

INTRODUCTION AND METHODOLOGY

- 8.1 This section considers the potential of the proposed development to impact upon air quality. The assessment considers the proposed reclamation of the Tip with imported inert waste; reclamation of the Void by infilling with non-hazardous wastes and the establishment of a compost maturation facility, with particular regard to:
- dust (nuisance and potential health effects including Corona Ions);
 - odour nuisance;
 - generation and release of bio-aerosols; and
 - emissions associated with traffic using the site;
- 8.2 The proposed development would only have the potential to affect air quality under the following conditions:
- pollutants are released to atmosphere from the site in sufficiently high concentrations; and
 - there is insufficient atmospheric dispersion to dilute emissions to a concentration that does not have a nuisance or health effect.
- 8.3 Therefore, the significance and resultant impacts of emissions to air from the proposed development are dependent upon the magnitude of the emissions; the prevailing meteorological conditions for that location; and the proximity of sensitive locations to the emission sources. The potential for these conditions to occur and give rise to nuisance and/or health impacts is assessed.

BASELINE ENVIRONMENT

Meteorology

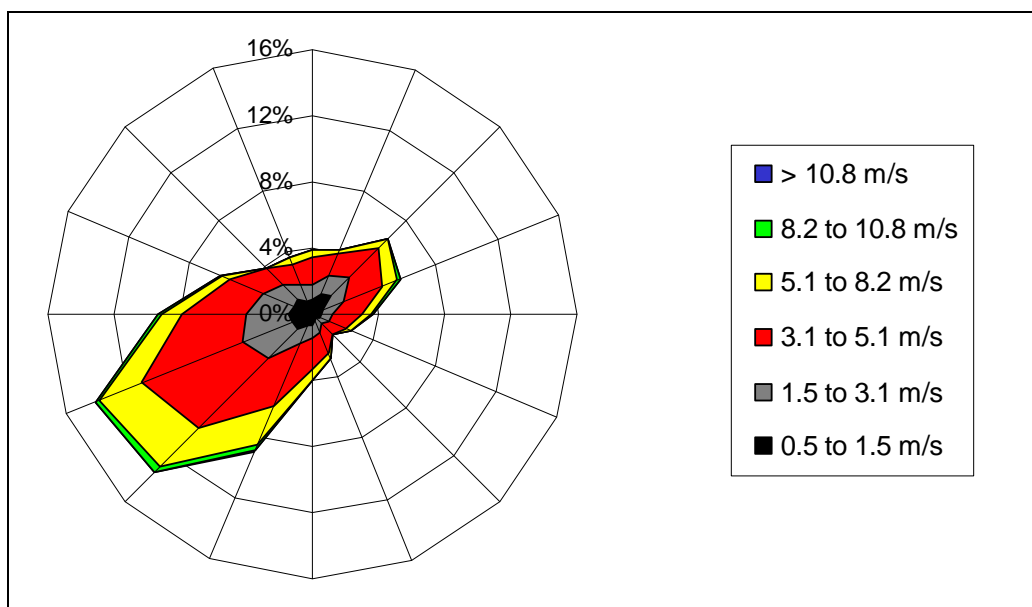
The Dispersion and Dilution of Emissions

- 8.4 The most important climatological parameters governing the atmospheric dispersion of pollutants are as follows.
- Wind direction determines the broad transport of the emission and the sector of the compass into which the emission is dispersed;
 - Wind speed;
 - Atmospheric stability (a measure of the turbulence).
- 8.5 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured, on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made. In the UK, all of these sites are quality controlled by the Meteorological Office.

Local Wind Speed and Direction Data

- 8.6 Five years (1999 to 2003) of hourly sequential meteorological data from Watnall observing station have been used in the assessment. Watnall observing station is located 7 km to the south of the application site. This observing station is the nearest to the application site with the observations required for dispersion modelling. Wind speed and direction data for the five years are presented as a windrose in Figure 8/1.

Figure 8/1 Windrose for Watnall Observing Station (1999 to 2003)



- 8.7 The predominant wind direction is from the west-south-west and south-west, occurring for 14.2% and 13.6% of the time, respectively. Winds from the east to south-south-east occur relatively infrequently. Calm conditions (*i.e.* wind speeds of less than 0.5 m/s) occur at the site 5.1% of the time.

Other Climate Data

- 8.8 A summary of other climate conditions applicable to the site is available from an observing station at Sutton Bonnington. This observing station is located at a height of 48m AMSL (above mean sea level), approximately 28km to the south of the application site. This is the closest observing station to the application site where summary data are provided by the Meteorological Office. Monthly and annual (1971 to 2000 averages) summaries of temperature, sunshine, rainfall amount and rainfall days are presented in Table 8/1.

**Table 8/1
Summary of Meteorological Observations for Sutton Bonnington (1971 to 2000)**

Month	Maximum Temperature (°C)	Minimum Temperature (°C)	Sunshine (hours)	Rainfall (mm)	Raindays (>=1mm)
January	6.9	1.2	50.5	54.8	11.2
February	7.2	1.2	64.7	42.7	9.3
March	9.8	2.7	100.4	45.3	10.8
April	12.1	3.8	133.5	46.6	9.3
May	15.8	6.3	179.2	42.4	8.4
June	18.6	9.2	157.5	60.8	9.6
July	21.3	11.4	185.1	43.8	7.4
August	21.1	11.3	180.4	51	8.1
September	17.9	9.5	132.6	52.5	8.3
October	13.9	6.7	102	54	10
November	9.7	3.7	61.2	53	10
December	7.6	2.1	40.9	59.3	10.9
Year	13.5	5.8	1388	606.2	113.3

8.9 As would be expected, temperature and sunshine hours show a strong seasonal variation with maxima during the summer months. Such a trend is not so clearly evident in the rainfall data, with high rainfall occurring during summer months (60.8 mm in June) as well as during the winter months. The total annual average rainfall for the thirty-year period was 606.2 mm and rainfall greater than 1 mm occurred on 31% of days of the year.

Topography

8.10 Local topographic features can influence the dispersal of pollutants in the atmosphere. The Void site rises out of a small valley, which is surrounded by rising ground to the north, east and south. Land to the north, south and west of the former colliery site declines in elevation and has been restored to agricultural land. Much of what remains un-restored is hidden from view from the surrounding land.

Ambient Air Quality

Suspended Particles

8.11 As part of Ashfield District Council's stage 3 review and assessment of air quality within the district, continuous monitoring of ambient PM₁₀ concentrations was undertaken in two locations within 1.5km of the application site boundary, both of which were adjacent to the M1 Motorway. Table 8/2 and 8/3 show the results of the monitoring carried out in two locations in the villages of Selston and Pinxton, from January to November 2000.

Table 8/2
24-Hour Mean PM₁₀ Concentrations (µg/m³) for Selston and Pinxton, Ashfield

Concentrations Jan to Nov ^(a) (µg m ⁻³)			Number of Exceedences of 50 µg m ⁻³				
Mean	Minimum	Maximum	Jan-Mar 2000 M1 Selston	Apr-Jun 2000 M1 Selston	Jul-Sept 2000 M1 Pinxton	Oct-Nov 2000 M1 Pinxton	Calendar Mean
30.1	1.0	137.0	5	10	6	0	21

(a) 27th Jan 2000 to 8th Nov 2000 = 264 days

8.12 The AQS objective for 24-hour mean PM₁₀ concentrations allows 35 exceedences per year. This equates to approximately 25.2 exceedences in 264 days. Twenty one exceedences were recorded. The Council found that the monitoring results for PM₁₀ at the properties close to the M1 suggested that the 24-hour mean objective would not be exceeded at those locations.

Table 8/3
Mean PM₁₀ Concentrations (µg m⁻³) for Selston and Pinxton, Ashfield

Jan-Mar 2000 M1 Selston	Apr-Jun 2000 M1 Selston	Jul-Sept 2000 M1 Pinxton	Oct-Nov 2000 M1 Pinxton	Calendar Mean
33	31	31	24	30

8.13 The mean concentration of PM₁₀ by the M1 in Selston and Pinxton throughout the year was 30 µg m⁻³, which is below the objective of 40 µg m⁻³.

8.14 The Selston site was located 150m west of the boundary of the former colliery tip site, the Pinxton site was located 1.5km north of the former colliery tip boundary, but both adjacent to M1. This source would have a strong influence on particle concentrations in the vicinity of the application site. The Council's review and assessment of PM₁₀ concentrations within the District indicated that the AQS objectives would be complied with by the relevant deadlines.

8.15 Subsequent monitoring of PM₁₀ in the Ashfield District Council area carried out during 2001 and 2002 as part of the updating and screening assessment predicted a potential exceedence of PM₁₀ objectives at the Pinxton site. Further monitoring was conducted at this location during 2003/4 as part of the district council's detailed assessment.

8.16 A total of 200 days (approx. 7 months) monitoring results were available for evaluation with data recorded over July 2003 – February 2004. Estimated annual means and predicted exceedences of the 24-hour objective were calculated to determine whether the 2004 and 2010 objectives would be compromised. Tables 8/4 and 8/5 tabulate the results.

Table 8/4
Summary of Monitoring Data Undertaken at Pinxton Green July 2003 to February 2004

24 hour means				
Location	Measured Period Mean ($\mu\text{g}/\text{m}^3$)	Min ($\mu\text{g}/\text{m}^3$)	Max ($\mu\text{g}/\text{m}^3$)	No. of exceedances of the $50\mu\text{g}/\text{m}^3$ objective
Pinxton Green (B6019)	27	5	62	15

8.17 The 24-hour objective refers to 35 exceedances per year, which equates to 19 exceedances in 200 days. There have been 15 exceedances of this objective throughout the monitoring period, with elevated levels of PM_{10} observed on 6th-9th, 11th August, 21st November and 10th, 16th –19th December 2003, 9th 12th-13th and 16th February 2004.

8.18 More recently¹, monitoring at a background location (away from traffic sources) was undertaken at Old Bleak Hall, Kirby Woodhouse, to the north east of the proposal area. The findings of this monitoring undertaken for a year from September 2004 and are presented in the Table below. There were 12 exceedances of this objective during the monitoring period. Elevated levels of PM_{10} were observed intermittently throughout the year, typically associated with higher regional background concentrations. There were however a small number of exceedances which are likely to be associated with local sources of particulate matter. The mean PM_{10} concentration during this monitoring period was $20.0\mu\text{g}/\text{m}^3$, significantly below the annual mean objective of $40\mu\text{g}/\text{m}^3$.

Table 8/5
Old Bleak Hall, Kirkby Woodhouse, Monitored Period, 22nd September 2004 to 22nd September 2005

24 hour means				
Location	Measured Period Mean ($\mu\text{g}/\text{m}^3$)	Min ($\mu\text{g}/\text{m}^3$)	Max ($\mu\text{g}/\text{m}^3$)	No. of exceedances of the $50\mu\text{g}/\text{m}^3$ objective
Old Bleak Hall, Kirkby Woodhouse	20	5	77	12

2004 Objectives

8.19 The estimated annual mean for Pinxton in 2004 was calculated as $27.8\mu\text{g}/\text{m}^3$ significantly below the objective of $40\mu\text{g}/\text{m}^3$. The number of 24-hour

¹Ashfield District Council, Review & Assessment Local Air Quality Management - Updating and Screening Assessment, April 2006.

exceedances of $50\mu\text{g}/\text{m}^3$ was calculated using the method described in the LAQM Technical Guidance (03) at 20 exceedances, well below the objective of 35 exceedances.

- 8.20 There were 15 exceedances of the 24-hour objective recorded during the monitoring period, however a number of these exceedances were the result of elevated regional background concentrations experienced at a number of AURN sites close to Ashfield District. The calculations denote that the 24-Hour mean would not be compromised at this location.

Estimated Background Concentrations

- 8.21 The National Environmental Technology Centre (NETCEN) has mapped annual average background PM_{10} concentrations for the UK for 2004. The data can then be corrected for future years using the methodology set-out in DEFRA Technical Guidance LAQM TG(03)². The mapped annual average PM_{10} concentrations at the application site for 2006 are estimated to be $23.2\mu\text{g}/\text{m}^3$.
- 8.22 Therefore, air quality in the area of the application site with respect to fine particles is considered good.

Deposited Dust

- 8.23 Dust deposition monitoring was carried out at a number of receptors close to the proposed landfill facility. Table 8/6 below shows the daily dust deposition levels at the seven stations monitored by Vibrock Limited and averaged for the four month period October 1997 to February 1998.

Table 8/6
Dust Deposition Levels (milligrams per square metre per day)

Monitoring Location	Undissolved Solids ($\text{mgm}^{-2}\text{d}^{-1}$)
1. Bleak Hall Farm, Annesley Woodhouse	7.2
2. Two Dale Farm, Selston Lane	11.9
3. Victoria Street, Selston	24.9
4. Arthur Green Ave, Kirkby Woodhouse	8.0
5. Boggs Farm, Salmon Lane	13.1
6. Adjacent to Mushroom Farm	5.4
7. Adjacent to Salmon Lane	7.7

Footnote: Average daily deposition rates over a 4 month period

- 8.24 There are no definitive standards for deposited dust in the UK or Europe although criteria have been developed in the United States and elsewhere.

² DEFRA (2003) *Local Air Quality Management Technical Guidance. Part IV of the Environment Act 1995.* LAQM.TG(03).

In England and Wales a ‘custom and practice’ limit of 200 mg/m² per day is used for measurements with dust deposition gauges³. Deposition rates greater than this may give rise to a nuisance. It can be seen from Table 8/6 that ambient conditions around the application site are substantially below this threshold.

Odours and Bio-aerosols

8.25 There are no measurements of ambient odour or bio-aerosol concentrations available in the vicinity of the application site.

SENSITIVE RECEPTORS

Receptors Considered

8.26 Locations with a high sensitivity to particulate emissions include hospitals and clinics, hi-tech industries, painting and furnishing and food processing. Locations classed as being moderately sensitive include schools, residential areas and food retailers.

8.27 There are a number of residential and commercial properties located around the site. A number of these properties have been identified for the purpose of assessing potential impacts of emissions from the existing and proposed development. They were selected on the basis that they are the closest, in all directions, around the site. The identified receptors are described in Table 8/7.

**Table 8/7
Location of Sensitive Receptors Around the Application Site**

Locations	Direction from Site Activity	Distance from Waste Management Facility/Reclamation
Croft Cottage	Compost Maturation – East Northeast	650m
	Tip Reclamation – East Northeast to East Southeast	375m
	Void Reclamation – North East to East Northeast	220m
Suvla Bay	Compost Maturation – South East	300m
	Tip Reclamation – East Southeast to South	500m
	Void Reclamation – South Southeast to South Southwest	180m
Bleakhall Farm	Compost Maturation – East Northeast	900m
	Tip Reclamation – East Northeast to East Southeast	575m
	Void Reclamation – East Northeast to East	420m

³ Environment Agency M17 – Monitoring of Particulate Matter in Ambient Air Around Waste Management Facilities (2004)

...cont		
Locations	Direction from Site Activity	Distance from Waste Management Facility/Reclamation
Two Dale Farm	Compost Maturation – South Southeast	575m
	Tip Reclamation – Southeast to South Southwest	600m
	Void Reclamation – South to South Southwest	470m
Bryngwyn/Salmon House	Compost Maturation – East Southeast	1050m
	Tip Reclamation – East to South East	925m
	Void Reclamation – East to South East	610m
Mushroom Farm 'Leedale' (Salmon Lane)	Compost Maturation – South Southwest	300m
	Tip Reclamation – South Southeast to South Southwest	400m
	Void Reclamation – South Southwest to West Southwest	420m
Kirkby Park's Farm (immediately east of M1)	Compost Maturation – West Southwest	370m
	Tip Reclamation – South Southeast to West	120m
	Void Reclamation – West Southwest to West Northwest	735m
Residential Property (immediately west of M1 near Selston)	Compost Maturation – South West	500m
	Tip Reclamation – South Southeast to South West	325m
	Void Reclamation – South Southwest to West Southwest	625m
Kirkby Lane Farm	Compost Maturation – West Northwest	850m
	Tip Reclamation – South West to West Northwest	325m
	Void Reclamation – West Southwest to West Northwest	900m
Kirkby Park's Farm (immediately west of M1)	Compost Maturation – West Northwest	1500m
	Tip Reclamation – West to Northwest	875m
	Void Reclamation – West to West Northwest	1400m
Hollies/High Cliff (B6018)	Compost Maturation – North Northwest	950m
	Tip Reclamation – North West to North Northeast	300m
	Void Reclamation – North West to North Northeast	770m
Wharf Yard	Compost Maturation – North East	950m
	Tip Reclamation – East Northeast to East	350m
	Void Reclamation – North Northeast to North East	330m
Properties on Beauvale Road (Kirkby Woodhouse)	Compost Maturation – East Northeast	875m
	Tip Reclamation – East Northeast to East Southeast	500m
	Void Reclamation – North East to East Southeast	350m

8.28 Other surrounding land uses/designations include:

- Boggs Wood, a SSSI located adjacent to the western boundary of the site;

- Annesley Woodhouse Quarry (disused), a SSSI located to the south-east of the application site; and
- normal arable/pastoral farming land.

8.29 These land uses are unlikely to be particularly sensitive to dust and odour at the likely levels arising from the proposed development of the application site.

Natural Attenuation and Dispersion

Dust

8.30 The distance from the source to the sensitive location is crucial. Both airborne dust concentrations, and dust deposition rates, fall off rapidly on moving away from the source. This is primarily due to its dispersion and dilution, but is also enhanced by the rapid deposition of the larger particles. The very largest particles usually only travel less than 20m before being deposited.

8.31 To allow for this effect of distance, buffer zones are often defined by mineral and waste planning authorities around potentially dusty activities to ensure that sufficient protection is provided. They have not been established in any rigorous scientific way, but usually range from 50 to 200m. The 1995 DoE Guidance on dust from surface mineral workings, however, recommends a stand-off distance of 100-200m from significant dust sources (excluding short-term sources), although it is recognised that these distances can be reduced if effective mitigation measures are identified and implemented. In general, surface mineral workings would be considered to have a greater potential for dust generation and release to atmosphere than a landfill site, however, they do have some potentially dusty activities in common (e.g. unsealed haul roads).

Odour, Gaseous Pollutants and Bioaerosols

8.32 As described above for dust, the distance from an odour source or source of gaseous pollutants to the sensitive location is also crucial. The greater the distance to sensitive receptors, the greater the opportunity there is for emissions to be dispersed to a level where they would not cause an impact. The stability of the atmosphere and wind speeds are important factors in how quickly pollutants would be dispersed and diluted following release. An unstable atmosphere combined with high wind speeds would promote the rapid dispersion of pollutants. Whereas under stable atmospheric conditions (which usually only occur at night) and low wind speeds, pollutants may not be effectively dispersed, particularly when released at ground level.

POTENTIAL AIR QUALITY IMPACTS AND SIGNIFICANCE

Introduction

- 8.33 The proposed development can be divided into a number of main activities including:
- Reclamation of the Tip with imported inert wastes from “muck shifting” operations. Imported wastes would be screened and crushed to remove any recyclable materials (such as rock, concrete etc) or impurities (steel). Recyclables would be exported off site, whilst impurities would be tipped within the adjacent landfill.
 - Reclamation of the Void by infill with biodegradable wastes which would include commercial, industrial and municipal solid waste (MSW), within a fully engineered containment landfill.
 - The establishment of a compost maturation facility. Compost from an off site plant would be imported and allowed to mature in a “dutch barn” style structure.
 - Construction of a new access road linking the site with the A608 to the south.
 - Ancillary development in the form of landfill gas infrastructure, leachate and offices/weighbridge.

Dust Assessment

Potential Dust Emissions and Control Measures

- 8.34 Dust (particles) can be generated by a range of natural and man-made processes and can be a significant air quality issue associated with landfill operations. There are a number of existing and proposed activities that have the potential to generate dust, these include:
- construction works (compost maturation facility, new access road and landfill cells);
 - waste handling and infilling activities;
 - compost maturation facilities; and
 - vehicle movements associated with all activities on site;

Potential Health Impact of Fugitive Dust

- 8.35 Airborne particles cover a wide range of particle sizes and types (e.g. wind blown dust, sea salt aerosols, biological material and secondary particles). As shown in Appendix 8/2, in the UK and Europe, air quality standards and guidelines are related to particles of less than 10 μm in aerodynamic diameter, referred to as PM_{10} . These particles are representative of the large

proportion of airborne particulate matter and may have a potential impact on health.

- 8.36 The Quality of Urban Air Review Group (QUARG) report comments⁴ on the potential health effects of airborne particles by reference to a detailed review of this issue undertaken by the Department of Health's Committee on the Medical Effects of Air Pollutants (COMEAP)⁵. However, there is no convincing evidence that healthy individuals would be significantly affected by ambient levels of particles occurring in the UK¹¹. Furthermore, with regard to the health effects from specific types of particles, the QUARG report states:

"It is unlikely, however, that coarse, wind-blown particles have a significant effect upon health."

- 8.37 A large proportion of particles generated from the cell engineering works, landfill and reclamation activities would be coarse particles generated from the mechanical break-up of soils. Therefore, it is unlikely that these activities would have a significant impact on health and it is concluded that the impact of dust from the construction, landfilling and reclamation activities would be limited to potential nuisance impacts only.
- 8.38 This conclusion is substantiated by research undertaken by DEFRA⁶.

Impact of Fugitive Dust

- 8.39 The creation and subsequent dispersion of dust from the Bentinck Tip and Void would be highly dependent on the weather conditions. The wind speed can determine the amount of dust raised, together with the degree of dispersion, while wind direction determines those areas that may be affected. The moisture content of the ground is also important, as dust is not likely to be raised when the ground is damp. It is therefore appropriate to focus on dry days, which account for around one third of the days in a year.
- 8.40 The wind rose presented in Figure 8/1 for Watnall illustrates that the predominant wind directions are from the west southwest and southwest. However, the potential for the generation of airborne dust would increase with wind speed. A wind rose showing the frequency of winds at wind speeds of greater than 5 m/s⁷ is presented in Figure 8/2. Wind speeds of above 5 m/s occur for approximately 17.2% of the time and for the majority of wind directions they occur infrequently at less than 1% of the time. Wind directions from the southwest occur most frequently for the higher wind speeds at 3.8%.

Figure 8/2

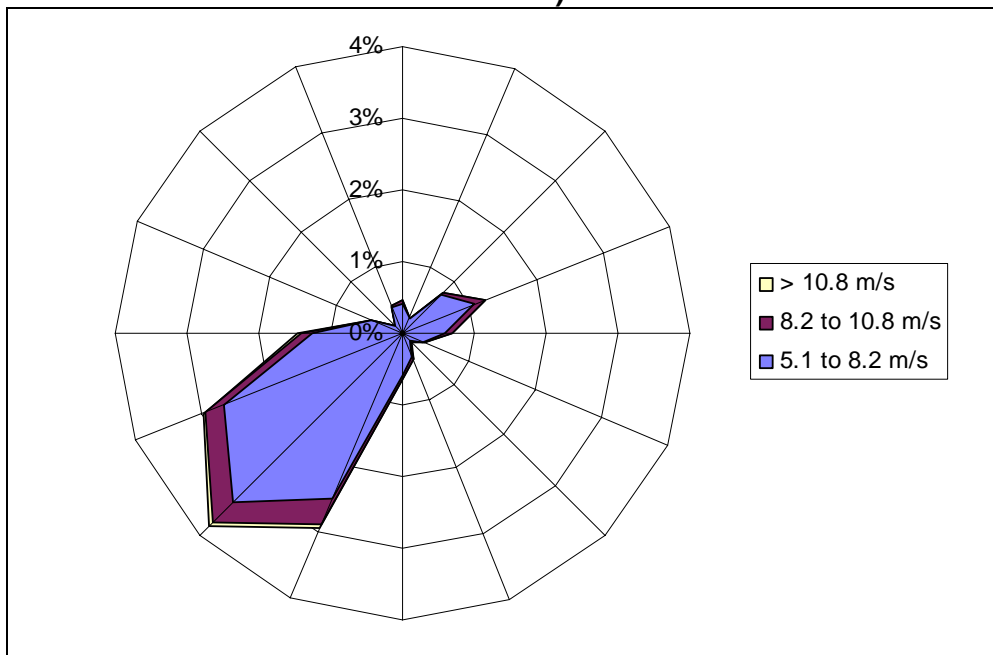
⁴ Airborne Particulate Matter in the UK, 3rd Report of the Quality of Urban Air Review Group (QUARG), May 1996.

⁵ Committee on the Medical Effects of Air Pollutants (COMEAP), Health Effects of Non-biological Particles (1995).

⁶ DEFRA (2004) *Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes*. Available at www.defra.gov.uk

⁷ Guidance such as DETR (1995) *Environmental Effects of Dust from Surface Mineral Workings* indicates that this is a speed above which the risk of windblow increases.

Frequency of Wind Directions for Moderate Wind Speeds at Watnall (1999 to 2003)



8.41 The distance from dust generating activities and frequency of wind speeds carrying airborne particles to the sensitive receptors from these activities is presented in Table 8/8.

Table 8/8
Frequency of Wind Directions towards Dust Sensitive Receptors

Receptor	Site Activity	Location Relative to Site Activity ^(a)	Frequency of All Wind Speeds ^(b) (%)	Frequency of Moderate Wind Speeds ^{(b)(c)} (%)
Croft Cottage	Compost	650m ENE	14.2	3.0
	Maturation – Tip			
	Reclamation – Void	375M ENE TO ESE	29.5	4.9
	Reclamation -	220M NE TO ENE	27.7	6.8
Suvla Bay	Compost	300m SE	4.0	0.1
	Maturation – Tip	500m ESE to S	17.6	1.5
	Reclamation – Void	180m SSE to SSW	11.7	1.1
	Reclamation -			
Bleakhall Farm	Compost			
	Maturation – Tip	900M ENE	14.2	3.0
	Reclamation – Void	575M ENE TO ESE	29.5	4.9
	Reclamation –	420M ENE TO E	23.5	4.5
Two Dale Farm	Compost			
	Maturation – Tip	575M SSE	3.6	0.4
	Reclamation – Void	600M SE TO SSW	15.8	1.2
	Reclamation –	470M S TO SSW	8.1	0.7
Bryngwyn/ Salmon House	Compost			
	Maturation – Tip	1050M ESE	6.0	0.5
	Reclamation – Void	925M E TO SE	19.4	2.1
	Reclamation –	610M E TO SE	19.4	2.1
Mushroom Farm ‘Leedale’ (Salmon Lane)	Compost			
	Maturation – Tip	300m SSW	4.2	0.2
	Reclamation – Void	400m SSE to SSW	11.7	1.1
	Reclamation –	420m SSW to WSW	16.4	2.3
Kirkby Park’s Farm (immediately east of M1)	Compost			
	Maturation – Tip	370M WSW	5.8	1.2
	Reclamation – Void	120M SSE TO W	27.6	3.8
	Reclamation –	735M WSW TO WNW	12.0	2.3

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Receptor	Site Activity	Location Relative to Site Activity ^(a)	Frequency of All Wind Speeds ^(b) (%)	Frequency of Moderate Wind Speeds ^{(b)(c)} (%)
Residential Property (immediately west of M1 near Selston)	Compost			
	Maturation – Tip	500M SW	6.5	0.8
	Reclamation – Void	325M SSE TO SW	18.2	1.9
	Reclamation –	625M SSW TO WSW	16.4	2.3
Kirkby Lane Farm	Compost			
	Maturation – Tip	850M WNW	2.6	0.3
	Reclamation – Void	325M SW TO WNW	18.5	3.1
	Reclamation –	900M WSW TO WNW	12.0	2.3
Kirkby Park's Farm (immediately west of M1)	Compost			
	Maturation – Tip	1500m WNW	2.6	0.3
	Reclamation – Void	875m W to NW	8.0	1.2
	Reclamation –	1400m W to WNW	6.2	1.0
Hollies/High Cliff (B6018)	Compost			
	Maturation – Tip	950M NNW	2.9	0.4
	Reclamation – Void	300M NW TO NNE	17.7	4.1
	Reclamation –	770m NW to NNE	4.7	0.6
Wharf Yard	Compost			
	Maturation – Tip	950M NE	13.6	3.8
	Reclamation – Void	350MENE TO E	23.5	4.5
	Reclamation –	330M NNE TO NE	22.5	6.7
Properties on Beauvale Road (Kirkby Woodhouse)	Compost			
	Maturation – Tip	875M ENE	14.2	3.0
	Reclamation – Void	500M ENE TO ESE	29.5	4.9
	Reclamation –	350M NE TO ESE	43.0	8.7

(a) Because landfilling of the Void and Tip would take place over a large area, the distances presented are the minimum separation between the landfilling activities and the receptor.

(b) Frequencies are based on the location of the sensitive locations relative to the site of the extension as a whole, for example, The Salmon Lane Properties are the closest sensitive receptor to where the Void landfilling would occur and located to the south of the site, therefore this area is affected by winds from the NNW, N & NNE.

(c) The frequencies presented are based on the worst-case assumption that the entire site would be occupied by dust generating activities simultaneously for the duration of proposed development.

8.42 The impact of the proposed development on each of the receptors is discussed below.

Site Preparation Works

8.43 The construction of the haul road and compost maturation facility would be relatively small scale compared to the main infill activities at the Void and

Tip. The cell engineering works would involve re-profiling using a hydraulic excavator and dump trucks. This re-profiling operation would take place within the voids and would be mainly below the level of the surrounding land, substantially reducing the risk of dust dispersal. Whilst dust may potentially be generated from this part of the operations, suppression using water bowsers or sprays and the fact that a small scale plant would be utilised means that this is not therefore considered to be of major significance.

Vehicular Movements on Site

8.44 The main vehicular access roads and areas around the compost maturation facility would be concrete or tarmac and this would result in reduced emissions of dust compared to unsurfaced roads. However, dust may be generated from material that may be deposited onto the surfaces as this may become entrained and distributed by the passage of vehicles in moderate to strong winds. Haul roads on the Tip and within the Void, which would be used for transporting waste material to the active tipping face, would not be sealed and are likely to have the most potential of all the proposed on-site activities for dust emissions as vehicles travel over them. Common and proven dust suppression methods would be utilised (dampening of unsealed road surfaces using water applied by a tractor and bower) to minimise dust generation from this source. Therefore, important methods of dust control from roads vehicular access areas are design, layout and good road maintenance and cleanliness.

Operation of the Compost Maturation Facility

8.45 It is proposed to construct compost maturation facility for imported compost from a local MBT facility. Dust may arise during the handling and treatment of the waste, for example:

- unloading of vehicles delivering compost;
- placement of compost in the dutch barn;
- the periodic turning of compost within the dutch barn; and
- the removal and transportation of the matured compost product.

8.46 Careful management of these processes is required to ensure that appropriate moisture levels in the compost are maintained (this is central to the composting process, but has the added benefit of suppressing dust emissions), and that attention is paid to the weather conditions during turning and placement to avoid dry periods and/or high winds.

8.47 The closest receptor to the compost maturation facility is the mushroom farm, which is located at a distance of 300m. The frequency with which unfavourable winds blow from the composting facility towards this receptor is 4.2% for all wind speeds. When moderate to high wind speeds are considered this frequency falls to 0.2%, making it very unlikely that a dust nuisance from the facility would be experienced by this receptor.

- 8.48 The highest frequency of moderate unfavourable winds experienced by any receptor in relation to the composting facility is 3.8% and is experienced by the Wharf Yard property in Kirkby Woodhouse. The distance of this receptor from the composting facility is 950m and therefore it is highly unlikely to experience nuisance dust from this source.
- 8.49 All other sensitive receptors identified are either more than 300m from the composting facility or experience a frequency of unfavourable moderate winds of less than 3.8% and are therefore unlikely to be subject to a nuisance dust.
- 8.50 The natural screening of the site by the surrounding land and vegetation combined with the separation distances to surrounding sensitive receptors should ensure that the potential for dust nuisance to arise from the operation of the compost maturation facility is negligible.

Reclamation of the Tip

- 8.51 It is proposed that inert waste material would be imported to the site for reclamation of the Tip site. The imported inert waste would be screened, with any rock, brick or concrete passed through a crusher to produce secondary aggregates. The majority of the screened material would comprise soils, soil forming materials and clays, which would be tipped in the area of the lagoons and spread and compacted. The screening and crushing operations have the potential to generate dust, but would be regulated under authorisation issued by the Environment Agency or local authority: as such, suitable dust suppression measures would be required by authorisation conditions. The tipping operations do not generally give rise to significant dust emissions.
- 8.52 Kirkby Park Farm, located adjacent to the M1 and west of the Tip is closest to the area of the site needing reclamation, at a distance of approximately 120m. Although this part of the application site is reasonably exposed, the frequency with which moderate winds that would carry airborne dust from the application site toward this receptor is low at 3.8% (for both wet and dry conditions). In addition, the farm is screened from the areas requiring restoration by the existing restored western slopes and stands of well-established trees on the boundary of the application site. The combination of the low frequency of winds toward the receptor and existing screening would act to minimise the potential for a dust nuisance to occur at the farm, even without dust suppression measures on-site.
- 8.53 The two residential properties (Hollies/High Cliff) located 300m north of the Tip would be the next closest receptors to the reclamation activities. These receptors experience only a slightly higher frequency of winds coming from the direction of the proposed reclamation works (south-east to south-west winds). Winds from the south to the south-west occur with a frequency of 17.7% for all wind speeds and 4.1% for moderate winds. These receptors are located at an elevation of around 120mAOD, whereas the area to be restored is at an elevation of 140 – 150mAOD. The residential buildings are

effectively screened from the application site by the slope of the terrain and thickly vegetated bunds on the boundary of the site. Despite the higher frequency of moderate winds, the additional separation distance and existing screening would ensure that the likelihood of a dust nuisance occurring at these residential properties as a result of the Tip reclamation activities is not significant.

- 8.54 Croft Cottage, Wharf Yard and the properties on Beauvale Road in Kirkby Woodhouse have higher frequencies of moderate winds blowing toward them from the proposed Tip reclamation activities at 4.9%, 4.5% and 4.9%, respectively. These receptors are located at a greater distance from the reclamation area than the receptors discussed above, whilst the frequency of unfavourable wind directions is not significantly higher. Therefore, they are unlikely to be affected by a dust nuisance. As with the first receptor discussed, on-site dust suppression measures such as the watering of haul roads and load out areas, and the grading and seeding restored areas as quickly as possible following completion, would minimise dust generation and ensure that the separation distances are adequate to protect the surrounding sensitive receptors from nuisance impacts.

Reclamation of Bentinck Void

- 8.55 Waste would normally be transported to the site by road. The delivery of waste would be by a paved site access road to the weighbridge area and then over unpaved roads across the site to the working face. The imported waste would be tipped in the active cell and spread and compacted by a landfill compactor.
- 8.56 The landfilling activities (waste emplacement and covering) are unlikely to generate significant dust emissions, primarily because the waste material being brought into the site would have a relatively high moisture content. The main source of dust emissions associated with the infilling activities would be waste vehicle movements to and from the active tipping face. Added to this, the distance between the landfill and most of the receptors would act to ensure that the potential for a dust nuisance to arise at any of the specified receptors is minimal. Landfilling activities proposed for the Void would come closest to Suvla Bay (180m) and Croft Cottage (220m). Winds blowing from the proposed landfill towards these receptors occur for 11.7% and 27.7% of the time, respectively. When considering only moderate winds these frequencies are reduced to 1.1% and 6.8%, respectively.
- 8.57 The frequency of 1.1% for Suvla bay is low and therefore it is unlikely that a dust nuisance would be experienced at this receptor, despite it being the closest receptor to the Void infilling activities.
- 8.58 The frequency of 6.8% for Croft Cottage has been calculated on the basis that the entire area proposed for infilling would be operational simultaneously (and without specific dust mitigation measures employed). This would not be the case in practice, as the development would be divided into seven engineered cells, which would be developed in sequence. When

considering the proportion of unfavourable wind directions for an individual phase, the frequencies are markedly reduced.

- 8.59 Towards the end of the operational phase of the landfill, Croft Cottage would be relatively close to potential dust-generating activities. A combination of moderate winds that would carry airborne dust from the site toward Croft Cottage occurring at moderate frequencies and the relatively low separation distance from the site means that there is a potential for dust emissions to give rise to a nuisance. However, the effective management of activities and the implementation of mitigation measures (including the planned phasing of the development), together with screening bunds, would ensure that the potential for a nuisance resulting from dust emissions from the proposed extension would be minimised, and unlikely to be significant.
- 8.60 In addition, the frequencies are for both wet and dry weather conditions, and the generation of dust is significantly reduced when surfaces are damp. Days where greater than 1mm of rain falls at the site occur for around a third of the year. When this is combined with the fact that the meteorological data includes wind directions and speeds for both night (when the landfill would not be operating) and day, it further reduces the frequency with which these closest receptors could potentially be affected by dust emissions from the site.
- 8.61 The only other receptors that experience frequencies of unfavourable winds from the landfill of over 5% are Wharf Yard and the properties on Beauvale Road in Kirkby Woodhouse at frequencies of 6.7% and 8.7% respectively. These are located at a greater distance from the landfill than Croft Cottage and it is only the northern most part of the development that would be at a similar elevation to these receptors; therefore, the terrain would provide a natural barrier to potential sources of dust.
- 8.62 For the remaining sensitive receptors, the prevailing wind speeds and directions, relatively large separation distances and existing and proposed screening (bunds and vegetation), would ensure the risk of dust emissions from the landfilling operations to give rise to nuisance is minimal, even in the absence of specific dust mitigation methods.

Impact of Bio-aerosols

- 8.63 For the landfill and composting operations, bio-aerosols may be produced during the following:
- waste arriving at the landfill site that may have already started to decompose which would have the potential to release bio-aerosols as the material is deposited at waste reception areas;
 - further handling of such wastes, such as spreading;
 - the treatment of leachate by means of physical agitation as micro-organisms may be present in the leachate collected from the active and completed cells;
 - handling and transfer of composted material; and

- the compost maturation process.
- 8.64 These activities have the potential to generate bio-aerosols. Although the infilling operations are a potential source of bio-aerosols, compaction of the waste and daily covering would minimise the release of biological material. Waste material and compost handling are also potential sources of bio-aerosols. All of these activities would be conducted using standard industry mitigation techniques, as outlined in the composting guidance⁸, which would prevent or minimise bio-aerosol emissions to atmosphere.
- 8.65 Off-site concentrations would decrease significantly as the bio-aerosols are dispersed and diluted, and concentrations of bio-aerosols would only increase above background levels if winds carry the aerosols towards receptors and there is insufficient dilution of the air to reduce concentrations (e.g. light winds and stable atmospheric conditions). Environment Agency and the Health and Safety Executive (HSE) research shows that bioaerosol concentrations would be at or below acceptable levels at a distance of 250m from the source under most atmospheric conditions. Concentrations also tend to reach background levels within 250m¹. Measures employed at the site to reduce odour nuisance would also minimise the release of bio-aerosols as conditions giving rise to odour may also generate bio-aerosols. The frequency of occurrence of these conditions is discussed in more detail in the Appendix 8/1 that deals with potential odour nuisance from the operation of the proposed landfill.
- 8.66 The mushroom farm ('Leedale') may draw ventilation air into the mushroom production buildings, however the farm is located 300m from the composting operation and 420m from the Void reclamation activities. Therefore, ambient concentrations of bio-aerosols would be at background levels, and the potential impact of any emissions of such material from the proposed composting operation on the mushroom farm would be negligible.

Impact of Corona Ions

- 8.67 A report of the National Radiological Protection Board (NRPB) assessed the creation of charged ions from the corona discharge associated with power lines. The report focused on particle inhalation and deposition on the skin and investigated the potential health effects. It was concluded that any health effects associated with long term exposure would be small and that it was not necessary to carry out further research in this area.
- 8.68 The dust mitigation measures employed on the site would limit the emissions to air of particulate matter and as a result this would limit the potential of corona discharges producing clouds of charged ions in the area surrounding the proposed development at Bentinck. When this is combined with the low potential for negative health effects, the likelihood of corona ions having adverse effects on the health of local residents is very low.

⁸ Technical Guidance on Composting Operations (Consultation Draft), Environment Agency (October 2001)

Fugitive Emissions of Landfill Gas

- 8.69 Landfill gas will principally contain methane and carbon dioxide. However, the gas would also contain trace organic compounds depending on the type of waste deposited at the site. Although the list of trace components identified in landfill gas is long (Parker *et al* identified 557⁹), a list of priority trace components of landfill gas is provided in Environment Agency guidance¹⁰. Hence, compounds have been identified on the basis of both odour and/or concerns regarding potential health effects of the compounds as a result of off-site or on-site exposure.
- 8.70 Although the concentrations vary from pollutant to pollutant over time and from landfill site to landfill site, these compounds are generally only present in landfill gas at low concentrations (e.g. for vinyl chloride, less than 5 mg/m³, or for ethylbenzenes, less than 20 mg/m³). Concentrations tend to be well below short and long term occupational exposure limits for the individual compounds, and are also generally below short term environmental assessment levels (EALs) for protection of human health.
- 8.71 The potential health effects associated with people living near waste management facilities has been investigated in a report published by the Department for Environment Food and Rural Affairs (DEFRA) in May 2004¹¹. One of the most likely source-pathway-receptor relationship concerning landfills is associated with emissions to air, and it is on this pathway that the report focused in particular. No evidence was found that living close to landfill sites significantly increases the incidence of poor health. Further consideration of the potential risks to health of the local population is presented in a report written by Professor Bridges (Professor of Toxicology and Environmental Health) in Appendix 8/3.
- 8.72 Even for on-site operators, exposure to raw landfill gas would not result in significant health effects as measured concentrations in the gas are likely to be substantially less than the relevant occupation exposure limits. For off-site receptors, there would be significant dilution and dispersion of any emissions before exposure would occur which would result in exposure concentrations substantially less than the relevant short term EALs. In addition, significant leakage of landfill gas from the landfill gas collection system would be readily identified by the on-site workforce repairs undertaken to rectify the situation.
- 8.73 In order to minimise the migration of gas from the site (potentially affecting off-site receptors from hazard, odour and health effects) a Landfill Gas Management Plan would be developed for the site.

⁹ Parker, T., Dotteridge, Kelly, S. & Rosevear, A. (2002) Prioritising trace components of landfill gas in the UK. In: *Waste 2002*, The Waste Conference Ltd. ISBN 0-9539301-1-4.

¹⁰ Guidance for Monitoring Trace Components in Landfill Gas (Consultation draft), Environment Agency (November 2002)

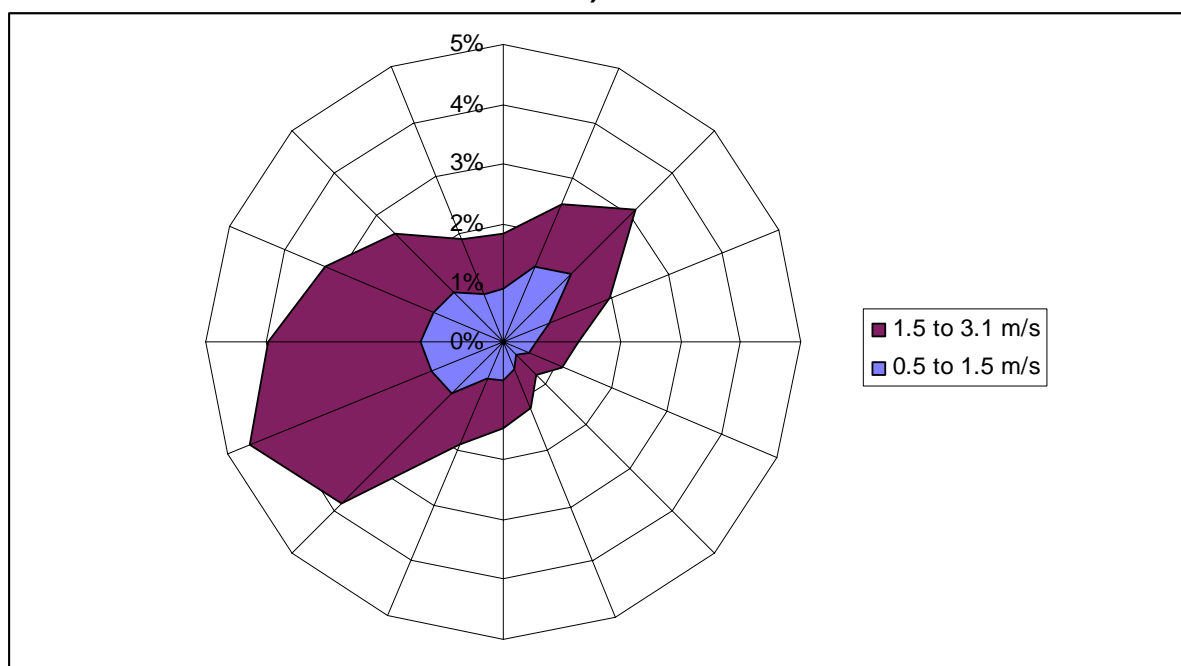
¹¹ Review of Environmental and Health Effects of Waste Management: Municipal Solid Waste and Similar Wastes, Department for Environment Food and Rural Affairs, (May 2004)

- 8.74 As described in Section 3, an active gas management system would be installed. This would consist of a network of pipes, collecting landfill gas from a series of gas collection wells within the waste. The gas would be directed to the gas management plant, with the gas extraction system being expanded progressively as the site develops.
- 8.75 The design, operation and monitoring of the gas management system would be regulated by the Environment Agency under the PPC permitting regime. Provided that the gas collection system operates in accordance with good practice the impact of landfill gas on off-site location is considered to be low.

Odour Impact Assessment

- 8.76 Without measures to reduce odour emissions the landfill, and to a lesser extent the composting facility, are likely to have a moderate to high risk of causing off-site odour nuisance. However, measures to control and manage odours are inherent in the design of the landfill site and, in particular, normal landfill practice under the PPC permitting regime would require that measures are employed on site to minimise releases, and this is taken into account in the assessment of odour nuisance.
- 8.77 As discussed previously, under unstable conditions, emissions from a source are rapidly dispersed and diluted. However, under stable conditions vertical motion is suppressed and hence, dispersion and dilution of emissions from a source are also suppressed. Therefore, odour nuisance from a ground level and/or diffuse sources is most likely to occur under stable conditions and low wind speeds. For an odour nuisance to occur there must also be a significant source of odours. Ambient temperature may also influence the occurrence of odour nuisance, as waste treated at the facility would decompose more rapidly during warm weather.
- 8.78 The wind rose presented in Figure 8/1 for Watnall illustrates that the predominant wind directions are from the west southwest and southwest. However, odour nuisance is likely to be exacerbated by low wind speeds ($<3 \text{ m s}^{-1}$), which occur for 37.2% of the time and the predominant wind direction under these conditions is from the west southwest and west at 4.6% and 4.0%, respectively.
- 8.79 For each of the sensitive receptors identified in this report, the distance from various odour generating activities and frequency of wind speeds carrying odours to the receptor from these activities are presented in Table 8/10. The distance from landfilling activities to each sensitive receptor has been included.

Figure 8/3
Frequency of Wind Directions for Low Wind Speeds at Watnall (1999 to 2003)



8.80 Table 8/10 provides a screening assessment of the odour nuisance risk at sensitive receptors surrounding the site. The risk is assessed qualitatively as high, medium or low on the basis of the proportion of low wind speeds blowing from the site towards each receptor and the distance of the receptor from the potential dust source.

Table 8/10
Odour risk screening Assessment

Receptor	Site Activity	Location Relative to Potential Odour Source	Frequency of Low Wind Speeds ^{(a)(b)}	Risk of Odour Nuisance Occurring ^(c)
Croft Cottage	COMPOSTING	650M ENE	4.6	L
	VOID RECLAMATION	220M NE TO ENE	8.4	H
Suvla Bay	COMPOSTING	300M SE	2.6	L
	VOID RECLAMATION	180M SSE TO SSW	6.2	M
Bleakhall Farm	Composting	900M ENE	4.6	L
	Void Reclamation	420M ENE TO E	8.6	M

AIR QUALITY 8

Receptor	Site Activity	Location Relative to Potential Odour Source	Frequency of Low Wind Speeds ^{(a)(b)}	Risk of Odour Nuisance Occurring (c)
Two Dale Farm	Composting	575M SSE	1.8	L
	Void Reclamation	470M S TO SSW	4.3	L
Bryngwyn/ Salmon Hse	Composting	1050M ESE	3.2	L
	Void Reclamation	6100M E TO SE	9.8	L
Mushroom Farm 'Leedale' (Salmon Lane)	Composting	300M SSW	2.5	L
	Void Reclamation	420M SSW TO WSW	7.6	M
Kirkby Park's Farm (immediately east of M1)	Composting	370M WSW	1.9	L
	Void Reclamation	735M WSW TO WNW	4.3	L
Residential Property (immediately west of M1 near Selston)	Composting	500M SW	3.1	L
	Void Reclamation	625M SSW TO WSW	7.6	L
Kirkby Lane Farm	Composting	850m WNW	1.1	L
	Void Reclamation	900m WSW to WNW	4.3	L
Kirkby Park's Farm (immediately west of M1)	Composting	1500M WNW	1.1	L
	Void Reclamation	1400M W TO WNW	2.3	L
High Cliff (B6018)	Composting	950M NNW	1.2	L
	Void Reclamation	770M NW TO NNE	5.3	L
Wharf Yard	Composting	950M NE	3.8	L
	Void Reclamation	330M NNE TO NE	5.7	L
Properties on Beauvale Road (Kirkby Woodhouse)	Composting	875M ENE	4.6	L
	Void Reclamation	350M NE TO ESE	15.6	M
(a)	Frequencies are based on the location of the sensitive locations relative to the site of the odour sources as a whole, for example, Salmon Farm is located to the East to Southeast of the site, therefore this area is affected by winds from the W, WNW & NW.			
(b)	The frequencies presented are based on the worst-case assumption that the entire site proposed for the biodegradable landfilling would be occupied by a potential source of odour at the same time.			
(c)	H - High; M - Medium; L - Low			

8.81 The majority of receptors are assessed as having a low risk of being affected by an odour nuisance as a result of the various activities proposed at the site. However, the risk of odour nuisance has been assessed as medium or high at a small number of receptors. As a result, detailed odour modelling

has been undertaken to quantify the potential impact on odour levels in the vicinity of the site and sensitive receptors, particularly those identified as having a medium to high risk of being affected by odours from the landfill site.

- 8.82 The quantitative assessment is included as Appendix 8/1. This assessment has been undertaken in accordance with Guidance issued by the Environment Agency (the 'Agency'), using advanced dispersion modelling techniques to determine exposure in terms of European Odour Units (ou_E/m^3).

Traffic Emissions Impact Assessment

Introduction

- 8.83 This part of the section encompasses emissions associated with road traffic.
- 8.84 Nitrogen dioxide (NO_2) and PM_{10} concentrations have been predicted at receptors for the baseline year (2007) and 2013 both with and without the development. Predictions have been made using the Design Manual for Roads and Bridges (DMRB) screening tool.
- 8.85 The following road links have been included in the assessment:
- A608 (East of access road junction). This is known as Location 1;
 - A608 (West of access road junction). This is known as Location 2; and
 - Site access road. This is known as Location 3.
- 8.86 Receptors have been chosen to represent the worst-case scenarios for each road link examined.
- 8.87 Suitable mitigation methods have been provided where air quality impacts have been identified.
- 8.88 Quantitative assessment of the impact on local air quality associated with operation of the development have been compared against National Air Quality Strategy objectives for NO_2 and PM_{10} as set out in Tables 8/1 and 8/2 in appendix 8/2
- 8.89 The predictive modelling only determines the relative contribution to air pollution levels in an area as a consequence the traffic flows and vehicle mix. In order to determine the total concentration at the identified receptors, appropriate 'background' concentrations are required to be taken into consideration.
- 8.90 Background concentrations of NO_2 and PM_{10} for this assessment are displayed in Table 8/11. These values have been corrected for the relevant years using the methodology described in DEFRA Technical Guidance TG(03) .

Traffic & Receptor Assumptions

- 8.91 Full details relating to the movements of traffic to and from the development are set out in Section 11.
- 8.92 Of the total traffic movements once vehicles leave the site access road, the proportion to each road link are as follows:
- Proportion following A608 east (towards A611): 15%
 - Proportion following A608 west (over M1 J27): 10%
 - Proportion following M1 North: 60%; and
 - Proportion following M1 South: 15%

Baseline Conditions

- 8.93 Baseline conditions for PM₁₀ have been described in paragraphs 8.11 to 8.22.
- 8.94 Consultation with Ashfield District Council (ADC) has identified the following:
- First round of Review and Assessment concluded after detailed assessment that there was no requirement for declaration of an AQMA;
 - The ADC second round Updating and Screening Assessment (USA) showed elevated levels of PM₁₀ near the M1 Motorway, however Objectives for all other pollutants were predicted to be met. On this basis, a detailed assessment for PM₁₀ was undertaken and concluded there was no requirement for declaration of an AQMA. The 2006 USA confirms this;
 - there are no significant industrial processes close to the site, which could cause exceedence of air quality objectives; and
 - real-time monitoring has been undertaken at locations close to the proposed access road to the site.

Background Pollutant Concentrations

- 8.95 Average pollutant concentrations in the square kilometre within which the application site is located displayed in Table 8/11. These have been derived from the DEFRA background pollutant database. These values have been corrected for the relevant years using the methodology set-out in DEFRA Technical Guidance LAQM TG(03).

Table 8/11
Background Pollutant Concentrations ($\mu\text{g}/\text{m}^3$)

Pollutant	2007	2013
Nitrogen Dioxide (NO_2)	23.4	19.1
Particulate Matter (PM_{10})	22.8	21.1

8.96 This square kilometre contains the M1 motorway and the use of this data for background values would not be appropriate. On this basis, and in accordance with Box 1.5 of LAQM.TG(03), concentrations have been taken from the square kilometre squares located 4km each side of the motorway to give a more representative background value. The adjusted background values (Table 8/12) show that background pollutant concentrations in the area are low and well below air quality objective values.

Table 8/12
Adjusted Background Pollutant Concentrations ($\mu\text{g}/\text{m}^3$)

Pollutant	2007	2013
Oxides of Nitrogen (NO_x)	21.7	17.5
Nitrogen Dioxide (NO_2)	15.9	13.0
Particulate Matter (PM_{10})	20.7	19.4

Measured Pollution Concentrations

8.97 ADC have historically measured NO_2 concentrations at locations close to the site. As a result of the requirement for a detailed assessment under LAQM, ADC also currently monitoring levels of PM_{10} near the motorway. Locations are shown in Drawing BC 8/1, and 2005 results are displayed in Table 8/13 and Table 8/14, below. Diffusion tube monitoring has also been undertaken at Salmon Lane over the M1, and shows an annual mean of $43.7 \mu\text{g}/\text{m}^3$.

Table 8/13
Monitored NO_2 Concentrations ($\mu\text{g}/\text{m}^3$)

Location	Measured period mean	24 Hour Means		No. of 1-hour excedences of Objective
		Min (1 hour)	Max (1 hour)	
Pinxton Green (B6019)	32.4	0.0	90.4	0.0
Old Bleak Hall (2005 data)	18.3	2.5	82.8	0.0

Table 8/14
Monitored PM₁₀ Concentrations (µg/m³)

Location	24 Hour Means			No. of exceedences of Objective
	Measured period mean	Min	Max	
Pinxton Green (B6019)	35.0	8.0	97.0	22.0

8.98 These monitored values can be used as a basis from which to validate screening. It can be seen that both NO₂ and PM₁₀ levels are significantly below objective levels, even at this location directly next to the M1 motorway.

Assessment of impacts, mitigation and residual effects

8.99 Table 8/15 shows the predicted concentrations at 2m from kerbside at Locations 1 and 2. This represents worst case, as in reality there are no receptors this close to the A608 east of M1 Junction 27.

8.100 For Location 3, predicted concentrations are 20m from the road link to allow a worst case situation at Two Dale Farm.

Table 8/15
Roads Impact 2007

Loc	NO ₂ (µg/m ³)			PM ₁₀ (µg/m ³)		
	Baseline	Development	Difference	Baseline	Development	Difference
Loc 1	32.83	33.33	0.50	25.83(14)	26.00(15)	0.17
Loc 2	32.83	33.33	0.50	25.83(14)	26.00(15)	0.17
Loc 3	23.40	24.53	1.13	22.80(8)	22.98(8)	0.18

(a) Value in parenthesis refers to number of days of >50 µg/m³ PM₁₀.

Table 8/16
Roads Impact 2013

Loc	NO ₂ (µg/m ³)			PM ₁₀ (µg/m ³)		
	Baseline	Development	Difference	Baseline	Development	Difference
Loc 1	25.72	25.84	0.12	22.80(8)	22.83(8)	0.03
Loc 2	25.72	25.84	0.12	22.80(8)	22.83(8)	0.03
Loc 3	19.10	19.82	0.72	21.10(5)	21.18(5)	0.08

(a) Value in parenthesis refers to number of days of >50 µg/m³ PM₁₀.

8.101 The predicted impact of the proposed development in 2007 (opening year) and 2013 (opening year + 6 years) is minor at each of the chosen receptor locations, as the contribution from development traffic does not lead to a breach of any of the air quality Objectives.

- 8.102 The traffic generated by the proposed development would lead to a negligible / minor increase in pollutant levels.
- 8.103 Once the proposed development has ceased operation, any impacts would cease.
- 8.104 There is no mitigation suggested specifically in relation to the generation of traffic-related pollutants.
- 8.105 It is anticipated that emissions from road traffic would continue to decline in future years as fuels become cleaner and vehicles more efficient, subsequently resulting in less emissions, although some of this benefit may be negated by national increases in traffic volume.

MITTIGATION MEASURES

- 8.106 Measures for minimising dust emissions are summarised in table 8/17 along with the estimated effectiveness of the measures proposed.

Table 8/17
Summary of Dust Control Measures and Estimate of Effectiveness

Site Operation	Dust Control Measures	Estimate of Effectiveness
Construction Works:	Water sprays to be used as required	High
	Avoid soils handling during adverse weather conditions	High
	Optimise timing re weather and seeding season	High
	Any soil bunds graded to minimise wind blown dust	Moderate
	Minimise double handling of material	Moderate/Low
Access & Internal Roads:	Paved site roads	High
	Roads to be regularly maintained by sweeping to minimise dust generation (if necessary)	High
	Speed controls to be implemented and enforced on all haul routes (10 – 15 mph)	Moderate
	Water bowsers to be used as required	High
Monitoring:	Weather monitoring equipment	High

Best Practice for Minimising Odour Nuisance and Release of Bio-Aerosols

- 8.107 It is considered that the appropriate response to odour problems on a landfill site is to consider a systemic and holistic approach to emissions, bearing in mind that the whole landfill is an integrated system. This is consistent with the approach to the PPC permitting regime. With such a comprehensive approach, the operator can be pro-active in preventing odour problems before they occur and control existing emissions at source. The Environment Agency internal guidance document on the Regulation of Odour at Waste Management Facilities ('Odour Guidance') states:

'The placing of a condition on a licence which, in itself, specifically seeks prescriptively to limit or eliminate odour from a waste management facility is not likely to be the most effective means of achieving such control. Proactive means are required to achieve adequate and effective control of odours at source by licence conditions which ensure good day to day site management of operational activities on the site'

8.108 This guidance therefore suggests that the primary and most effective way to control odours is to deal with them at source. Many of these measures would reduce the release of bio-aerosols as well as odour.

8.109 Operational measures include:

- minimising the area of the active tipping face;
- ensuring that the layer of cover material is applied regularly throughout daily operations;
- placing daily cover material over the exposed existing cover material layer to prevent odour release prior to over tipping;
- a limit on the depth of waste deposits;
- a restriction on the time of acceptance of malodorous wastes;
- immediate burial of odorous wastes;
- ready availability of inert landfill cover material to facilitate the immediate covering of wastes.

8.110 Leachate and landfill gas collection and treatment systems include:

- the use of sealed wells and chambers where this is practicable; and
- the use of a sophisticated landfill gas extraction system and utilisation of the collected gas.

8.111 Off-site monitoring and control mechanisms include:

- daily odour monitoring surveys on the site boundary; and
- monitoring and remedial measures.

8.112 A summary of activities and potential odour sources are identified in Table 8/18, along with measures to control odour generation and release.

**Table 8/18
Odour and Bio-Aerosol Control Measures**

Activity and/or Source	Mitigation Measures
Waste storage and transport	Minimise storage periods
	Minimise transit times
Disposal of odorous waste	Waste vehicles sheeted
	Waste is compacted and covered as soon as practicable
	Regular use of daily cover
	Use of intermediate cover on temporary faces
Operational Activities	Ensure cover is adequate and consistent
	Minimise the active tipping area; Review location of tipping – move tipping area
	Cover progressively
Landfill Gas	Ensure type and depth of cover are adequate
	Progressively reinstate and extend the gas abstraction system as the extension is over-tipped and capped
	Where possible, maximise distance of location of landfill gas equipment from sensitive receptors (eg. a temporary flare)
	Regular monitoring of the efficiency of the gas collection system
	Regular inspection and maintenance of the gas collection system to prevent failures (e.g. pumps or pipe work)
Leachate System	Adequate sealing of gas abstraction wells
	Connecting leachate wells to gas abstraction system
	Monitoring of biological processes to ensure maximum efficiency and minimum odour
Weather conditions	Assess localised use of odour neutralisers (should be used selectively and with caution)
	Monitor on-site
	Consider phasing of tipping sequence in respect of daily wind and weather conditions

Landfill Gas and Landfill Gas Combustion Emissions

8.113 A Landfill Gas Management Plan would be developed for the site to provide a framework for the management and monitoring of landfill gas based on the site characteristics and the potential risks presented by the site. The Landfill Gas Management Plan would be developed as part of the PPC permitting process and would be approved and regulated by the Environment Agency.

Control Measures

8.114 The gas management system would incorporate the active management of generated gases and would ensure that the gases would be treated and

disposed of via landfill gas engines with excess gas being directed to a flare for combustion. The gas utilisation plant would be expanded as production rates increase and make additional gas engines economically viable.

- 8.115 The Landfill Gas Management Plan would include construction quality assurance (CQA) procedures to ensure the gas extraction and collection systems are constructed to an appropriate standard. Operation and maintenance procedures (in accordance with the manufacturers' instructions) would ensure the continued operation of the extraction system, gas engines and flares and would minimise system and plant downtimes due to unscheduled events.
- 8.116 To support both the EIA and the PPC permit application, the landfill gas combustion emissions have undergone a detailed atmospheric dispersion modelling assessment¹². The model used for assessment of impact in this study was AERMOD dispersion model, developed by the US Environmental Protection Agency and provided in the form of Breeze AERMOD GIS Pro v5.0, approved by the Agency for such studies. The impact of the stack emissions from the proposed landfill gas engine and flares has been assessed using the dispersion model to predict ground level concentrations of pollutants arising as a result of the operation of these units. The results of the modelling have been compared to relevant air quality standards and guidelines. The impact on air quality of the gas engines/flares with regard to concentrations of Nitrogen dioxide, particulates (PM₁₀), Sulphur dioxide and Benzo-a-pyrene has been the focus of the assessment, further to a screening study.
- 8.117 The predicted ground level concentrations of all pollutants assessed indicate that the contributions from the landfill gas utilisation plant would not lead to off-site exceedences of Air Quality Strategy objectives and Environmental Assessment Levels for any of the assessed pollutants at any location.

SUMMARY AND CONCLUSIONS

- 8.118 An assessment has been made of the potential air quality impacts associated with the proposed development. The assessment considered the proposed infilling of the Tip and Void and the establishment of a compost maturation facility with regard to potential dust, odour, bio aerosols and traffic emissions.
- 8.119 The natural screening, sealing of the haul roads and the separation distances between receptors and the compost maturation facility result in a dust nuisance from this source being very unlikely to occur.
- 8.120 Good management of activities, the low frequency of unfavourable winds and the relatively large separation distances to the sensitive receptors mean that activities associated with the inert infilling of the Tip are unlikely to result in a dust nuisance at any of the receptors identified within the report.

¹² SLR Consulting, Proposed Bentinck Landfill: Detailed Assessment of Air Quality: Landfill Gas Combustion Emissions, September 2006 (SLR Ref 4C.197.299), undertaken on behalf of WRG.

- 8.121 Croft Cottage would at some point be relatively close to the Void infilling activities and experiences a relatively high frequency of unfavourable winds. However, effective site management and the implementation of mitigation measures would ensure that a dust nuisance is unlikely to be experienced at this receptor.
- 8.122 Monitoring of particulates would allow effective assessment of mitigation measures in place and would assist with implementing good site management practices.
- 8.123 The quantitative odour modelling identified that Croft Cottage has the greatest risk of exceeding the limit criterion set out for odour. However, the application of best available techniques and appropriate mitigation measures would ensure that this risk is minimal and below the impact criterion.
- 8.124 The good management of activities with the potential to generate bio aerosols combined with adequate separation distances from the potential sources to the sensitive receptors would ensure that levels experienced by all receptors would be no greater than expected background concentrations. The mushroom farm receptor, which is potentially very sensitive to raised bio aerosol levels, is over 250m from any sources of bio aerosols and therefore levels would be expected to no higher than background concentrations, even without the implementation of on site mitigation measures.
- 8.125 The design, operation and monitoring of the gas management system would be regulated to ensure that the impact of landfill gas on off site receptors is minimal. Evidence of potential health effects associated with living near to landfill sites is inconclusive as the recent study was not able to separate the potential effect of the landfill from other confounding factors.
- 8.126 The impact of traffic associated with the proposed development would result in a very minor increase in PM₁₀ and NO₂ levels with the Air Quality Strategy Objectives being met for these pollutants.