonnes per annum.

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 SSBRAs 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) 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 (DETR, 2000).

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 three tiered approach to risk assessment of risk screening; generic quantitative risk assessment and a detailed quantitative risk assessment (see Figure 1). Where the generic quantitative risk assessment indicates that further refined techniques are required then a tailored quantitative risk assessment should be carried out. The tiered approach to risk assessment is based on the 'source-pathway-receptor' concept. An identifiable or plausible relationship must exist between the three components for there to be a risk (Sykes, 2007).

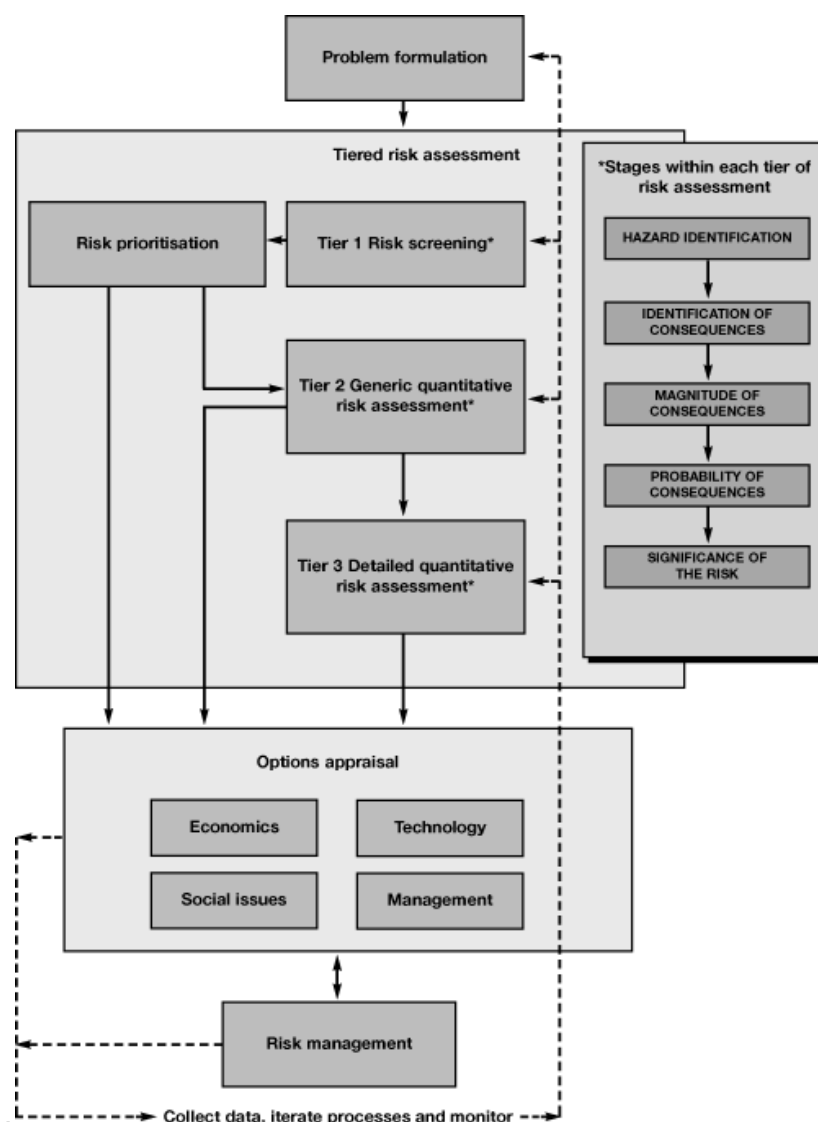


Figure 1: Tiered approach to environmental risk assessment and management [Source: DETR, 2000]

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 each tier of an environmental risk assessment should follow a process 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, 2000).

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 Definition

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/m³ 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/m³ for an agricultural area, 0 to 560 cfu/m³ at a coastal area and 100 to 4000 cfu/m³ 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/m³ (Lacey, 1997; Wheeler *et al.*, 2001; Recer *et al.*, 2001). In contrast, static compost windrows typically emit bioaerosols at rates of 10^3 cfu/m³ 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
<i>Aspergillus fumigatus</i>	500
Gram-negative Bacteria	300

3.0 Site Details and Process

3.1 Site Description

The Maindiff Court Farm lies on the east side of the A465 trunk road, near Abergavenny in Monmouthshire. The farm is a mixed farm, i.e. arable and livestock that has diversified by developing a green waste composting operation. The land surrounding the farm buildings and composting area are used for grazing sheep, cattle and horses.

Current

Green waste composting is currently undertaken in an in-building composting area, housed in farm buildings on the east side of the farm. In addition, adjacent to the buildings, an open concrete pad area is used for delivery and short-term storage of green waste and for maturation of the output of the in-building bays. The green waste composted at the site comes from civic amenity sites and individual commercial deliveries, i.e. tree surgeon and landscape gardening waste.

The site currently operates under permit number EPR/BP3392LC/A001, with a working area of approximately 2500 m² and a permitted capacity for the composting of green waste up to 6,000 tonnes per annum.

The current composting area is bordered by agricultural buildings to the east and west and a bund, approximately 2.5m in height, to the south. To the north, the ground slopes upwards from the concrete area to a hedgerow approximately 1.7m high.

Proposed

The application for a permit variation would increase the composting area, by the construction of an additional hard standing, approximately 2500m² in area, located to the east of the existing working area. The variation includes an increase in the capacity of green waste composted to a maximum of 15,000 tonnes per annum. Copies of the plans accompanying the planning application for the development are contained figures 2 and 3 below.

The proposed additional hard standing area will be constructed up to the existing ground level. The existing hedgerow along the north side of the proposed working area will be retained and grown and maintained to a height of 2m. Similarly, the

existing bund to the south will be retained. A new bund will be created along the eastern boundary of the new working area.

3.2 Site Layout

Activities at the Maindiff Court Farm composting facility are currently carried out in two areas:

- an in-building composting area. Windrows are housed within bays of an agricultural building. After shredding, material is formed in to piles within bays. The East facing side of the building is open.
- an open concrete pad area, used for delivery and short-term storage of green waste and for maturation of the output of the in-building bays.

Proposed Operation

Delivery of material will continue to be made to the existing concrete yard area. Deposited green waste material will be shredded and formed in to windrows on the existing concrete yard. The initial phases of composting, i.e. before screening, will no longer be carried out within the bays of the agricultural buildings. Windrows will be turned once before being screened. Following screening, oversize material (>40mm) will be put back in to the system, while screened material (<40mm) will be transported to the new hard standing area, using a tractor and trailer and formed in to maturation windrows. All shredding and screening work will continue to take place on the existing concrete yard area.

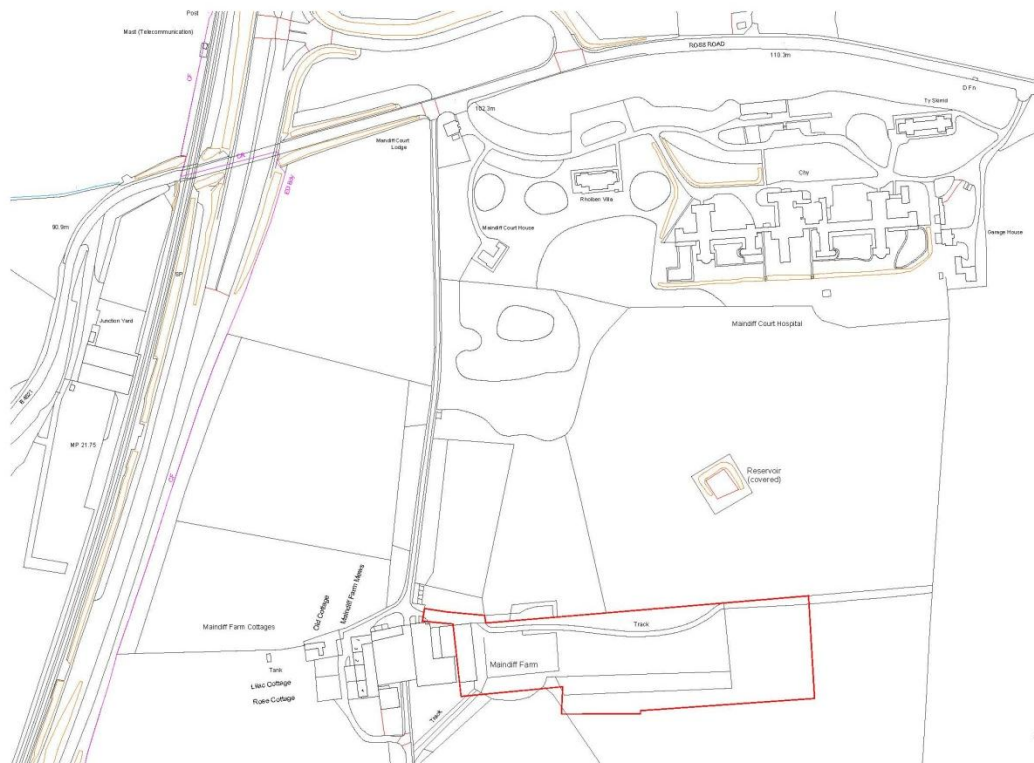
Material in maturation windrows will be left for approximately 2½ to 3 months and turned every three weeks. The new hard standing will house up to four windrows with a maximum height of 2.5m.

A leachate lagoon will be constructed south of the recently constructed agricultural building to store run-off from the new hard standing area. Leachate will be removed from the lagoon using an agricultural slurry tanker and spread on the surrounding fields. The frequency of the removal of leachate from the lagoon will vary on the rate of deposition but will not exceed once per week.

Figure 2 – Proposed location plan.

The scaling of this drawing cannot be assured

Revision	Date	Drm	Clkd
A	22.04.14	NG	JTo
B	07.05.14	NG	JTo



KEY
— Site Boundary

Project
Maindiff Farm
Abergavenny
 Drawing Title
Site Location Plan

Date	Scale	Drawn by	Check by
08.04.14	1:2500@A3	NG	JTo
Project No	Drawing No	Revision	
23206	PL-01	B	

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3.3 Process Stages

Stage 1 - Green waste delivery and storage:

Green waste delivered to the site is deposited and stored in a temporary green waste storage area on the existing concrete working area. Material is stored in the purpose built bay, formed by concrete partitioning until sufficient material has been deposited to be shredded.

There are currently 2 – 3 deliveries of green waste per day. It is forecast that at full capacity, between 6 and 8 deliveries of green waste would be made per day.

Stage 2 - Shredding

Shredding is undertaken on the existing composting pad using a Jenz 660 high speed shredder. The shredder is located adjacent to the green waste delivery area to minimise transport. Once shredded, material is currently transported to windrows in the bays of the adjacent farm building. When the new composting area is completed, material will be formed in to windrows on the existing concrete pad area.

At present, intervals between shredding are variable and dependant on when material is available but is undertaken approximately once to twice a week. Shredding is carried out in sessions approximately 2 hours in length. It is forecast that at full capacity, shredding would take place on two occasions per week, lasting approximately 4hrs per session.

Stage 3 - Maturation and turning

Once shredded, material is currently formed in to windrows in the adjacent farm building. Material is left to compost in the buildings for between 6 and 8 days and is turned once during this period. Windrows are turned using a telehandler with bucket attached, progressively turning the bays. Turning windrows activity is carried out approximately on a weekly basis and lasts for approximately 2 hours per session.

When the new composting area is completed, material will continue to stay in windrows for between 6 and 8 days, being turned once in this period. However, the initial composting stage will be undertaken on the existing concrete yard area. Windrows will be no greater than 2.5m in height. It is forecast that at full capacity, turning would be carried out on two occasions each week, lasting approximately 3hrs per session.

Stage 4 - Screening

After the initial 'pasteurisation' phase, lasting between 6 and 8 days, windrows are screened. Screening takes place using a Neuenhauser star screen located on the existing concrete composting area. Finished product is moved to an adjacent stockpile, while oversized material is returned to the system for further composting. Screening is carried out approximately twice per month and lasts approximately 3 hours per session.

Once the new composting area is constructed, following screening, material for maturation will be transported to the new hard standing by tractor and trailer and formed in to windrows no greater than 2.5m in height. It is forecast that at full capacity, screening would take place once per week and last approximately 3 hours per session.

Stage 5 – Turning maturation windrows

Material remains in maturation windrows for between 2 ½ and 3 months, being turned every three week, with a minimum of three turns. Turning is carried out once a week and takes approximately 1hour per session. It is forecast that at full capacity, turning would take place once a week and take approximately 3 hours per session.

3.4 Surrounding Topography and land use

Maindiff Court Farm is a mixed farm to the east of Abergavenny. The site and surrounding land slopes gently from east to west, lying at approximately 100 m above Ordnance Datum (AOD). To the north, the site is bordered by a hedgerow, 1.5m in height. This hedgerow will be grown and maintained to a height of 2m when the additional hard standing area is constructed. The site is bordered on the south side by constructed soil bunding, ranging between 2m and 3m in height. To the east, the site is currently bordered by a hedgerow, which is to be replaced by bunding. To the west, the site is bordered by agricultural buildings which back on to the farm yard, farm house and residential cottages. An agricultural building, 8.5m in height, separates the two composting areas.

The land immediately surrounding the site is farmland, predominantly used for grazing livestock and animal feed crops. The grounds of Maindiff Court Hospital lie approximately 210m from the working area, to the north. The hospital buildings lie approximately 235m from the working area. To the east, the agricultural land is

interspersed with residential and recreational buildings and stands of trees. To the west lies the A465 trunk road, the Abergavenny to Hereford railway line and the town of Abergavenny. A detailed description of receptors in the vicinity of Maindiff Court Farm is given in Table 3.

3.5 Prevailing Wind

Annual meteorological data is not currently available for Maindiff Court Farm, therefore it is not possible to accurately produce wind rose data for the prevailing wind direction.

Meteorological data was recorded during the four bioaerosol monitoring visits to Maindiff Court Farm. The wind directions recorded throughout the monitoring periods has been summarised in the table below.

Table 2 – Summarised wind direction data during monitoring visits.

Wind Direction	Monitoring date			
	Apr-13	Jul-13	Nov-13	Mar-14
N	0%	10%	20%	0%
NNE	0%	16%	11%	0%
NE	0%	17%	1%	0%
ENE	0%	8%	0%	0%
E	0%	7%	0%	0%
ESE	1%	8%	0%	0%
SE	3%	4%	0%	0%
SSE	4%	0%	0%	0%
S	9%	1%	7%	0%
SSW	9%	7%	34%	0%
SW	19%	4%	0%	2%
WSW	22%	10%	0%	26%
W	23%	1%	1%	43%
WNW	10%	0%	1%	24%
NW	1%	3%	7%	6%
NNW	0%	3%	19%	0%

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

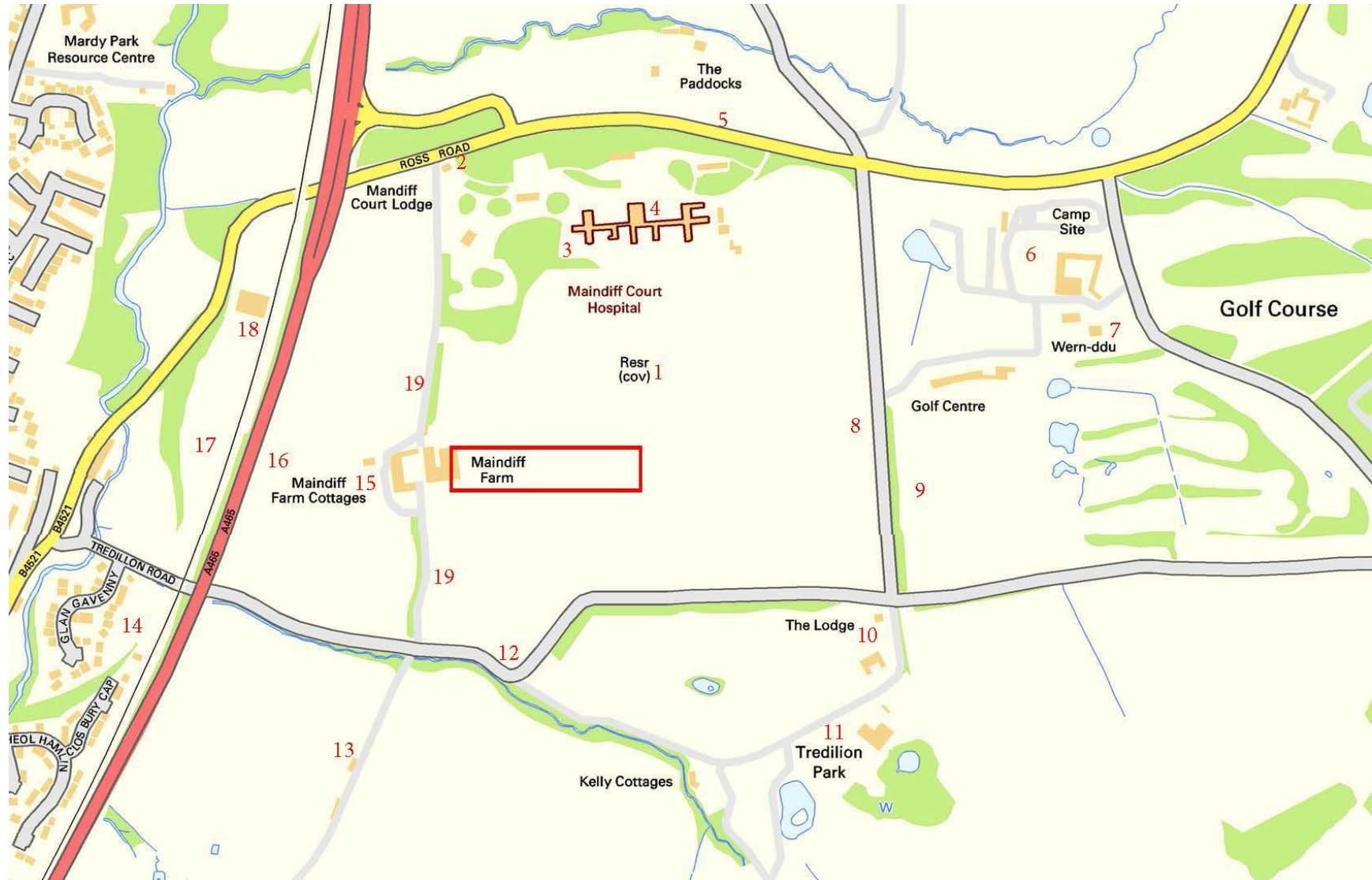
3.6 Receptors

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 Plan, Figure 4.

Figure 4: Nearest Receptor Plan



Contains Ordnance Survey data © Crown copyright and database right 2011

Table 3 – Receptors

Ref.	Receptor	Type	Single/Linear/Multiple	Distance	Direction	Pathway' topography
1	Covered Reservoir	Utility	Single	60m	N	Low bunding topped with hedge, open grazing land.
2	Maindiff Court Lodge	Residential	Single	330m	N	Hedgerow, open grazing land, woodland.
3	Maindiff Court Hospital grounds	Healthcare (Workplace/Residential)	Single	210m +	NNW - NNE	Low bunding topped with hedge, open grazing land.
4	Maindiff Court Hospital buildings	Healthcare (Workplace/Residential)	Multiple	235m +	N - NE	Low bunding topped with hedge, open grazing land, ornamental gardens, areas of tree screening.
5	Ross Road	Minor Highway	Linear - East/West	350m	N	Low bunding topped with hedge, open grazing land, ornamental gardens and tree screening.
6	Blossom Holiday Park	Workplace/Recreational	Multiple	500m	NE	Low bunding topped with hedge, open grazing land.
7	Wern Ddu	Residential	Single	550m	NE	Low bunding topped with hedge, open grazing land.
8	Unnamed Road	Minor Highway	Linear - North/South	340m	E	Low bunding topped with hedge, open grazing land, hedge and tree screening.
9	Wern Ddu Golf Club	Recreational/Workplace	Single	340m +	E	Low bunding topped with hedge, open grazing land, hedge and tree screening.

Table 3 (Continued)

Ref.	Receptor	Type	Single/Linear/Multiple	Distance	Direction	Pathway' topography
10	Tredilion Lodge	Residential	Single	450m	ESE	Low bunding topped with hedge/bunding, open grazing land, hedge and tree screen.
11	Tredilion Park	Residential	Multiple	500m +	SE	Bund, open grazing land, hedge and tree screen.
12	Tredilion Road	Minor Highway	Linear - East/West	250m +	S	Bund, open grazing land, hedge and tree screen.
13	Green Acres Farm	Workplace	Single	425m	SSW	Bund, open grazing land, hedge and tree screen.
14	Glan Gavenny	Residential	Multiple	325m	SW	Bund, open grazing land, hedge and tree screen, trunk road, railway line.
15	Maindiff Court Farm cottages	Residential	Multiple	60m	W	Agricultural building (approx. 6m high), open concrete yard/road bordered by hedgerow and trees.
16	A465	Trunk Road	Linear - North/South	250m +	W	Agricultural buildings, open grazing, tree screen.
17	Welsh Marches Line	Railway	Linear – North/South	260m +	W	Agricultural buildings, open grazing, trunk road, tree screen.
18	Abergavenny Sawmill	Workplace	Single	325m	NW	Agricultural buildings, open grazing, tree screen, trunk road, railway line, tree screen.
19	Access to Maindiff Court Farm & Cottages	Private road	Linear – North/South	30m +	NW - SW	Agricultural building (approx. 6m high), open concrete yard/hedgerow and trees.

Note:

The covered reservoir is owned by Maindiff Court Farm and is no longer in use. The covered reservoir would therefore not be a receptor.

The agricultural land within 250m of the working area, surrounding Maindiff Court Farm, is in the ownership of Maindiff Court Farm. Exposure to bioaerosols of workers and visitors to the farm fall within Health & Safety legislation and are outside the remit of this risk assessment.

A Site of Special Scientific Interest (SSSI), Cwm Mill Section, Maerdy SSSI, lies approximately 400m to the north west of Maindiff Court Farm. This SSSI has been designated for its geological value and would therefore not be a receptor.

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
Shredding green waste	Green waste shredding and formation of windrows	Weekly, approx. twice a week	4	High
Static windrows	'Pasteurisation' and maturation windrows	Daily	Constant	Low
Turning 'Pasteurisation' Windrows	Turning	Weekly, approx. twice a week	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	3	High
Compost product stockpiles	Screened material that has completed composting and maturation.	Daily	Constant	Low
Leachate Lagoon	Lagoon to store run-off from maturation hard standing.	Daily	Constant	Low
Leachate spreading	Leachate spread on adjacent fields using agricultural slurry tanker.	Weekly	1	High

N.B. – Frequency and duration details contained in Table 4, are based on forecasts of maximum frequency and duration at full capacity of 15,000 tonnes per annum. These forecasts are greater than current levels.

Agricultural activities

Animal and straw waste

At certain times, in particular during lambing or cold winter weather, sheep are housed in buildings around the farm. The bedding and animal waste produced may be a source of bioaerosol. Material is stockpiled before being transported off-site for disposal. Undisturbed stockpiles would be a low source of bioaerosol. Stockpiles are not disturbed at the same time as composting activities take place therefore they would not provide a significant addition to bioaerosol concentrations.

Stockpiled wood waste

Wood, used for the wood fuelled boiler at Maindiff Court Farm, is stockpiled close to the composting area. The wood stock pile does not contain 'green' material and the stockpile is kept well drained or covered. Bioaerosol emissions from the wood stockpile is considered to be insignificant.

Stockpiled fodder beet

Harvested fodder beet is stockpiled close to the composting area for short periods during winter months. Harvested beet may be a source of bioaerosols when disturbed, during delivery. However this source will be a short timescale. Bioaerosol emissions from undisturbed stockpiles is considered to be insignificant.

4.0 Tier 1 Risk Screening

The aim of the Tier 1 Risk Screening exercise is to provide a qualitative assessment to identify where a source-pathway-receptor relationship may exist and determine whether further Tiers of risk assessment are required. In order that the risk assessment is site specific, the risk screening must include sources and receptors identified during the Problem Definition stage.

Table 5 provides a qualitative analysis of bioaerosol sources and receptors at Maindiff Court Farm. The table demonstrates that several 'source-pathway-receptor' linkages exist and therefore a more detailed assessment of the risks is required. The risk arising from the 'source-pathway-receptor' linkages identified 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.

Consequently a Tier 2 Generic quantitative risk assessment, supported by site-specific bioaerosol monitoring data, has been undertaken to further characterise these risks in accordance with the current guidance.

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

Typical Receptor	Site Specific Bioaerosol Sources							
	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 Maindiff Court Farm. Exposure to bioaerosols of workers and visitors to the farm fall within Health & Safety legislation.

5.0 Tier 2 Generic Quantitative Risk Assessment

As the Risk Screening in the Tier 1 assessment indicated the presence of at least one 'source-pathway-receptor' linkage that could not be simply ranked and prioritised a Generic Quantitative Risk Assessment is required. The aim of the Tier 2 Generic Quantitative Risk Assessment is to provide sufficient generic information, so that the significance of the risk can be established and general risk control measures can be proposed (Pollard et al, 2000).

In complex cases a Tier 3 Detailed Quantitative Risk Assessment may be required to assess the significance of the risk fully. Inputs in to a Tier 3 assessment include a large amount of site specific data and assumptions (Pollard et al, 2000). In the case of a bioaerosol risk assessment, this would not be possible due to the limitations and knowledge gaps that exist with regard to bioaerosol exposure, as indicated in the Problem Definition (Section 2.0) but 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.

Due to uncertainties in the data required, a Tier 3 Risk Assessment is not possible in the case of bioaerosols. Therefore a tailored Tier 2 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 Generic assessment: 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 Maindiff Court Farm Composting Facility

Source	Hazards	Outcome	Transport Mechanism	Pathway	Medium of exposure	Receptor
Composting activities at Maindiff Court Farm.	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 5) details the criteria used to combine the severity of the risk and probability of exposure in the assessment.

Probability of exposure	High	Low	Medium	High	High
	Medium	Low	Medium	Medium	High
	Low	Low	Low	Medium	Medium
	Very Low	Very Low	Low	Low	Medium
		Very Low	Low	Medium	High
		Consequences			

Figure 5: Magnitude of the Risk

5.5 Tailored Generic Risk Assessment

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

Data from four seasonal bioaerosol monitoring exercises carried out at Maindiff Court Farm have been used to inform the preparation of the tailored generic risk assessment. The seasonal bioaerosol assessments suggest that bioaerosol levels at the closest sensitive receptor, Maindiff Court cottages 65m from the working area, can be maintained below appropriate levels suggested by the Environment Agency, at the present working capacity of 6,000 tonnes per annum.

The seasonal bioaerosol assessments suggest that bioaerosol levels return to levels of the same order of magnitude as background levels within 250m of the working area.

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 Generic 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 Generic 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 in an Easterly and Southerly direction.
- Shredding and screening activities should only be carried out on the existing concrete yard area. Agitation activities on the proposed hard standing area to the east of the current working area should be limited to the forming and turning of maturation windrows.
- The hedgerow on the northern boundary of the proposed hard standing area should be grown to and maintained to a height of 2m for the entire length of the working area.
- Constructed soil bunding to the south and east of the hard standing area should be constructed to a height of 2m above the level of the hard standing surface.
- Spreading of leachate on fields should not be undertaken in fields immediately upwind of the private driveway, Maindiff Court cottage or within the field adjacent to Maindiff Court Hospital, when those fields are upwind of the receptor. Leachate spreading should be undertaken when wind speeds are calm.

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 24 & 25

Table 9: - Tier 2 Generic 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
Private Driveway. Receptor: Private access road to Maindiff Court Farm and Cottages (19).	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 an Easterly direction.	Very Low
Minor public highway 250m – 500m Receptor: Ross Road (5), Un-named road (8), Tredillion Road (12). Main public highway 250m – 500m Receptor: A465 Trunk Road (16), Welsh Marches Line (17).	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 an Easterly direction (16 & 17). Shredding, turning and screening activities not carried out when prevailing wind is in an Southerly direction (5).	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: Maindiff Court Farm cottages (15).	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. Emissions from static windrows. Screening effect of buildings.	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 an Easterly direction.	Low
Healthcare - within 250m Receptor: Maindiff Court Hospital grounds and buildings (3 & 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. Medium proximity to the working area, towards outer limit of zone of significant influence of working area. Emissions from static windrows only, due to control measures. Screening effect of bunding and hedgerow. Patients - Potentially susceptible population but short to medium 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 an Southerly direction. Shredding and screening activities undertaken on concrete yard area only.	Low
Residential - 250m to 500m Receptor: Maindiff Court Lodge (2), Tredilion Lodge (10), Tredilion Park (11), Glan Gavenny (14).	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. From monitoring, outside the zone of significant influence of working area. Screening effect of bunding and trees.	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
Workplace/Recreational – 250m to 500m Receptor: Blossom Holiday Park (6), Wern Ddu Golf Club (9), Green Acres Farm outbuilding (13), Abergavenny Sawmill (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	Low	Low	Volume of material. From monitoring, outside the zone of significant influence of working area. Exposure during working hours/recreational use. Screening effect of bunding and trees.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low
Residential - 500m + Receptor: Wern Ddu (7), Tredilion Park (11).	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. From monitoring, outside the zone of significant influence of working area. Screening effect of bunding and trees.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	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
Private Driveway. Receptor: Private access road to Maindiff Court Farm and Cottages (19).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	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 an Easterly direction.	Low
Minor public highway 250m – 500m Receptor: Ross Road (5), Un-named road (8), Tredillion Road (12). Main public highway 250m – 500m Receptor: A465 Trunk Road (16), Welsh Marches Line (17).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	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 an Easterly direction (16 & 17). Shredding, turning and screening activities not carried out when prevailing wind is in an Southerly direction (5).	Low

Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Residential - within 250m Receptor: Maindiff Court Farm cottages (15).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Medium	Medium	Medium	Volume of material. Close proximity to the working area. Emissions from static windrows due to control measures. Screening effect of buildings.	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 an Easterly direction.	Low
Healthcare - within 250m Receptor: Maindiff Court Hospital grounds and buildings (3 & 4).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Medium	Medium	Medium	Volume of material. Medium proximity to the working area, towards outer limit of zone of significant influence of working area. Emissions from static windrows only, due to control measures. Screening effect of bunding and hedgerow. Patients - Potentially susceptible population but short to medium 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 an Southerly direction. Shredding and screening activities undertaken on concrete yard area only.	Low
Residential - 250m to 500m Receptor: Maindiff Court Lodge (2), Tredilion Lodge (10), Tredilion Park (11), Glan Gavenny (14).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Medium	Medium	Medium	Volume of material. From monitoring, outside the zone of significant influence of working area. Screening effect of bunding and trees.	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
Workplace/Recreational – 250m to 500m Receptor: Blossom Holiday Park (6), Wern Ddu Golf Club (9), Green Acres Farm outbuilding (13), Abergavenny Sawmill (18).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Medium	Medium	Medium	Volume of material. From monitoring, outside the zone of significant influence of working area. Exposure during working hours/recreational use. Screening effect of bunding and trees.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low
Residential - 500m + Receptor: Wern Ddu (7), Tredilion Park (11).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from agitation of waste (shredding, turning, screening).	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Low	Medium	Medium	Volume of material. From monitoring, outside the zone of significant influence of working area. Screening effect of bunding and trees.	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
Private Driveway. Receptor: Private access road to Maindiff Court Farm and Cottages (19).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Low	Low	Volume of material. Continuous but low level emission. 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 an Easterly direction.	Very Low
Minor public highway 250m – 500m Receptor: Ross Road (5), Un-named road (8), Tredillion Road (12). Main public highway 250m – 500m Receptor: A465 Trunk Road (16), Welsh Marches Line (17).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Chronic respiratory disease/condition.	Air transport then inhalation.	Very Low	Low	Very Low	Volume of material. Continuous but low level emission. 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 an Easterly direction (16 & 17). Shredding, turning and screening activities not carried out when prevailing wind is in an Southerly direction (5).	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: Maindiff Court Farm cottages (15).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Very Low	Low	Volume of material. Continuous but low level emission. Close proximity to the working area. Screening effect of buildings.	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 an Easterly direction.	Low
Healthcare - within 250m Receptor: Maindiff Court Hospital grounds and buildings (3 & 4).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Low	Low	Volume of material. Medium proximity to the working area, towards outer limit of zone of significant influence of working area. Continuous but low level emission. Screening effect of bunding and hedgerow. Patients - Potentially susceptible population but short to medium 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 an Southerly direction.	Low
Residential - 250m to 500m Receptor: Maindiff Court Lodge (2), Tredilion Lodge (10), Tredilion Park (11), Glan Gavenny (14).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Low	Low	Volume of material. Continuous but low level emission. From monitoring, outside the zone of significant influence of working area. Screening effect of bunding and trees.	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
Workplace/Recreational – 250m to 500m Receptor: Blossom Holiday Park (6), Wern Ddu Golf Club (9), Green Acres Farm outbuilding (13), Abergavenny Sawmill (18).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Low	Low	Volume of material. From monitoring, outside the zone of significant influence of working area. Exposure during working hours/recreational use. Screening effect of bunding and trees.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Residential - 500m + Receptor: Wern Ddu (7), Tredilion Park (11).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Chronic respiratory disease/condition.	Air transport then inhalation.	Very Low	Low	Low	Volume of material. From monitoring, outside the zone of significant influence of working area. Screening effect of bunding and trees.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	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
Private Driveway. Receptor: Private access road to Maindiff Court Farm and Cottages (19).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Low	Medium	Medium	Volume of material. Continuous but low level emission. 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: Ross Road (5), Un-named road (8), Tredilion Road (12). Main public highway 250m – 500m Receptor: A465 Trunk Road (16), Welsh Marches Line (17).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Low	Medium	Medium	Volume of material. Continuous but low level emission. 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
Residential - within 250m Receptor: Maindiff Court Farm cottages (15).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Low	Medium	Medium	Volume of material. Continuous but low level emission. Close proximity to the working area. Screening effect of buildings.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Low
Healthcare - within 250m Receptor: Maindiff Court Hospital grounds and buildings (3 & 4).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Low	Medium	Medium	Volume of material. Medium proximity to the working area, towards outer limit of zone of significant influence of working area. Continuous but low level emission. Screening effect of bunding and hedgerow. Patients - Potentially susceptible population but short to medium 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
Residential - 250m to 500m Receptor: Maindiff Court Lodge (2), Tredilion Lodge (10), Tredilion Park (11), Glan Gavenny (14).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Low	Low	Low	Volume of material. Continuous but low level emission. From monitoring, outside the zone of significant influence of working area. Screening effect of bunding and trees.	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
Workplace/Recreational – 250m to 500m Receptor: Blossom Holiday Park (6), Wern Ddu Golf Club (9), Green Acres Farm outbuilding (13), Abergavenny Sawmill (18).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Low	Low	Low	Volume of material. Continuous but low level emission. From monitoring, outside the zone of significant influence of working area. Exposure during working hours/recreational use. Screening effect of bunding and trees.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low
Residential - 500m + Receptor: Wern Ddu (7), Tredilion Park (11).	Bioaerosol (bacteria, fungi, actinomycetes, cell components and metabolites) emissions from passive windrows, stockpiles and leachate lagoon.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Low	Low	Low	Volume of material. Continuous but low level emission. From monitoring, outside the zone of significant influence of working area. Screening effect of bunding and trees.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA.	Very Low

Chronic respiratory disease/condition from spreading leachate from the lagoon on fields.

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Private Driveway. Receptor: Private access road to Maindiff Court Farm and Cottages (19).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate from the lagoon on fields.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Very Low	Low	Small 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. Leachate not spread in fields immediately upwind of private access roads.	Very Low
Minor public highway 250m – 500m Receptor: Ross Road (5), Un-named road (8), Tredilion Road (12). Main public highway 250m – 500m Receptor: A465 Trunk Road (16), Welsh Marches Line (17).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate from the lagoon on fields.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Very Low	Low	Small volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence. 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
Residential - within 250m Receptor: Maidiff Court Farm cottages (15).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate from the lagoon on fields.	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Small volume of material. 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. Leachate not spread on fields immediately upwind of Maidiff Farm cottages.	Low
Healthcare - within 250m Receptor: Maidiff Court Hospital grounds and buildings (3 & 4).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate from the lagoon on fields.	Chronic respiratory disease/condition.	Air transport then inhalation.	Medium	Low	Medium	Small volume of material. Infrequent and short duration of activity. Short transient duration of exposure.. Patients - Potentially susceptible population but short to medium 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. Leachate not spread on field adjacent to Hospital when prevailing wind is in a Southerly direction.	Low
Residential - 250m to 500m Receptor: Maidiff Court Lodge (2), Tredilion Lodge (10), Tredilion Park (11), Glan Gavenny (14).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate from the lagoon on fields.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Low	Low	Small volume of material. Infrequent and short duration of activity. Short transient duration of exposure. From monitoring, outside the zone of significant influence.	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
Workplace/Recreational – 250m to 500m Receptor: Blossom Holiday Park (6), Wern Ddu Golf Club (9), Green Acres Farm outbuilding (13), Abergavenny Sawmill (18).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate from the lagoon on fields.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Low	Low	Small volume of material. From monitoring, outside the zone of significant influence of working area. Exposure during working hours/recreational use. 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
Residential - 500m + Receptor: Wern Ddu (7), Tredilion Park (11).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate from the lagoon on fields.	Chronic respiratory disease/condition.	Air transport then inhalation.	Low	Low	Low	Small volume of material. From monitoring, outside the zone of significant influence of working area. 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

Acute respiratory disease/condition from spreading leachate from the lagoon on fields

Data and information				Judgement				Action	
Receptor category.	Source	Harm	Pathway	Probability of exposure	Consequence	Magnitude of Risk	Justification for magnitude	Risk Management	Residual Risk
Private Driveway. Receptor: Private access road to Maindiff Court Farm and Cottages (19).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate on fields.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Medium	Medium	Medium	Small 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. Leachate not spread on fields immediately upwind of private driveway.	Low
Minor public highway 250m – 500m Receptor: Ross Road (5), Un-named road (8), Tredillion Road (12). Main public highway 250m – 500m Receptor: A465 Trunk Road (16), Welsh Marches Line (17).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate on fields.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Low	Medium	Medium	Small volume of material. Infrequent and short duration of activity. 250m and greater away, therefore lies outside limit of significant influence. 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
Residential - within 250m Receptor: Maidiff Court Farm cottages (15).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate on fields.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Medium	Medium	Medium	Volume of material. Close proximity to the working area. Emissions from static windrows due to control measures. Screening effect of buildings.	Site operations undertaken in line with control and management measures outlined in Section 7 of the SSBRA. Leachate not spread on fields immediately upwind of Maidiff Farm cottages.	Low
Healthcare - within 250m Receptor: Maidiff Court Hospital grounds and buildings (3 & 4).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate on fields.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Medium	Medium	Medium	Small volume of material. Infrequent and short duration of activity. Short transient duration of exposure.. Patients - Potentially susceptible population but short to medium 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. Leachate not spread on field adjacent to Hospital when prevailing wind is in a Southerly direction.	Low
Residential - 250m to 500m Receptor: Maidiff Court Lodge (2), Tredilion Lodge (10), Tredilion Park (11), Glan Gavenny (14).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate on fields.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Medium	Medium	Medium	Small volume of material. Infrequent and short duration of activity. Short transient duration of exposure. From monitoring, outside the zone of significant influence.	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
Workplace/Recreational – 250m to 500m Receptor: Blossom Holiday Park (6), Wern Ddu Golf Club (9), Green Acres Farm outbuilding (13), Abergavenny Sawmill (18).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate on fields.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Medium	Medium	Medium	Small volume of material. From monitoring, outside the zone of significant influence of working area. Exposure during working hours/recreational use. 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.	Low
Residential - 500m + Receptor: Wern Ddu (7), Tredilion Park (11).	Bioaerosols (bacteria, fungi, actinomycetes, cell components and metabolites) from spreading leachate on fields.	Acute respiratory disease/condition.	Air transport and inhalation, air transport and absorbance.	Low	Medium	Medium	Small volume of material. From monitoring, outside the zone of significant influence of working area. 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.	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
Private Driveway. Receptor: Private access road to Maindiff Court Farm and Cottages (19).	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: Maindiff Court Farm cottages (15).	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
Private Driveway. Receptor: Private access road to Maindiff Court Farm and Cottages (19).	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: Maindiff Court Farm cottages (15).	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 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
Private Driveway. Receptor: Private access road to Maindiff Court Farm and Cottages (19).	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: Maindiff Court Farm cottages (15), Maindiff Court Lodge (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

Acute respiratory disease/condition from 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
Private Driveway. Receptor: Private access road to Maindiff Court Farm and Cottages (19).	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: Maindiff Court Farm cottages (15), Maindiff Court Lodge (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

6.0 Conclusions

The Centre for Health Safety and Environment at the Cardiff Metropolitan University has been requested by Maindiff Court Farm to undertake a Site Specific Bioaerosol Risk Assessment for their green waste composting activities.

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

In order to inform the Risk Assessment data from seasonal bioaerosol monitoring carried out over the previous year at the site was analysed. The seasonal bioaerosol assessments suggest that bioaerosol levels at the closest sensitive receptor, Maindiff Court cottages 65m from the working area, can be maintained below appropriate levels suggested by the Environment Agency, at the current working capacity of 6,000 tonnes per annum. The data also suggest that bioaerosol levels return to the order of magnitude of background levels within 250m of the working area.

As the proposal is to increase the capacity at the site, it is recommended that control measures should be adopted in addition to those currently in place to ensure that appropriate levels can be maintained. In order to control emissions that have potential to affect the closest receptors, activities that involve the agitation of waste (i.e. shredding, turning and screening) should not be undertaken when the wind is from the east or south. It is recommended that a suitable weather station, with terminal and data logging facility, be established at Maindiff Court Farm. The terminal should be consulted prior to commencing agitation of waste.

The monitoring data used to develop the risk assessment suggests that bioaerosol levels return to levels of the same order of magnitude to those witnessed at background levels within 250m of the working area when one agitation activity is taking place. Therefore it is proposed that one composting activity that involves vigorous agitation, i.e. shredding, turning or screening of biodegradable waste should be undertaken at any time.

The proposal includes the creation of an additional hard standing area to the east of the current working area. This would reduce the distance between the working area and the boundary of the Maindiff Court Hospital. During monitoring on 07th March 2014, concentrations of all micro-organisms measured had returned to levels of the same order of magnitude as background levels, over similar topography as that between the working area and Maindiff Court Hospital, within 237m of the site. This distance is similar to the distance between the proposed working area and the hospital buildings. However, it is proposed that shredding and screening activities would continue to be undertaken on the existing hard standing area. As a result, the only agitation activity to take place on the new hard standing would be the turning of maturation windrows.

It is suggested that the Maindiff Court Cottages remain as the sensitive receptor for the site, for the purpose of future monitoring exercises. It is also suggested that the additional downwind monitoring location at the same distance from the working area as the boundary of Maindiff Court Hospital grounds is continued at the revised distance of 210m from the working area.

The assessment determined that, with the implementation of effective risk control measures, the risk to receptors from bioaerosols at Maindiff Court Farm 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, from data collected during the seasonal bioaerosol monitoring exercises and the Tier 2 Risk Assessment undertaken, 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 Tier 2 of the SSBRA should be used to minimise the generation of bioaerosols and the transport of bioaerosols to receptors. These are:

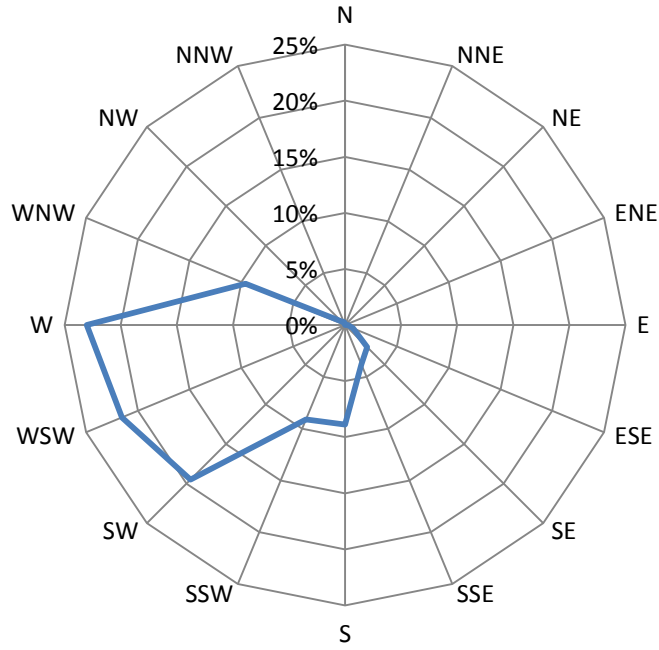
- Activities that agitate waste, i.e. shredding, turning and screening, should not be carried out when the wind blows in an Easterly and Southerly direction.
- Shredding and screening activities should continue to be undertaken on the existing concrete yard area.
- Spreading of leachate on fields should not be undertaken in fields immediatly upwind of the private driveway, Maindiff Court cottage or within the field adjacent to Maindiff Court Hospital, when those fields are upwind of the receptor. Leachate spreading should be undertaken when wind speeds are calm.

It is recommended that a bio-aerosol monitoring program is continued 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. There may also be a case for a further reduction in monitoring frequency at a later stage depending on the operating capacity of the site.

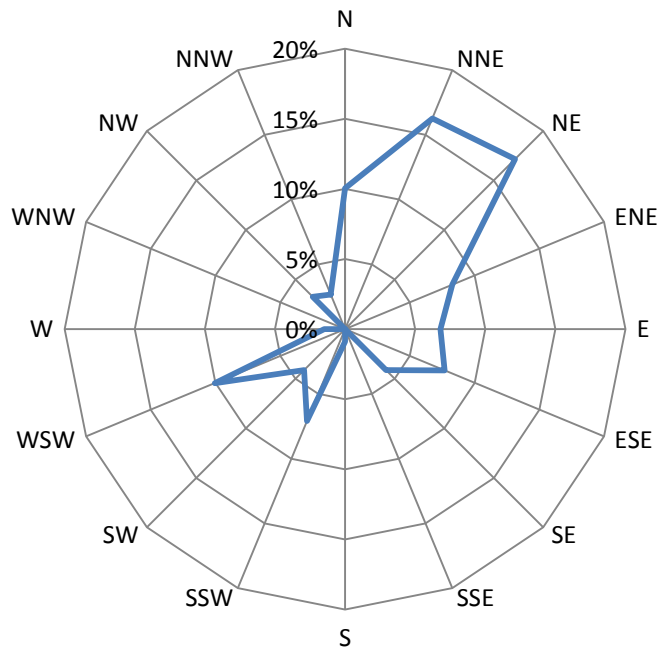
Appendices

Appendix 1 – Graphical representation of summary wind data

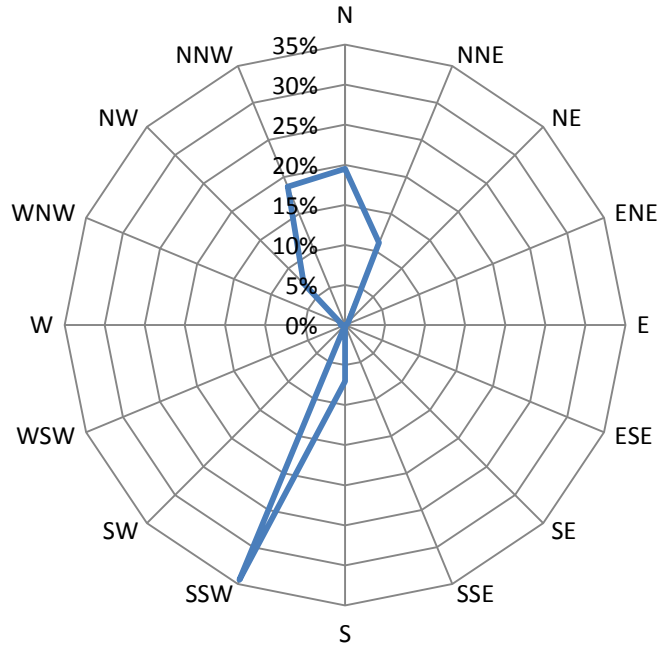
April 2013



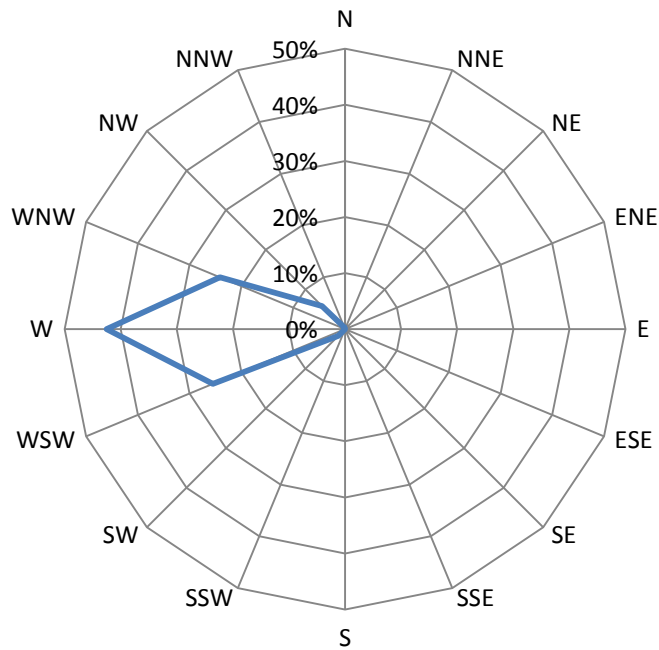
July 2013



November 2013



March 2014



Appendix 2 – Bioaerosol Monitoring Report – Spring 2013

Bioaerosol Monitoring Report – April 2013 included under separate cover.

Appendix 3 – Bioaerosol Monitoring Report – Summer 2013

Bioaerosol Monitoring Report – July 2013 included under separate cover.

Appendix 4 – Bioaerosol Monitoring Report – Autumn 2013

Bioaerosol Monitoring Report – November 2013 included under separate cover.

Appendix 5 – Bioaerosol Monitoring Report – Winter 2014

Bioaerosol Monitoring Report – March 2014 included under separate cover.

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