Mineral Products Association

The Trade Association for the Aggregates, Asphalt, Cement, Concrete, Dimension Stone, Lime, Mortar and Silica Sand Industries

Quarries and dust

INTRODUCTION

The mineral products industry provides essential raw materials to build many things including homes, schools and hospitals. The crushed rock and sand and gravel our members work are used to make cement, asphalt, concrete and bricks and much more. Most sites are in rural locations, and while some may be close to communities, operators work to the highest standards to ensure air quality, and principally dust, are properly controlled.

The industry[1] takes its environmental responsibilities seriously as documented in more than over a decade of Sustainable Development reports. The planning and permitting processes that control mineral extraction consider the potential effects of quarry developments on both the environment and local communities. Where necessary, controls are put in place to manage, mitigate and monitor any potential effects of the extraction operations and to ensure they remain within acceptable limits.

One of the concerns that may be raised is the potential effects on air quality, that may arise from finer airborne particulates (generally described as dust) created by the quarrying and processing operations that may travel beyond the boundary of a site.

On a national scale, quarries are not a significant source of airborne particulates. However, they may have the potential to contribute to local levels if not controlled.

This document outlines types and potential sources of dust and any impacts these emissions could have upon communities. With the necessary precautions and control measures in place the impact of dust emissions beyond operational site boundaries is negligible. As part of this document, MPA draws upon both UK and international air quality research to shape its advice to members.

Types of dust and its sources

Types of Dust

- **Nuisance dust** - Visible dust, normally over 10 microns.
- **PM10** - often called "particulate matter", it is an air pollutant consisting of small particles with a diameter less than or equal to 10 microns.
- **PM2.5** - an air pollutant, forming a fraction of PM10, with an average diameter of up to 2.5 microns, often referred to as the "fine particle fraction" or respirable dust.
- **RCS (Respirable Crystalline Silica)** - forming a fraction of PM2.5, RCS is the term used to refer to silica in crystalline form in the PM2.5 fraction.

Airborne particulate matter (PM) is everywhere and can come from a wide range of natural sources such as pollen, sea spray and wind blown desert dust as well as human sources such as smoke from domestic heating, agriculture, transport (including tyre and brake wear), and a wide variety of emissions from industry including the processing of quarried materials.

As shown in diagram 1, alongside visible dust, particulate matter in the atmosphere that's not visible to the naked eye is typically categorised in two ways: PM10 particles have diameters less than 10 micrometres; and PM2.5, a sub-set of PM10, which are finer particles with diameters less than 2.5 micrometres.

Charts 1 and 2 show the contribution of different industrial sectors, activities to national emissions of PM10[2] and PM2.5[3], with quarrying contributing less than 5% of PM10 emissions and just 1% of PM2.5 emissions.

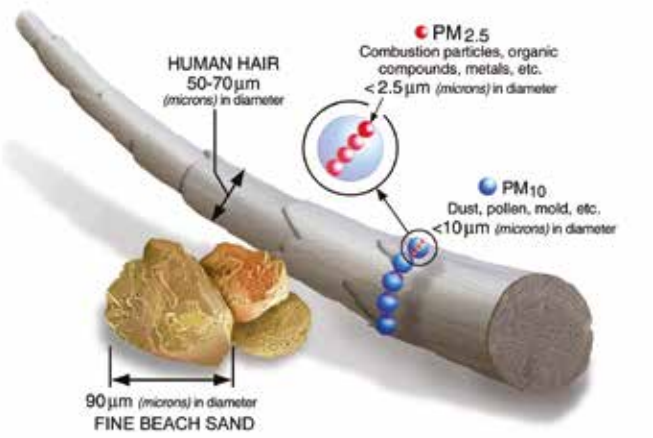

Diagram 1 showing size comparisons for PM particles. Source: United States Environmental Protection Agency, Particulate Matter (PM) Basics

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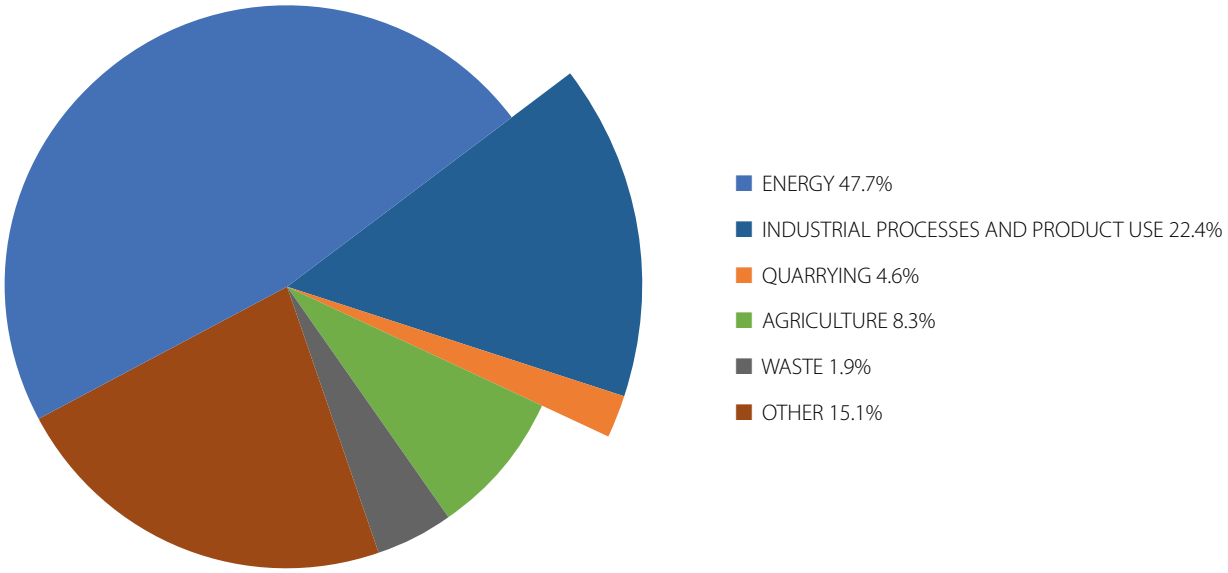
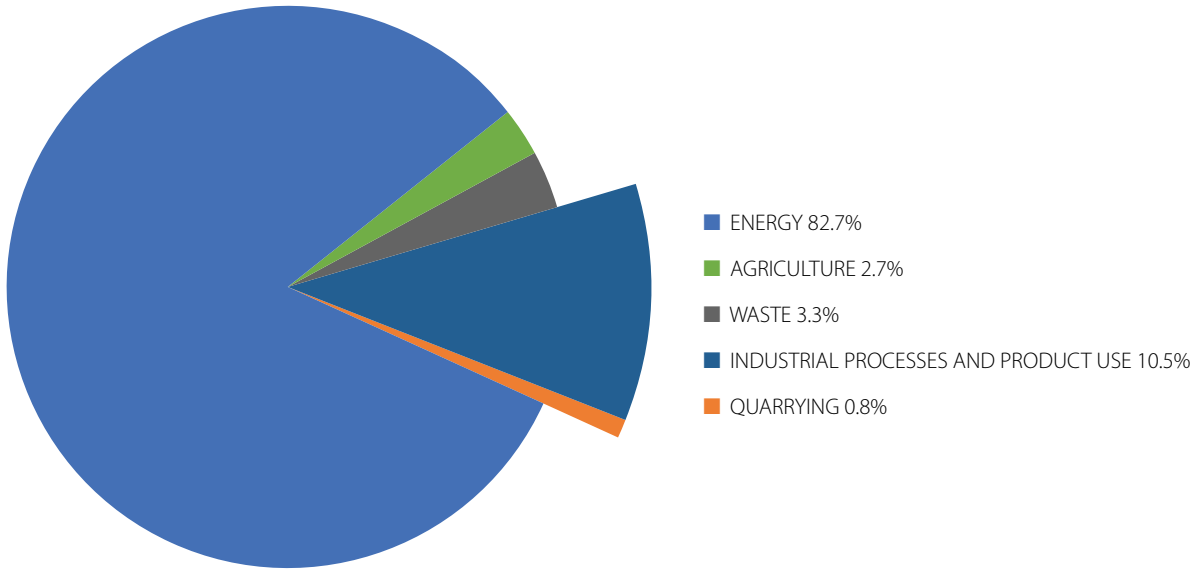
Chart 1 total PM10 emissions in the UK in 2018.



PM10 emissions split for the industrial processes and product use sector showing percentage contribution to total emissions[2].

Source: UK National Atmospheric Emissions Inventory, 2019, MPA calculations

Chart 2 total PM2.5 emissions in the UK in 2018.



Emissions arising from incidents such as forest fires, are excluded as per the NAEI data set. PM2.5 emissions split for the industrial processes and product use sector showing percentage contribution to total emissions[3].

Source: UK National Atmospheric Emissions Inventory 2019, MPA calculations

DUST EMISSIONS AND QUARRIES

Dust emissions for the context of this document should be considered to include nuisance dust, PM10 and PM2.5 as all are elements of general dust emitted from quarries.

Normally, dust emissions are not derived from a single source, so their contribution to overall air quality is more difficult to quantify, compared to emissions from chimney stacks, for example. Mineral extraction can result in a number of potential sources of dust through the exposure of soil and the underlying mineral deposits, as well as the extraction, transport, processing and storage of the material (see Table 1). Although dust emissions can be difficult to quantify, the sources along with the potential impact on local communities, are well documented[4]. The industry and its regulators recognise the importance of putting in place suitable control measures to ensure local air quality is not adversely affected.

Evidence published by the Institute of Air Quality Management Mineral Guidance Working Group[5] suggests that airborne dust that goes beyond site boundaries is typically deposited close to its point of origin.

The distance dust can travel beyond the boundary of a minerals site will be dependent on the geology and the processing operations taking place, along with local geography and prevailing wind direction.

Table 1 Typical sources of dust that may be associated with mineral extraction.

Activity	Relevance for mineral types	Duration of activity	Potential for dust emission
Soil handling	Most minerals	Relatively short	**Significant** but depends on dryness and silt or clay content of the material and transportation to stockpiles.
Overburden handling	Most minerals, but quantities vary considerably	Varies. Can be intermittent over life of site	**Significance varies (high to low)** and highly dependent on the nature of overburden, particularly during unloading and haulage
Drilling and blasting	Usually for hard rocks	Short, but can take place frequently	Without control, drill rigs can be a **very significant** source of dust. However, most drill rigs now use shrouds and any dust generation is very localised. Properly designed and controlled blasts have limited potential for the creation of dust therefore **not generally significant.**
Initial loading activities	All mineral types	Ongoing during extraction	**Significance varies (high to low)** and dependent on the nature of material, whether wet or dry, volumes handled and equipment used.
Crushing and screening	Most minerals, but not always at the place of extraction	Varies, generally ongoing	**Very significant** if unmitigated. Significance varies depending on type of equipment and exposure to wind. Controlled through the EPR permit regulated sites.
Storage of minerals within site	Most mineral types	Usually ongoing during extraction	**Significance varies (high to moderate)** depending on the volume of material stored, moisture content, exposure to wind, covering of stockpiles.
Transport and loadout within site	All mineral types	Usually ongoing	**Significance varies (high to moderate)** depending on type of vehicle. if transported by road then the size of vehicle, speed and nature of roads (surface or unmade) are important factors.
Transport off-site (mainly by road)	All mineral types	Usually ongoing	**Not generally significant** (except near sites exits due to the re-suspension of road dust) as lorries tend to be covered. Can be mitigated by road sweeping but this can also raise dust.
Soil and overburden storage	Most minerals	Varies	**Very significant** but depends on the condition and exposure to wind, seeding or covering of the bund or mound.

Source: Management, mitigation and monitoring of nuisance dust and PM10 emissions arising from the extractive industries: an overview, 2011, table 7.1[7]

CONTROLS AND MITIGATION

Average yearly limits are put in place by Government and organisations such as the World Health Organisation (WHO) to prevent pollutants such as PM10 and PM2.5 causing harm to human health. Table 2 shows current limits.

Mineral developments are subject to stringent controls and conditions regulated by mineral planning authorities, the Environment Agency, environment health officers and the Health and Safety Executive. Through these controls the potential issues associated with dust emissions are reflected in the way that mineral operations are managed and controlled.

To allow mineral extraction to take place, planning permission must be obtained and as part of this process, a full environmental impact assessment (EIA) is required to support any planning application for mineral extraction sites. The EIA must identify, describe and assess the direct and indirect effects of the proposed development on a wide range of factors, including the local community and health.

The planning application is developed through an iterative process, which requires consultation with local communities, regulators and other interested parties to ensure all the potential impacts are identified and assessed. This process will then determine whether the predicted impacts on the natural environment and local communities are acceptable.

The operator will be required to manage any dust emissions, considering the geographic setting of the site, the proposed operations and meteorological conditions, including prevailing wind speed and direction, and precipitation levels. The development process can impose explicit planning conditions which may require a dust management plan (DMP) to be agreed prior the start of work and then strictly implemented. Routinely, these are included in the operators own environmental management system.

Further advice on the assessment of effects of mineral development and ways to mitigate this is provided in guidance issued by the Institute of Air Quality Management (Guidance of the assessment of mineral dust impacts for planning, IAQM (2016))[6].

Table 2 showing published annual mean limits for air pollutants that have been set to protect human health

Air pollutant	Guidance	Regulator	Annual mean
PM10	Air Quality Assessment Level	Environment Agency	40µg/m^3 [10]
PM2.5	Air Quality Assessment Level	Environment Agency	25 µg/m^3 [11]
PM10	WHO Guidance (2021)	WHO	15 µg/m^3
PM2.5	WHO Guidance (2021)	WHO	5µg/m^3

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MITIGATION, MANAGEMENT & MONITORING

Many mineral sites will have a DMP and a dust action plan (DAP) in place either through a requirement in the planning permission and/or as part of a site environmental management system, a framework through which a site's environmental performance can be monitored, improved and controlled. The DMP will set out the measures that the site operator will undertake to manage and mitigate any dust emissions. The effectiveness of the DMP will be monitored by a regulator, through the planning permission or an environmental permit, or through an independent assessor of the company environmental management system.

A wide range of measures are available to minimise dust originating from site activities. These include, dust suppression by spraying water on transit roads or working areas, minimising the size of operational areas, planting, landscaping and screening around active areas, reducing vehicle speeds on haul roads, enclosure of conveyors and machinery and covering of material transported by lorries. Operations can be modified during high winds or certain wind directions or following prolonged dry spells, and by minimising the height of stockpiles.

The effectiveness of the DMP will be monitored as required, potentially through the use of gauges located at the site boundary or close to the site.

The DAP identifies procedures necessary to investigate and take action in response to results identified in the dust monitoring scheme or when climatic conditions require action.

Planning Policy and Development Control

In England, national planning policy for minerals is set out in the National Planning Policy Framework (NPPF). Under the heading 'Facilitating the sustainable use of minerals' this states:

"When determining planning applications, local planning authorities should:

b) ensure that there are no unacceptable adverse impacts on the natural and historic environment, human health or aviation safety, and take into account the cumulative effect of multiple impacts from individual sites and/or from a number of sites in a locality;

c) ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source, and establish appropriate noise limits for extraction in proximity to noise sensitive properties…".[9]

The NPPF is further supported by national Planning Practice Guidance, within which the Minerals section states:

"Where dust emissions are likely to arise, mineral operators are expected to prepare a dust assessment study, which should be undertaken by a competent person/organisation with acknowledged experience of undertaking this type of work." [10]

Local planning authorities are required to reflect these national policy requirements in the policies they develop for the Mineral Local Plans they prepare.

SILICA AND DUST

Crystalline silica, also known as silica or quartz, is one of the most common minerals on the planet, making up around 59% of the earth's crust[7]. The presence of silica dust in the natural environment is therefore not unusual.

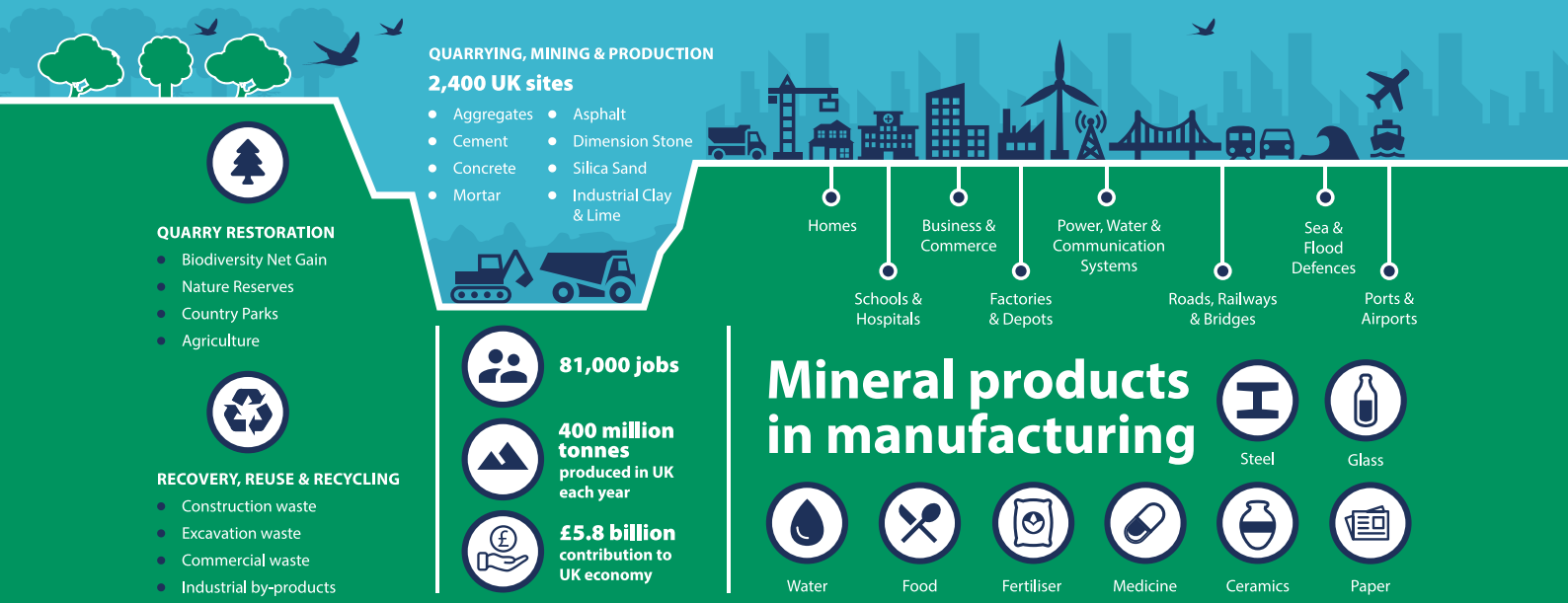
If rock types containing crystalline silica are cut or crushed by industrial processes, very fine Respirable Crystalline Silica dust (RCS) can be generated. These processes will normally take place within buildings or enclosed spaces, and unless protective masks are worn by workers the freshly formed dust can be inhaled. Should high levels of RCS be inhaled regularly over many years, particles can irritate the lining of the lungs, and over time cause lung conditions such as silicosis. Because of this potential, RCS dust is classified as a carcinogen under the EU Directive "Protection of workers from exposure to carcinogens or mutagens at work" (Directive 204/37/EC). Other materials covered by this directive include hardwood dusts, engine oils and diesel engine exhaust emissions.

The conditions required to create high levels of RCS will typically involve the use of machinery within a building. Consequently, health and safety controls are employed by mineral operators to manage the potential exposure to employees working on the site. In turn, such control measures also serve to reduce the likely impact of dust outside the processing building, and therefore the site.

The presence of silica dust beyond the boundary of a minerals site will be dependent on the geology and the processing operations, along with local geography and prevailing wind direction.

The mineral planning and regulatory regimes that are in place ensure that all potential issues associated with dust emissions, including silica dust and RCS, are reflected in the way that mineral operations are permitted, managed and controlled.

Mineral products in construction



1 MPA https://www.mineralproducts.org/Sustainability/Reporting.aspx

2 Data taken from UK National Atmospheric Emissions Inventory (NAEI) UK emissions data selector PM10 (Particulate Matter < 10 µm). Sources of emissions are grouped according to the NFR (Nomenclature for Reporting)/ CRF (Common Reporting Format) code used by the NAEI. Data set available at UK emissions data selector - NAEI, UK (beis.gov.uk)

3 Data taken from UK National Atmospheric Emissions Inventory (NAEI) UK emissions data selector PM2.5 (Particulate Matter < 2.5 µm). Sources of emissions are grouped according to the NFR (Nomenclature for Reporting)/ CRF (Common Reporting Format) code used by the NAEI. Data set available at UK emissions data selector - NAEI, UK (beis.gov.uk)

4 EMEP/ EEA air pollutant emission inventory guidebook 2019, technical guidance to prepare national emission inventories- 2.A.5. a Quarrying and mining of minerals other than coal : EMEP/EEA air pollutant emission inventory guidebook 2019 - European Environment Agency (europa.eu)

5 Guidance on the Assessment of Mineral Dust Impacts for Planning, IAQM, 2011

6 Guidance on the Assessment of Mineral Dust Impacts for Planning, IAQM, 2016"

7 silica | Definition & Facts | Britannica

8 National Policy Framework, Ministry of Housing, Communities & Local Government, 2021

9 Guidance- Minerals, Planning Practice Guidance, Ministry of Housing, Communities & Local Government, 2014

10 National air quality objectives and European Directive limit and targets for values for the protection of human health, Defra, 2010 https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf

11 WHO Air quality guideline values, WHO, 2021 https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health

The Mineral Products Association is the trade association for the aggregates, asphalt, cement, concrete, dimension stone, lime, mortar and silica sand industries.

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