

10.0 AIR QUALITY

10.1 INTRODUCTION

This section presents an assessment of the potential impacts of the proposed extension to the mineral extraction operations at Melton Ross Quarry on air quality, with particular regard to the potential for dust impacts.

The significance and resultant impacts of dust emissions to air from the development are dependent upon the magnitude of the emissions, the proximity of sensitive locations to the emission sources, and the prevailing meteorological conditions for that location. The potential for these to occur and give rise to nuisance and health impacts is assessed.

10.2 POTENTIAL AIR QUALITY IMPACTS

10.2.1 Dust: Potential for Nuisance and Health Effects

Introduction

Airborne particles cover a wide range of particle sizes and types (e.g. wind blown dust, sea salt aerosols, biological material and secondary particles). In the UK, and more recently in Europe, air quality standards and guidelines are related to particles of less than 10 µm in aerodynamic diameter, referred to as PM₁₀. These particles are representative of the large proportion of airborne particulate matter and may have a potential impact on health. Particles of less than PM_{2.5} are referred to as the fine fraction. Particles between PM_{2.5} and PM₁₀ are termed the coarse fraction. Generally, particles generated from combustion processes and the condensation of vapours fall within the fine fraction (PM_{2.5}) whereas those particles generated from mechanical break up of solids and liquids are within the coarse fraction (PM_{2.5} and above)⁸.

Dust Nuisance

For quarry developments the most common concern regarding dust emissions is their potential nuisance effect. The nuisance effects of dust emissions are related to both emissions of large and fine particles. Deposition of these particles onto surfaces, such as windows and cars, may cause soiling that, if sufficiently great, can be considered to be a nuisance.

Potential Health Effects from Dust

The Quality of Urban Air Review Group (QUARG) report provides a discussion on the potential health effects of airborne particles⁸ 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)⁹. The Group found there is no convincing evidence that healthy individuals will be significantly affected by ambient levels of particles occurring in the UK⁸. Furthermore, with regard to the health effects from specific types of particles, the QUARG report states:

⁸ Airborne Particulate Matter in the UK, 3rd Report of the Quality of Urban Air Review Group (QUARG), May 1996.

⁹ Committee on the Medical Effects of Air Pollutants (COMEAP), Health Effects of Non-biological Particles (1995).

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

Therefore, given that a large proportion of particles generated from quarrying activities will be coarse particles generated from the mechanical break-up of materials, it is unlikely that these activities will have a significant impact on health.

This conclusion is supported up by research undertaken by the former British Coal Opencast at opencast coal sites in South Wales. This research indicated that levels of PM₁₀ are much the same upwind and downwind of their study sites *ie* that relatively little dust in this size range is produced by this type of development¹⁰. In addition, work undertaken at Derlwyn Opencast Coal Site over a period of six years which included continuous monitoring of respirable dust using a wide range of the best available instrumentation and techniques concluded that, although some dust had been generated at Derlwyn it was "*barely detectable*" and the possibility of any effect on the health of the local population was "*likely to be remote*"¹⁰.

10.3 RELEVANT LEGISLATION AND GUIDANCE

10.3.1 Introduction

Activities associated with the proposed development that have the potential to create dust emissions to atmosphere may be subject to the following:

- planning conditions attached to any planning consent granted by the Local Authority;
- any process control powers exercised by the Local Authority relating to the mobile screening processes arising from the Environmental Protection Act, 1990;
- Noise and Statutory Nuisance Act, 1993. This legislation allows the local authority to serve an abatement notice where a statutory nuisance exists.

10.3.2 UK Air Quality Strategy

The National Air Quality Strategy (NAQS) for England, Scotland, Wales and Northern Ireland fulfils the requirement under the Environment Act 1995 for a national air quality strategy which sets out policies for the management of ambient air quality. The first strategy was published in March 1997, with a revised version of the strategy published in January 2000. At this time, the NAQS became the Air Quality Strategy (AQS) in accordance with The Air Quality (England) Regulations 2000. This was followed by addenda in 2003 and 2004 following completion of The Air Quality (England) (Amendment) Regulations 2002. In February 2007 this was superseded with the Air Quality Standards Regulation 2007. For full details, please refer to the DEFRA website¹¹.

The Air Quality Strategy (AQS), and the subsequent addendum, set health-based standards and objectives for nine main air pollutants and deadlines for achieving

¹⁰ Dust from Derlwyn: The end in sight? Opencast Mining (1996)

¹¹ <http://www.defra.gov.uk/environment/airquality/index.htm>

them. These are given statutory status through the relevant Regulations. The pollutants covered are benzene (C₆H₆), 1,3-butadiene, carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), ozone (O₃), particles (PM₁₀), sulphur dioxide (SO₂) and polycyclic aromatic hydrocarbons (PAHs). The standards and objectives for each pollutant are given in the Air Quality Regulations. Compliance with the AQS is regulated at the Local Authority level.

10.3.3 Technical Guidance on Surface Mineral Workings

Minerals Policy Statement 2 (MPS2) was published in March 2005 and sets out the policies and considerations in relation to the environmental effects of minerals extraction. The Government expects Mineral Planning Authorities in England to follow this when preparing development plans and in considering applications for minerals development. MPS 2 considers other environmental effects of mineral extraction and in particular dust; Annex 1 of the guidance document focuses on dust and formalises the research published in 1995.

10.3.4 Local Authority Air Quality Review and Assessment

Local air quality management requires local authorities to periodically review and assess the current and future quality of air in their areas. Where it is determined that an air quality objective is not likely to be met within the relevant time period, the authority must designate an Air Quality Management Area (AQMA). The AQS provides a phased approach to assess air quality. The first stage must be undertaken by all authorities to assess the potential for elevated levels of pollutants. A second stage might involve further screening, modelling and monitoring of pollutant levels. The third stage would involve a more detailed and accurate assessment using monitoring, modelling, and emission inventories.

North Lincolnshire District Council has completed its local Air Quality Management Review and Assessment to Stage 3. For Stage 1 of the Council's air quality assessment, industrial and transport sources were reviewed. It was concluded that a Second Stage Review & Assessment was required for all the pollutants contained within the Air Quality (England) Regulations 2000, including PM₁₀.

The Stage 2 report was published in May 2001 and identified a possible exceedance of the Air Quality Objectives for NO₂ within Scunthorpe. With regard to PM₁₀, the Stage 2 report concluded that a Stage 3 assessment was not required as there was no risk of exceeding AQS objectives.

The 2004 Detailed Assessment and 2005 Progress Report concluded that an Air Quality Management Area should be declared in Scunthorpe and consequently further work on PM₁₀ emissions in Scunthorpe is continuing.

10.3.5 Air Quality Standards and Guidelines Relating to Dust

Deposited Dust

In the UK and Europe, there are no definitive standards for deposited particles. However, criteria and guidelines have been developed in many other countries, for example, the United States and Australia and published⁸ criteria range from between 133 to 350 mg m⁻² day⁻¹. Long term deposited dust criteria have been suggested for urban/semi-rural areas at, typically 200 mg m⁻² day⁻¹, averaged over a monthly

period¹². The former British Coal Opencast Executive used the figure of 200 mg m⁻² day⁻¹ as a nuisance threshold for operations on its opencast sites in the UK¹³.

A more stringent guideline that has been suggested of 100 mg m⁻² day⁻¹ (as a monthly average) and quoted as likely to provoke complaints at peak periods within that month¹⁴.

However, a study published in December 1995¹⁵ by the former Department of the Environment when considering "Dust Standards and Guidelines" states that *"until more information and UK monitoring data specific to mineral sites and nuisance effects is available, it is recommended that care is taken in the use of any guidelines."*

The DoE study recommended that *"no one definitive absolute standard should be defined for the nuisance effects of mineral dust, and that the emphasis in the regulation and control of dust should be the adoption and promotion of best practices on site."*

SLR agrees with the DoE study's recommendation but in its experience many mineral operators adopt a guideline of 200 mg m⁻² day⁻¹ (expressed as the monthly average of daily mean measurements) as part of dust monitoring schemes, mainly for environmental management purposes as a nuisance trigger level, above which further investigation is initiated.

10.4 BASELINE ENVIRONMENT

10.3.2 Local Climate

Introduction

Unlike other atmospheric pollutants, the generation of fugitive dust is particularly dependent upon weather conditions. The prevailing meteorological conditions at any site would be dependent upon many factors including its location in relation to macroclimatic conditions as well as more site specific, micro-climatic conditions. Clearly the most significant meteorological factor, in addition to rainfall, is the predominant wind direction, and consequently data has been collected regarding the predominant wind directions and climate within the development area.

Local Wind Speeds and Directions

Wind speed and direction data has been obtained for Finningley over a period of 5 years. Finningley is located approximately 50 km to the west southwest of Melton Ross Quarry site and this observing station is one of the nearest that has wind speed and direction data appropriate for characterising the wind climate at the proposed development site. Wind speed and direction data for Finningley are presented as a wind rose in Figure 10/1.

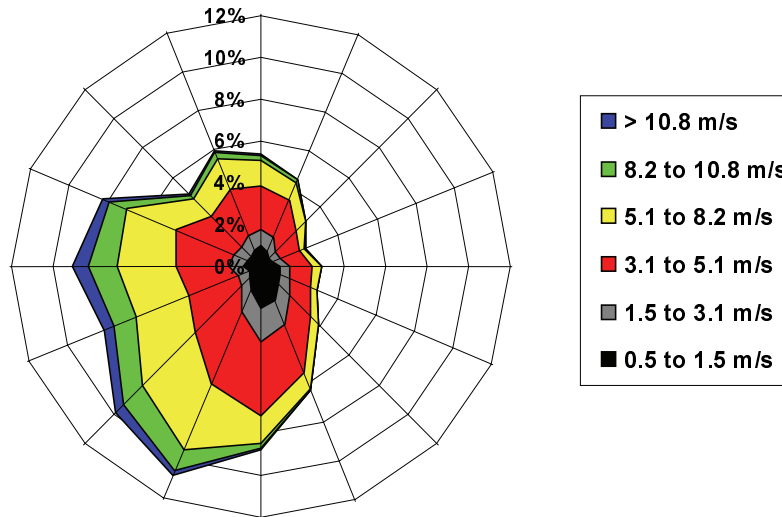
¹² Williams J, "Fugitive Dust", Mine & Quarry, pp 9–10 (March 1986)

¹³ British Coal Opencast Northern – Environmental Review (1993)

¹⁴ Vallack H W and Shillito D E, Suggested Guidelines for Deposited Dust, Atm. Env., 32 (16) (1998).

¹⁵ The Environmental Effects of Dust from Surface Mineral Workings, Department of the Environment, Minerals Division (December 1995)

**FIGURE 10/1
WINDROSE FOR FINNINGLEY**



The predominant wind directions are from the south-westerly quarter, with winds from the south southwest occurring most frequently for 10.8% of the time. Winds from the west, south and southwest occur for 9.1%, 8.7% and 9.8% of the time, respectively. Wind directions from the northeast sector occur relatively infrequently.

Other Climate Data

A summary of other climate conditions applicable to the site is available for an observing station at Finningley. This observing station is located at a height of 10m AMSL (above mean sea level), approximately 50 km to the west southwest of Melton Ross Quarry and will be representative of climate conditions at the site. Monthly and annual (1961 to 1990 averages) summaries of temperature, sunshine, rainfall amount and rainfall days are presented in Table 10/2.

**TABLE 10/2
SUMMARY OF METEOROLOGICAL OBSERVATIONS
FINNINGLEY (1961 TO 1990)**

MONTH	MAXIMUM TEMPERATURE(°C)	MINIMUM TEMPERATURE (°C)	SUNSHINE HOURS	RAINFALL (mm)	RAINDAYS (>=1mm)
January	6.5	0.7	53.4	45	9.9
February	6.7	0.6	64.9	36	7.4
March	9.5	2.0	102.0	44	9.1
April	12.1	3.8	132.5	47	8.9
May	15.9	6.4	183.2	51	9.3
June	19.2	9.4	185.1	54	8.7
July	21.0	11.3	171.4	49	7.6
August	20.8	11.2	165.6	55	8.9
September	18.2	9.3	129.4	50	7.6
October	14.4	6.6	95.5	44	8.6
November	9.5	3.1	64.4	51	9.8
December	7.2	1.4	46.0	50	10.0
Year	13.4	5.4	1393.4	576	105.8

In general, the highest rainfall occurs during the months September through to January, but the summer months of June and August also have high rainfall. The annual average rainfall for the thirty-year period was 576 mm and rainfall greater than 1 mm occurred on 30% of days of the year. An Environment Agency rainfall gauge at Somerby Top, some 6km from the site, records a slightly higher long term average rainfall of 648 mm per annum.

10.4.2 Existing Air Quality

Ambient Air Quality

This section describes the existing baseline air quality in the area of Melton Ross Quarry. Background concentrations for PM₁₀ have been obtained from air quality monitoring stations located within the area. Due to the relatively remote nature of the site there is little data to characterise the area immediately surrounding the application site. Two monitoring sites are located within 20km of the site. Descriptions of these monitoring sites are given below:

- The Scunthorpe Town monitoring station (OS Grid: 490316, 410837) is described as an Urban Industrial site situated approximately 18 km west of the application site. The monitoring site is located in an open grassed field approximately 5 metres from Rowland Road, there is housing to the west and south. Busy Brigg Road lies approximately 300 metres to the east. The British Steel complex lies approximately 350m to the east. Measured PM₁₀ concentrations are likely to be higher than those at the application site.
- The Hull Freetown monitoring station (OS Grid: 490316, 410837) is an Urban Centre type monitor located at Freetown Way, Kingston upon Hull. It is located

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approximately 18km to the north-northwest of the application site. The monitoring station is within a self-contained, air conditioning housing located on the northern edge of a car park that is situated on the northern edge of the city centre. The nearest urban road is approximately 50 metres south of the monitoring station. Immediately to the east and west are landscaped areas of shrubs and saplings. As with the Scunthorpe monitoring site, PM₁₀ concentrations recorded at this site are likely to be higher than those encountered at the application site.

Data from Scunthorpe and Hull Freetown for the last three years are presented in Table 10/3. As discussed, measurements made at these monitoring sites are likely to be higher compared to the quarry but provide an indication of the maximum concentrations that may be encountered at the site with regard to a worst case scenario.

**TABLE 10/3
ANNUAL MEAN CONCENTRATIONS OF PM₁₀ AT MONITORING SITES CLOSE
TO MELTON ROSS QUARRY**

MONITORING DATE	SCUNTHORPE	HULL FREETOWN
2007	23.7	24.1
2006	29.5	25.1
2005	24.8	22.7
AIR QUALITY STANDARD	40	40

Note: 2007 data has not been ratified and is provisional only, Scunthorpe Town is complete up until 09.05.2007, Hull Freetown is complete up until 09.05.2007.

Since there is some question over the comparability of the air quality at the Scunthorpe and Hull Freetown to that of the application site, an alternative source of ambient PM₁₀ concentrations can be used to supplement that shown above. Background concentration ranges for PM₁₀, for use by local authorities in their Review and Assessment reports, can be calculated in accordance with Local Air Quality Management (LAQM) Technical Guidance from mapped data provided by the National Environmental Technology Centre (NETCEN) on their website. The estimated 2007 annual mean background PM₁₀ concentration for the grid square containing the Singleton Birch Site (GR 508800, 411500) is 19.1 µg/m³.

This estimate is lower than the concentrations measured at the Scunthorpe and Hull Freetown monitoring locations over the past three years. The emissions of primary combustion particles from road transport will be affected by legislation on vehicle emission standards, whilst the emissions of secondary particles will be affected more by controls on large combustion plant and the emissions of nitrogen dioxide and sulphur dioxide. Emissions of coarse particles are largely uncontrolled and so are unlikely to change.

As mentioned above, there is one major trunk road in the immediate vicinity of the Application Site. The A180(T) is immediately adjacent to the current site to the north and runs to the immediate south of the proposed extension area. At such a close proximity to the application site, the trunk road is likely to strongly influence the air quality at the site. Although North Lincolnshire District Council's review and

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assessment of PM₁₀ concentrations in Scunthorpe has led to a recommendation for an Air Quality Management Area (AQMA) to be declared in Scunthorpe, this is not considered relevant to the area of the application site.

As part of the investigations for the North Lincolnshire Council's 2004 detailed assessment the Environment Agency's National Compliance Assessment Service (NCAS) deployed its mobile monitoring facility (MMF) at Croxton. The MMF was on site between 21 January 2004 and 14 April 2004 (85 days) to investigate ambient air quality in the vicinity of the Singleton Birch quarrying and landfill operations.

The MMF was equipped with a TEOM to monitor PM₁₀. A summary of this data, as presented in the 2004 Detailed Assessment Report, is listed in Table below.

**TABLE 10/4
SUMMARY OF MMF MONITORING OF PM₁₀ RECORDED AT CROXTON**

PERIOD	PERIOD MEAN (µg/m ³ grav)	ESTIMATED ANNUAL MEAN	NO. OF EXCEEDENCES OVER PERIOD OF 24HR 50µg/m ³ grav	PREDICTED NO. OF EXCEEDENCES OF 24HR MEAN FOR 2004
21 Jan 04 to 14 Apr 04	23.9 (C)	23.9 (C)	2 (E)	9(E)
C – Concentration, E – Exceedence (35 permissible)				

The detailed assessment found that the predicted number of exceedences from the ratified data was only a quarter of the permissible number of exceedences for 2004 and that the predicted annual mean is also well within the annual mean objective for 2004.

The report therefore concluded that there was no need to declare an air quality management area for the Croxton/Barnetby area as a result of the 24-hour mean air quality objective, and also that there was no need for further action in respect of PM₁₀ in Croxton/Barnetby at this time.

Therefore, air quality in the area of the application site with respect to fine particles is likely to be good.

Deposited Dust

For rural areas, existing levels of deposited dust would typically be in the order of 39 mg m⁻² day⁻¹ as an annual median¹⁶. Corresponding levels in a rural area that include a specific source of dust emissions (for example power stations) would typically be of the order of 59 mg m⁻² day⁻¹ as an annual median. Data are not reported after this time. More recent data indicate the following typical deposition rates¹⁷ (expressed as monthly means):

- 30 – 80 mg m⁻² day⁻¹ for urban locations; and
- 10 – 50 mg m⁻² day⁻¹ for rural locations.

¹⁶ Warren Spring Laboratory (WSL), The Investigation of Atmospheric Pollution – Deposit Gauge and Lead Dioxide Observations, October 1965 – March 1982 Inclusive.

¹⁷ Parret P W, Dust Emissions – A Review, Computational Mechanics Publications (1992).

North Lincolnshire Council has received a small number of complaints concerning dust from the existing quarry. The complaints were received over 1997 – 2000 and averaged one per year. No complaints regarding dust from the Melton Ross Quarry site have been received since then.

Sensitive Receptors

Sensitive locations are those where the public may be exposed to dust from the site. Locations with a high sensitivity to dust 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. In terms of identifying sensitive locations, consideration generally only needs to be given to sensitive locations within 500m of the site boundary. There are no schools or hospitals within 500 m of the site. The nearest school is situated over 6km to the west southwest of the site.

There are a number of residential properties located around the site. A group of these properties has been selected for the purpose of assessing potential impacts of dust emissions from the proposed development. They were selected on the basis that they are the closest to the proposed development at the site in all directions. The selected receptors are as follows:

- **Sheep Dip Farm** – Farm located 650m north north-west of the proposed Phase 1 to 6¹⁸ area. The farm lies 750m north-east of the proposed Phase 7 to 12 area.
- **Grange Farm** – Farm located 1 km east north-east of the proposed Phase 1 to 6 area, and over 1 km to the north-east and east north-east from the proposed 7 to 12 area
- **Croxton** – A small collection of residential properties, the nearest are located approximately 720m east-south-east of the proposed Phase 6 to 11 area, and over 1 km to the east of the proposed Phase 12 to 17.
- **Stonecroft Homes (east)** – Residential properties located approximately 2km south-southeast to south-south-west of the proposed phasing areas.
- **Stonecroft Homes (west)** – Residential properties located approximately 2km south-south-east to south-south-west of the proposed phasing areas.
- **Hall Farm** – Farm located approximately 1km south southeast to south south-west of the proposed phasing areas.
- **Melton Ross** – A collection of residential properties, the nearest being White Lodge located approximately 1km south to southwest of the proposed phasing areas.
- **Melton High Wood** – A residential property located 190m west of the proposed Phase 7 to 12 area. The property is located over 1 km west southwest of the proposed Phase 1 to 6 areas.

¹⁸ The proposed extension to the quarry would be undertaken in a number of phases. The location and order of the phases is shown in *Drawing MRQ 3/1/07*

- **High Wood Farm** – Farm located 440m northwest of the proposed Phase 7 to 12 area, and over 1 km west to north-west of the proposed Phase 1 to 6 area.

10.5 DUST ASSESSMENT

10.3.2 Potential Dust Emissions and Control Measures

General

The current operations, and those proposed for the site, have the potential to generate dust if not appropriately controlled. Dust in the quarrying industry is generally created by firstly the breakdown of materials and secondly the handling of previously broken down materials. Dust arises when small particles, typically less than 75 µm in diameter, are raised into the air and dispersed by the wind. The critical wind speed for raising particles into the air will be dependent on the physical condition of the surface and the size range of particles present.

Natural Dilution and Dispersion

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 10-20 m before being deposited. PM₁₀ particles, on the other hand, are not readily deposited and can travel for long distances. The vast majority of quarry dust is likely to be deposited within 100 m of the source, and hence it is in this zone that the risk of problems from dust is greatest.

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 200 m. The 1995 DoE Guidance⁸ on dust from surface mineral workings, however, recommended a stand-off distance of 100-200 m 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. By far the most important way that dust may be controlled on any site is by the vigilant management of operations on the site ensuring that all dust suppression methods are implemented and continuously monitored.

Dust emissions may be generated from vehicles travelling over dry, bare soils as well as by the handling and crushing of potentially dusty materials. The amount of dust generated by each activity depends on the size of particles and, crucially, upon their moisture content. Dust emissions are greatest when there is a plentiful supply of small dry particles. The principal activities that would give rise to potential for dust emissions from the development have been identified as follows and are considered in turn below.

Soil and Overburden Removal

The in-situ chalk that is proposed to be extracted lies beneath a layer of topsoil, subsoil and overburden and this requires removal prior to chalk extraction. The actual stripping and loading of trucks sometimes has the potential for significant dust emissions depending upon, for example, the type, friability and moisture content of the

material being handled. In general, the inherent moisture content of the soils being stripped is high enough to prevent significant dust emissions, with any dust emissions being confined to immediately around the loading and dumping areas.

It is intended that where possible any stripped soils and overburden be used directly in the progressive restoration works for previously worked areas of the site. Initially, however, to provide screening and as part of the planned operations, soils would be placed in temporary storage mounds or bunds around the area designated for chalk extraction. Screening bunds around the extraction areas would be approximately 3m in height, with the remaining soil used directly in restoration processes.

The screening bunds would be graded and seeded as soon as practicable upon completion to minimise the potential for dust emissions from this source. Any storage mounds which would be in place for longer than six months would also be seeded as soon as practicable following construction. The excavation, transport and placement of topsoils and overburden would be undertaken during a relatively short period, typically between April and September, when soils are drier and friable. The entire area of an individual phase would be stripped prior to extraction activities commencing. The stripped areas would be a potential source of dust, particularly during periods of dry, windy weather. Under such circumstances, watering dry areas by bowser (as with haul roads) would be an effective means of minimising dust generation and emission.

Chalk Extraction

Excavation of chalk would be undertaken in the same manner as that currently employed in the operational area of the existing quarry, and would follow a similar pattern of progressive phases (as shown in Drawing MRQ 3/1/07). The chalk would be excavated by means of conventional blasting, working a two-bench system as with the existing quarry. Blasted material would be fed to a primary crusher at the face by a wheeled loading shovel. The primary crushed material would then be transported to the main processing plant by a field conveyor.

Potential for dust emissions can be greatly reduced by minimising drop heights. Drop heights can be minimised by matching shovel and hopper such that the excavator is not physically too big for the hopper. The correct matching of machines also helps to prevent spilling of material around the hopper, which may potentially dry out and become a source of loose material for dust emission. Transfer points on the conveyor are generally enclosed or the drop height minimised to ensure dust emissions are reduced as far as practicable.

In addition, as the extraction proceeds, the floor of the excavations is progressively lowered relative to the surround land, which affords the excavations more shelter from the wind. Overall, the moisture content of the chalk and the screening provided by bunds and depth of excavation will ensure that the extraction activities are not a significant source of dust.

Haulage on Site

The weight of vehicles, their speed and number of wheels in contact with the ground can all affect the generation of fugitive dust. Due to the use of a conveyor system to transfer extracted chalk from the proposed extension area to the processing plant, the main source of potential dust emissions would be the movement of vehicles

transporting top soils, sub soils and overburden across the site on haul roads during initial stripping operations.

As with hard surfaced roads, the amount of loose material lying on the surface is an important source of dust as this becomes entrained and distributed by the passage of vehicles. However, some loose material on haul roads may become entrained from activities other than vehicular traffic, for example wind-blow. Wind has the potential to lift dust from surfaces, depending on wind speed, the condition of the surface and the size of the dust particles.

It should be noted that wind-blow is not unique to industrial type activities such as those undertaken at the site and can affect agricultural and horticultural land, particularly during dry periods when there is no vegetation cover. In addition, the passage of vehicles over the haul road leads to a continuous breakdown of the surface layer making more material available for potential dust emission. Thus important methods of dust control from unsurfaced roads are design, layout and good road maintenance.

The regular grading of haul roads periodically removes loose material from the surface. It also increases fuel efficiency and minimises wear and tear on the mobile plant using the haul road. Therefore it is usually an integral part of any operator's work practice. It is also a highly effective method of dust control as it removes one of the main sources of potential dust emission. The amount of dust created by the passage of vehicles over an unsurfaced road is directly linked to the speed of the vehicles. By restricting haul road speeds the amount of dust created is also reduced. Site management would typically enforce a site speed limit of a maximum of 10 - 20 mph. This would be moderately effective in reducing potential dust emissions from haul roads.

The design of haul roads to avoid sharp corners or steep gradients that would encourage sharp braking is undertaken wherever possible but obviously differs from site to site. The layout of haul roads to distance them from sensitive receptors, the use of natural or site generated screening such as top soil mounds, *etc* are all moderately effective methods of reducing the potential dust impact from a development. The use of vehicles with upward pointing exhausts and radiator cowls is also moderately effective in reducing potential dust emissions.

However, by far the greatest method of reducing dust emission is by the watering of haul roads. The use of water sprays on haul roads, for example, has been documented as being able to reduce dust emissions by over 90%¹⁹ depending upon the degree of wetting and the frequency of application. This is a very effective dust control measure.

Restoration Works

The activities associated with restoration works also have the potential to generate dust emissions. The potential is effectively the same as that associated with the stripping, transfer and storage of topsoil, subsoil and overburden, because for the majority of the development, these activities will be closely associated. Therefore, the dust control measures will be the same as those detailed above for soil and overburden removal.

¹⁹ Environment Effects of Surface Mineral Workings. DoE, October 1991

Processing and Storage of Excavated Material

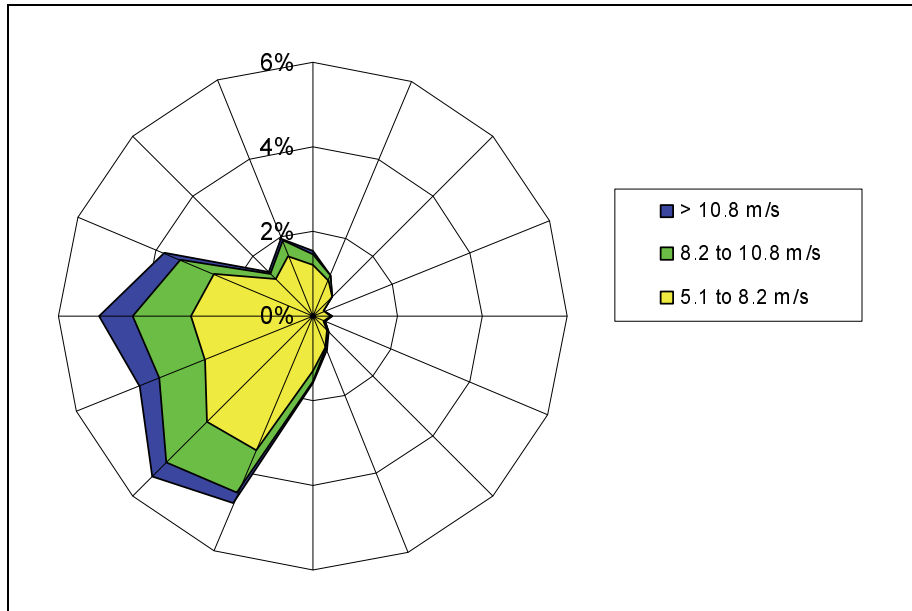
All processing and storage of excavated material would be undertaken in accordance with existing permissions within the existing site area.

10.6 ASSESSMENT OF DUST IMPACTS

10.3.2 Local Climate Conditions

A wind rose for the site is presented in Figure 10/1 for Finningley observing station and illustrates a predominant wind direction from the southwesterly quarter. However, the potential for the generation of airborne dust will increase with wind speed. A wind rose showing the frequency of winds at wind speeds of greater than 5 ms^{-1} is presented in Figure 10/2. Wind speeds (all directions) of above 5 ms^{-1} occur for 34.1% of the time, and for the majority of wind directions they occur for less than 2% of the time. Wind directions from the south-westerly sector occur most frequently for the higher wind speeds as these wind directions are most commonly associated with frontal weather systems. Moderate winds from the south-west, west, south south-west, and west south-west occur most frequently at 5.4%, 5.0%, 4.8% and 4.4% of the time, respectively.

**FIGURE 10/2
FREQUENCY OF WIND DIRECTIONS FOR HIGHER SPEEDS
AT FINNINGLEY OBSERVING STATION**



For each of the sensitive receptors identified in Section 10.4.3 of this document, the distance from various dust generating activities and frequency of wind speeds carrying airborne particles to the residential property from these activities is presented in Table 10/5.

**TABLE 10/5
FREQUENCY OF WIND DIRECTIONS TOWARDS
DUST SENSITIVE RECEPTORS**

RECEPTOR	SITE ACTIVITY	LOCATION RELATIVE TO SITE ACTIVITY ^(a)	FREQUENCY OF ALL WIND SPEEDS ^{(b)(c)}	FREQUENCY OF MODERATE TO HIGH WIND SPEEDS ^{(b)(c)}
Sheep Dip	Phases 1-6	650m NNW to NNE	25.8%	7.2%
	Phases 7-12	>1km NNE to NE	20.6%	10.1%
Grange Farm	Phases 1-6	1km ENE	8.1%	4.4%
	Phases 7-12	>1km NE to ENE	17.9%	9.8%
Croxtton	Phases 1-6	700m ESE	8.2%	3.8%
	Phases 7-12	>1km E	9.1%	5.0%
Stonecroft Homes (east)	All Phases ^(d)	2km SE to SSE	10.8%	3.4%
Stonecroft Homes (west)	All Phases ^(d)	2km SSE to SSW	15.8%	4.5%
Hall Farm	All Phases ^(d)	>1km SSE toSSW	15.8%	4.5%
Melton Ross	All Phases ^(d)	>1km S to SW	15.9%	3.2%
Melton High Wood	Phases 1-6	>1km WSW	2.3%	0.3%
	Phases 7-12	190 W	2.9%	0.5%
High Wood Farm	Phases 1-6	>1km W	2.9%	0.5%
	Phases 7-12	400 NW	3.9%	0.5%

(a) Where frequencies are presented for a group of phases (e.g. Phases 6-11), a worst case situation has been assumed where soil stripping, chalk extraction and restoration is occurring across the entire area simultaneously.

(b) Frequencies are based on the location of the receptor relative to the site of dust-generating activities, for example Top Farm is one of the closest receptors (to Phases 6 to 11) and located to the west northwest to north northeast of the proposed phasing activity, therefore this receptor is affected by winds from the ESE, SE, SSE, S & SSW.

(c) Different frequencies are presented for different phases and activities. This is a reflection of the different locations of the phases and activities relative to the receptor.

(d) Some receptors are at a great enough distance from all of the phases that they can be considered as one phase.

The impact of the proposed development on each of these residential properties is discussed below. Because the development is proposed to proceed in a phased manner, as has been the case in the past, the assessment of potential dust impacts has been divided according to groups of phases. The impacts have been assessed in the absence of any mitigation and only takes into account wind directions and stand offs.

Phases 1 to 6

Sheep Dip is most likely to be affected by any dust emissions, in the absence of any mitigation, from these phases of the proposed development, because of the prevailing south southwest wind direction in the area and the proximity of the farm to the site (650m north northwest to north northeast). Moderate winds that would carry dust emissions from these phases to the receptor occur with a frequency of 7.2%, for both wet and dry conditions. As discussed previously, the generation of dust is significantly reduced when surfaces are damp. Therefore, the probability with which these receptors may experience dust nuisance without any mitigation is further reduced from that indicated by the wind direction frequencies due to the mitigative effects of rainfall. This is the greatest frequency of unfavourable moderate winds for any of the sensitive receptors identified. As before, it has been assumed that all the phases would be stripped at once and subsequent extraction would occur across all the phases concurrently. Therefore, the frequency with which dust nuisance from these phases could potentially affect Sheep Dip is lower than suggested by the frequencies shown in Table 10/5 because only one phase at a time would be stripped and excavated. In addition, following soil stripping activities, the excavation would be further screened by 3m bunds around the site perimeter. Overall, the separation distance and screening (predominantly), combined with a reasonably low frequency of unfavourable wind direction, would mean that the likelihood of this receptor being affected by a dust nuisance from Phases 1 – 6 (or any of the other phases) is small even in the absence of mitigation.

Croxton is the next closest receptor after Sheep Dip, at a distance of 700m and in a location where unfavourable winds are less frequent. Furthermore, proposed advanced planting along the eastern boundary of the application site will provide additional screening of dust for those receptors located in Croxton. The additional separation distance would act to prevent a dust nuisance arising at these receptors as a result of the activities undertaken in Phases 1 – 6. This situation prevails for the remaining receptors referred to in Section 10.4.3.

Phases 7 to 12

Sheep Dip, Grange Farm and Croxton are most likely to be affected by any unmitigated dust emissions, should they arise, from these phases of the proposed development on the basis of unfavourable wind directions. Moderate winds ($>5 \text{ ms}^{-1}$) that would carry dust emissions from these areas to the receptors occur with a frequency of 10.1%, 9.8% and 5.0%, respectively, for all weather conditions. Although Sheep Dip has the highest frequency of the three receptor locations, the distance between the farm and these phases is over 1km, which would ensure any unmitigated dust emissions from Phases 7-12 would not produce a dust nuisance at sheep Dip.

Melton High Wood is the closest receptor to Phases 7-12 at a distance of 190m. However, the frequency with which moderate winds blow from the site toward this receptor is small at 0.5%. Therefore, the potential for this receptor to experience a dust nuisance due to any unmitigated dust emissions from Phases 7-12 would be minimal. High Wood Farm is a further 190m further from the site than Melton High Wood, and therefore, less likely to experience a dust nuisance. In addition, both of these receptors would be afforded extra protection from dust emissions by proposed screening bunds and plantings on the western boundary.

For all other receptors described in *Section 10.4.3*, the separation distance to the closest phase is in excess of 1km and the frequency of winds of concern is small, so that the likelihood of a dust nuisance arising as a result of emissions from the site is considered negligible.

Stockpiling and Processing

No stockpiling of soil will take place other than the small proportion of soils which would be used as screening bunds, with the remainder used directly for restoration. Processing of the chalk would continue in the same area currently utilised for the existing chalk operations and in accordance with existing permissions.

10.7 PROPOSED MITIGATION MEASURES

10.7.1 General Measures

The assessment in 10.6 has considered the potential impact of the quarry operations proposed for the Melton Ross Quarry extension. Notwithstanding, the low potential incidences of impacts that have been identified, it is considered necessary to identify mitigation measures, which are recognised as good practice within the industry, in order to reduce residual impacts to a practical minimum.

Accordingly, the following measures would be adopted as an integral part of the operation of the quarry facility:

- (a) Site management would continuously monitor operations likely to cause the generation of dust within the site boundary and all findings, including prevailing weather conditions should be recorded.
- (b) The site operator would provide on site, and maintain at all times, an adequate supply of water for spraying equipment, to ensure a sufficient supply for the rapid filling of static and mobile spraying units, to have available a sufficient number of units, and to ensure that the rate of application would be sufficient for the purposes of wetting the ground to minimise dust emissions.
- (c) All plant used on site would have upward facing exhausts as specified by the manufacturer so as to prevent dust generation
- (d) An appropriate on-site speed limit would be established and enforced.
- (e) Wheel and tyre cleaning equipment at the site entrance would be maintained in good operational order and utilised at all times by vehicles attending the site.
- (f) Any initial landscaping works (e.g. soil bunds) would be seeded to grass at the earliest opportunity and adequately maintained for the life of the site.

Further, measures for minimising dust emissions are summarised in Table 10/6 along with the comparative effectiveness of the measures proposed.

**TABLE 10/6
SUMMARY OF PROPOSED DUST CONTROL MEASURES
AND ESTIMATE OF EFFECTIVENESS**

SITE OPERATION	DUST CONTROL MEASURES	ESTIMATE OF EFFECTIVENESS
Soil/Overburden Removal and Replacement:	Water sprays to be used as required	High
	Avoid soils handling during adverse weather conditions	High
	Optimise timing re weather and seeding season	High
	Soil bunds & mounds graded to minimise wind blown dust	Moderate
	All long-term soil bunds & mounds to be seeded immediately upon completion of construction	High
	Soil mound heights restricted to minimise dust emissions	Moderate
	Progressive restoration minimises the area exposed to wind erosion	Moderate
Mineral Extraction:	Minimise double handling of material	Moderate/Low
	Drop heights to be minimised at all times	Moderate
	Restrict access to restored areas	High
	No stockpiling of mineral in excavation areas	High
	Drop heights to be minimised at all times	Moderate
	Use of water sprays as and when necessary	High
	Use of water sprays on stock piles, when necessary	High
Topsoil/Overburden Haul Roads:	Siting of stock piles to take advantage of shelter from wind	High
	Haul routes to be regularly maintained by grading to minimise dust generation	High
	Optimise separation distances to sensitive receptors	High
	Water bowsers to be used as required	High
Access Road:	Use of wheel cleaning equipment.	Moderate/High
	Speed controls to be implemented and enforced on all haul routes (15 mph).	Moderate
	Controlled use of fixed haul routes	Moderate/High
	Use of water bowsers on access road when required.	High
	Use of road sweeper on paved road when required.	Moderate
	Use of fixed water spray system as required.	High

10.7.2 Assessment of Residual Impacts

Implementation of the above dust mitigation measures would ensure that likelihood of any residual impacts at the nearest receptor locations (Sheep Dip, Croxton and Melton High Wood) as a result of dust emissions is minimal. The excavation activities are unlikely to generate significant amounts of airborne dust due to the inherent moisture of the soils and mineral. Similarly, transfer of the quarried material is unlikely to be a significant dust source through the use of covered conveyors, rather than dump trucks via unsealed haul roads (which are generally the most significant sources of dust at quarries).

The majority of receptors are 1km or further from the excavation activities. This alone would act to ensure that the potential for a dust nuisance is minimal even without dust suppression, and the potential for residual impacts considered negligible assuming the above mitigation measures were implemented and managed appropriately.

10.8 CONCLUSIONS

The assessment has considered the impact of the proposed quarry extension and operation on dust nuisance and health. Potential dust from the operations are likely to be primarily of relatively large particle size. As described in *Sections 10.2 and 10.3*, studies have shown that particles arising from activities such as those proposed are unlikely to have an effect on health. Consequently, the impact on health of these particles is unlikely to be significant compared to the smaller particle sizes associated with combustion type processes (<2.5 µm), such as those from vehicle engines and domestic solid fuel burning. It is likely that any dust arising from the proposed quarry development would be limited to nuisance impact in the immediate vicinity of the dust generating activities even without dust suppression. This is due to the predominantly coarse and 'moist' nature of the material being extracted. For the majority of the residential properties the potential for being affected by dust nuisance as a result of dust emissions from the proposed extension at Melton Ross Quarry is minimal.

For those residential properties down prevailing wind and/or closer to the dust-generating activities as a result of the proposed extension, the implementation of all current mitigation measures employed at the site would act to minimise potential dust nuisance impacts. The proposed quarrying operations are the same as those currently undertaken at the site and do not have a significant potential for generating dust emissions that could cause nuisance off-site. This is due to the inherent moisture of the material being extracted (and stripped) and the use of a conveyor system to transport excavated material (rather than dump trucks via haul roads). Furthermore, the majority of sensitive residential receptors are at least 1km from the proposed quarry, meaning dust generated at the application site is unlikely to cause nuisance at these sites.

The Planning Authority is able to impose conditions on any permission issued, to require all appropriate mitigation methods at the site, to ensure the impact of any dust emissions is minimised. In addition, the phasing of the proposed development has been designed to ensure that operations in the areas proposed for development are completed in the shortest possible time so that potential for dust impacts is further reduced. Each phase would have bunds around the perimeter to provide screening, with the potential for dust impacts reducing as each phase progresses because of the greater protection afforded by the lowering of the working surface.