Matthew Stoaling

AIR QUALITY

CD6/4/B

Appeal A: APP/EPR/636: Daneshill Soil Treatment Facility

Appeal B: APP/EPR/651: Daneshill Soil Treatment Facility

Appeal C: APP/EPR/652: Maw Green Landfill Site

Proof of Evidence by Mr Matthew Stoaling

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FOR FCC Recycling (UK) Ltd and 3C Waste Ltd

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Isopleth Ltd.
Registered in England and Wales No. 9150373

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1.0 INTRODUCTION

Qualifications and Experience

1.1 My name is Matthew Stoaling. I am the founder of Isopleth Ltd, an independent air quality consultancy. I hold a Bachelor of Science Degree with Honours in Agriculture and Environmental Science from the University of Newcastle upon Tyne. I also hold a Master of Science Degree from the University of Newcastle upon Tyne in Environmental Resource Assessment. I am a Fellow of the Institute of Air Quality Management (IAQM), a Member of the Institute of Environmental Science (IES) and a Chartered Environmentalist.

1.2 I have been a practising air quality and odour specialist for over 25 years. During this time I have provided air quality advice and services to a range of industry sectors and clients, including those involved with solid waste, agriculture, waste water, residential and commercial development. I have also worked on behalf of local authority and government agencies advising on air quality and odour issues, including documents published by the Environment Agency, Sniffer and the Institute of Air Quality Management.

1.3 In June 2023 I was formally appointed by the appellents to give air quality evidence at the inquiry in relation to the Environmental Permitting appeal for the Daneshill Soil Treatment Facility (STF). My instruction was subsequently expanded to encompass the 3 Environmental Permitting appeals relevant to the two STFs:

i. Daneshill STF: The STF is located on the Daneshill Landfill site, Daneshill Road, Lound, Retford, DN22 8RB; and

ii. Maw Green STF: The STF is located on the Maw Green Landfill site, Maw Green Road, Crewe, CW1 5NG.

1.4 These sites require Environmental Permits to operate, regulated by the Environment Agency (EA).

1.5 I have visited the both sites and surrounding areas, in addition to an operational STF site at Edwin Richard Quarry (Rowley Regis).

Setting of Sites and Development Descriptions

1.6 Full descriptions of the location and setting of each site is provided in application documents for both the site at Daneshill (CD2/1) and Maw Green (CD2/3). I have included further detail only where is it directly relevant to my air quality evidence.

Background to Appeals

1.7 Full descriptions of the background for each of the 3 appeals (APP/EPR/636, APP/EPR/651, APP/EPR/652) are described in the Appeal Documents (CD4/1 – 4/4) and I shall not repeat these other than to confirm that no specific issues relating to atmospheric dispersion were raised by the EA in their Statements of Case (CD5/1), however a general concern was raised relating to the potential for release of asbestos fibres from the STF and impact at sensitive receptor locations.

1.8 Notably the concerns relating to the potential for release of asbestos fibres from the STFs and subsequent impact at sensitive receptor locations (i.e. dispersion) was not raised in any of the issued Permitting Decision documents.

Scope of Evidence

1.9 Discussion of the potential for asbestos release (i.e. 'source') is a topic covered by Dr Simon Cole (**CD6/1/B**).

1.10 My evidence describes the potential for air quality impacts from the STFs on potentially sensitive receptors in the event that asbestos fibres were to be released in significant numbers, which the appellant contends they will not. Specifically this relates to the effect of atmospheric dispersion (i.e. 'pathway') at each site. Discussion of the potential for asbestos release is a topic covered by Dr Simon Cole (**CD6/1/B**).

1.11 In particular, I have quantitatively assessed the potential site specific dispersion factors at each of the STFs which may then be used to assess the risk of any impacts in the event that asbestos fibres were to be released.

1.12 Associated issues are are addressed by other technical experts (**CD6**), such as:

i. Risk of asbestos release;
ii. Policy and Regulatory Standards; and
iii. Whether the measures constitute Best Available Techniques.

1.13 The scope of my evidence also includes my responses to concerns raised by 3rd parties in relation to the Daneshill STF. There have been no concerns raised by 3rd parties in relation to the Maw Green STF.

1.14 I have also prepared a Summary Proof or Evidence (**CD6/4/A**).

2.0 ASSESSMENT APPROACH

Guidance

2.1 Environment Agency '*Risk assessments for specific activities: environmental permits*' is web-based Guidance[1] for the assessment of risk to air, water and soil from sites subject to Environmental Permitting.

2.2 The section of the web-based Guidance relevant to atmospheric dispersion is '*Air emissions risk assessment for your environmental permit*'. This section provides standard dispersion factors (DFs). DFs are mathematical factors of dispersion / dilution which take into account the emission release rate (RR) from the source, basic information relating to the source (such as release height and area) and the averaging time over which the pollutant is released.

2.3 The standard web-based DFs are a rough tool for impacts screening. The EA Guidance states that:

'You can have detailed modelling done if you've used the risk assessment tool to do your risk assessment but you want to provide data that's:

- *more accurate – the tool does not include the plume rise (a factor that affects the effective height of release) of your emissions in its calculations*
- *less pessimistic – for example if you want to show that your emissions are a lower risk than the risk assessment tool's estimates'*

2.4 For purposes of these Permitting Appeals I have completed detailed dispersion modelling for the two STFs. This means that more accurate site-specific dispersion factors are available than the generic EA screening values.

2.5 Detailed dispersion modelling is typically associated with gaseous emissions. However it can also be used for (very) small particles and the EA accepts the use of modelling for these (PM_{10} and $PM_{2.5}$, for example). In the event that asbestos fibres are released from a source, these are unlikely to behave in an identical manner to a small dust or smoke particle, for example. However, peer reviewed and published research is available[2] which demonstrates that dispersion models (such as ADMS or AERMOD) are effective tools for releases of asbestos fibres and have found a good relationship between modelled and monitored concentrations.

[1] https://www.gov.uk/government/collections/risk-assessments-for-specific-activities-environmental-permits

[2] **CD1/3/MS1** Kang D, Hwang Y, Choi Y, Kim SY, Kim YK. *Monitoring and Simulating Environmental Asbestos Dispersion from a Textile Factory*. Int J Environ Res Public Health. 2018 Jul 3;15(7):1398.

2.6 Based on the information available I am of the view that the detailed dispersion modelling of asbestos fibres is superior to the use of the web-based screening DFs in this case.

2.7 It should be noted that, although EA Guidance '*M17 monitoring of particulate matter in ambient air around waste facilities*' (**CD1/N**) does mention asbestos[3], it does not specifically address issues of dispersion, or present dispersion factors for particulates and / or asbestos.

Baseline Conditions

2.8 The dispersion modelling results are presented as a dispersion factor. This is therefore independent of any baseline levels of dust or particulate (and asbestos, as discussed in the Evidence of Dr Simon Cole **CD6/1**).

Particle Re-suspension

2.9 Dispersion models do not take into account particle re-suspension. Particle resuspension is the re-entrainment of particles initially at rest on the ground into the air flow. This will occur when the 'friction velocity' at the surface of the particle exceeds a 'critical velocity' (also called threshold or pick-up velocity).

2.10 The critical velocity depends on a number of parameters[4], such as:

i. particle and substrate material;
ii. particle and substrate roughness;
iii. particle shape and size;
iv. height of surrounding vegetation (i.e. surface roughness);
v. air humidity;
vi. moisture; and
vii. temperature.

2.11 The wind speed required to re-suspend particles is therefore highly variable. Research (Banari *et al* **CD1/3/MS2**) indicates that:

i. Simulations performed with a wind speed below 7 m/s (15.7mph, a 'Moderate breeze') did not show any significant resuspension;
ii. particle resuspension of dry material starts becoming significant at high wind speed, that is >10 m/s (22.4mph, a 'Fresh breeze'); and

[3] Such as in: Section 7.4 *Fibres: Asbestos and Man-Made Mineral Fibres*

[4] **CD1/3/MS2** Banari, A., Hertel, D., Schlink, U. et al. Simulation of particle resuspension by wind in an urban system. Environ Fluid Mech 23, 41–63 (2023).

iii. At very-high wind speed, that is beyond 14 m/s (31.3 m/s, a 'Near gale') and in the absence of significant vegetation, there is a high potential for resuspension of dry material.

2.12 Furthermore, scientific studies published in the UK and in The Netherlands have established the significance of soil moisture on asbestos fibre release from soil. The laboratory studies reported by IOM (1988)[5] indicate that a soil moisture content of 10% reduced measured airborne fibres by a factor of 10. Similar studies by TNO and reported by RIVM (2003)[6] indicated that a soil moisture content of 5-10% reduced the re-suspension of asbestos fibres in air by a factor of 100.

2.13 The principal assumption made by the authors in the study of farm tracks in South Cambridgeshire (IOM, 2007)[7] on the effects of weather on fibre release was that the airborne fibre concentration on wet days would be 'small, probably negligible' compared to that on dry days.

2.14 In HSG248[8] (Appendix 8) it is stated (A8.4) that:

'if the soil surface is damp almost no release of asbestos fibres to air will occur'

2.15 This is consistent with HSE (2017) EM5 'asbestos essentials' which specifically requires the wetting of asbestos as a method for prevention of fibre release.

2.16 As such, very specific conditions would need to occur for resuspension of asbestos particles to occur, including all of the following management controls:

i. Dry conditions;

ii. Absence of significant vegetation which would operate as a barrier; and

iii. Sufficiently high wind speeds.

[5] **CD1/3/MS3** IOM, 1988. *The release of dispersed asbestos fibres from soils*, Addison J, Davies LST, Robertson A, Willey RJ, Historical Research Report TM/88/14, Institute of Occupational Medicine, Edinburgh, 1988. Sections 4.2 (p15) and 5.4 (p19).

[6] **CD1/R** RIVM, 2003. *Assessment of the risks of soil contamination with asbestos*, F.A Swartjes, P.C Tromp, J.M Wezenbeek, RIVM report 711701034/2003 **CD1/R**

[7] **CD1/3/MS4** IOM, 2007. *An assessment of risks due to asbestos on farm tracks and rights of way in South Cambridgeshire*, Jones, AD, Cherrie, JW, Cowie, H, and Soutar, A. Research Report TM/05/07(rev), Institute of Occupational Medicine, Edinburgh, 2007. Section 5.4.1 (p15)

[8] **CD1/O** HSE, 2023. *Asbestos: The Analysts' Guide, HSG248*, Second Edition, Health and Safety Executive, July 2021.

Dispersion Modelling

2.17 I have used the BREEZE AERMOD Pro v11.0.0.7 dispersion model for the calculation of dispersion factors at both sites. This dispersion model is accepted for use by the EA.

Source Term (Modelling Approach)

2.18 The same general source term has been used for the calculation of dispersion factors at both sites. This is a theoretical dispersion modelling exercise only, FCC remains of the view that the measures in place at the proposed site will prevent the release of 'significant' quantities of asbestos to air. The terms 'significant' in relation to these Permitting Appeals has been defined by Dr Simon Cole in his Proof of Evidence (**CD6/1**).

2.19 For each site, sources of 10m x 10m have been modelled, representing 100m^2 each. A specific emission rate of 0.01g/m^2/s has been used, therefore representing 1g/sec emission from each of the areas. It is essential to note that this emission rate does not represent the emissions from the STF and are theoretical factors only used for calculation of a dispersion factor.

2.20 A steady-state emission factor has been used. For example no account has been taken of wet days when any particicle emissions would be naturally supressed.

2.21 Similarly there has been no diurnal variation factor applied. In reality the site will not operate for all (i.e. 8760) hours of the year. However for purposes of this dispersion modelling this scenario has been modelled in order to ensure that the hours with highest impact (i.e. lowest dispersion factor) have been captured within the data set.

2.22 By comparing these emissions with the results at each receptor, site specific DFs (short term and long term) have been calculated.

Local Meteorological Data

2.23 For meteorological data to be suitable for dispersion modelling purposes a number of meteorological parameters need to be measured on a continuous basis. These include parameters which are not available for every weather station. As such, 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 Met Office.

2.24 If observed suitable meteorological data are not available, then high quality 'numerical weather prediction' (NWP) data should be used. NWP computer models process current weather observations to forecast future weather (rather than recording readings of observed data).

2.25 There is no long term site-specific wind data available for the Daneshill STF or Maw Green STF which records the meteorological parameters needed for dispersion modelling.

2.26 For each site, the dispersion modelling has been carried out using five years (2018-2022) of hourly sequential meteorological data in order to take account of inter-annual variability and reduce the effect of any atypical conditions.

Topography

2.27 The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away. AERMOD utilises digital elevation data to determine the impact of topography on dispersion from a source.

Building Downwash / Entrainment

2.28 The presence of buildings close to some emission sources can significantly affect the dispersion of pollutants by leading to downwash. Downwash effects are only significant where emissions are from a point source (such as a stack) and building heights are greater than 40% of the emission release height. The downwash structures also need to be sufficiently close for their influence to be significant. Downwash effects are not significant for fugitive emissions (such as have been modelled in this case) and are therefore not considered further.

Sensitive Human Health Receptors

2.29 The term 'sensitive receptors' in this case includes any persons, locations or systems that may be susceptible to changes as a consequence of particulate emissions (including asbestos) from the proposed facility.

2.30 Human receptors may be classed as those which are relevant to long term averging periods (such as annual) or short term averaging periods (such as hourly)[9]:

i. Long term: Building façades of residential properties, schools, hospitals, care homes etc.;

ii. Short term: those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more.

2.31 There is no evidence to suggest that asbestos fibres have any effect on vegetation or designated (protected) ecological sites.

[9] **CD1/3/MS5** Adapted from DEFRA LAQM TG22 (page 19). Box 1-1 *Examples of Where the Air Quality Objectives Should Apply*

3.0 DANESHILL STF

3.1 In this section a site specific (theoretical) DF has been calculated for the Daneshill STF based on the inputs described below.

3.2 The EA has issued an Environmental Permit for this site (**CD3/1**, **CD3/2**), indicating that it is satisfied that general issues of disamenity dust / fine particulate matter are not significant.

Dispersion Modelling Inputs

Emission Rate

3.3 The emission rate used for this assessment has been selected to allow simple calculation of the dispersion factor at each of the selected model receptors. Three areas of emission have been modelled:

i. Screening / Processing;
ii. Biotreatment Pile - South; and
iii. Biotreatment Pile - North.

3.4 It should be noted that the Biotreatment Piles are not expected to be a source of asbestos emission. However, given that the facility layout is indicative at this time, I have modelled these locations as potential sources, for completeness.

3.5 A source of 10m x 10m has been modelled from each area, representing 100m^2 each. A specific emission rate of 0.01g/m^2/s has been used for this modelling excercise, therefore representing 1g/sec emission from each of the areas. The locations of the 3 No. emission points are shown below and drawing AQ1DH (**CD6/4/C**).

Table 3-1
Source Locations

Stack	OS Xm	OS Ym
Screening / Processing	467585.3	386681.6
Biotreatment South	467595.9	386727.8
Biotreatment North	467587.5	386760.6

3.6 These emissions do not represent the emissions from the Daneshill soil treatment site and are theoretical factors only. By comparing these emissions with the results at each receptor the total dilution (short term and long term) may be calculated.

Local Meteorological Data

3.7 Five years (2018-2022) of hourly sequential meteorological data from the Doncaster Sheffield (formerly Robin Hood) Airport meteorological station has been used for the assessment. This site is the most representative data currently available for the area which provides the level of completeness required for dispersion modelling (i.e. minimal missing data).

3.8 Notably, to the south of the Daneshill landfill site STF is a very significant belt of mature deciduous trees (See Photo 7-1, Section 7). These trees will act as a shelterbelt, particularly during the growing season when the trees will be in full leaf, typically March / April to October. The shelterbelt will act to reduce the wind speeds between the STF and caravan site and therefore mitigation particle resuspension.

3.9 The meteorological data has been prepared based on a surface roughness of 0.25m with the Albedo / Bowen is characterised as deciduous forest (20%), urban (30%) and cultivated land (50%).

Particle Re-suspension

3.10 The Daneshill STF dispersion modelling data set contains 51370 data points. Of these 1429 (2.78%) have a wind speed >10m/s. There are 78 values (0.15%) with a wind speed >14m/s. There was only a single hour of the 51370 in the met data set in which the wind blew over 14 m/s from the north (towards the Travellers site), which occurred at 6pm on 28th March 2020. It had rained during that day. The above data does not include the effects of the shelterbelt to the south of the STF.

3.11 Rainfall data for the local area of the site has been obtained from the Met Office records with 1981 – 2010 mapped averages across the UK. The annual average number of days where the rate of rainfall exceeds 1mm is 113.6 days per year (31% of the year). On these days the release of dusts and fibres will be naturally supressed.

Topography

3.12 The site lies at a basal elevation of around 10m AoD. To the immediately north of the STF the topography is dominated by the pre-settlement profile of the (now closed) landfill site, as showing in Photo 7-2.

3.13 The surrounding land is Topographical data for the site has been obtained in OS digital (.ntf) format. Data was processed by the AERMAP function within AERMOD to calculate terrain heights.

Sensitive Human Health Receptors

3.14 A selection of the closest receptors to the development which have been used for modelling purposes are shown in Table 3.2. It is recognised that this list is not exhaustive, however these receptors have been selected in order to provide an indication of impacts in all directions from the proposed development.

3.15 The Environment Agency[10] has noted that there are no assessment receptors listed on the Northern side of the site within the assessment screening distance used and this is indeed the case. The building at OS GR 467615, 387457 (distance approx. 680 m North of STF area) listed by the EA is, in any event, not an occupied dwelling.

Table 3-2
Modelled Receptors

Reference	Description	OS GR Xm	OS GR Ym
D1	Travellers Site 1	467591.3	386492.8
D2	Travellers Site 2	467695.7	386478.7
D3	Daneshill Cottages	467050.0	386592.0
D4	Loundfield Farm 1	468136.2	386659.7
D5	Loundfield Farm 2	468230.0	386636.0
D6	Tudorstone Building Materials	467725.3	386374.9
D7	Tomlinson Family Settlement	467311.0	386327.0

3.16 Points on the site boundary have also been modelled:

Table 3-3
Boundary Modelling Points

Reference	Description	OS GR Xm	OS GR Ym
B1	Boundary	467488.8	386771.7
B2	Boundary	467658.4	386791.7
B3	Boundary	467670.1	386725.1
B4	Boundary	467659.9	386655.4
B5	Boundary	467497.8	386673.8
B6	Boundary	467456.2	386734.5

3.17 All of the above locations are shown on Appendix Drawing AQ1DH (**CD6/4/C**).

[10] The Environment Agency's Response: To The Additional Documentation Served By The Appellant. DATE: 22nd November 2023 **CD5/5**

Results: Dispersion Factors

3.18 The results of the dispersion modelling for the Daneshill STF, based on the fixed emission factors described above, are presented below. As I have described above, these emissions do not represent the emissions from the Daneshill soil treatment site and are theoretical factors only.

Annual Average DF

3.19 The annual average impact predictions are below.

Table 3-4
Simulated Impact Concentrations (g/m^3): Annual

Receptor	All Sources	Screening / Processing	Biotreatment Pile South	Biotreatment Pile North
D1	0.000029	0.000013	0.000007	0.000009
D2	0.000026	0.000011	0.000007	0.000008
D3	0.000004	0.000001	0.000001	0.000001
D4	0.000009	0.000003	0.000003	0.000003
D5	0.000006	0.000002	0.000002	0.000002
D6	0.000014	0.000006	0.000004	0.000005
D7	0.000006	0.000002	0.000002	0.000002
B1	0.000100	0.000039	0.000030	0.000031
B2	0.000255	0.000048	0.000113	0.000094
B3	0.000268	0.000074	0.000074	0.000120
B4	0.000184	0.000097	0.000032	0.000055
B5	0.000073	0.000033	0.000019	0.000021
B6	0.000053	0.000022	0.000015	0.000016

3.20 Therefore, the model predicts that the release of 1g/s of particulate from the surface of the screening / processing area would, on average over the year, be diluted to 0.000013g/m^3 (13µg/m^3) at R1 the Travellers site. The model predicts that the release of 3g/s of particulate from all emitting areas would, on average over the year, be diluted to 0.000029g/m^3 (29µg/m^3) at R1 the Travellers site.

3.21 The annual average dispersion factors are therefore shown below. The dispersion factor from the screening / processing area is lower than for the biotreatment piles as would be expected given that this source is closer to R1 the Travellers site.

Table 3-5
Dispersion Factors: Annual

Receptor	All Sources	Screening / Processing	Biotreatment Pile South	Biotreatment Pile North
D1	103483	75675	141413	114886
D2	114981	91018	147871	119880
D3	827684	762713	872570	856582
D4	348770	350301	356181	340204
D5	463197	462815	472999	454157
D6	212235	178513	253541	217898
D7	529077	470170	583812	546308
B1	30106	25640	33283	32680
B2	11781	20881	8881	10621
B3	11183	13518	13549	8300
B4	16329	10323	31075	18293
B5	40971	30135	52760	47429
B6	56213	45192	65331	62758

3.22 It can be seen that the dispersion factors are very large even at the STF boundary locations, at above 10,000. In simple terms this means that the releases from the modelled area sources would be diluted by a factor of >10,000 at the boundary location when averaged over the year.

24 hour Average DF

3.23 The 24 hour average impact predictions are below. The highest 24 hour value is shown.

Table 3-6
Simulated Impact Concentrations (g/m^3): 24 hour

Receptor	All Sources	Screening / Processing	Biotreatment Pile South	Biotreatment Pile North
D1	0.00057	0.00026	0.00015	0.00016
D2	0.00058	0.00025	0.00016	0.00019
D3	0.00009	0.00003	0.00003	0.00003
D4	0.00011	0.00004	0.00004	0.00004
D5	0.00008	0.00003	0.00003	0.00003
D6	0.00034	0.00013	0.00010	0.00011
D7	0.00014	0.00006	0.00004	0.00005
B1	0.00135	0.00058	0.00087	0.00046
B2	0.00174	0.00044	0.00099	0.00068
B3	0.00260	0.00067	0.00119	0.00114
B4	0.00249	0.00149	0.00066	0.00100
B5	0.00115	0.00072	0.00044	0.00053
B6	0.00107	0.00033	0.00031	0.00052

3.24 Therefore, the model predicts that the release of 1g/s of particulate from the surface of the screening / processing area would, be diluted to 0.00026g/m^3 at R1 the Travellers site for the highest 24 hour averaging period in the year. The model predicts that the release of 3g/s of particulate from all 3 areas would be diluted to 0.00057g/m^3 at R1 the Travellers site for the highest 24 hour averaging period in the year.

3.25 The 24 hour average dispersion factors are shown below. The highest 24 hour value is shown.

Table 3-7
Dispersion Factors: 24 hour

Receptor	All Sources	Screening / Processing	Biotreatment Pile South	Biotreatment Pile North
D1	5302	3920	6727	6170
D2	5163	4055	6336	5232
D3	32428	31137	33954	31936
D4	27740	26942	26971	26098
D5	35438	35204	33630	33936
D6	8858	7544	10443	9063
D7	20780	16600	23671	21142
B1	2226	1733	1154	2179
B2	1723	2261	1013	1468
B3	1155	1494	839	880
B4	1205	673	1505	996
B5	2610	1387	2251	1874
B6	2800	2986	3183	1935

3.26 It can be seen that the dispersion factors are very large even at the STF boundary locations, at above 1,000 for all sources. The factor is above 5,000 at the modelled receptor locations. In simple terms this means that the releases from the three modelled area sources would be diluted by a factor of >5,000 at the receptor locations when averaged over the year.

Maximum 1 hour DF

3.27 The hourly maximum impact predictions are below. This represents the highest impact of the 51370 hours modelled.

Table 3-8
Simulated Impact Concentrations (g/m^3): 1 hour

Receptor	All Sources	Screening / Processing	Biotreatment Pile South	Biotreatment Pile North
D1	0.00342	0.00147	0.00090	0.00108
D2	0.00274	0.00112	0.00077	0.00092
D3	0.00094	0.00034	0.00033	0.00033
D4	0.00106	0.00035	0.00034	0.00038
D5	0.00085	0.00029	0.00028	0.00030
D6	0.00172	0.00067	0.00051	0.00057
D7	0.00117	0.00044	0.00037	0.00039
B1	0.00643	0.00247	0.00350	0.00287
B2	0.01022	0.00272	0.00631	0.00527
B3	0.00955	0.00475	0.00448	0.00667
B4	0.00802	0.00541	0.00261	0.00383
B5	0.00595	0.00407	0.00251	0.00290
B6	0.00463	0.00223	0.00228	0.00225

3.28 Therefore, the model predicts that the release of 1g/s of particulate from the surface of the screening / processing area would be diluted to 0.00147 µg/m^3 at R1 the Travellers site for the highest modelled hour in the 5 year data set. The model predicts that the release of 3g/s of particulate from the surface of the screening / processing area would, on average over the year, be diluted to 0.0032g/m^3 at R1 the Travellers site for the highest modelled hour in the 5 year data set. The dispersion factors are shown below.

Table 3-9
Dispersion Factors: 1 hour

Receptor	All Sources	Screening / Processing	Biotreatment Pile South	Biotreatment Pile North
D1	877	681	1108	928
D2	1095	890	1293	1091
D3	3205	2923	3073	3060
D4	2843	2855	2909	2624
D5	3537	3451	3633	3343
D6	1745	1483	1975	1756
D7	2559	2268	2722	2561
B1	467	406	286	348
B2	294	368	158	190
B3	314	210	223	150
B4	374	185	384	261
B5	504	245	399	345
B6	648	449	439	444

3.29 It can be seen that the dispersion factor for all sources is above 800 at the modelled receptor locations. In simple terms this means that the releases from the three modelled area sources would be diluted by a factor of >800 at the receptor locations for the highest modelled hour in the 5 year data set.

3.30 Dr Simon Cole discusses in his evidence (**CD6/1**) the relevance of the asbestos levels found at STFs (though monitoring) and what the additional dispersion would mean in relation to these in terms of the (lack of) potential for impact at receptor locations.

4.0 MAW GREEN STF

4.1 In this section a site specific (theoretical) DF has been calculated for the Maw Green STF based on the inputs described below.

Dispersion Modelling Inputs

Emission Rate

4.2 Two areas of emission have been modelled. As for Daneshill, a source of 10m x 10m has been modelled from each area, representing 100m^2 each. A specific emission rate of 0.01g/m^2/s has been used, therefore representing 1g/sec emission from each of the areas. The locations of the 2 No. emission points are shown below and drawing AQ1MG.

Table 4-1
Source Locations

Stack	OS Xm	OS Ym
Emission Area 1	371779.3	357282.7
Emission Area 2	371850.6	357346.1

4.3 These emissions do not represent the emissions from the Maw Green soil treatment site and are theoretical emission rates only. By comparing these emissions with the results at each receptor the total dilution (short term and long term) may be calculated.

Local Meteorological Data

4.4 Although wind speed and direction is recorded as Reaseheath Hall, Nantwich, this does not record all parameters required for detailed dispersion modelling. For this reason, five years (2018-2022) of hourly sequential meteorological data from an NWP meteorological station has been used for the assessment. This site is the most representative data currently available for the area which provides the level of completeness required for dispersion modelling (i.e. minimal missing data).

4.5 The meteorological data has been prepared based on a surface roughness of 0.2625m with the Albedo / Bowen is characterised as deciduous forest (10%), urban (30%), grassland (30%) and cultivated land (30%).

4.6 A windrose for all years of meteorological data are presented in Appendix B.

Particle Re-suspension

4.7 The Maw Green dispersion modelling data set contains 43824 data points. Of these 708 (1.62%) have a wind speed >10m/s. There are 21 values (0.05%) with a wind speed >14m/s.

4.8 Rainfall data for the local area of the site has been obtained from the Met Office records with 1981 – 2010 mapped averages across the UK. The annual average number of days where the rate of rainfall exceeds 1mm is 148 days per year (40.5% of the year). On these days the release of dusts and fibres will be naturally supressed.

Topography

4.9 The site lies at a basal elevation of around 40m – 45m AoD. Topographical data for the site has been obtained in OS digital (.ntf) format. Data was processed by the AERMAP function within AERMOD to calculate terrain heights.

Sensitive Human Health Receptors

4.10 A selection of the closest receptors to the development which have been used for modelling purposes are shown in Table 4.2. It is recognised that this list is not exhaustive, however these receptors have been selected in order to provide an indication of impacts at those closest to the Maw Green STF. The STF boundary modelling points are within the landfill boundary and therefore provide worst case dispersion factors for other allocated sites that may be developed in the future.

Table 4-2
Modelled Receptors

Reference	Description	OS GR Xm	OS GR Ym
R1	Brook House Farm	372139.1	357327.8
R2	Brook House Barns	372174.0	357310.6
R3	Meadow Croft Cottage	371910.4	357125.4
R4	New Development (Maw Green Road)	371852.8	357074.0
R5	New Development (Maw Green Road)	371883.7	357102.6
R6	New Development (Maw Green Road)	371936.4	357156.0
R7	New Development (Maw Green Road)	371956.0	357183.9
R8	South of Maw Green Road	371642.8	357074.7
R9	South of Maw Green Road	371583.3	357074.0
R10	Windy Nook	371459.1	357112.4
R11	Shandon Barn	371359.0	357373.6
R12	Cattle Arch Farm	371722.6	357066.2

4.11 Points on the site boundary have also been modelled:

Table 4-3
Boundary Modelling Points

Reference	Description	OS GR Xm	OS GR Ym
B1	Boundary	371932.2	357394.1
B2	Boundary	371901.3	357310.8
B3	Boundary	371864.2	357214.7
B4	Boundary	371838.0	357149.4

4.12 These locations are shown on Appendix Drawing AQ1MG (**CD6/4/C**).

Results: Dispersion Factors

4.13 The results of the dispersion modelling for the Maw Green STF, based on the fixed emission rate described above, are presented below. As I have described above, these emissions do not represent the emissions from the Maw Green STF and are theoretical emission rates only.

Annual Average DF

4.14 The annual average impact predictions are below.

Table 4-4
Simulated Impact Concentrations (g/m^3): Annual

Receptor	All Sources	Emission Area 1	Emission Area 2
R1	0.00001	0.00001	0.00001
R2	0.00001	0.00000	0.00001
R3	0.00003	0.00002	0.00001
R4	0.00002	0.00001	0.00000
R5	0.00002	0.00002	0.00001
R6	0.00004	0.00002	0.00001
R7	0.00004	0.00002	0.00002
R8	0.00001	0.00001	0.00000
R9	0.00001	0.00000	0.00000
R10	0.00001	0.00000	0.00000
R11	0.00001	0.00000	0.00000
R12	0.00001	0.00001	0.00000
B1	0.00011	0.00002	0.00008
B2	0.00021	0.00004	0.00017
B3	0.00008	0.00006	0.00002
B4	0.00003	0.00003	0.00001

4.15 Therefore, the model predicts that the release of 2g/s of particulate from the modelled sources would, on average over the year, be diluted to 0.00004g/m^3 at R6 / R7 (New Development on Maw Green Road).

4.16 The annual average dispersion factors are shown below.

Table 4-5
Dispersion Factors: Annual

Receptor	All Sources	Emission Area 1	Emission Area 2
R1	142353	178579	118345
R2	172532	211296	145786
R3	68954	51405	104695
R4	126927	85245	248379
R5	86926	59480	161403
R6	56613	48890	67235
R7	50965	51890	50072
R8	215174	170640	291162
R9	263364	212564	346071
R10	363449	303857	452118
R11	381773	326878	458825
R12	198327	162393	254682
B1	18947	43072	12145
B2	9330	23303	5833
B3	25203	16250	56125
B4	58638	37024	140880

4.17 It can be seen that the dispersion factors are very large even at the STF boundary locations, at above 9,000. They are above 50,000 at the closest residences, the new housing on Maw Green Road.

24 hour Average DF

4.18 The 24 hour average impact predictions are below. The highest 24 hour value is shown.

4.19 It should be noted that for the short term predictions (such as 24-hour averages) the highest result for Emission Area 1 may not be the same 24 hour period as for Emission Area 2, therefore the result for 'all sources' will not be the same as the 2 sources added together.

Table 4-6
Simulated Impact Concentrations (g/m^3): 24 hour

Receptor	All Sources	Emission Area 1	Emission Area 2
R1	0.00019	0.00009	0.00012
R2	0.00016	0.00008	0.00011
R3	0.00055	0.00040	0.00021
R4	0.00033	0.00028	0.00012
R5	0.00046	0.00035	0.00016
R6	0.00060	0.00032	0.00035

Receptor	All Sources	Emission Area 1	Emission Area 2
R7	0.00056	0.00032	0.00040
R8	0.00027	0.00017	0.00010
R9	0.00021	0.00013	0.00009
R10	0.00014	0.00009	0.00005
R11	0.00016	0.00009	0.00007
R12	0.00029	0.00019	0.00012
B1	0.00162	0.00036	0.00126
B2	0.00228	0.00069	0.00228
B3	0.00115	0.00093	0.00043
B4	0.00066	0.00059	0.00020

4.20 The model predicts that the release of 2g/s of particulate from the STF would, be diluted to 0.0006g/m^3 at R6 for the highest 24 hour averaging period in the 5 year data set.

4.21 The 24 hour average dispersion factors are shown below. The highest 24 hour value is shown.

Table 4-7
Dispersion Factors: 24 hour

Receptor	All Sources	Emission Area 1	Emission Area 2
R1	10532	11215	8305
R2	12398	12951	8922
R3	3635	2517	4775
R4	6137	3601	8360
R5	4390	2853	6331
R6	3343	3089	2846
R7	3550	3149	2481
R8	7281	5824	9709
R9	9311	7712	11746
R10	14720	11521	19186
R11	12325	10607	14709
R12	6954	5387	8257
B1	1231	2749	791
B2	876	1444	438
B3	1737	1076	2316
B4	3048	1693	4895

4.22 The dispersion factors for all sources are above 3,000 at the closest residences, the new housing on Maw Green Road.

Maximum 1 hour DF

4.23 The hourly maximum impact predictions are below. This represents the highest impact of the 43824 hours modelled.

4.24 As for the 24-hour results, the the highest 1-hour maximum prediction for Emission Area 1 is unlikely to be the same 1 hour period as for Emission Area 2, therefore the result for 'all sources' will not be the same as the 2 sources added together. It therefore follows that the emission factor will also not be an average of the 2 values.

Table 4-8
Simulated Impact Concentrations (g/m³): 1 hour

Receptor	All Sources	Emission Area 1	Emission Area 2
R1	0.00139	0.00065	0.00095
R2	0.00122	0.00061	0.00080
R3	0.00175	0.00138	0.00126
R4	0.00159	0.00129	0.00085
R5	0.00162	0.00144	0.00103
R6	0.00183	0.00155	0.00138
R7	0.00188	0.00153	0.00157
R8	0.00174	0.00103	0.00071
R9	0.00138	0.00082	0.00056
R10	0.00112	0.00064	0.00048
R11	0.00089	0.00052	0.00046
R12	0.00179	0.00127	0.00080
B1	0.00615	0.00171	0.00482
B2	0.00810	0.00314	0.00810
B3	0.00364	0.00364	0.00239
B4	0.00240	0.00227	0.00151

4.25 The model predicts that the release of 2g/s of particulate from the STF would, be diluted to 0.00188g/m^3 at R7 for the highest hour in the 5 year data set.

4.26 The dispersion factors are shown below.

Table 4-9
Dispersion Factors: 1 hour

Receptor	All Sources	Emission Area 1	Emission Area 2
R1	1438	1541	1049
R2	1640	1645	1244
R3	1143	722	792
R4	1254	773	1176
R5	1234	696	968
R6	1091	645	724

Receptor	All Sources	Emission Area 1	Emission Area 2
R7	1061	652	635
R8	1150	970	1414
R9	1452	1218	1790
R10	1791	1562	2100
R11	2241	1919	2163
R12	1120	785	1255
B1	325	585	207
B2	247	318	123
B3	549	274	418
B4	833	441	662

4.27 The dispersion factors for all sources are above 1,000 at the closest residences, the new housing on Maw Green Road. The dispersion factors are above 500 for the sources individually.

4.28 Dr Simon Cole discusses in his evidence (**CD6/1**) the relevance of the asbestos levels found at STFs (though monitoring) and what the additional dispersion would mean in relation to these in terms of the (lack of) potential for impact at receptor locations.

5.0 3RD PARTY COMMENTS

5.1 It is my understanding that there were no 3rd party comments received in relation to the Maw Green Permitting Appeal (Appeal C: APP/EPR/652). Similarly, there were a number of general (non specific) objections received in relation to Appeal A (APP/EPR/636) relating to Daneshill. These did not mention dispersion and I have therefore not commented on these.

5.2 Mr Chambers commented generally that levels of asbestos will be higher as a result of the proposals. Dr Simon Cole has presented detailed evidence (**CD6/1**) as to why the Lound area will not have 'regular asbestos contamination'. The evidence that I have presented in this evidence further confirms the very large dispersion factors at the site. This also addresses the comments of Ms Nicholson, Lound Parish Council, Mr and Mrs George and Ms Bell which were related to winds impacting towards the Lound area.

5.3 Mr Helliwell made points relating to HGV movements, specifically dust released from trackout and resuspension as well as the blowing of asbestos dusts from the material carried in the HGVs. The transport of materials on the wide road network is not an issue for the Environmental Permit. Notwithstanding this, the standard measures for control of dusts from HGVs would be used at the Daneshill STF (such as vehicle sheeting).

5.4 Mr Helliwell also made the point that there are winds from all directions. As described in this evidence all monitored hourly winds over a 5 year period have been used in the dispersion modelling. The impact of the STF remain insignificants at all locations irrespective of wind direction.

5.5 Ms Thomas is a resident of Loundfield Farm. The dispersion factors at this residence was predicted for receptors D4 and D5 in my detailed dispersion modelling as described in Section 3.0 above. The dispersion modelling used 51370 hours of meteorological data, which will include the 9.3% of hours where the wind blows from the sector 266° – 288°, those most relevant to Loundfield Farm. According to the meteorological data set, the wind blows from this sector at a speed greater than 7m/s for 1.9% of the year (including days when it was raining). As such the assessment does take into account winds towards Loundfield Farm. However, clearly in this case the key factor is the lack of significant asbestos emissions, as described in the evidence of Mr Simon Cole (**CD6/1**).

5.6 In summary, there have been no specific points raised in the 3rd party representations that were either not addressed at the application stage (including further submissions) however I have provided further information in this PoE as has Dr Simon Cole in his submissions (**CD6/1**) in order to provide further context and reassurance. There is no evidence to suggest that there will be significant asbestos emissions from the site, and even were this the case the dispersion factors are very large meaning that they would be highly unlikely to have any effect at offsite locations where humans are likely to be present.

6.0 CONCLUSIONS

6.1 My evidence describes the potential for air quality impacts from the Daneshill STF and Maw Green STF on potentially sensitive receptors in the event that asbestos fibres were to be released in significant numbers, which the appellant contends they will not. Specifically I present site specific long and short term dispersion factors (DFs), obtained through detailed dispersion modelling. Discussion of the potential for asbestos release is a topic covered by Mr Simon Cole (**CD6/1**).

6.2 I have visited both sites and surrounding areas, in addition to an operational STF site at Edwin Richard Quarry (Rowley Regis).

6.3 I have used the BREEZE AERMOD Pro v11.0.0.7 dispersion model for the calculation of dispersion factors at both sites. This dispersion model is accepted for use by the EA. The purpose of the dispersion modelling is to provide DFs for each of the sites, as related to the closest human receptor points (residences) as well as boundary points.

6.4 The dispersion modelling results are to be used for calculation of the dispersion factors only. A source of 10m x 10m has been modelled from each area, representing 100m^2 each. A specific emission rate of 0.01g/m^2/s has been used, therefore representing 1g/sec emission from each of the areas. These emissions do not represent the emissions from the STFs and are theoretical emission rates only in order to enable calculation. By comparing these emissions with the results at each receptor the total dilution (short term and long term) may be calculated.

6.5 As described in the evidence of Mr Simon Cole (**CD6/1**), there is no evidence to suggest that there will be significant asbestos emissions from the STF sites. My work shows that, even were this the case, the dispersion factors are very large (for both sites) meaning that they would be highly unlikely to have any effect at locations where humans are likely to be present.

6.6 As such I disagree with the EA that there is significant risk of asbestos exposure from the operation of the Daneshill STF and Maw Green STF as proposed by the operators.

The evidence which I have prepared and provide in this PoE is true and has been prepared and is given in accordance with the guidance of my professional institution and I confirm that the opinions expressed are my true and professional opinions.

7.0 PHOTOGRAPHS

Photo 7-1
Daneshill STF Tree Barrier (December 2023)

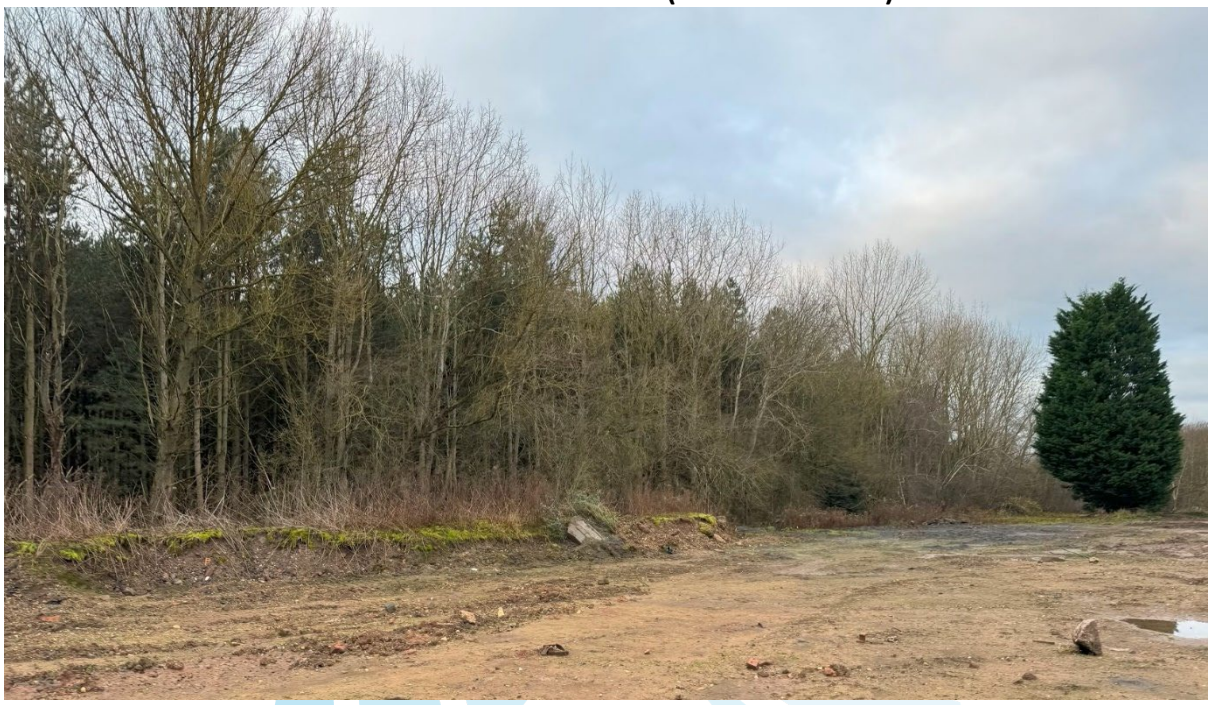
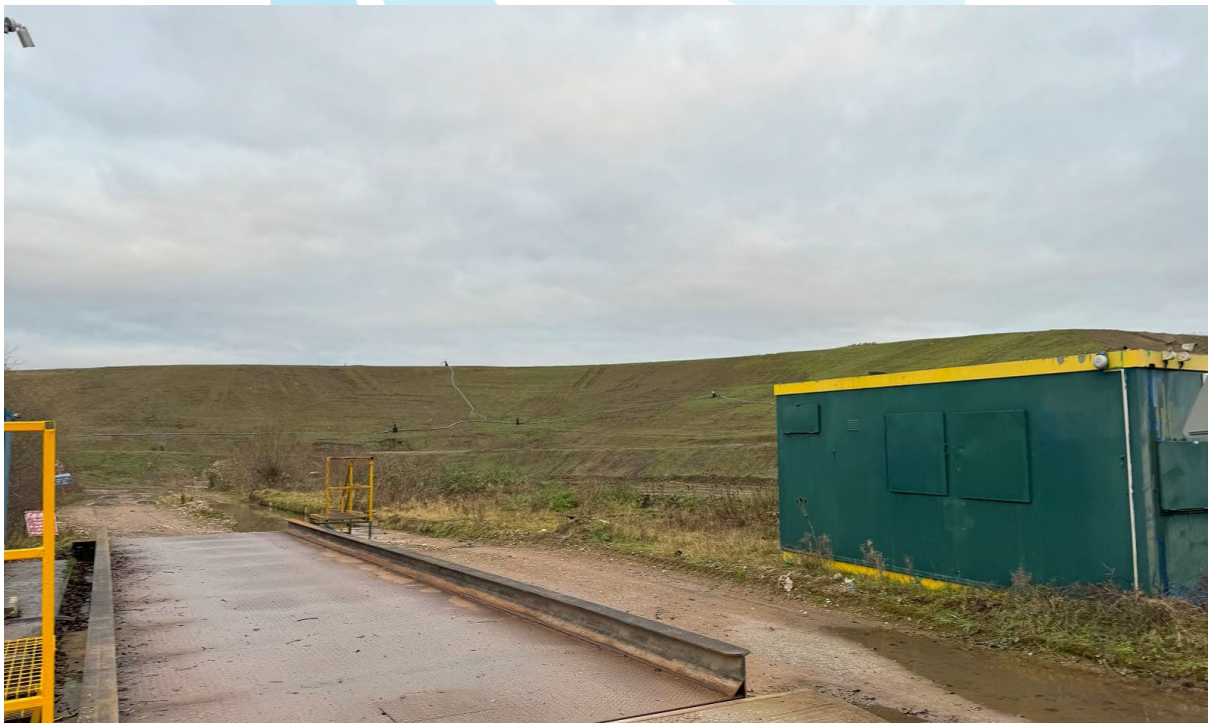


Photo 7-2
Daneshill Landfill Pre-Settlement Profile



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