APPENDIX 1

Bioaerosol Risk Assessment

Bioaerosol Risk Assessment

Kings Tree Services Ltd

Co. Wicklow

Waste Licence Application No. 218-1

Prepared For: -

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5th July 2005

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1. INTRODUCTION

Kings Tree Services Ltd (KTS) have applied to the Environmental Protection Agency (Agency) for a green waste composting facility at Coolbeg, Co. Wicklow (Application Register No. 218-1). In a Notice issued in accordance with Article 14(2)(b)(ii) of the Waste Management Licensing Regulations, the Agency have requested the submission of a site-specific bioaerosol risk assessment which shows that the operation will not have negative impacts on the nearest sensitive receptors to the site and that bioaerosols can be maintained at appropriate levels.

This document provides an assessment of the risk of bioaerosol impacts of the greenwaste composting facility on nearest sensitive receptors. It includes a bioaerosol control plan that describes how bioaerosol levels will be maintained at appropriate levels at the facility.

The assessment is based on OCM's experience of composting processes with capacities ranging from 2,000 to 50,000 tonnes per annum and a review of national and international literature on composting facilities and specifically greenwaste composting.

2. PROJECT DESCRIPTION

2.1 Overview

The green waste will comprise wood wastes generated by the KTS tree surgery business, garden and park waste produced during improvement and maintenance works by landscape gardeners, grass and shrub trimmings produced by individual householders and timber and wood waste recovered during construction and demolition works. Biocide treated wood wastes will not be accepted at the facility.

The site encompasses approximately 2.5 ha and will be occupied by the compost process area, ancillary buildings including the reception office, workshop and weighbridge and parking areas. The composting process areas will comprise the waste reception area, windrows, maturation area, finished product storage and a leachate storage lagoon.

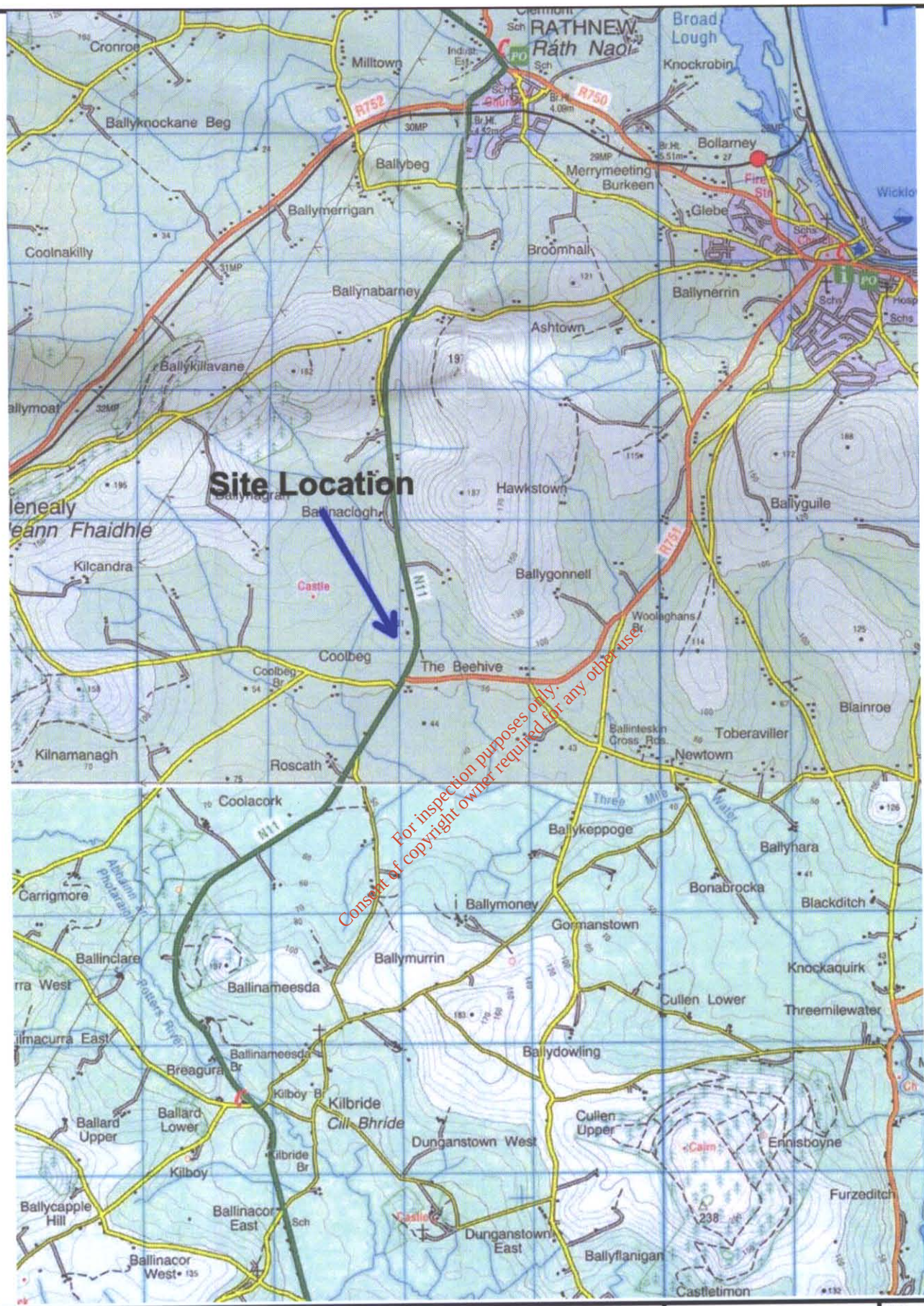
The composting operation will involve pre-treatment to shred and mix the green waste, composting in open windrows, maturation and post treatment screening to remove impurities. The finished product will be suitable for horticultural and agricultural use. When fully operational the facility will accept approximately 40,000 tonnes of green waste annually and produce approximately 25,000 tonne of compost. In the start-up phase it is envisaged that there will be an annual throughput of 4,500 tonnes of green waste.

2.2 Site Location

The site is located in a worked out sand and gravel pit approximately 4 km to the south west of Wicklow Town and 3 km to the south east of Glenealy, as shown on Figure 2.1. It is at an elevation of approximately 60 mOD.

2.3 Site Layout

The facility will be developed in two stages. Stage 1 will include the reception office (240 m^2), workshop (540 m^2) and weighbridge and parking areas, the waste reception area (c. 1250 m^2), windrows (c. 720 m^2), maturation area (700 m^2), finished product storage (c. 2375/2 m^2) and a leachate storage lagoon (1250 m^2). This stage is designed to process up to 4,500 tonnes of waste annually.



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CLIENT
Kings Tree Services

TITLE
Site Location

Details

O.S. Licence Agreement Number AR 0038702

Ordnance Survey Ireland. Government of Ireland.

FIG. No
2.1

Scale
NTS

Rev.
A

Stage 2 will involve the extension of the windrow area to ca 9500 m^2 to accommodate the processing of up to 40,000 tonnes of waste annually. The final site layout is shown on Drawing No. 1360-P1. The layout took into consideration the need to minimise the risk from potential sources of bioaerosol generation presented to off-site activities.

2.4 Compost Areas

2.4.1 Waste Reception

The Waste Reception Area will, at full capacity, encompass 1200 m^2. The area is designed to provide storage for up to 5 days intake at maximum production and to accommodate pre-treatment (shredding). It is estimated the peak delivery will be 200 tonnes per day, which is likely to occur in the spring, summer and autumn (April - October). This requires a storage capacity of 1000 tonnes.

2.4.2 Windrow

The Windrow Area, which will encompass 9,500 m^2 and at maximum capacity, will accommodate up to 15 individual windrows. In the initial stage it is envisaged that a single windrow will be operated. The windrow will be approximately 5 m wide, 2.5 m high and 50 m long. As waste inputs increase the length of the windrow will increase to a maximum of 107 m. Additional windrows will be provided, with a space of 1 m between each windrow.

2.4.3 Screening & Maturation

The Screening and Maturation area will encompass 700 m^2 at maximum capacity and is designed to accommodate 8 weeks storage.

2.4.4 Finished Product Storage

The Finished Product Storage area will encompass c 2375 m^2. It is designed to accommodate 8,000 tonnes of product.

2.5 Climate

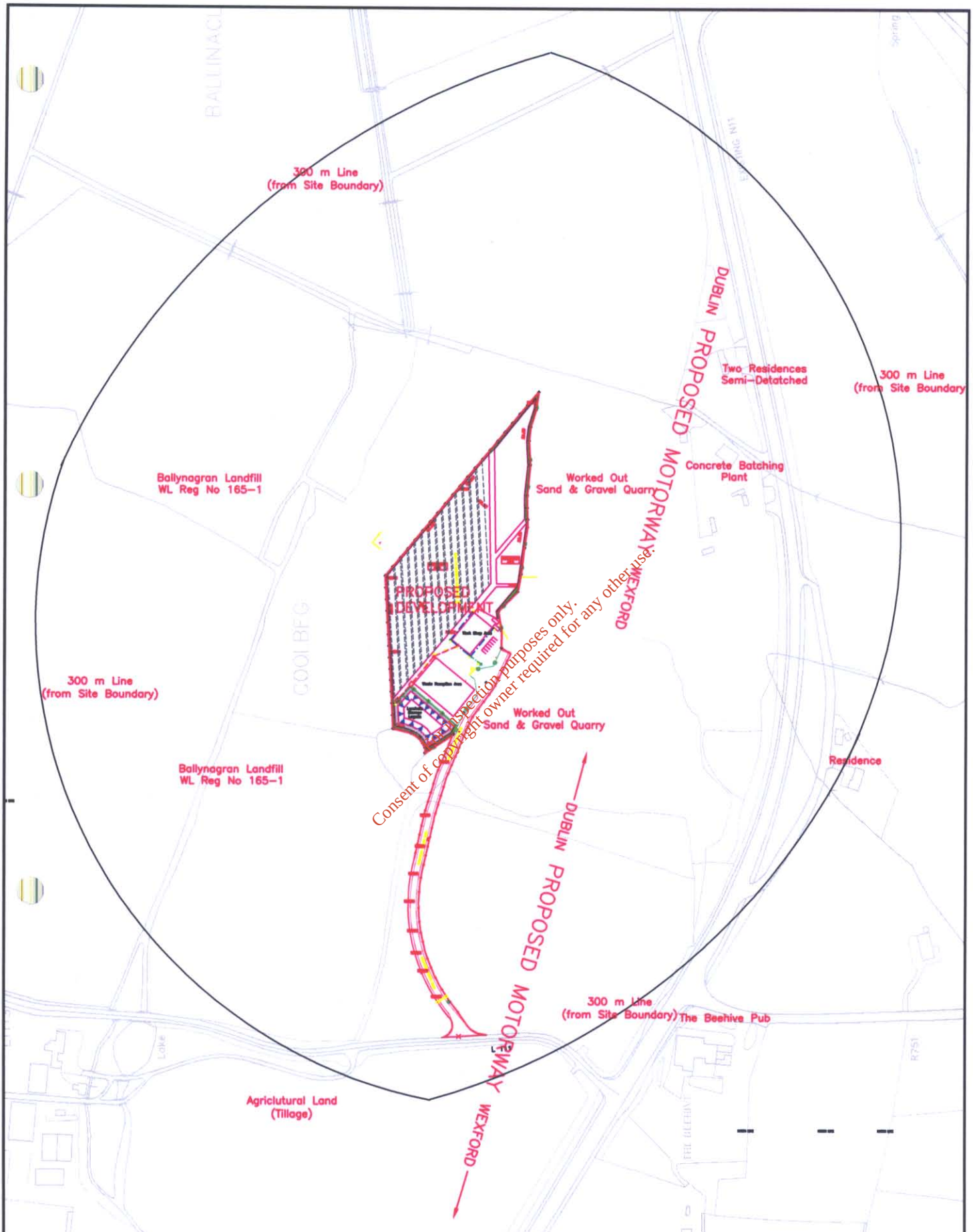
The description of the climatic conditions is based on meteorological data obtained from the Dublin Airport Meteorological Station located approximately 45 km to the north of the site (wind speed and direction, temperature and humidity) and the station at Glenealy County Wicklow (rainfall). Average rainfall, temperature, humidity and wind speed and direction are presented in Table 2.1. The climate is mild and wet, with the prevailing wind direction from the south west which occurs approximately 25% of the year. The wind rose for Dublin Airport is included in Appendix 1.

Table 2.1 Meteorological Data : Dublin

Rainfall –	
Annual average	732.7 mm
Average maximum month (Dec)	75.6 mm
Average minimum month (July)	49.9 mm
Temperature	
Mean Daily	9.6°C
Mean Daily Maximum (July)	18.9°C
Mean Daily Minimum (Feb)	2.5°C
Relative Humidity	
Mean at 0900UTC	82%
Mean at 1500UTC	72%
Wind (Knots)	
Frequency of calms	2.2%
Prevailing direction	South West: Approx. 25% of the Time
Prevailing sector	South West

2.6 Surrounding Land Use & Sensitive Receptors

There are three residential properties within 300 m of the site (Ref. Figure 2.2). The nearest properties (two semi detached houses) are approximately 150 m north east of the northern site boundary but are 350 m from the Shredding area and 220 m from the Screening and Windrow areas. These properties are surrounded by mature trees as can be seen in Photo 1 in Appendix 2. The third property is located across the N11 approximately 300 m to the east. The Beehive Public House is approximately 320 m to the south east of the southern site boundary.



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CLIENT
Kings Tree Services Ltd

DETAILS

Fig No
2.2

TITLE
Surrounding Landuse

SCALE
NTS

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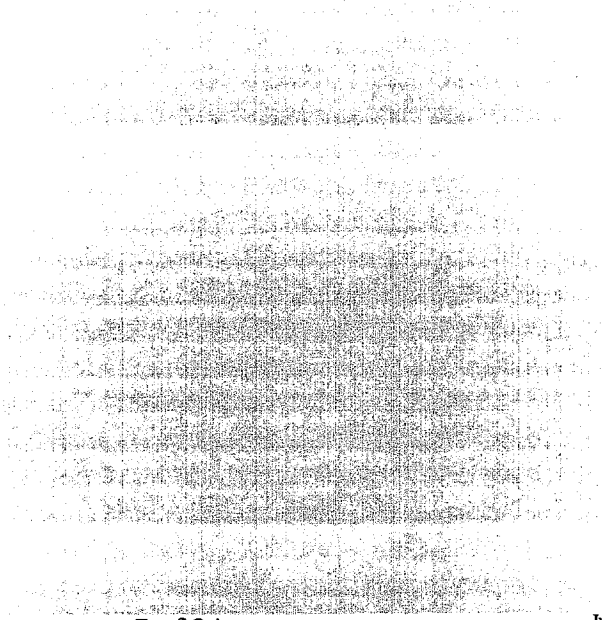
The nearest settlement to the site is the village of Glenealy located approximately 3 km to the north west of the site.

There is a concrete batching plant located approximately 180 m east of the site boundary, between the site and the N11. The plant is approximately 300 m from the Shredding area and 200 m from Windrow Area and the Screening and Maturation Area.

The lands to the north and west are currently in agricultural use, primarily tillage. The lands adjoining the western site boundary will be developed in the near future as a non-hazardous residual waste landfill. There will be a buffer of approximately 500 m between the footprint of the landfill cells and the site boundary. The administration offices serving the landfill will be located approximately 420 m from the western site boundary.

The site is currently accessed off the N11. Wicklow County Council proposes to upgrade this section of the N11 to dual carriageway standard as part of the provision of the Rathnew to Arklow Bypass. The upgrade will include the provision of a new access road and a four lane dual carriageway, which will run between the eastern site boundary and the existing route of the N11. The dual carriageway and associated landscape works will be located between the facility and the closest sensitive receptors i.e. the residences located to the north east and the concrete batching plant. The location of the proposed roadways is shown on Drawing No. P8A.



3. LITERATURE REVIEW - BIOAEROSOLS & GREENWASTE COMPOSTING

3.1 Introduction

OCM completed a search of national and international literature on composting, bioaerosol generation and control, and impacts. The search identified a number of recently published assessments of the international research and reports on the evaluation of risks presented by composting facilities, which OCM considers represents the most up to date information available.

These documents include publications by The Composting Association of Ireland (Cre), the UK Health and Safety Executive (HSE), the Department of Environment and Conservation (New South Wales) in partnership with The University of New South Wales as the recycled Organic Unit and UK Environment Agency (EA). In addition OCM reviewed a number of the primary research sources referenced in the above reports.

3.1.1 Cre

Cre published a literature evaluation of bioaerosol impacts from composting facilities. (Bioaerosols and Composting: A Literature Evaluation, 2004). The report is intended as a reference document for bioaerosol emission management at composting facilities in Ireland. Its conclusions are based on a comprehensive review of international literature on bioaerosol concentrations from composting facilities in Europe, the United States and elsewhere.

The report, which cites extensively from the published literature, includes an assessment of the potential health risks associated with bioaerosols and makes recommendations on measures to minimise bioaerosol generation. A copy of the report is included in Appendix 3 and relevant sections related to green waste composting are summarised below. To avoid confusion, where an extract from the document is cited it is attributed to Cre rather the authors of the particular research paper. The Cre report includes the full bibliography of the sources reviewed.

3.1.2 HSE

The HSE published 'A Critical Review of Published Data on Occupational and Environmental Exposure to Bioaerosols from Composts and Potential Health Effects' (2003).

The objective of the study was to critically review published literature related to studies of airborne micro-organisms or their constituent parts (bioaerosols) associated with organic waste composting facilities, and to establish whether there is a risk to worker health, neighboring facilities or residents, leading to health concerns. The review also looked at evidence of bioaerosol dissemination from sites, potential exposures and reported ill health.

3.1.3 ROU

The Department of Environment and Conservation (New South Wales) in partnership with The University of New South Wales as the Recycled Organics Unit (ROU) have prepared a report on Occupational Health and Safety and Commercial Composting including A Review of Potential Risks of Infection and Risk Management Strategies, March 2003. The report provides an overview of infection risks due to bioaerosols and organics dusts and recommendations of the appropriate training for facility staff on mechanisms to minimise impacts.

3.1.4 EA

OCM reviewed the position statement published by the Environment Agency in 2001 outlining its position in relation to health effects from composting. The statement is based on an research conducted by the Agency and the UK Department of the Environment Transport and the Regions and includes recommendations on buffer zones between composting facilities and workplaces and dwellings.

3.2 Types of Bioaerosol Exposure & Health effects

Bioaerosols are organisms or biological agents that can be dispersed through the air and affect human health. They can contain living organisms including bacteria, fungi, actinomycetes, arthropods and protozoa as well as biological products such as endotoxin, microbial enzymes, β-1,3 glucans and Mycotoxins (ROU 2003).

Composting is a natural process that involves the action of micro-organisms (fungi and bacteria) to breakdown the organic substrate. There is the potential for these bacteria and fungi to become airborne as bioaerosols. The average human inhales about 10 m^3 of air per day, consequently inhalation is the predominant route of human exposure and adverse health effects from bioaerosols.

A normal individual will inhale millions of bioaerosol or organic dust particles daily with many of these being potentially pathogenic. However, the vast majority of these inhaled particles will be deposited on airway surfaces, lodge in mucus and ultimately be cleared by the lungs. Only a small proportion of these particles will enter the deep lung where gas exchange takes place. The bodies defence system typically responds and generally combat any infection. However, the bioaerosols can cause inflammatory and allergic responses in certain individuals (ROU, 2003). The most common types of bioaerosols are discussed below.

3.2.1 Fungi and Aspergillus Fumigatus

During the handling of fresh green waste the micro-organisms present are predominantly the saprophytic "field" fungi such as Aspergillus fumigatus, which is a highly ubiquitous fungus. It has been associated with soil, crop plants, bird droppings, chicken roosts, cattle dung, horse dung, hay, fodder, corn, straw, grass and compost. It is also found on refrigeration and bathroom walls and building vent systems where moulds have had a chance to grow (Cre 2004).

Aspergillus fumigatus is an allergenic fungus and is an opportunistic pathogen which can cause aspergillosis (fungal growth in the lungs) in immunocompromised subjects. Healthy individuals are at minimal risk of infection from Aspergillus fumigatus whereas individuals with damaged lungs or compromised immune systems are more at risk (H&SE, 2003).

3.2.2 Actinomycetes

Actinomycetes are filamentous gram-positive bacteria that are commonly found associated with soil and plant materials. Thermophilic actinomycetes, with a growth temperature range of 30 to 60°c, thrive in wet compost that has begun the self heating process. Therefore, they can be used as indicator organisms for self heating of organic material and as indicator organisms for the presence of bioaerosols generated from compost (Cre 2004).

Thermophilic actinomycete species are recognised respiratory allergens. Actinomycetes produce thousands of very small spores (1 - 3 um diameter) which easily become airborne in large numbers when heavily colonised material is disturbed. Their small size means that they are potentially capable of penetrating deep into the human lung. They are primarily responsible for occupational allergic lung diseases such as Farmers Lung Disease and Mushroom Workers Lung Disease, which are forms of extrinsic allergic alveolitis (H&SE 2003).

3.2.3 *Endotoxin*

Endotoxins are constituents of gram-negative bacteria. Endotoxin is a macromolecule with a lipopolysaccharide core, which is found in the cell walls of all gram-negative bacteria. Gram-negative bacteria are present in the oral cavities and intestinal tracts of humans and animals; they also live on the surfaces of animals and plants. Consequently, the general population is exposed to low levels of environmental endotoxin and it is found in house dust (H&SE 2003).

Inhalation of endotoxin in large quantity can cause short term illness, with flu-like symptoms, fever, myalgia, and malaise. This is often termed inhalation fever or organic dust toxic syndrome (ODTS). This acute clinical symptom response occurs between 6 - 12 hours after exposure and lasts about 4 hours. Chronic exposure to endotoxin has been linked to work related symptoms such as inflammation leading to chronic bronchitis, chronic obstructive pulmonary disease and reduced lung function (H&SE 2003).

Endotoxin concentrations drop considerably when certain measures were taken (e.g. if the compost is moistened). There is also a good correlation between total respirable dust and endotoxin concentrations, indicating any measures taken to reduce dust would effectively reduce endotoxin concentrations (Cre 2004).

3.2.4 *Glucans*

Glucan is a polyglucose compound in the cell walls of fungi, some bacteria and plants. It is a potent inflammatory agent that induces non-specific inflammatory reactions and may also be a respiratory immunomodulatory agent. Glucans may be involved in contributing to the inflammatory responses resulting in respiratory symptoms and adverse lung function effects in response to the inhalation of bioaerosols. As it is present as a component of fungi, it will be present in compost and potentially therefore airborne dust associated with compost (H&SE, 2003).

3.2.5 *Mycotoxins*

Mycotoxins are non volatile low molecular weight toxic secondary metabolites produced by some species of fungi during their growth in organic materials. The most common route of exposure is by ingestion of fungally contaminated food. Aspergillus fumigatus produce mycotoxins which is usually present in the dust generated during the handling of compost. It has been suggested that mycotoxin exposure may contribute to occupational lung disease in workers exposed to organic dusts. It is considered that compost handling, like other industries such as grain and animal feed handling, could represent a theoretical hazard of mycotoxin exposure (H&SE 2003).

3.3 Levels of Bioaerosols in Ambient Environment

Bioaerosols are naturally present in the environment, and may occur naturally at levels similar to those found in waste facilities (EA 2002). A 1983 study found that in the absence of any significant bioaerosol sources, natural atmospheric conditions in a typical suburban gave rise to 0 - 7.2 x 103 (mean 273) cfu/m^3 mesophilic fungi, 0 - 193 (mean 2.1) cfu/m^3 thermophilic fungi, 0 - 71 (mean 1) cfu/m^3 Aspergillus. fumigatus, 42 - 1.6 x 10^3 (mean 79) cfu/m^3 bacteria. The highest concentrations occurred during summer and autumn (Cre 2004).

A 1998 found concentrations of viable airborne micro-organisms outdoors to be: 500 cfu/m^3 total bacteria, 10 cfu/m^3 Gram-negative bacteria, 1,200 cfu/m^3 total mesophilic fungi, 300 cfu/m^3 thermophilic fungi and 60 cfu/m^3 thermophilic bacteria and actinomycetes.

A 1978 study reported ambient levels of viable airborne bacteria in an agricultural area were as being, 2 - 3.4 x 10^3 (mean 99) cfu/m^3, and in a city 100 - 4.0 x 103 cfu/m^3 (mean 850) (HSE 2003).

3.4 Levels of Bioaerosols from Greenwaste Composting

A 2001 study of microbial emissions from a green waste composting site in the UK. Found that handling of green waste compost in the open generated levels of airborne bacteria which exceeded 106 colony forming units (cfu; a measure of culturable microbial cells) /m^3 air sampled on occasions. Levels of Gram-negative bacteria, fungi and actinomycetes each at times exceeded 105 cfu/m^3 air sampled. Levels of airborne bacteria were highest during shredding and turning, airborne fungi during screening and airborne actinomycetes during screening and shredding.

The HSE includes data from an investigation conducted by Hryhorczuk et al (1996; 2001) and Curtis et al (1999) who measured bioaerosol emissions from a green waste composting facility in Chicago. Concentrations of airborne bacteria, total fungal spores, endotoxin and beta glucans were significantly higher on-site than off-site, i.e., beyond the boundary fence 75 metres away from the nearest windrows. Levels of bacteria next to the compost windrows reached 7.9 x 104 cfu/m^3 and averaged 11,879 on-site, compared to 3,204 off-site. Total fungal spores reached 26,067 spores/m^3 (average 13,451 spores/m^3 on-site 8,772 spores/m^3 off-site), levels of viable fungi reached 1.8 x104 cfu/m^3. Mean total viable fungi were higher off-site than on-site (average 3,068 on-site, 8,651 off-site). Endotoxin levels on-site reached 6.06 ng/m^3 (60 EU/m^3) (average 1.94 ng/m^3 on-site, 0.14 off-site) and beta Glucans reached 14.45 ng/m^3 (average 2.17 ng/m3 on-site, 0.24 off-site).

3.5 Bioaerosol Dispersion

Bioaerosols are formed when the composting materials are agitated. Concentrations decrease to background when waste processing activities stop, indicating that windblown aerosolisation is insignificant (HSE 2003). As bioaerosols are small with low settling velocities they can be carried long distances by wind and thermal currents.

The pattern of dispersal from a composting facility is determined by a number of factors including the rate of emission, prevailing atmospheric conditions (e.g. wind speed and direction, temperature gradients, relative humidity) and local topography that determines the air flow around the site (HSE 2003).

The optimisation of bioaerosol (including dust and Aspergillus fumigatus) dispersal can be achieved through increasing the height of release and increasing the turbulence in the air flow thereby increasing the spread of the bioaerosols. Air turbulence can be increased by providing structures that impede the airflow. These can be walls or fences, or natural structures such as tree screens (Cre 2004).

A study carried out for the EA 2001 found that spore (fungi especially Aspergillus fumigatus) concentrations decreased by 80% to 90% from 20 m to 40 m from the source (composting facility) (Cre 2004). A 2002 study in the UK which monitored bioaerosols emissions from two composting facilities, one of which was an open green waste windrow process, found that levels decreased to background levels 200m from the site (HSE 2003).

3.6 Buffers

While there are a number of studies that investigated the fate of bioaerosols and dispersal patterns from the source there is limited information on minimum buffer distances that should be maintained between composting facilities and potentially sensitive receptors.

The EA's position on siting composting facilities is *"There will be a presumption against permitting [and to object to any planning application] of any new composting process [or any modification to an existing process] where the boundary of the facility is within 250 metres of a workplace or the boundary of a dwelling, unless the application is accompanied by a site-specific risk assessment, based on clear, independent scientific evidence which shows that the bioaerosol levels are and can be maintained at appropriate levels at the dwelling or workplace:"* (EA, 2001).

This approach is based on the findings of a study completed in 2001, which included a modelling exercise that assumed the bioaerosols had gaseous properties. The author of the study acknowledged that many of the bioaerosols formed aggregates large enough to demonstrate non-gaseous behaviours and it was suggested that the concentrations would decline at a greater rate with distance than the model predicted. However, the 250 m was taken to provide an additional factor of safety to the 200 m distance less suggested in other studies (HSE 2003).

Cre suggest that a 200 m distance would be particularly applicable to 'benign' feedstocks, e.g. greenwaste composting, but that this could be further reduced depending on control measures.

3.7 Mitigation Measures

There is international consensus that operational controls can effectively mitigate bioaerosol generation. These controls include: -

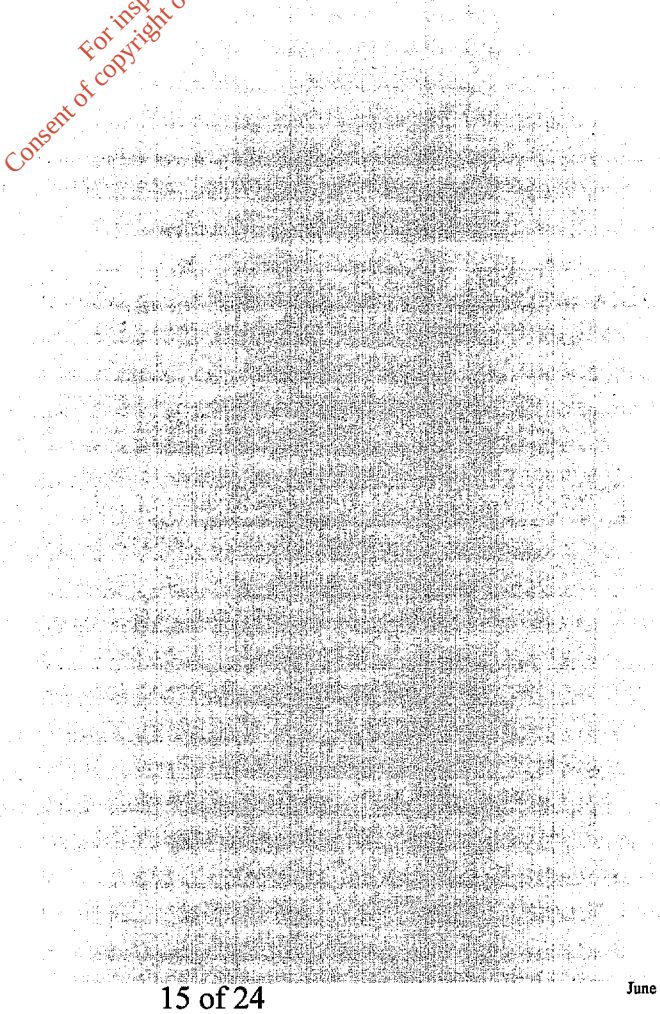
- Maintaining a proper composting environment. Regular and thorough mixing of windrows (2 - 3 times per week) to minimise the presence of *Aspergillus fumigatus*.
- Maintaining optimal moisture content in the windrows (50 - 60%.) Dust levels can be greatly reduced if moisture levels are maintained at optimal concentrations.
- Maintaining a clean site including access roads and storage areas and provision of a damping system to reduce dust generation from dry surfaces.
- Proper training of all facility operators in methods of dust and bioaerosol control.
- Arranging work rosters to ensure facility exposure to potentially high bioaerosol generating activities is minimized.
- Construction of windrows as high as possible, but not so as to reduce the efficacy of the composting process. The increased height of release of bioaerosols enhances dispersion. The windrows can also be used to create an effective barrier and to increase turbulence.

3.8 Conclusions

The literature review indicates that the potential health risks associated with bioaerosol generation at composting facilities to the general public are minimal and can be managed if the proper operational controls are applied. The risks to facility personnel can be minimised by the provision of appropriate training, personnel protective equipment and operational control measures.

There is limited consensus on buffers distances that must be maintained between green waste composting facilities and sensitive receptors. The literature review indicates that bioacrosols are reduced to background levels within 200 metres of composting facilities where source operational controls and the influence of barriers to air flow are not taken into account. Cre suggest that a 200 m distance would be particularly applicable to 'benign' feedstocks, e.g. greenwaste composting, but that this could be further reduced depending on control measures. The EA recommends a 250 m buffer.

Both Cre and the EA allow for a reduction the buffers based on evidence that bioaerosols can be maintained at appropriate levels at the sensitive receptors. Cre suggests that this can be achieved by the application of appropriate operational control measures and site specific factors such as impediments to air flow which can improve dispersion.



4. BIOAEROSOL CONTROL PLAN - COOLBEG

4.1 Introduction

A Bioaerosol Control Plan has been developed for the facility based on the source-pathway-receptor risk assessment model. The effective mitigation of the impacts on sensitive receptors requires the application of operational controls at the source that minimises the release to the pathway which is the air. The proposed measures for controlling emissions from the site and the factors affecting the movement of the bioaerosols along the pathway to the potential receptors are discussed below.

4.2 Location and Site Layout

4.2.1 Site Location

The site is located in a worked out sand and gravel quarry, which extends to the east and south of the property boundary. There are three residential properties within 300 m of the site. The nearest properties are approximately 150 m north east of the northern site boundary. The third property is located across the N11 approximately 300 m away to the east. The Beehive Public House is approximately 320 m to the south east of the southern site boundary. There is a concrete batching plant located approximately 180 m east of the eastern site boundary, between the site and the N11.

The lands adjoining the western site boundary will be developed in the near future as a non-hazardous residual waste landfill. There are mature hedgerows and small areas of woodland along the western site boundary. It is intended to maintain these hedgerows and woodland. There will be a buffer of approximately 500 m between the footprint of the landfill cells and the site boundary and the administration offices serving the landfill will be located approximately 420 m from the western site boundary.

4.2.2 Site Layout

The site layout was designed to maximise the distance between the potential sources of bioaerosols and potential receptors. The eastern side of the site will be used for finished product storage, maturation, car park and quarantine area, site buildings. There is the potential for bioaerosol generation during screening activities in the maturation area.

The southern and western portion of the site will be used for green waste reception and shredding, windrows and leachate storage. Of these areas there is the potential for bioaerosol generation from the shredding and the windrows turning.

4.3 Operational Controls

The following operational control measures will be employed at the facility: -

- Regular and thorough mixing of the Windrows (2 - 3 times a week) will be carried out to aid proper composting and minimise the presence of *Aspergillus fumigatus*. Temperature sensors will be placed at different locations and depths in each windrow. These will be monitored on a daily basis by KTS personnel to ensure that optimum temperatures are maintained.

- The optimal moisture content for windrows is 50 - 60%. Dust concentrations can be greatly reduced if moisture levels are maintained within the optimal levels. The windrows will be visually inspected on a daily basis to confirm the moisture level is in the optimum range. Leachate/contaminated run-off from the on-site leachate storage lagoon will be added to the windrow using the windrow turning machine as required to maintain optimum moisture levels.

- Maintaining a clean site to reduce dust generation. A flexible hose will be provided for use in damping down the site during dry weather conditions.

- All facility operators and compost workers will be trained in the appropriate methods of dust and bioaerosol control.

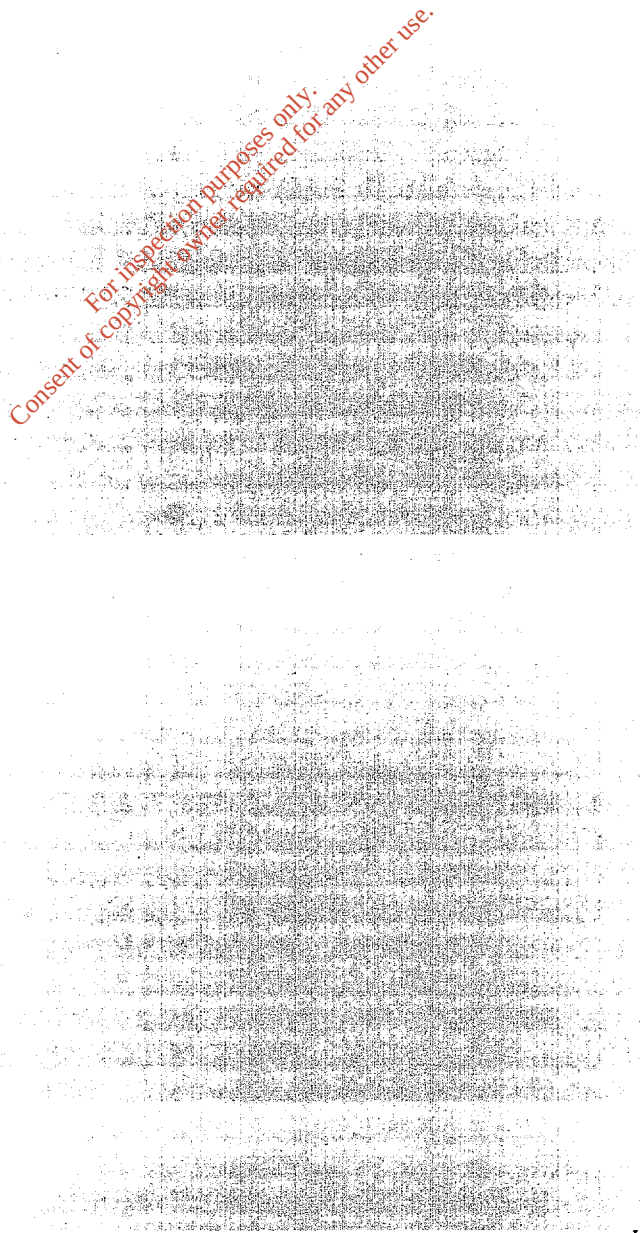
- The windrows will be as high as possible to, but not so as to reduce the efficacy of the composting process. The average height will be 2.5 m.

4.4 Abatement Measures

Apart from the operational measures described above the dust mitigation measures which will be employed at the facility have been shown to reduce bioaerosol dispersion. The measures include dust suppression systems on the shredder and screening machine and regular cleaning of the site. The specific shredder/screeners that will be used at the facility have not yet been purchased, but will include a sprinkler system.

4.5 Monitoring

Baseline dust monitoring has already been conducted at the facility and it is proposed to conduct monitoring at three locations on the property boundary biannually. It is proposed to conduct baseline bioaerosol monitoring prior to waste acceptance. The monitoring locations will, subject to the agreement to the owners, be at the site boundary and the nearest sensitive receptor i.e. the residential properties located to the north east of the facility boundary and the batching plant. It is also proposed to conduct bioaerosol monitoring once the facility is operational on an annual basis.



5. RISK ASSESSMENT

5.1 Introduction

The risk assessment is based on the likely emissions from facility, the proposed composting processes, site specific characteristics and the locations of the nearest potentially sensitive receptors i.e. the residential property to the north east, the concrete batching plant to the east and the proposed landfill development to the west.

5.2 Bioaerosol Impact Criteria & Potential

The concentration of bioaerosols declines with distance from the source due to atmospheric dispersion and dilution. Most published data indicate that bioaerosols are reduced to background levels within 250 metres of composting facilities. Studies have also shown that spore concentrations were reduced by 80% to 90% at a distance of 20 m to 40 m from the bioaerosol (spore) source.

In assessing the impact criteria therefore it is necessary to analyse the source-pathway-receptor process that will apply at the KTS facility. At maximum capacity the facility will process 40,000 tonnes of waste per annum and produce approximately 25,000 tonnes of compost. Dispersion of bioaerosols will occur through the air dependant on wind speed and direction and any obstacles which will impede air flow. The potential receptors site are the residential properties to the north east and east, the concrete batching plant to the east and the landfill to the west.

5.3 Site Location

The site is located in a worked out sand and gravel quarry, which extends to the east and south of the property boundary. There are three residential properties within 300 m of the site. The nearest properties are approximately 150 m north east of the northern site boundary but are 350 m from the Shredding area and 220 m from the Screening and Windrow Areas. These properties are surrounded by mature trees. The third property is located across the N11 approximately 300 m away to the east. The Beehive Public House is approximately 320 m to the south east of the southern site boundary.

There is a concrete batching plant located approximately 180 m east of the eastern site boundary, between the site and the N11. The plant is approximately 300 m from the Shredding area and 200 m from the Screening and Windrow Areas. The lands to the north and west are currently in agricultural use, primarily tillage.

The lands adjoining the western site boundary will be developed in the near future as a non-hazardous residual waste landfill. There are mature hedgerows and small areas of woodland along the western site boundary and it is intended that these will be maintained There will be a buffer of approximately 500 m between the footprint of the landfill cells and the site boundary and the administration offices serving the landfill will be located approximately 420 m from the western site boundary.

The site is currently accessed off the N11. Wicklow County Council proposes to upgrade this section of the N11. The upgrade will include the provision of a new access road and a four lane dual carriageway will be located between the facility and the closest sensitive receptors i.e. the residence located to the north east and the concrete batching plant.

5.4 Site Layout

The site layout was designed to maximise the distance between the potential sources of bioaerosols and potential receptors. The eastern side of the site will be used for finished product storage, maturation, car park and quarantine area, site buildings. There is the potential for bioaerosol generation during screening activities in the maturation area. The maturation area is approximately 220 m from the residential properties and approximately 200 m from the concrete batching plant.

The nearest residences are to the north east of the site and down prevailing wind. However, these are surrounded by trees which will aid the dispersal of any bioaerosols as a result of wind turbulence. The upgrade of the N11, which will result in the construction of a four lane dual carriage way and access road between the site and the residences, is also likely to result in air turbulence associated with landscape measures and vehicle movements.

The southern and western portion of the site will be used for green waste reception and shredding, windrows and leachate storage. Of these areas there is the potential for bioaerosol generation from the shredding and the windrows turning. The greenwaste reception and shredding area is located approximately 350 m from the residential properties and approximately 300 m from the concrete batching plant. The closest windrow to the receptors will be approximately 220 m from the residential properties and approximately 200 m from the concrete batching plant.

All of the potential sources of bioaerosol generation will be more that 400 m from the administration and operational areas of the landfill which will be developed on the lands to the west.

5.5 Site Activities

5.5.1 Waste Reception

Proper mixing of the material is important to allow for both a proper composting process and the production of compost with a consistent quality. Some green waste streams may contain relatively high or low concentrations of certain elements, e.g. nitrogen, sulphur. To prevent process disturbances (e.g. high C/N ratio), excessive emissions (e.g. ammonia, H_2S) and bad quality compost, proper mixing is essential. To achieve proper mixing certain waste streams (e.g. branches, timber, stumps) will be chipped/shredded.

There is a risk of bioaerosol generation during shredding. The shredder machine will be located in the southern portion of the site, approximately 350 m from the nearest residence. The shredder will be fitted with a dust suppression system to control dust emissions.

5.5.2 Windrow

The green waste will be placed on the ground at the front of the windrow using an industrial front-end loader. In the early stages of the process the windrow will be turned two to three times a week using a hydraulic excavator. The excavator will work through the composting section from the back-end to the front-end. It starts by removing the mature compost (at the back-end) to the compost refinement area, and subsequently move (turn) the material along the windrow. Once it has turned the whole composting section, the area at the front-end will be empty and ready for the intake of fresh green waste. The height of each windrow (approximately 2.5 m) will be kept constant over the total composting period.

It is considered unlikely that significant volumes of bioaerosols will be generated from the static windrows. There is however a risk of generation from the agitation of the windrow during turning. In order to minimise this, the moisture content will be maintained at the appropriate level. The windrow turning machine will be fitted with water sprinkler nozzles which will be used to add water during the mixing process as required.

The nearest windrow to receptors will be approximately 220 m from the residential properties, approximately 200 m from the concrete batching plant and greater than 400 m from operational areas of the landfill.

5.5.3 Screening & Maturation

Following the composting process, the material will be transferred to the maturation area, where it will be screened to remove impurities. The equipment used will comprise a mobile hopper/trommel system, with adjustable sieving plates in the trommel and dust suppression water sprinklers. The screening will be carried out 3 to 4 times a week. The screening area is approximately 220 m from the residential properties, approximately 200 m from the concrete batching plant and more than 400 m from operational and administration areas of the proposed landfill.

5.5.4 Finished Product Storage

The finished product will be stored on-site in the dedicated product storage area. The product will be loaded onto trucks for removal off-site to its final destination/end market. This activity will not be a source of bioaerosols.

5.6 Meteorological Data

The description of the climatic conditions is included in Section 2.5 and is based on meteorological data obtained from the Dublin Airport Meteorological Station located approximately 45 km to the north of the site (wind speed and direction, temperature and humidity) and the station at Glenealy County Wicklow (rainfall). The climate in the area of Coolbeg can be described as mild and wet, with the prevailing wind direction from the south west approximately 25% of the year.

5.7 Risk to Sensitive Locations

5.7.1 Residential Properties & Concrete Batching Plant

The nearest private residences are located generally down prevailing wind of the facility. The literature review indicates that bioaerosols are reduced to background levels within 200 metres of composting facilities where source operational controls and the influence of barriers to air flow are not taken into account. Cre recommend a buffer of 200 m between composting facilities and sensitive receptors and the UK Environment Agency recommends a 250 m buffer. However, it is recognised that site specific factors, including on-site bioaerosol control measures and local topographical and man made features will reduce bioaerosol emission rates and increase dispersion to atmosphere allowing for a buffer lower than 200 m.

The activity with the potential to cause the greatest bioaerosol generation, shredding, will be at least 350 m from the residential properties and 300 m from the concrete batching plant. The other activities with the potential to generate bioaerosols (windrow turning and screening) will be located at least 220 m from the residential properties and at least 200 m from the concrete batching plant.

The operational control procedures and abatement measures proposed for the facility which are described in the Bioaerosol Control Plan will minimise the rate of generation and emission if bioaerosols from the facility.

The prevailing wind is from the south west. The mature hedgerows and woodland along the western site boundary will induce turbulence in the air flow across the site. The perimeter fence and that surround the residences nearest the site will also contribute to air turbulence and enhance the bioaerosol dispersal rate. The proposed access road and dual carriageway, which will run between the site and the nearest receptors will also influence air flow patterns and dispersal rates.

5.7.2 Greenstar Landfill

The Greenstar landfill is located up prevailing wind of the KTS facility. The areas where Greenstar staff will be based i.e. the landfill footprint and the site administration offices are both greater than 400 m away form the site boundary.

5.8 Monitoring

Baseline dust monitoring has already been conducted at the facility and it is proposed to conduct monitoring at three locations on the property boundary biannually. It is proposed to conduct baseline bioaerosol monitoring prior to waste acceptance. It is also proposed to conduct bioaerosol monitoring once the facility is operational on an annual basis.

The monitoring locations will, subject to the agreement to the owners, be at the site boundary and the nearest potential receptors i.e. the residential properties located to the north east of the facility boundary and the batching plant. The monitoring data will be used to assess the efficacy of the facility's operational control measures in maintaining bioaerosols concentrations at ambient levels at the nearest potential receptors.

5.9 Conclusions and Recommendations

Cre concludes that a 200 m buffer between composting facilities and potential sensitive receptors is suitable to 'benign' feedstocks, e.g. greenwaste composting but that this could be further reduced depending on control measures and site specific features. The nearest residential properties are located at least 220 m from the potential bioaerosol generating areas. The concrete batching plant is located at least 200 m from the bioaerosol generating areas and the operational and administrations areas of the proposed landfill are greater than 400 m away.

The mature hedgerows and woodland along the western site boundary, the proposed perimeter fence and the trees surrounding the nearest receptors will all contribute to creating turbulence in the air flow across the site, which will enhance the dispersal rate of bioaerosols generated by the active.

A Bioaerosol Control Plan has been prepared for the facility which includes operational controls to minimise bioaerosol emissions levels and further reduce the bioaerosols to a level that presents negligible risk to the receptors. The influence of future works in the area, including landscape measures at the facility and particularly the construction of the dual carriageway between the facility and the nearest receptors will further reduce the risk. Routine dust and bioaerosol monitoring will be carried out at the nearest sensitive receptors to confirm that bioaerosols are at ambient levels.

It is considered that, in the context of the site conditions, proposed composting activities and operational controls, the distances between the potential sources of bioaerosols and the potential receptors are adequate to achieve the necessary dispersion and dilution of bioaerosols to ambient levels at the receptors.

DRAWINGS

Drawing No. 1360-P1 - Site Layout

Drawing No. P8A - Proposed N11 Upgrade