APPENDIX 6 - 1 Dust Risk Assessment

A1 Dust Risk Assessment Methodology

The criteria developed by the Institute of Air Quality Management[Error! Bookmark not defined.] for the assessment of air quality impacts arising from mineral dust was used as the basis for the assessment methodology discussed in the following sections.

Screen the need for a detailed dust assessment

The need for a detailed dust assessment can be made based on the distance from a mineral site to potentially sensitive receptors using the following criteria:

- PM_{10} needs to be assessed if there are sensitive receptors within 1 km from 'dust generating activities' rather than the site boundary. If there are no relevant receptors within 1 km of the operations, then a detailed assessment can be screened out.
- If there are relevant human and/or ecological receptors within 250 m or 400 m (depending on the rock type) then a disamenity dust impact assessment will almost always be required.

A '*human receptor*' refers to a any location where a person may experience the disamenity effects of dust, or the health effects from exposure to PM_{10} over a period relevant to the ambient air quality objectives.

An '*ecological receptor*' refers to any sensitive habitat affected by dust soiling. This includes the direct impacts on vegetation or aquatic ecosystems, and the indirect impacts on fauna (e.g. on foraging habitats). For locations with a statutory designation, such as a National Nature Reserve (NNR), Ramsar site, Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC) or Special Protection Areas (SPA), consideration should be given as to whether the particular site is sensitive to dust. Some non-statutory sites may also be considered if appropriate, such as a Site of Importance for Nature Conservation (SINC).

Step 1: Describe Site Characteristics and Baseline Conditions

The proposed development and the surrounding area should be described. Factors that need to be considered are:

- Extent of site including site boundary;
- Existing site operations, including currently-consented workings;
- Scale and duration of operations, including phasing;
- Type and location of processing activities, including secondary processing (e.g. concrete batching);
- Mineral type and characteristics (size, moisture content, friability, colour, and opacity);
- Production rate;
- Method/s of working;
- Method/s of materials handling;

- Location/s of storage areas and stockpiles; and
- Location/s and number of access routes and haul roads

The assessment should also consider the principal existing dust sources (other than the application site) such as dust from existing mineral operations, agricultural activities and construction activities. The following information is likely to be required to understand the site characteristics and the baseline conditions:

- The main existing sources of dust in the area. This should include any available monitoring data;
- Background PM_{10} concentrations provided by Defra, and, if available, any existing relevant local monitoring data;
- The location and nature of dust sensitive receptors, shown on a map and/or in a table detailing the direction, and distance from the site boundary or relevant site activity;
- The location of likely sources of dust emission from within the site;
- Any natural or existing mitigating features such as topography and areas of vegetative screening; and
- Local wind roses showing the frequency of directions and speed, and possibly rainfall and ground moisture conditions.

Step 2: Estimate Dust Impact Risk

The dust impact risk for each representative receptor needs to be determined by combining the residual source emissions with the pathway effectiveness.

Estimation of Residual Source Emissions

The level of residual (i.e. abated) dust emissions from the main dust-generating activities on site should be estimated.

This judgement needs to consider the emission potential of each of the sources on the site (including source strength, frequency and duration) and how effectively they are likely to be controlled by designed–in measures proposed as part of the scheme such as the location of particular activities on site and the landscaping at the site boundary.

The following seven types of dust-generating activities on mineral extraction sites are likely to have the greatest potential for dust emissions:

- Site preparation and restoration (including soil and overburden handling;
- Mineral extraction (including blasting);
- Materials handling (e.g. loading onto haul trucks or conveyors);
- On-site transportation (haul roads);
- Mineral processing (e.g. crushing and screening);
- Stockpiles and other exposed surfaces;
- Off-site transportation (e.g. leading to trackout onto external road network).

The Residual Source Emissions should be classified as Small, Medium or Large for each relevant operational activity based on the scale of the anticipated operations considering the designed-in mitigation.

Estimation of Pathway Effectiveness

The site-specific factors determining the Effectiveness of the Pathway are the distance and direction of sensitive receptors surrounding the Proposed Development relative to the prevailing wind directions.

The frequencies of the wind speed in each direction should be calculated in relation to each representative receptor within 400 m of the site boundary based upon meteorological data for 5 years from a representative meteorological station and assigned to the categories in **Table A-1**.

Table A-1: Categorisation of Frequency of Potentially Dusty Winds

Frequency Category	Criteria
Infrequent	Frequency of winds (>5 m/s) from the direction of the dust source on dry days are less than 5%.
Moderately Frequent	The frequency of winds (>5 m/s) from the direction of the dust source on dry days are between 5% and 12%.
Frequent	The frequency of winds (>5 m/s) from the direction of the dust source on dry days are between 12% and 20%.
Very Frequent	The frequency of winds (>5 m/s) from the direction of the dust source on dry days are greater than 20%.

The distance between each representative receptor and the dust source should be categorised as outlined in **Table A-2**.

Table A-2: Categorisation of Receptor Distance from Source

Frequency Category	Criteria
Distant	Receptor is between 200 m and 400 m from the dust source
Intermediate	Receptor is between 100 m and 200 m from the dust source
Close	Receptor is less than 100 m from the dust source

The pathway effectiveness should be classified using the Frequency of Potentially Dusty Winds from **Table A-1** and the Receptor Distance from Source from **Table A-2** and the matrices in **Table A-3.**

*Table A-3: **Pathway effectiveness***

		Frequency of potentially dusty winds			
		Infrequent	**Moderately Frequent**	**Frequent**	**Very Frequent**
Receptor Distance Category	**Close**	Ineffective	Moderately Effective	Highly Effective	Highly Effective
	Intermediate	Ineffective	Moderately Effective	Moderately Effective	Highly Effective
	Distant	Ineffective	Ineffective	Moderately Effective	Moderately Effective

Estimation of Dust Impact Risk

The Residual Source Emissions (**Table A-1**) and the Pathway effectiveness (**Table A-3**) should be combined using the matrices in **Table A-4** to predict the Dust Impact Risk.

*Table A-4: **Estimation of Dust Impact Risk***

		Residual Source Emissions		
		Small	**Medium**	**Large**
Pathway Effectiveness	**Highly Effective Pathway**	Low Risk	Medium Risk	High Risk
	Moderately Effective Pathway	Negligible Risk	Low Risk	Medium Risk
	Ineffective Pathway	Negligible Risk	Negligible Risk	Low Risk

Step 3: Estimate Likely Magnitude of Disamenity Effects

Dust sensitivities of representative receptors to dust soiling effects, human health effects of PM_{10}, and ecological effects should be categorised as high, medium or low in accordance with IAQM guidance.

The magnitude of dust effect should be determined form the Dust Impact Risk (**Table A-4**) and the Receptor Sensitivity as shown in **Table A-5**.

Table A-5: Descriptors for magnitude of dust effects

		Receptor Sensitivity		
		Low	**Medium**	**High**
Dust impact risk	**High Risk**	Slight Adverse Effect	Moderate Adverse Effect	Substantial Adverse Effect
	Medium Risk	Negligible Effect	Slight Adverse Effect	Moderate Adverse Effect
	Low Risk	Negligible Effect	Negligible Effect	Slight Adverse Effect
	Negligible	Negligible Effect	Negligible Effect	Negligible Effect

General Approach to Assessing Health Effects

The IAQM recommends the following approach to assessing health effects of PM_{10} from mineral sites:

- Determine the existing background ambient concentration of PM_{10}. This can be based on publicly available background data, or where this is not adequate from site-specific monitoring data. The reason behind the choice of data used should be clearly stated.
- If the long term background PM_{10} concentration is less than 17µg/m^3 there is little risk that the Process Contribution (PC) would lead to an exceedance of the annual-mean objective and such a finding can be put forward qualitatively, without the need for further consideration, in most cases. This will obviously depend on the distance between dust generating activities on the site and the closest receptor, the type of quarry/mine and designed mitigation measures. If this is the case, there would be no need for a detailed assessment.

Evidence provided by the IAQM Minerals Guidance Working Group suggests that the maximum annual mean PC is likely to be around 15 µg/m^3 although occasionally it can be greater. The value of 17 µg/m^3 is derived by extracting 15 µg/m^3 from 32 µg/m^3. The latter value is that provided in LAQM (TG16)**Error! Bookmark not defined.** as an indication of the relationship between annual mean concentrations and the risk of the daily PM_{10} objective being exceeded. Based on the currently available information 17 µg/m^3 is a suitable screening value for an assessment of annual mean PM^{10} concentrations.

APPENDIX 6-2 Dust Risk Assessment

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Table A-3: Pathway effectiveness

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	Intermediate	Ineffective	Moderately Effective	Moderately Effective	Highly Effective
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Estimation of Dust Impact Risk

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Table A-4: Estimation of Dust Impact Risk

		Residual Source Emissions		
		Small	**Medium**	**Large**
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A2 Dust Risk Assessment

Identify the Need for Detailed Assessment

The Proposed Quarry Extension will result in dust generating activities at sensitive human and ecological receptors within 400m of the site boundary therefore a detailed dust assessment was undertaken.

Step 1: Describe Site Characteristics and Baseline Conditions

A description of site characteristics and baseline conditions is provided in Environmental Statement **Volume 2: Chapter 2 Section** Error! Reference source not found.

Sensitive Receptors

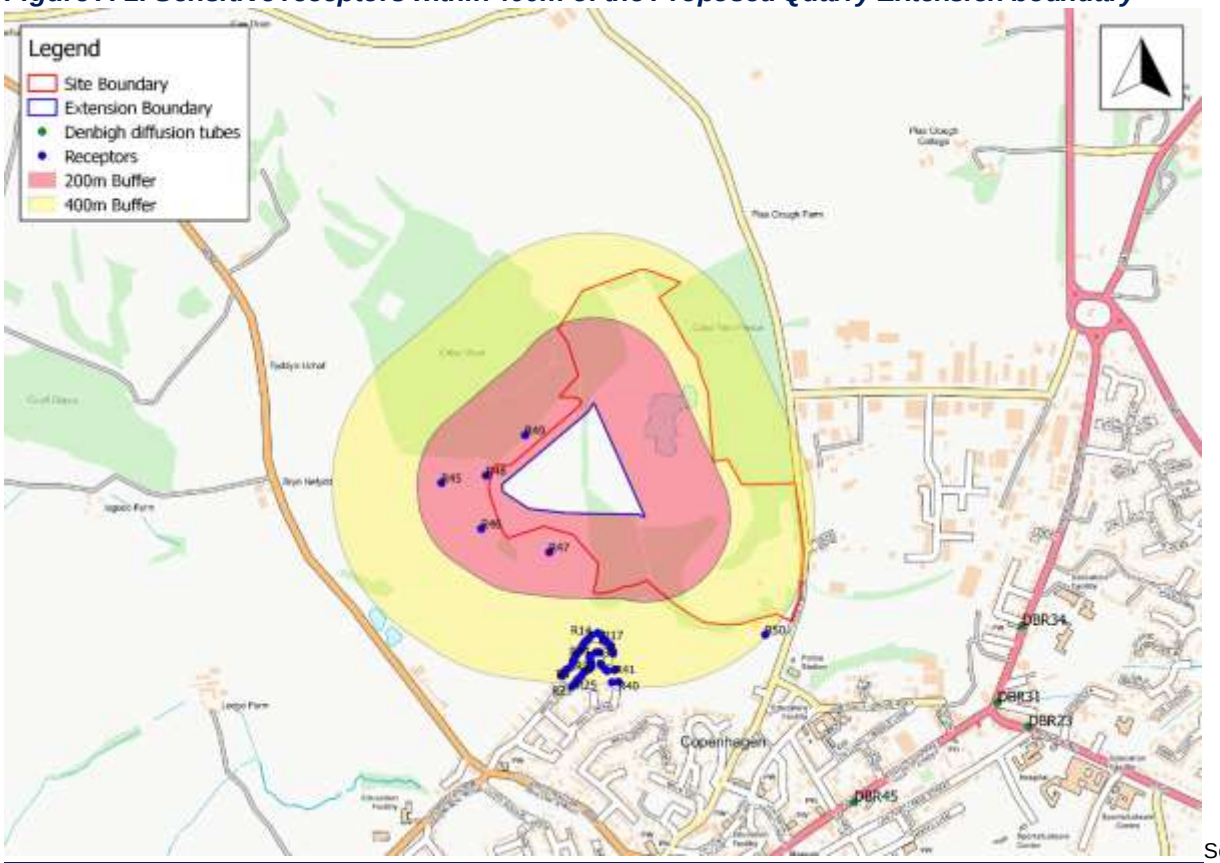
Most sensitive human receptors within 400m of the Proposed Quarry Extension boundary are residential dwellings located to the south east at Bryn Seion, there is also a residential dwelling adjacent to Ffordd Y Graig as well as farmland and footpaths. Craig Mawr Wood is a Site of Special Scientific Interest (SSSI) located north west of the Proposed Extension boundary. The location and nature of dust sensitive receptors are shown in **Figure A-1** provided in **Table A6**.

Table A-6: Sensitive receptors within 400m of the Proposed Quarry Extension boundary

Receptor Reference	x	y	Description	Distance (m) and Location relative to Quarry Extension Boundary	Sensitivity to Dust Soiling Effects	Sensitivity to Health Effects of PM_{10}
R1	304779	366543	Residential Dwelling	390 S	High	High
R2	304784	366551	Residential Dwelling	385 S	High	High
R3	304790	366558	Residential Dwelling	372 S	High	High
R4	304800	366564	Residential Dwelling	365 S	High	High
R5	304805	366578	Residential Dwelling	352 S	High	High
R6	304810	366586	Residential Dwelling	345 S	High	High
R7	304815	366595	Residential Dwelling	335 S	High	High
R8	304820	366600	Residential Dwelling	330 S	High	High
R9	304824	366606	Residential Dwelling	324 S	High	High
R10	304828	366613	Residential Dwelling	316 S	High	High
R11	304832	366620	Residential Dwelling	310 S	High	High
R12	304837	366626	Residential Dwelling	303 S	High	High
R13	304843	366631	Residential Dwelling	295 S	High	High
R14	304849	366639	Residential Dwelling	287 S	High	High
R15	304864	366644	Residential Dwelling	282 S	High	High
R16	304869	366641	Residential Dwelling	284 S	High	High
R17	304876	366627	Residential Dwelling	299 S	High	High
R18	304882	366625	Residential Dwelling	302 S	High	High
R19	304891	366617	Residential Dwelling	308 S	High	High
R20	304895	366614	Residential Dwelling	311 S	High	High

Receptor Reference	x	y	Description	Distance (m) and Location relative to Quarry Extension Boundary	Sensitivity to Dust Soiling Effects	Sensitivity to Health Effects of PM_{10}
R21	304899	366601	Residential Dwelling	322 S	High	High
R22	304900	366596	Residential Dwelling	331 S	High	High
R23	304804	366518	Residential Dwelling	403 S	High	High
R24	366531	366524	Residential Dwelling	400 S	High	High
R25	304814	366531	Residential Dwelling	395 S	High	High
R26	304817	366535	Residential Dwelling	391 S	High	High
R27	304,825	366542	Residential Dwelling	385 S	High	High
R28	304831	366551	Residential Dwelling	375 S	High	High
R29	304835	366555	Residential Dwelling	371 S	High	High
R30	304844	366559	Residential Dwelling	366 S	High	High
R31	304849	366565	Residential Dwelling	361 S	High	High
R32	304847	366576	Residential Dwelling	350 S	High	High
R33	304846	366583	Residential Dwelling	342 S	High	High
R34	304845	366590	Residential Dwelling	335 S	High	High
R35	304859	366598	Residential Dwelling	328 S	High	High
R36	304869	366598	Residential Dwelling	326 S	High	High
R37	304870	366572	Residential Dwelling	352 S	High	High
R38	304873	366567	Residential Dwelling	358 S	High	High
R39	304897	366528	Residential Dwelling	398 S	High	High
R40	304913	366529	Residential Dwelling	400 S	High	High
R41	304905	366558	Residential Dwelling	366 S	High	High
R42	304903	366557	Residential Dwelling	367 S	High	High
R43	304886	366555	Residential Dwelling	369 S	High	High
R44	304882	366558	Residential Dwelling	367 S	High	High
R45	304496	366997	Farmland	142 W	Low	Low
R46	304590	366889	Farmland	100 SW	Low	Low
R47	304750	366834	Farmland	95 W	Low	Low
R48	304601	367014	Footpath	40 W	Low	Low
R49	304693	367109	Local Nature reserve	50 NE	High	High
R50	305258	366640	Residential Dwelling	395 SE	High	High

Figure A-1: Sensitive receptors within 400m of the Proposed Quarry Extension boundary



Source: Contains OS data © Crown copyright and database right 2018.
Red buffer represents a 200 m around the quarry extension. Yellow represents a 400 m buffer.

Meteorological Conditions

A five-year average windrose (2014-2018) from Shawbury Meteorological station located 13 km from the Application Site is shown in **Figure A-2**.

Table A-7 shows average wind speeds (m/s) and wind direction for Shawbury Meteorological Station 2014-2018.

The prevailing wind direction at the Application Site is from the south west and most wind speeds above 5 m/s are from between the south and the west. Moderate to high wind speeds with the potential to carry airborne dust from the Proposed Quarry activities towards sensitive receptors are therefore likely to be infrequent.

Figure A-2: Shawbury Meteorological Station five-year average windrose (2014-2018) direction from which the wind is blowing

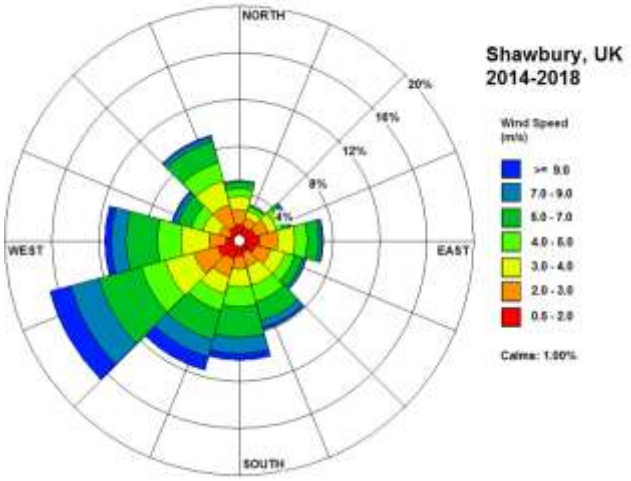


Table A-7: Shawbury Meteorological Station five-year average wind speeds and directions (wind blowing from) 2014-2018

Wind Direction (deg. True)*	**346 to 15**	**16 to 45**	**46 to 75**	**76 to 105**	**106 to 135**	**136 to 165**	**166 to 195**	**196 to 225**	**226 to 255**	**256 to 285**	**286 to 315**	**316 to 345**	**ALL OBS**
Mean wind speed (m/s)													
0													**1.0%**
0.5 TO 2	1.4 %	1.2 %	1.4 %	1.7 %	1.5 %	1.1 %	1.3 %	1.6 %	2.0 %	1.2 %	0.9 %	1.3 %	**16.6 %**
2 TO 3	1.2 %	0.8 %	1.1 %	1.5 %	1.4 %	1.2 %	1.1 %	1.6 %	2.1 %	1.5 %	0.9 %	1.9 %	**16.4 %**
3 TO 4	1.1 %	0.6 %	0.8 %	1.5 %	1.2 %	1.7 %	1.5 %	1.5 %	2.5 %	2.3 %	1.4 %	2.1 %	**18.1 %**
4 TO 5	0.7 %	0.4 %	0.5 %	1.1 %	0.8 %	1.4 %	1.6 %	1.5 %	2.1 %	2.0 %	1.0 %	1.6 %	**14.7 %**
5 TO 7	0.6 %	0.2 %	0.5 %	1.0 %	0.8 %	1.7 %	2.6 %	2.5 %	3.8 %	2.7 %	1.2 %	1.9 %	**19.5 %**
7 TO 9	0.1 %	0.0 %	0.2 %	0.3 %	0.3 %	0.6 %	1.3 %	1.5 %	2.5 %	1.2 %	0.4 %	0.4 %	**8.9%**
>=9	0.0 %	0.0 %	0.1 %	0.1 %	0.0 %	0.2 %	0.6 %	1.2 %	1.8 %	0.5 %	0.1 %	0.1 %	**4.7%**
Missing /Incomplete													**0.0%**
ALL OBS %	**5.2**	**3.2**	**4.6**	**7.1**	**5.9**	**7.8**	**10.2**	**11.4**	**16.7**	**11.4**	**6.0**	**9.3**	**100.0**

*The true wind direction is the direction from which the wind is blowing

Step 2: Estimate Dust Impact Risk

Estimation of Residual Source Emissions

The level of residual (i.e. abated) dust emissions from the main dust dust-generating activities associated with the Proposed Quarry Extension were determined and are shown in **Table A-8**.

Table A-8: Estimation of Residual Source Emissions from the Proposed Quarry Extension

Activity	Assumptions	Residual Source Emissions
Site Preparation and Restoration	• Relatively small working area (5 ha); • Low bunds (approximately 2m on northern boundary and 3 m on southern boundary); • Low volume of material movement (approx. 6,000m^3 material required for formation of bunds and Xm^3 material moved during topsoil and overburden stripping; • <5 heavy plant simultaneously active; • Bunds seeded; and • Material of medium dust potential.	Small
Mineral Extraction	• Relatively small working area (5 ha); • High energy extraction methods (drilling and blasting) used approximately every six to eight weeks; • Material of high dust potential (limestone); and • Low extraction rate (approximately 200,000 tpa).	Medium
Materials Handling	• Small number of heavy loading plant; • Plant operating more than 100m from the site boundary within the quarry void; and • Plant transferring material with high dust potential but with dust control measures in place (Water vacuum tank to sprinkle around the Quarry)	Small
On site transportation	• Use of unpaved haul roads; • Road surfaced of high dust potential; • Low number of HDV movements (<100 per day); and • Controlled (low) vehicle speed (maximum 15 mph).	Medium
Mineral processing	• Concrete batching plant onsite; • Mobile crushing and screening plant onsite; • Low volume of material processed (approximately 200,000 tpa); and • Material with high dust potential.	Medium
Stockpiles/Exposed Surfaces	• Long term stockpiles (duration > 1 month); • Stockpiles are large (7,000 to 10,000 tonnes each); • Material transfers from stockpiles are frequent; • Stockpiles located >100m from the site boundary well within quarry void; • Material with high dust potential but low wind speeds likely in quarry void where materials will be stored; • Dust control measures in place.	Medium
Off-site transportation	• Moderate number of HDV movements per day (<100); • Paved surfaced site access road >50m in length; • Effective HDV cleaning facilities (wheel wash); and • Water vacuum tank to sprinkle the haul roads and around the Quarry.	Small

Estimation of Pathway Effectiveness

The pathway effectiveness was classified using the Frequency of Potentially Dusty Winds from **Table A-1** and the Receptor Distance from Source from **Table A-2** and the matrices in **Table A-3.** The estimated pathway effectiveness is shown in **Table A-9**.

The Pathway effectiveness was estimated to be ineffective for all receptors. This was influenced by the distance between the receptors and the Quarry Extension and their orientation relative to the prevailing wind.

IAQM guidance**Error! Bookmark not defined.** states that '*it is commonly accepted that the greatest impacts will be within 100 m of a source and this can include both large (>30 µm) and small dust particles. The greatest potential for high rates of dust deposition and elevated PM_{10} concentrations occurs within this distance*' The majority of receptors are located between 200 m and 400 m from the Quarry Extension.

All receptors are located upwind of the Proposed Quarry Extension where potentially dusty winds (> 5 m/s) are infrequent.

Table A-9: Estimation of Pathway Effectiveness

Receptor Reference	Distance from Proposed Extension Boundary (m)	Direction relative to Proposed Extension Boundary	Receptor Distance Category	Wind direction affecting receptor (degrees)	Wind direction, % over 5m/s	Frequency of potentially dusty winds	Pathway Effectiveness
R1	390	S	Distant	355 to 10	1	Infrequent	Ineffective
R2	385	S	Distant	355 to 10	1	Infrequent	Ineffective
R3	372	S	Distant	355 to 10	1	Infrequent	Ineffective
R4	365	S	Distant	355 to 10	1	Infrequent	Ineffective
R5	352	S	Distant	355 to 10	1	Infrequent	Ineffective
R6	345	S	Distant	355 to 10	1	Infrequent	Ineffective
R7	335	S	Distant	355 to 10	1	Infrequent	Ineffective
R8	330	S	Distant	355 to 10	1	Infrequent	Ineffective
R9	324	S	Distant	355 to 10	1	Infrequent	Ineffective
R10	316	S	Distant	355 to 10	1	Infrequent	Ineffective
R11	310	S	Distant	355 to 10	1	Infrequent	Ineffective
R12	303	S	Distant	355 to 10	1	Infrequent	Ineffective
R13	295	S	Distant	355 to 10	1	Infrequent	Ineffective
R14	287	S	Distant	355 to 10	1	Infrequent	Ineffective
R15	282	S	Distant	355 to 10	1	Infrequent	Ineffective
R16	284	S	Distant	355 to 10	1	Infrequent	Ineffective
R17	299	S	Distant	355 to 10	1	Infrequent	Ineffective
R18	302	S	Distant	355 to 10	1	Infrequent	Ineffective
R19	308	S	Distant	355 to 10	1	Infrequent	Ineffective
R20	311	S	Distant	355 to 10	1	Infrequent	Ineffective
R21	322	S	Distant	355 to 10	1	Infrequent	Ineffective

Receptor Reference	Distance from Proposed Extension Boundary (m)	Direction relative to Proposed Extension Boundary	Receptor Distance Category	Wind direction affecting receptor (degrees)	Wind direction, % over 5m/s	Frequency of potentially dusty winds	Pathway Effectiveness
R22	331	S	Distant	355 to 10	1	Infrequent	Ineffective
R23	403	S	Distant	355 to 10	1	Infrequent	Ineffective
R24	400	S	Distant	355 to 10	1	Infrequent	Ineffective
R25	395	S	Distant	355 to 10	1	Infrequent	Ineffective
R26	391	S	Distant	355 to 10	1	Infrequent	Ineffective
R27	385	S	Distant	355 to 10	2	Infrequent	Ineffective
R28	375	S	Distant	355 to 10	1	Infrequent	Ineffective
R29	371	S	Distant	355 to 10	1	Infrequent	Ineffective
R30	366	S	Distant	355 to 10	1	Infrequent	Ineffective
R31	361	S	Distant	355 to 10	1	Infrequent	Ineffective
R32	350	S	Distant	355 to 10	1	Infrequent	Ineffective
R33	342	S	Distant	355 to 10	1	Infrequent	Ineffective
R34	335	S	Distant	355 to 10	1	Infrequent	Ineffective
R35	328	S	Distant	355 to 10	1	Infrequent	Ineffective
R36	326	S	Distant	355 to 10	1	Infrequent	Ineffective
R37	352	S	Distant	355 to 10	1	Infrequent	Ineffective
R38	358	S	Distant	355 to 10	1	Infrequent	Ineffective
R39	398	S	Distant	355 to 10	1	Infrequent	Ineffective
R40	400	S	Distant	355 to 10	1	Infrequent	Ineffective
R41	366	S	Distant	355 to 10	1	Infrequent	Ineffective
R42	367	S	Distant	355 to 10	1	Infrequent	Ineffective
R43	369	S	Distant	355 to 10	1	Infrequent	Ineffective
R44	367	S	Distant	355 to 10	1	Infrequent	Ineffective
R45	142	W	Intermediate	65 to 85	1	Infrequent	Ineffective
R46	100	SW	Intermediate	65 to 85	1	Infrequent	Ineffective
R47	95	W	Close	55 to 65	1	Infrequent	Ineffective
R48	40	W	Close	65 to 85	1	Infrequent	Ineffective
R49	50	NE	Close	75 to 90	1	Infrequent	Ineffective
R50	395	SE	Distant	300 to 310	2	Infrequent	Ineffective

Estimation of Dust Impact Risk

The Residual Source Emissions (**Table A-8**) and the Pathway effectiveness (**Table A-9**) were combined using the matrices in **Table A-4** to determine the Dust Impact Risk from activities at the Proposed Quarry Extension.

Dust impact risks are detailed in **Table A-10** for Site Preparation and Restoration, Materials Handling and Off-site Transportation activities (which all have small residual source emissions), **Table A-11**

for Mineral Extraction, Onsite Transportation, Mineral Processing and Stockpiles/Exposed Surfaces (which all have medium residual source emissions).

Table A-10: Estimation of Dust Impact Risk for Site Preparation and Restoration, Materials Handling and Off-site Transportation

Receptor	Residual Source Emissions Site Preparation and Restoration, Materials Handling and Offsite Transportation	Pathway Effectiveness	Dust Impact Risk Site Preparation and Restoration, Materials Handling and Offsite Transportation
R1	Small	Ineffective	Negligible
R2	Small	Ineffective	Negligible
R3	Small	Ineffective	Negligible
R4	Small	Ineffective	Negligible
R5	Small	Ineffective	Negligible
R6	Small	Ineffective	Negligible
R7	Small	Ineffective	Negligible
R8	Small	Ineffective	Negligible
R9	Small	Ineffective	Negligible
R10	Small	Ineffective	Negligible
R11	Small	Ineffective	Negligible
R12	Small	Ineffective	Negligible
R13	Small	Ineffective	Negligible
R14	Small	Ineffective	Negligible
R15	Small	Ineffective	Negligible
R16	Small	Ineffective	Negligible
R17	Small	Ineffective	Negligible
R18	Small	Ineffective	Negligible
R19	Small	Ineffective	Negligible
R20	Small	Ineffective	Negligible
R21	Small	Ineffective	Negligible
R22	Small	Ineffective	Negligible
R23	Small	Ineffective	Negligible
R24	Small	Ineffective	Negligible
R25	Small	Ineffective	Negligible
R26	Small	Ineffective	Negligible
R27	Small	Ineffective	Negligible
R28	Small	Ineffective	Negligible
R29	Small	Ineffective	Negligible
R30	Small	Ineffective	Negligible
R31	Small	Ineffective	Negligible
R32	Small	Ineffective	Negligible
R33	Small	Ineffective	Negligible
R34	Small	Ineffective	Negligible
R35	Small	Ineffective	Negligible

Receptor	Residual Source Emissions Site Preparation and Restoration, Materials Handling and Offsite Transportation	Pathway Effectiveness	Dust Impact Risk Site Preparation and Restoration, Materials Handling and Offsite Transportation
R36	Small	Ineffective	Negligible
R37	Small	Ineffective	Negligible
R38	Small	Ineffective	Negligible
R39	Small	Ineffective	Negligible
R40	Small	Ineffective	Negligible
R41	Small	Ineffective	Negligible
R42	Small	Ineffective	Negligible
R43	Small	Ineffective	Negligible
R44	Small	Ineffective	Negligible
R45	Small	Ineffective	Negligible
R46	Small	Ineffective	Negligible
R47	Small	Ineffective	Negligible
R48	Small	Ineffective	Negligible
R49	Small	Ineffective	Negligible
R50	Small	Ineffective	Negligible

Table A-11: Estimation of Dust Impact Risk for Mineral Extraction, Onsite Transportation, Mineral Processing and Stockpiles/Exposed Surfaces

Receptor	Residual Source Emissions Mineral Extraction, Onsite Transportation, Mineral Processing and Stockpiles/Exposed Surfaces	Pathway Effectiveness	Dust Impact Risk Mineral Extraction, Onsite Transportation, Mineral Processing and Stockpiles/Exposed Surfaces
R1	Medium	Ineffective	Negligible
R2	Medium	Ineffective	Negligible
R3	Medium	Ineffective	Negligible
R4	Medium	Ineffective	Negligible
R5	Medium	Ineffective	Negligible
R6	Medium	Ineffective	Negligible
R7	Medium	Ineffective	Negligible
R8	Medium	Ineffective	Negligible
R9	Medium	Ineffective	Negligible
R10	Medium	Ineffective	Negligible
R11	Medium	Ineffective	Negligible
R12	Medium	Ineffective	Negligible
R13	Medium	Ineffective	Negligible
R14	Medium	Ineffective	Negligible
R15	Medium	Ineffective	Negligible
R16	Medium	Ineffective	Negligible
R17	Medium	Ineffective	Negligible
R18	Medium	Ineffective	Negligible

Receptor	Residual Source Emissions Mineral Extraction, Onsite Transportation, Mineral Processing and Stockpiles/Exposed Surfaces	Pathway Effectiveness	Dust Impact Risk Mineral Extraction, Onsite Transportation, Mineral Processing and Stockpiles/Exposed Surfaces
R19	Medium	Ineffective	Negligible
R20	Medium	Ineffective	Negligible
R21	Medium	Ineffective	Negligible
R22	Medium	Ineffective	Negligible
R23	Medium	Ineffective	Negligible
R24	Medium	Ineffective	Negligible
R25	Medium	Ineffective	Negligible
R26	Medium	Ineffective	Negligible
R27	Medium	Ineffective	Negligible
R28	Medium	Ineffective	Negligible
R29	Medium	Ineffective	Negligible
R30	Medium	Ineffective	Negligible
R31	Medium	Ineffective	Negligible
R32	Medium	Ineffective	Negligible
R33	Medium	Ineffective	Negligible
R34	Medium	Ineffective	Negligible
R35	Medium	Ineffective	Negligible
R36	Medium	Ineffective	Negligible
R37	Medium	Ineffective	Negligible
R38	Medium	Ineffective	Negligible
R39	Medium	Ineffective	Negligible
R40	Medium	Ineffective	Negligible
R41	Medium	Ineffective	Negligible
R42	Medium	Ineffective	Negligible
R43	Medium	Ineffective	Negligible
R44	Medium	Ineffective	Negligible
R45	Medium	Ineffective	Negligible
R46	Medium	Ineffective	Negligible
R47	Medium	Ineffective	Negligible
R48	Medium	Ineffective	Negligible
R49	Medium	Ineffective	Negligible
R50	Medium	Ineffective	Negligible

Step 3: Estimate Likely Magnitude of Disamenity Effects

Dust sensitivities of receptors to dust soiling effects, human health effects of PM_{10}, and ecological effects are detailed in **Table A-6**.

The magnitude of dust effect was determined form the Dust Impact Risk (**Table A-10 and Table A-11**) and the Receptor Sensitivity (**Table A-6**) and is shown in **Table A-12** for Site Preparation and Restoration, Materials Handling and Off-site Transportation activities (which all have small residual

source emissions), **Table A-13** for Mineral Extraction, Onsite Transportation, Mineral Processing and Stockpiles/Exposed Surfaces (which all have medium residual source emissions).

Table A-12: Estimation of likely magnitude of Disamenity Effects for Site Preparation and Restoration, Materials Handling and Off-site Transportation

Receptor	Receptor details and location	Distance (m) and Location relative to Quarry Extension Boundary	Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust Effect
R1	Residential Dwelling	390 S	Small	Ineffective	Negligible	High	Negligible
R2	Residential Dwelling	385 S	Small	Ineffective	Negligible	High	Negligible
R3	Residential Dwelling	372 S	Small	Ineffective	Negligible	High	Negligible
R4	Residential Dwelling	365 S	Small	Ineffective	Negligible	High	Negligible
R5	Residential Dwelling	352 S	Small	Ineffective	Negligible	High	Negligible
R6	Residential Dwelling	345 S	Small	Ineffective	Negligible	High	Negligible
R7	Residential Dwelling	335 S	Small	Ineffective	Negligible	High	Negligible
R8	Residential Dwelling	330 S	Small	Ineffective	Negligible	High	Negligible
R9	Residential Dwelling	324 S	Small	Ineffective	Negligible	High	Negligible
R10	Residential Dwelling	316 S	Small	Ineffective	Negligible	High	Negligible
R11	Residential Dwelling	310 S	Small	Ineffective	Negligible	High	Negligible
R12	Residential Dwelling	303 S	Small	Ineffective	Negligible	High	Negligible
R13	Residential Dwelling	295 S	Small	Ineffective	Negligible	High	Negligible
R14	Residential Dwelling	287 S	Small	Ineffective	Negligible	High	Negligible
R15	Residential Dwelling	282 S	Small	Ineffective	Negligible	High	Negligible
R16	Residential Dwelling	284 S	Small	Ineffective	Negligible	High	Negligible
R17	Residential Dwelling	299 S	Small	Ineffective	Negligible	High	Negligible
R18	Residential Dwelling	302 S	Small	Ineffective	Negligible	High	Negligible
R19	Residential Dwelling	308 S	Small	Ineffective	Negligible	High	Negligible
R20	Residential Dwelling	311 S	Small	Ineffective	Negligible	High	Negligible

Receptor	Receptor details and location	Distance (m) and Location relative to Quarry Extension Boundary	Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust Effect
R21	Residential Dwelling	322 S	Small	Ineffective	Negligible	High	Negligible
R22	Residential Dwelling	331 S	Small	Ineffective	Negligible	High	Negligible
R23	Residential Dwelling	403 S	Small	Ineffective	Negligible	High	Negligible
R24	Residential Dwelling	400 S	Small	Ineffective	Negligible	High	Negligible
R25	Residential Dwelling	395 S	Small	Ineffective	Negligible	High	Negligible
R26	Residential Dwelling	391 S	Small	Ineffective	Negligible	High	Negligible
R27	Residential Dwelling	385 S	Small	Ineffective	Negligible	High	Negligible
R28	Residential Dwelling	375 S	Small	Ineffective	Negligible	High	Negligible
R29	Residential Dwelling	371 S	Small	Ineffective	Negligible	High	Negligible
R30	Residential Dwelling	366 S	Small	Ineffective	Negligible	High	Negligible
R31	Residential Dwelling	361 S	Small	Ineffective	Negligible	High	Negligible
R32	Residential Dwelling	350 S	Small	Ineffective	Negligible	High	Negligible
R33	Residential Dwelling	342 S	Small	Ineffective	Negligible	High	Negligible
R34	Residential Dwelling	335 S	Small	Ineffective	Negligible	High	Negligible
R35	Residential Dwelling	328 S	Small	Ineffective	Negligible	High	Negligible
R36	Residential Dwelling	326 S	Small	Ineffective	Negligible	High	Negligible
R37	Residential Dwelling	352 S	Small	Ineffective	Negligible	High	Negligible
R38	Residential Dwelling	358 S	Small	Ineffective	Negligible	High	Negligible
R39	Residential Dwelling	398 S	Small	Ineffective	Negligible	High	Negligible
R40	Residential Dwelling	400 S	Small	Ineffective	Negligible	High	Negligible
R41	Residential Dwelling	366 S	Small	Ineffective	Negligible	High	Negligible
R42	Residential Dwelling	367 S	Small	Ineffective	Negligible	High	Negligible
R43	Residential Dwelling	369 S	Small	Ineffective	Negligible	High	Negligible

Receptor	Receptor details and location	Distance (m) and Location relative to Quarry Extension Boundary	Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust Effect
R44	Residential Dwelling	367 S	Small	Ineffective	Negligible	High	Negligible
R45	Farmland	142 W	Small	Ineffective	Negligible	Low	Negligible
R46	Farmland	100 SW	Small	Ineffective	Negligible	Low	Negligible
R47	Farmland	95 W	Small	Ineffective	Negligible	Low	Negligible
R48	Footpath	40 W	Small	Ineffective	Negligible	Low	Negligible
R49	Local Nature reserve	50 NE	Small	Ineffective	Negligible	High	Negligible
R50	Residential Dwelling	395 SE	Small	Ineffective	Negligible	High	Negligible

Table A-13: Estimation of likely magnitude of Disamenity Effects for Mineral Extraction, Onsite Transportation, Mineral Processing and Stockpiles/Exposed Surfaces

Receptor	Receptor details and location	Distance (m) and Location relative to Quarry Extension Boundary	Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust Effect
R1	Residential Dwelling	390 S	Medium	Ineffective	Negligible	High	Negligible
R2	Residential Dwelling	385 S	Medium	Ineffective	Negligible	High	Negligible
R3	Residential Dwelling	372 S	Medium	Ineffective	Negligible	High	Negligible
R4	Residential Dwelling	365 S	Medium	Ineffective	Negligible	High	Negligible
R5	Residential Dwelling	352 S	Medium	Ineffective	Negligible	High	Negligible
R6	Residential Dwelling	345 S	Medium	Ineffective	Negligible	High	Negligible
R7	Residential Dwelling	335 S	Medium	Ineffective	Negligible	High	Negligible
R8	Residential Dwelling	330 S	Medium	Ineffective	Negligible	High	Negligible
R9	Residential Dwelling	324 S	Medium	Ineffective	Negligible	High	Negligible
R10	Residential Dwelling	316 S	Medium	Ineffective	Negligible	High	Negligible
R11	Residential Dwelling	310 S	Medium	Ineffective	Negligible	High	Negligible

Receptor	Receptor details and location	Distance (m) and Location relative to Quarry Extension Boundary	Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust Effect
R12	Residential Dwelling	303 S	Medium	Ineffective	Negligible	High	Negligible
R13	Residential Dwelling	295 S	Medium	Ineffective	Negligible	High	Negligible
R14	Residential Dwelling	287 S	Medium	Ineffective	Negligible	High	Negligible
R15	Residential Dwelling	282 S	Medium	Ineffective	Negligible	High	Negligible
R16	Residential Dwelling	284 S	Medium	Ineffective	Negligible	High	Negligible
R17	Residential Dwelling	299 S	Medium	Ineffective	Negligible	High	Negligible
R18	Residential Dwelling	302 S	Medium	Ineffective	Negligible	High	Negligible
R19	Residential Dwelling	308 S	Medium	Ineffective	Negligible	High	Negligible
R20	Residential Dwelling	311 S	Medium	Ineffective	Negligible	High	Negligible
R21	Residential Dwelling	322 S	Medium	Ineffective	Negligible	High	Negligible
R22	Residential Dwelling	331 S	Medium	Ineffective	Negligible	High	Negligible
R23	Residential Dwelling	403 S	Medium	Ineffective	Negligible	High	Negligible
R24	Residential Dwelling	400 S	Medium	Ineffective	Negligible	High	Negligible
R25	Residential Dwelling	395 S	Medium	Ineffective	Negligible	High	Negligible
R26	Residential Dwelling	391 S	Medium	Ineffective	Negligible	High	Negligible
R27	Residential Dwelling	385 S	Medium	Ineffective	Negligible	High	Negligible
R28	Residential Dwelling	375 S	Medium	Ineffective	Negligible	High	Negligible
R29	Residential Dwelling	371 S	Medium	Ineffective	Negligible	High	Negligible
R30	Residential Dwelling	366 S	Medium	Ineffective	Negligible	High	Negligible
R31	Residential Dwelling	361 S	Medium	Ineffective	Negligible	High	Negligible
R32	Residential Dwelling	350 S	Medium	Ineffective	Negligible	High	Negligible
R33	Residential Dwelling	342 S	Medium	Ineffective	Negligible	High	Negligible
R34	Residential Dwelling	335 S	Medium	Ineffective	Negligible	High	Negligible

Receptor	Receptor details and location	Distance (m) and Location relative to Quarry Extension Boundary	Residual Source Emissions	Pathway Effectiveness	Dust Impact Risk	Receptor Sensitivity	Magnitude of Dust Effect
R35	Residential Dwelling	328 S	Medium	Ineffective	Negligible	High	Negligible
R36	Residential Dwelling	326 S	Medium	Ineffective	Negligible	High	Negligible
R37	Residential Dwelling	352 S	Medium	Ineffective	Negligible	High	Negligible
R38	Residential Dwelling	358 S	Medium	Ineffective	Negligible	High	Negligible
R39	Residential Dwelling	398 S	Medium	Ineffective	Negligible	High	Negligible
R40	Residential Dwelling	400 S	Medium	Ineffective	Negligible	High	Negligible
R41	Residential Dwelling	366 S	Medium	Ineffective	Negligible	High	Negligible
R42	Residential Dwelling	367 S	Medium	Ineffective	Negligible	High	Negligible
R43	Residential Dwelling	369 S	Medium	Ineffective	Negligible	High	Negligible
R44	Residential Dwelling	367 S	Medium	Ineffective	Negligible	High	Negligible
R45	Farmland	142 W	Medium	Ineffective	Negligible	Low	Negligible
R46	Farmland	100 SW	Medium	Ineffective	Negligible	Low	Negligible
R47	Farmland	95 W	Medium	Ineffective	Negligible	Low	Negligible
R48	Footpath	40 W	Medium	Ineffective	Negligible	Low	Negligible
R49	Local Nature reserve	50 NE	Medium	Ineffective	Negligible	High	Negligible
R50	Residential Dwelling	395 SE	Medium	Ineffective	Negligible	High	Negligible

Estimate of Health Effects

2019 and 2020 PM_{10} background concentrations from the UK Air Quality Archive for the 1 km x 1 km grid square centred on OS co-ordinates 305100, 36700, corresponding to the location of the Proposed Development are well below 17 µg.m^3 (Error! Reference source not found.), therefore there is little risk that the Process Contribution from the Proposed Quarry Extension would lead to an exceedance of the annual mean PM_{10} objective.