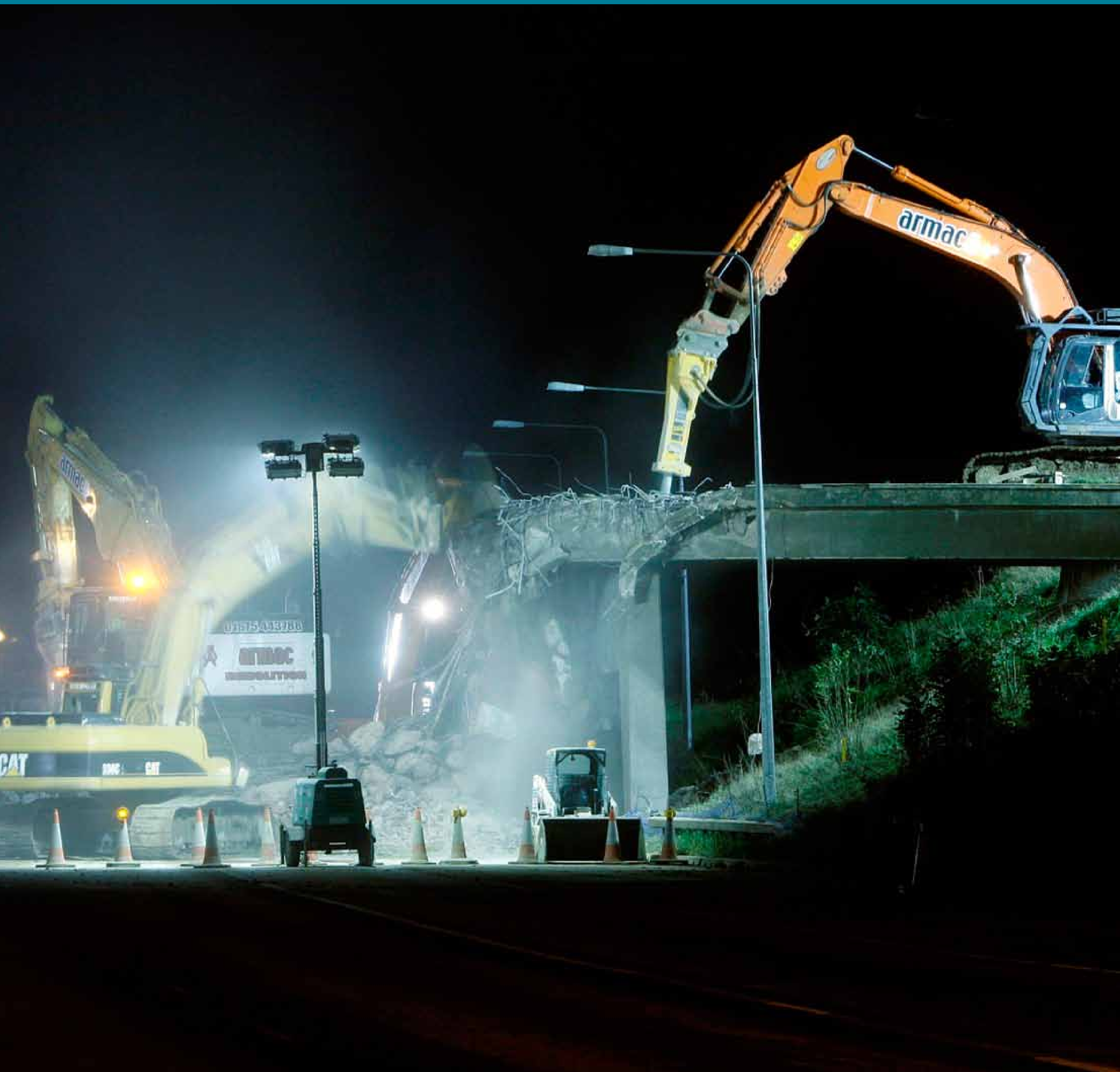
Institute of
Air Quality
Management

Guidance on the assessment of dust from demolition and construction

Version 1.1



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About the Institute of Air Quality Management (IAQM): The IAQM aims to be the authoritative voice for air quality by maintaining, enhancing and promoting the highest standards of working practices in the field and for the professional development of those who undertake this work. Membership of IAQM is mainly drawn from practicing air quality professionals working within the fields of air quality science, air quality assessment and air quality management.

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1. Introduction

Emissions of dust to air can occur during the preparation of the land (e.g. demolition, land clearing, and earth moving), and during construction. Emissions can vary substantially from day to day, depending on the level of activity, the specific operations being undertaken, and the weather conditions. A large proportion of the emissions result from site plant and road vehicles moving over temporary roads and open ground. If mud is allowed to get onto local roads, dust emissions can occur at some distance from the originating site. The scale of these impacts depends on the dust suppression and other mitigation measures applied.

In terms of effects, construction sites can give rise to annoyance due to the soiling of surfaces by dust. Very high levels of soiling can also damage plants and affect the diversity of ecosystems. Additionally, there is evidence of major construction sites increasing long term particulate matter (PM_{10}) concentrations[1] and the number of days[2] when PM_{10} concentrations exceed 50µg/m^3, the daily limit value for this pollutant. Exposure to PM_{10} has long been associated with a range of health effects[3].

Local planning authorities often require the air quality impacts of new developments to be assessed as part of the decision making process[4], either as a standalone document or as part of a wider Environmental Impact Assessment (EIA). The latter requires both the construction and operational phases of developments to be considered, and as a result many stand-alone air quality assessments also consider the impacts of both phases of new developments. In London the Mayor has recently introduced a requirement for construction impact assessments for major developments[5].

This document is designed to provide guidance for developers, their consultants and environmental health practitioners on how to undertake a construction impact assessment (including demolition and earthworks as appropriate). The construction impact assessment may be a standalone document (possibly including other environmental impacts such as noise) or incorporated into an Air Quality Assessment or EIA.

The impacts depend on the mitigation measures adopted. Therefore the emphasis in this document is on classifying the risk of dust impacts from a site, which will then allow mitigation measures commensurate with that risk to be identified.

In Environmental Statements (ESs) and Air Quality Assessments the terms ‘impacts’ and ‘effects’ are often used interchangeably. In this document the term ‘impact’ has been used to describe a change in concentration or dust deposition and ‘effect’ to describe the consequences of any impacts.

The operational phases of minerals (and some waste) sites share some common features with construction activities; however, minerals sites can be of a significantly larger scale. A qualitative dust assessment for a minerals site would therefore normally be expected to be at least as rigorous as one carried out in accordance with the IAQM construction dust method, reflecting the potential for minerals sites to have a greater impact than construction sites. The underlying Source-Pathway-Receptor concept used in the IAQM construction dust method is applicable to a wide range of applications, including minerals developments; however, the detailed guidance in this document (particularly on source strength and pathway distances) is specifically for construction and demolition and cannot be used, without appropriate modification, for other activities. Notwithstanding this, and in the current absence of other detailed guidance, the IAQM construction dust method can be taken as a starting point for a minerals dust assessment provided it is used with appropriate modifications to the various terms and factors; some aspects of this guidance, such as the assessment of dust from earthworks and track-out, may be applicable with only minor adjustments. It is the intention of the IAQM to produce separate guidance on the assessment of the impact of mineral and waste sites at a future date.

This guidance is aimed primarily for use in the UK, where the vast majority of IAQM members work. However, it is recognised that the membership of IAQM is international and that the guidance may be applied elsewhere. Where this occurs careful consideration should to be given to its applicability where there are different climates, construction working practices and statutory assessment criteria.

As stated above, the emphasis has been on classifying demolition and construction sites according to the risk of impacts, to identify mitigation measures appropriate to the risk. It is anticipated that with the implementation of effective site-specific mitigation measures the environmental effect will not be significant in most cases. Nonetheless a robust assessment of the dust impact risk is necessary (and is described here) in order to determine the level of site-specific mitigation that should be applied.

This guidance represents an update of the 2012 IAQM publication[6]. The guidance will continue to be updated as knowledge regarding its use expands and as a result of legislative or other requirements. The user should therefore check the IAQM website (www.iaqm.co.uk) to ensure that the latest guidance is being followed.

[1] Stuart Upton and Vina Kukadia, 2004, Measurements of air pollution emissions from a construction site: a case study, Report for Greater London Authority, BRE Environment, Watford.
Air Quality Expert Group (AQEG), 2005, Particulate Matter in the UK, Section 6.3.6 Construction Activities.
[2] Gary D Fuller and David Green, 2004, The impact of local fugitive PM_{10} emissions from building works and road works on the assessment of the European Union limit value, Atmospheric Environment, 38, 4993-5002. [3] There is evidence that short-term exposure to coarse particles i.e. those between PM_{10} and $PM_{2.5}$, typically associated with demolition and construction activities, including crustal material, are associated with adverse respiratory and cardiovascular effects on health (World Health Organization, REVIHAAP Project: Technical Report, 2013, www.euro.who.int/en/what-we-do/health-topics/environment-and-health/air-quality/publications/2013/review-of-evidence-on-health-aspects-of-air-pollution-revihaap-project-final-technical-report). [4] For example, the National Planning Practice Guidance for England (Beta Version) includes air quality as a relevant considered in planning decisions and specifically includes "significant impact (such as dust) during construction for nearby sensitive locations".

[5] Mayor of London, 2013, Sustainable Design and Construction Special Planning Guidance, Draft.
[6] IAQM, 2012, Guidance on the assessment of the impacts of construction on air quality and the determination of their significance.

▼ **Photo credit: Daniel Marsh**

2. Terminology

The construction impact assessments reviewed by IAQM identified the use of a range of different terminology, often with different meanings. This section aims to provide some definitions to help ensure consistency between the dust impact assessments produced by different organisations.

Annoyance (dust)	Loss of amenity due to dust deposition or visible dust plumes, often related to people making complaints, but not necessarily sufficient to be a legal nuisance.
AQMA	Air Quality Management Area, declared by a local authority where its review and assessment of air quality shows that an air quality objective is likely to be exceeded.
Construction	Any activity involved with the provision of a new structure (or structures), its modification or re-furbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc.
Construction Impact Assessment	An assessment of the impacts of demolition, earthworks, construction and trackout. In this Guidance, specifically the air quality impacts.
Demolition	Any activity involved with the removal of an existing structure (or structures). This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time.
Deposited Dust	Dust that is no longer in the air and which has settled onto a surface. Deposited dust is also some-times called amenity dust or nuisance dust, with the term nuisance applied in the general sense rather than the specific legal definition.
DMP	Dust Management Plan; a document that describes the site-specific methods to be used to control dust emissions.
Dust	Solid particles that are suspended in air, or have settled out onto a surface after having been sus-pended in air. The terms dust and particulate matter (PM) are often used interchangeably, although in some contexts one term tends to be used in preference to the other. In this guidance the term 'dust' has been used to include the particles that give rise to soiling, and to human health and ecological effects. Note: this is different to the definition given in BS 6069, where dust refers to particles up to 75µm in diameter.
Earthworks	Covers the processes of soil-stripping, ground-levelling, excavation and landscaping.
Effects	The consequences of the changes in airborne concentrations and/or dust deposition for a receptor. These might manifest as annoyance due to soiling, increased morbidity or mortality due to exposure to PM_{10} or $PM_{2.5}$ or plant dieback due to reduced photosynthesis. The term 'significant effect' has a specific meaning in EIA regulations. The opposite is an insignificant effect. In the context of construction impacts any effect will usually be adverse, however, professional judge-ment is required to determine whether this adverse effect is significant based on the evidence presented. There is further discussion of this in **Section 10** of this document.
EIA	Environmental Impact Assessment, as required by The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2011; The Town and Country Planning (Environmental Impact Assessment (Scotland) Regulations 2011; and The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) as may be amended from time to time having regard to the Environmental Impact Assessment Directive (85/337/EEC) (as amended).
ES	Environmental Statement, the document that reports the work undertaken for EIA.
HDV	Heavy duty vehicles defined as vehicles with a gross weight greater than 3.5 tonnes.
Impacts	The changes in airborne concentrations and/or dust deposition. A scheme can have an 'impact' on airborne dust without having any 'effects', for instance if there are no receptors to experience the impact.
NRMM	Non-road mobile machinery, in this context the plant used for demolition and construction activities, e.g. diggers.

▶

Nuisance	The term nuisance dust is often used in a general sense when describing amenity dust. However, this term also has specific meanings in environmental law: (a) Statutory nuisance, as defined in S79(1) of the Environmental Protection Act 1990 (as amended from time to time). (b) Private nuisance, arising from substantial interference with a person's enjoyment and use of his land. (c) Public nuisance, arising from an act or omission that obstructs, damages or inconveniences the rights of the community. Each of these applying in so far as the nuisance relates to the unacceptable effects of emissions. It is recognised that a significant loss of amenity may occur at lower levels of emission than would constitute a statutory nuisance. Note: as nuisance has a specific meaning in environmental law, and to avoid confusion, it is recommended that the term is not used in a more general sense
PM	Abbreviation for particulate matter suspended in the air. PM_{10} is airborne particulate matter with an aerodynamic diameter less than 10 microns (µm); $PM_{2.5}$ is less than 2.5µm.
Receptor	A location that may be affected by dust emissions during demolition and construction. Human receptors include locations where people spend time and where property may be impacted by dust. Ecological receptors are habitats that might be sensitive to dust. See **Section 4.2.**
Risk	The likelihood of an adverse event occurring.
Trackout	The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction/demolition site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.

3. Background

At the end of 2009 IAQM produced its *Position on the Description of Air Quality Impacts and the Assessment of their Significance*. This provides guidance for defining the significance of an air quality impact arising from the operation of a new development, based on the magnitude of change (i.e. the increase or decrease in predicted concentrations as a result of a proposed development) and the sensitivity of the receptors (i.e. the air quality in the area with respect to the air quality objectives). This guidance was incorporated into *Development Control: Planning for Air Quality (2010 Update)*, published by Environmental Protection UK (EPUK), and has been widely used by air quality professionals across the country. A review of this guidance was initiated in 2013, jointly with EPUK.

Environmental Impact Assessment (EIA) requires the consideration of any impacts associated with the demolition/construction phases of a proposed development. Assessment of impacts associated with construction and demolition is also frequently required for planning purposes outside of the formal EIA process.

The Building Research Establishment (BRE) undertook research, in association with the construction industry, to investigate the efficacy of dust mitigation measures, which resulted in BRE guidance being published in 2003[7].

In 2006 the Greater London Authority (GLA) with the London Councils produced *The Control of Dust and Emissions from Construction and Demolition: Best Practice Guidance*, with the assistance of BRE and others. The Mayor of London committed to updating this guidance in his 2010 Air Quality Strategy, and a revised version is due to be published in 2014.

In the development of this IAQM guidance there has been much debate over the evidence for the numbers used to define the risk categories. Given the state of knowledge these can only be indicative at the current time. In particular, the evidence on the distance over which impacts may occur is limited. Extensive monitoring of PM_{10} around construction sites has occurred since the GLA Best Practice Guidance was first published. However, there has been little or no attempt to pull this information together. It is often collected on a site by site basis, by developers who have no direct interest in extending the knowledge base by publishing the findings.

The original guidance, published in January 2012, has been updated to reflect experience of its use. It is anticipated that further updates will be required in the future as the evidence base develops.

▲ **Photo credit: Roger Barrowcliffe**

[7] Vina Kukadia, Stuart Upton, David Hall, 2003, Control of Dust from Construction and Demolition Activities, BRE.

4. Potential Impacts

4.1 Introduction

The main air quality impacts that may arise during demolition and construction activities are:

1. dust deposition, resulting in the soiling of surfaces;
2. visible dust plumes, which are evidence of dust emissions;
3. elevated PM_{10} concentrations, as a result of dust generating activities on site; and
4. an increase in concentrations of airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment used on site (non-road mobile machinery) and vehicles accessing the site[8].

The most common impacts are dust soiling and increased ambient PM_{10} concentrations due to dust arising from activities on the site. Dust soiling will arise from the deposition of dust in all size fractions. The ambient dust relevant to health outcomes will be that measured as PM_{10}, although most of this will be in the coarse ($PM_{2.5\text{-}10}$) fraction, rather than the $PM_{2.5}$ fraction. Research undertaken in the USA[9] suggests that 85% to 90% by weight of the fugitive dust emissions of PM_{10} from construction sites are $PM_{2.5\text{-}10}$ and 10% to 15% are in the $PM_{2.5}$ fraction.

There are other potential impacts, such as the release of heavy metals, asbestos fibres or other pollutants during the demolition of certain buildings, such as former chemical works, or the removal of contaminated soils. The release of certain fungal spores during the demolition of old buildings can also give rise to specific concerns if immune-compromised people are likely to be exposed, for example close to an oncology unit of a hospital. These issues need to be considered on a site by site basis, and are not covered by this Guidance.

Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur. For site traffic on the public highway, if it cannot be scoped out (for example by using the EPUK's criteria), then it should be assessed using the same methodology and significance criteria as operational traffic impacts. The impacts of exhaust emissions from on-site plant and site traffic are not considered further in this Guidance.

4.2 Receptors

A 'human receptor', refers to any location where a person or property may experience the adverse effects of airborne dust or dust soiling[10], or exposure to PM_{10} over a time period relevant to the air quality objectives, as defined in the Government's technical guidance for Local Air Quality Management[11]. In terms of annoyance effects, this will most commonly relate to dwellings, but may also refer to other premises such as buildings housing cultural heritage collections (e.g. museums and galleries), vehicle showrooms, food manufacturers, electronics manufacturers, amenity areas and horticultural operations (e.g. salad or soft-fruit production). Care should be taken to ensure that the assessment takes into account whether exposure will arise in practice (e.g. computer chip manufacture is sensitive to dust and so premises are likely to have extensive dust filtering equipment and exposure may therefore not be increased).

An 'ecological receptor' refers to any sensitive habitat affected by dust soiling. This includes the direct impacts on vegetation[12] or aquatic ecosystems of dust deposition, and the indirect impacts on fauna (e.g. on foraging habitats). For locations with a statutory designation, e.g. Special Areas of Conservation (SACs) and Sites of Special Scientific Interest (SSSIs), consideration should be given as to whether the particular site is sensitive to dust and this will depend on why it has been designated. Some non-statutory sites (i.e. local wildlife sites) and/or locations with very specific sensitivities may also be considered if appropriate. The inclusion or exclusion of sites should be justified in the assessment.

Dust from demolition and construction sites deposited on vegetation may create ecological stress within the local plant community. During long dry periods dust can coat plant foliage adversely affecting photosynthesis and other biological functions. Rainfall removes the deposited dust from foliage and can rapidly leach chemicals into the soil. Plant communities near short-term works are likely to recover within a year of the dust soiling stress ceasing. However, large scale construction sites may give rise to dust deposition over an extended period of time and adversely affect vascular plants. For example cement dust deposited on leaves can increase the surface alkalinity, which in turn can hydrolyse lipid and wax components, penetrate the cuticle, and denature proteins, finally causing the leaf to wilt[13].

Limestone dust coating of lichen has been shown to damage its photosynthetic apparatus[14]. These types of damage over a long period have the potential to change plant community structure and function. Noticeable effects include the increase in ruderal and pioneer plant communities.

The sensitivity of specific human and ecological receptors is discussed in **Section 7.3**.

4.3 Risk of Dust Emissions

The risk of dust emissions from a demolition/construction site causing loss of amenity and/or health or ecological impacts is related to:

- the activities being undertaken (demolition, number of vehicles and plant etc.);
- the duration of these activities;
- the size of the site;
- the meteorological conditions (wind speed, direction and rainfall);
- the proximity of receptors to the activities;
- the adequacy of the mitigation measures applied to reduce or eliminate dust; and
- the sensitivity of the receptors to dust.

The quantity of dust emitted from construction operations will be related to the area of land being worked, and the level of construction activity (nature, magnitude and duration). Emissions from construction vehicles passing over unpaved ground can be particularly important. These will be related to the silt content of the soil (defined by the US Environmental Protection Agency as particles smaller than 75 micrometres [μm] in diameter), as well as the speed and weight of the vehicle, the soil moisture content, the distance covered and the frequency of vehicle movements.

The wind direction, wind speed and rainfall, at the time when a construction activity is taking place, will also influence whether there is likely to be a dust impact. Due to the variability of the weather, it is impossible to predict what the weather conditions will be when specific construction activities are being undertaken.

Local wind speed and direction influences the dispersion of dust. This will depend on the frequency that the receptor is downwind and the distance of the receptors from the construction activities. Higher wind speeds will result in the highest potential for release of dust from a site. Buildings, structures and trees can also influence dispersion.

Adverse impacts can occur in any direction from a site. They are, however, more likely to occur downwind of the prevailing wind direction and/or close to the site. It should be noted that the 'prevailing' wind direction is usually the most frequent direction over a long period such as a year; whereas construction activity may occur over a period of weeks or months during which the most frequent wind direction might be quite different. The most frequent wind direction may also not be the direction from which the wind speeds are highest. The use of the prevailing wind direction in the assessment of risk is most useful, therefore, for construction projects of long duration.

Dust impacts are more likely to occur during drier periods, as rainfall acts as a natural dust suppressant.

Impacts during the summer and winter months are generally different, and if it can be guaranteed that the construction will take place during a particular season (with this enforced through a planning condition, for example), consideration could be given to using seasonal wind and rainfall data. This type of guarantee is not usual because the start of construction depends on many factors.

Local conditions also need to be accounted for. Topography and natural barriers (e.g. woodland) will reduce airborne concentrations due to impaction. In addition, if the locality has a history of dust generating activities, such as quarrying, a given level of additional dust may be more acceptable, i.e. more readily tolerated, than in a suburban residential area. Alternatively, impacts may be less acceptable, where nearby residents have become sensitised to dust, have a history of complaining and may therefore be more likely to complain about a new dust source. Similarly, in rural areas agricultural activities may generate dust and this should be taken into account in the assessment of risk.

For PM_{10}, Defra's background concentrations and/or any local monitoring and modelling data can be used to determine whether the 24-hour mean objective is likely to be exceeded as a result of the construction activities. The risk of PM_{10} exceedences will be greatest at receptors very close to the site boundary, especially if combined with PM_{10} from a major road, or other source.

[8] In the UK the maximum permitted sulphur content of fuels used in road and off-road applications is 10 ppm, and therefore sulphur dioxide is no longer a significant pollutant from these sources.
[9] Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors Prepared by Midwest Research Institute (Chatten Cowherd, MRI Project Leader), For Western Governors' Association Western Regional Air Partnership (WRAP), MRI Project No. 110397, Finalized November 1, 2006.
[10] Occupational settings are relevant in terms of annoyance effects.
[11] Local Air Quality Management Technical Guidance LAQM. TG(09), Defra, February 2009.
[12] A Farmer, 1993, The Effects of Dust on Vegetation - A Review, Environmental Pollution 79, 63-75.
[13] Guderian R. 1986. Terrestrial ecosystems: particulate deposition. In: Air Pollutants and Their Effects on the Terrestrial Ecosystem (Legge AH, Krupa SV, eds). Advances in Environmental Science and Technology, Vol. 18. 339-363, Wiley, New York, USA.
[14] Arianoutsou M, Lanaras T, Zaharopoulou A. 1993. Influence of dust from a limestone quarry on chlorophyll degradation of the lichen Physcia adscendens (Fr.) Oliv. Bulletin of Environmental Contaminants and Toxicology, 50: 852–855.

5. Assessment Procedure

This guidance provides a framework for the assessment of risk. Every site is different and therefore this guidance cannot be too prescriptive and professional judgement is required (see **Section 11**). Any judgements must be fully auditable in the dust assessment report, with the source(s) defined and choice of dust risk category justified for each activity (see below). Where justification cannot be given, a precautionary approach must be taken and the highest level of mitigation recommended.

Activities on construction sites have been divided into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

The potential for dust emissions is assessed for each activity that is likely to take place. Obviously, if an activity is not taking place, e.g. demolition, then it does not need to be assessed.

The assessment methodology considers three separate dust impacts:

- annoyance due to dust soiling;
- the risk of health effects due to an increase in exposure to PM_{10}; and
- harm to ecological receptors

with account being taken of the sensitivity of the area that may experience these effects.

The assessment is used to define appropriate mitigation measures[15] to ensure that there will be no significant effect.

The assessment steps are summarised below and in **Figure 1**.

STEP 1 is to screen the requirement for a more detailed assessment.

No further assessment is required if there are no receptors within a certain distance of the works.

STEP 2 is to assess the risk of dust impacts. This is done separately for each of the four activities (demolition; earthworks; construction; and trackout) and takes account of:

- the scale and nature of the works, which determines the potential dust emission magnitude (**STEP 2A**); and
- the sensitivity of the area (**STEP 2B**).

These factors are combined in **STEP 2C** to give the risk of dust impacts.

Risks are described in terms of there being a low, medium or high risk of dust impacts for each of the four separate potential activities. Where there are low, medium or high risks of an impact, then site-specific mitigation will be required, proportionate to the level of risk.

Based on the threshold criteria and professional judgement one or more of the groups of activities may be assigned a 'negligible' risk. Such cases could arise, for example, because the scale is very small and there are no receptors near to the activity.

STEP 3 is to determine the site-specific mitigation for each of the four potential activities in **STEP 2**. This will be based on the risk of dust impacts identified in **STEP 2**. Where a local authority has issued guidance on measures to be adopted at demolition / construction sites, these should also be taken into account.

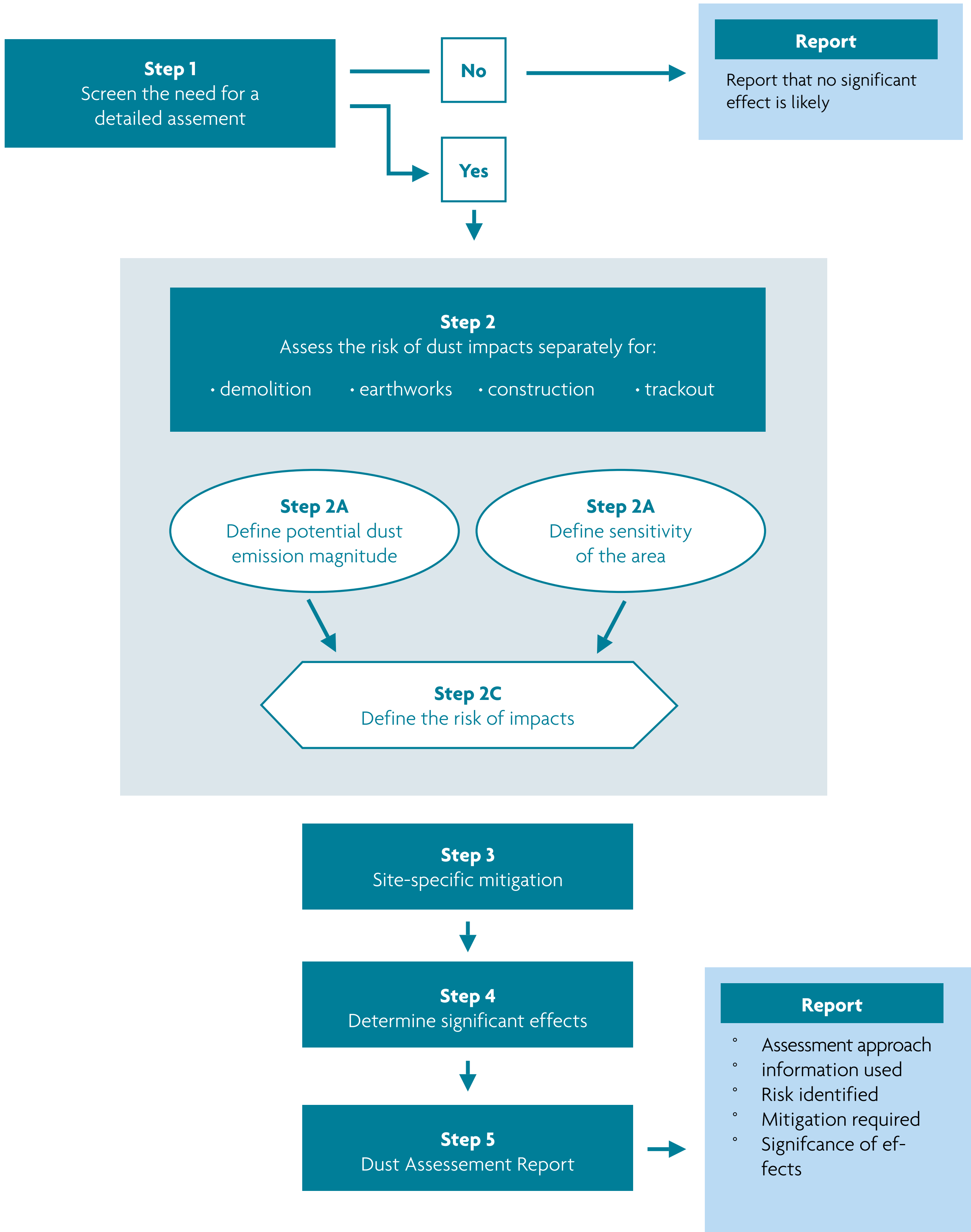
STEP 4 is to examine the residual effects and to determine whether or not these are significant.

STEP 5 is to prepare the dust assessment report.

▲ **Photo credit: Hannah Dalton**

[15] There is little legislation that explicitly seeks to control dust emissions from construction sites. Certain equipment/processes on construction sites are controlled under The Environmental Permitting (England and Wales) Regulations 2010, and equivalent legislation in Scotland and Northern Ireland. Dust is controlled indirectly, through the duty of care provisions for waste under Part 11, Environmental Protection Act 1990 (EPA) (applicable to England, Wales and Scotland) with respect to the transport of waste materials. Part III of the EPA includes provisions for Statutory Nuisance (see **Section 2** on Terminology). Exhaust emission from road vehicles and non-road mobile machinery (NRMM) are controlled through European Directives.

Figure 1: Steps to Perform a Dust Assessment



6. STEP 1: Screen the Need for a Detailed Assessment

Box 1: Screening Criteria

An assessment will normally be required where there is:

- a 'human receptor' within:
    - 350 m of the boundary of the site; or
    - 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).
- an 'ecological receptor' within:
    - 50 m of the boundary of the site; or
    - 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

This step is deliberately chosen to be conservative, and will require assessments for most schemes. The distances cited here, and in subsequent sections, take account of the exponential decline in both airborne concentrations and the rate of deposition with distance, as well as practical experience of members of the Working Group.

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is "negligible", and any effects will be not be significant.

▼ **Photo credit: Roger Barrowcliffe**

7. STEP 2: Assess the Risk of Dust Impacts

7.1 Introduction

The risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk. A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (**STEP 2A**); and
- the sensitivity of the area to dust impacts (**STEP 2B**), which is defined as low, medium or high sensitivity .

These two factors are combined in **STEP 2C** to determine the risk of dust impacts with no mitigation applied. The risk category assigned to the site can be different for each of the four potential activities (demolition, earthworks, construction and trackout). More than one of these activities may occur on a site at any one time.

Where appropriate, the site can be divided into 'zones' for the dust risk assessment. This may result in different mitigation levels being applied to each zone. This could be where different parts of a large site are different distances from the nearest receptors, or where development activities move away from a receptor through time on a large scheme.

However, on complex sites where activities are not easily segregated the mitigation appropriate for the highest risk category should be applied. The aim is to ensure that it is clear what mitigation is supposed to be implemented on a site and to make auditing this simpler.

Box 2: Technical Competency of Assessor

The following risk assessment procedure requires 'professional judgement'. Those who are responsible for making this judgement must be able to demonstrate technical competency in the assessment of dust impacts. It is difficult to define precisely who has sufficient experience and expertise to make reasonable judgements, but, a person with full Membership of IAQM *and* experience of assessing dust impacts for a minimum of 10 diverse projects, including some complex multi-phase projects and similar projects to that being assessed, is likely to be technically competent.

IAQM is the only professional body specifically for air quality practitioners in the UK, although there are a number of more general environmental professional bodies, whose members may be competent.

Every site is different in terms of timing (seasonality), building type (construction materials), duration and scale (area, volume and height), and therefore professional judgement must be applied by a technically competent assessor (see **Box 2**) when allocating activities into one of the three potential dust emission magnitude categories. Justification of the category used must be stated in the report. Where there is doubt, the higher risk category should be applied (e.g. if the site is assessed as low/medium then mitigation appropriate to a medium site should be applied). Further information on professional judgement is provided in **Section 11**.

7.2 STEP 2A - Define the Potential Dust Emission Magnitude

The dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium, or Large.

The following are examples of how the potential dust emission magnitude for different activities can be defined. Note that, in each case, not all the criteria need to be met, and that other criteria may be used if justified in the assessment:

Demolition: Example definitions for demolition are:

- **Large:** Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- **Medium:** Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- **Small:** Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months.

Earthworks: Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Example definitions for earthworks are:

- **Large**: Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;
- **Medium**: Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes; and
- **Small**: Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any

Box 3: Crushing and Screening

Mobile crushing equipment can be a significant source of dust associated with the demolition phase. This equipment is regulated by District Councils or Unitary Authorities in England and Wales, SEPA in Scotland and District Councils in Northern Ireland, under the Environmental Permitting Regulations 2010 in England and Wales, and equivalent legislation in Scotland and Northern Ireland.

Equipment should be designed and operated in accordance with the most recent version of Process Guidance Note 3/16 for Mobile Crushing and Screening (note this is under review).

Professional judgement will be required to determine how the use of crushing and screening equipment will affect the dust emission magnitude. For example, it may be appropriate to increase the dust emission magnitude by one or more classes.

Box 4: Concrete Batching Plant

Concrete batching equipment is regulated by District Councils or Unitary Authorities in England and Wales, SEPA in Scotland and District Councils in Northern Ireland under the Environmental Permitting Regulations 2010 and equivalent legislation in Scotland and Northern Ireland.

Such equipment should be operated in accordance with the latest version of Process Guidance Note 3/1 on Guidance for Blending, Packing, Loading, Unloading and Use of Bulk Cement.

Professional judgement will be required to determine how the use of concrete batching equipment will affect the dust emission magnitude. For example, it may be appropriate to increase the dust emission magnitude by one or more classes.

one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.

Construction: The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. Example definitions for construction are:

- **Large:** Total building volume >100,000 m^3, on site concrete batching, sandblasting;
- **Medium:** Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and
- **Small:** Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout: Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology and duration. As with all other potential sources, professional judgement must be applied when classifying trackout into one of the dust emission magnitude categories. Example definitions for trackout are:

- **Large**: >50 HDV (>3.5t) outward movements[16] in any one day[17], potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;
- **Medium**: 10-50 HDV (>3.5t) outward movements[16] in any one day[17], moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and
- **Small**: <10 HDV (>3.5t) outward movements[16] in any one day[17], surface material with low potential for dust release, unpaved road length <50 m.

These numbers are for vehicles that leave the site after moving over unpaved ground, where they will accumulate mud and dirt that can be tracked out onto the public highway.

[16] A vehicle movement is a one way journey. i.e. from A to B, and excludes the return journey.
[17] HDV movements during a construction project vary over its lifetime, and the number of movements is the maximum not the average.

Box 5: Importance of Dust Raised by Vehicles

Research[a] carried out in the United States, has shown that haul trucks generate the majority of dust emissions from surface mining sites, accounting for an estimated 78%-97% of total dust emissions. Vehicles using unpaved haul roads in UK construction sites will lead to the release of dust via the same mechanical processes (i.e. re-suspension) and are likely to be a dominant source. Emissions will also arise from vehicles travelling over any unpaved ground on a construction site.

[a] W.R and J.A.Organiscak, undated, Evaluation of dust exposure to truck drivers following the lead haul truck, NIOSH, www.cdc.gov/niosh/mining/UserFiles/works/pdfs/eodet.pdf

It may be useful to set out the dust emission magnitude for each activity as shown in the example in **Table 1**.

Table 1: Example of the How the Dust Emission Magnitude for a Site Could be Presented

Activity	Dust Emission Magnitude
Demolition	Large
Earthworks	Large
Construction	Medium
Trackout	Small

7.3 Step 2B - Define the Sensitivity of the Area

The sensitivity of the area takes account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

The type of receptors at different distances from the site boundary or, if known, from the dust generating activities, should be included. Consideration also should be given to the number of 'human receptors'. Exact counting of the number of 'human receptors', is not required. Instead it is recommended that judgement is used to determine the approximate number of receptors *(a residential unit is one receptor)* within each distance band. For receptors which are not dwellings professional judgement should be used to determine the number of human receptors for use in the tables, for example a school is likely to be treated as being in the >100 receptor category.

The likely routes the construction traffic will use should also be included to enable the presence of trackout receptors to be included in the assessment. As general guidance, without site-specific mitigation, trackout may occur along the public highway up to 500 m from large sites (as defined in **STEP 2A**), 200 m from medium sites and 50 m from small sites, as measured from the site exit.

A number of attempts have been made to categorise receptors into high, medium and low sensitivity categories; however, there is no unified sensitivity classification scheme that covers the quite different potential effects on property, human health and ecological receptors.

A series of boxes provide guidance on the sensitivity of different types of receptor to dust soiling (**Box 6**), health effects (**Box 7**) and ecological effects (**Box 8**).

In all cases the specific circumstances should be taken into account and may mean that on occasion the examples given will be subject to exceptions. For instance, the first occupants moving into residential dwellings on a large phased housing development, may reasonably be expected to be less sensitive to dust soiling effects (albeit for a limited time) than other residential receptors. **Box 9** contains additional factors that may need to be taken into account.

Box 6: Sensitivities of People to Dust Soiling Effects

For the sensitivity of people and their property to soiling, the IAQM recommends that the air quality practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the following general principles:

High sensitivity receptor – surrounding land where:

- users can reasonably expect enjoyment of a high level of amenity; or
- the appearance, aesthetics or value of their property would be diminished by soiling; and
- the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land.
- indicative examples include dwellings, museums andother culturally important collections, medium andlong term car parksb and car showrooms. ▶

Medium sensitivity receptor

- users would expect[a] to enjoy a reasonable level of amenity, but would not reasonably expect[a] to enjoy the same level of amenity as in their home; or
- the appearance, aesthetics or value of their property could be diminished by soiling; or
- the people or property wouldn't reasonably be expected[a] to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.
- indicative examples include parks and places of work.

Low sensitivity receptor

- the enjoyment of amenity would not reasonably be expected[a]; or
- property would not reasonably be expected[a] to be diminished in appearance, aesthetics or value by soiling; or
- there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
- indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks[b] and roads.

[a] People's expectations will vary depending on the existing dust deposition in the area, see **Section 4.2**.
[b] Car parks can have a range of sensitivities depending on the duration and frequency that people would be expected to park their cars there, and the level of amenity they could reasonably expect whilst doing so. Car parks associated with work place or residential parking might have a high level of sensitivity compared to car parks used less frequently and for shorter durations, such as those associated with shopping. Cases should be examined on their own merits.

Box 7: Sensitivities of People to the Health Effects of PM_{10}

For the sensitivity of people to the health effects of PM_{10}, the IAQM recommends that the air quality practitioner assumes that there are three sensitivities based on whether or not the receptor is likely to be exposed to elevated concentrations over a 24-hour period, consistent with the Defra's advice for local air quality management (Defra. 2009, LAQM Technical Guidance LAQM.TG(O9).

High sensitivity receptor

- locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).[a]
- Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.

Medium sensitivity receptor

- locations where the people exposed are workers[b], and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).
- indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.

Low sensitivity receptor

- locations where human exposure is transient.[c]
- indicative examples include public footpaths, playing fields, parks and shopping streets.

[a] This follows Defra guidance as set out in LAQM.TG(09).
[b] Notwithstanding the fact that the air quality objectives and limit values do not apply to people in the workplace, such people can be affected to exposure of PM_{10}. However, they are considered to be less sensitive than the general public as a whole because those most sensitive to the effects of air pollution, such as young children are not normally workers. For this reason workers have been included in the medium sensitivty category.
[c] There are no standards that apply to short-term exposure, e.g. one or two hours, but there is still a risk of health impacts, albeit less certain.

Box 8: Sensitivities of Receptors to Ecological Effects

Dust deposition due to demolition, earthworks, construction and trackout has the potential to affect sensitive habitats and plant communities.

Dust can have two types of effect on vegetation: physical and chemical.Direct physical effects include reduced photosynthesis, respiration and transpiration through smothering. Chemical changes to soils or watercourses may lead to a loss of plants or animals for example via changes in acidity. Indirect effects can include increased susceptibility to stresses such as pathogens and air pollution. These changes are likely to occur only as a result of long-term demolition and construction works adjacent to a sensitive habitat. Often impacts will be reversible once the works are completed, and dust emissions cease.

The advice of an ecologist should be sought to determine the need for an assessment of dust impacts on sensitive habitats and plants[a]. Professional judgement is required to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the likely effect and the value of the ecological asset. A habitat may be highly valuable but not sensitive, alternatively it may be less valuable but more sensitive to dust deposition. Consequently, specialist ecological advice should also be sought to determine the sensitivity of the ecological receptors to dust impacts. In general most receptors will either be of high sensitivity or low sensitivity i.e. either sensitive or not to dust deposition. The following provides an example of possible sensitivities:

High sensitivity receptor
- locations with an international or national designation *and* the designated features may be affected by dust soiling; or
- locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain[b].
- indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.

Medium sensitivity receptor
- locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or
- locations with a national designation where the features may be affected by dust deposition.
- indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.

Low sensitivity receptor
- locations with a local designation where the features may be affected by dust deposition.
- indicative example is a local Nature Reserve with dust sensitive features.

[a] A Habitat Regulation Assessment of the site may be required as part of the planning process, if the site lies close to an internationally designated site i.e. Special Conservation Areas (SACs), Special Protection Areas (SPAs) designated under the Habitats Directive (92/43/EEC) and RAMSAR sites.
[b] Cheffing C. M. & Farrell L. (Editors) (2005), The Vascular Plant. Red Data List for Great Britain, Joint Nature Conservation Committee.

Table 2, **Table 3**, and **Table 4** show how the sensitivity of the area may be determined for dust soiling, human health and ecosystem impacts respectively. These tables take account of a number of factors which may influence the sensitivity of the area. When using these tables, it should be noted that distances are to the dust source and so a different area may be affected by trackout than by on-site works. The highest level of sensitivity from each table should be recorded. *It is not necessary to work through the whole of each table once it is clear that the highest level of sensitivity has been determined.*

While these tables are necessarily prescriptive, professional judgement may be used to determine alternative sensitivity categories, and the factors set out in **Box 9** may be useful to consider. Any judgements made should be fully documented. Whatever approach to determining sensitivity of the area is taken, it is important that the basis of the decision is documented, and **Table 5** presents an example of how the sensitivity of the area may be presented.

Box 9: Additional Factors to Consider when Determining the Sensitivity of the Area

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact, as a receptor may become more sensitive over time; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Table 2: Sensitivity of the Area to Dust Soiling Effects on People and Property [a b]

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)[c]			
		<20	<50	<100	<350
High	**>100**	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	**>1**	Medium	Low	Low	Low
Low	**>1**	Low	Low	Low	Low

[a] The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout. See **STEP 2B**, **Box 6** and **Box 9.**

[b] Estimate the total number of receptors within the stated distance. Only the *highest level* of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors <50 m is 102. The sensitivity of the area in this case would be high.

[c] For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table 3: Sensitivity of the Area to Human Health Impacts [a] [b]

Receptor Sensitivity	Annual Mean PM_{10} concentration[c]	Number of Receptors[d]	Distance from the Source (m)[e]				
			<20	<50	<100	<200	<350
High	>32 µg/m^3 (>18 µg/m^3 in Scotland)	**>100**	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3 (16-18 µg/m^3 in Scotland)	**>100**	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3 (14-16 µg/m^3 in Scotland)	**>100**	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3 (<14 µg/m^3 in Scotland)	**>100**	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m^3 (>18 µg/m^3 in Scotland)	**>10**	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3 (16-18 µg/m^3 in Scotland)	**>10**	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3 (14-16 µg/m^3 in Scotland)	**>10**	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3 (<14 µg/m^3 in Scotland)	**>10**	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	**≥1**	Low	Low	Low	Low	Low

[a] The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout. See **STEP 2B**, **Box 7** and **Box 9**.

[b] Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 m), noting that only the **highest level** of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors <50 m is 102. If the annual mean PM_{10} concentration is 29 µg/m^3, the sensitivity of the area would be high.

[c] Most straightforwardly taken from the national background maps, but should also take account of local sources. The values are based on 32 µg/m^3 being the annual mean concentration at which an exceedence of the 24-hour objective is likely in England, Walesand Northern Ireland. In Scotland there is an annual mean objective of 18µg/m^3.

[d] In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

[e] For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table 4: Sensitivity of the Area to Ecological Impacts [a b]

Receptor Sensitivity	Distance from the Source (m)[c]	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

[a] The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout and for each designated site. See **STEP 2B**, **Box 8** and **Box 9**.
[b] Only the highest level of area sensitivity from the table needs to be considered.
[c] For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site.

Table 5: Example of the Outcome of Defining the Sensitivity of the Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	Medium
Human Health	High	High	High	High
Ecological	Medium	Medium	Low	Low

7.4 STEP 2C - Define the Risk of Impacts

The dust emission magnitude determined at **STEP 2A** (**Section 7.2**) should be combined with the sensitivity of the area determined at **STEP 2B** (**Section 7.3**) to determine the *risk* of impacts with no mitigation applied. The matrices in **Table 6**, **Table 7**, **Table 8** and **Table 9** provide a method of assigning the level of risk for each activity. This should be used to determining the level of mitigation that must be applied. Mitigation is discussed in **STEP 3** (**Section 8**). For those cases where the risk category is 'negligible', no mitigation measures beyond those required by legislation will be required.

Table 6: Risk of Dust Impacts - Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 7: Risk of Dust Impacts - Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 8: Risk of Dust Impacts - Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 9: Risk of Dust Impacts - Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

The risk of dust impacts for the four activities can usefully be summarised in a table. An example of a completed risk table is provided in **Table 10**.

Table 10: Example of a Summary Dust Risk Table to Define Site-Specific Mitigation

Potential Impact	Risk			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust Soiling	High Risk	High Risk	Low Risk	Medium Risk
Human Health	High Risk	Medium Risk	Low Risk	Medium Risk
Ecological	Negligible	Negligible	Negligible	Negligible

8. STEP 3: Site-specific Mitigation

8.1 Introduction

The dust risk categories for each of the four activities determined in **STEP 2C** should be used to define the appropriate, site-specific, mitigation measures to be adopted. Local authorities may have a Code for Construction Practice, or equivalent document, that should be taken into account during the development of the mitigation measures and incorporated within the full set of mitigation measures in this document.

Mitigation measures for London are set out in *The Control of Dust and Emissions from Construction and Demolition.*[18] There are some differences between this London guidance and the IAQM recommended mitigation measures. For example, the London document uses the terms 'compulsory' and 'discretionary', the IAQM uses the terms ' highly recommended', and 'desirable'.

One measure that is included in the London guidance that has not been included in this guidance is the application of dust suppressants to reduce trackout of dust from construction sites. There is some evidence of the efficacy of applying dust suppressants such as calcium magnesium acetate (CMA) to waste and construction sites in reducing local PM_{10} concentrations[19]. However, there is a lack of detailed knowledge on how often and where it should applied, but this may improve over time with use. In addition, CMA is known to react with bentonite, used during piling.

For those cases where the risk is assigned as 'negligible', no mitigation measures beyond those required by legislation are required. However, additional mitigation measures as defined in **Section 8.2** may be applied as part of good practice.

Given the variety of development sites and the individual issues they face, professional judgement should be used to determine the site-specific mitigation measures to be applied. These will need to be written into a dust management plan (DMP), which should be approved by the local planning authority prior to commencement of work on site. For major sites the DMP may be integrated into a Code of Construction Practice or the Construction Environmental Management Plan, and compliance monitoring may be required.

The most important aspects of the DMP are assigning responsibly for dust management to an individual member of staff of the principal contractor, training staff to understand the importance of the issue, and communicating with the local community. Good dust management practices implemented at high risk sites have resulted in no or minimal complaints, which illustrates the value of the recommended approach.

The local authority, developer and contractor all have important roles to ensure that effective dust mitigation practices are implemented. The approach illustrated in **Figure 2** is recommended.

Responsibility	Action
1. Developer	Commission a construction impact assessment with detailed mitigaiton measures, following the IAQM guidance, and submit as part of planning application.
2. Local Authority	Require a DMP to be agreed with Local Planning Authority prior to construction commencing as a condition to the planning consent
3. Developer	During the tender process for the Principal Contractor (or equivalent) the Developer should include the list of detailed mitigation measures, as set out in the construction impact assessment in the invitiaiton to tender.
4. Contractor	Prior to work commencing the Contractor should prepare a method statement and a comprehensive, site specific DMP, and agree the DMP with the Local Planning Authority. The measures in the DMP maydiffer from the mitigation measures in the construction impact assessment due to the specific methods to be used on-site. For example, measures related to activities that will not take place on the site do not need to be included. This provides some flexibility for the Developer.
5. Local Authority	Agree DMP with the Developer/Contractor
6. Developer	Audit compliance with DMP
7. Local Authority	Monitor compliance with DMP

Figure 2: Responsibilities for Dust Mitigation for Demolition and Construction Sites. Note: 'construction' includes demolition and earthworks.

[18] Mayor of London, 2013, The Control of Dust and Emissions During Construction and Demolition, Draft Supplementary Planning Guidance.

[19] Barrett B., Carslaw D., Fuller G., Green D and Tremper A., 2012, Evaluation of the impact of dust suppressant application on ambient PM_{10} concentrations in London, Prepared for Transport for London under contract to URS Infrastructure & Environment Ltd., Kings College London.

▲ Photo credit: Claire Holman

8.2 Dust and Air Emissions Mitigation Measures

The mitigation measures have been divided into general measures applicable to all site and measures applicable specifically to demolition, earthworks, construction and trackout, for consistency with the assessment methodology. The following tables detail the mitigation required for high, medium and low risk sites, as determined in **STEP 2C.**

For those mitigation measures that are general, the highest risk category should be applied. For example, if the site is medium risk for earthworks and construction, but a high risk for demolition and track-out, the general measures applicable to a high risk site should be applied.

It should be noted that it is difficult to provide generic guidance, as each site and its location will be different and professional judgement is required.

Key to tables:

H Highly recommended
D Desirable
N Not required

Mitigation for all sites: Communications

Mitigation measure	Low Risk	Medium Risk	High Risk
1. Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	N	H	H
2. Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	H	H	H
3. Display the head or regional office contact information	H	H	H

Mitigation for all sites: Dust Management

Mitigation measure	Low Risk	Medium Risk	High Risk
4. Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. In London additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, real-time PM10 continuous monitoring and/or visual inspections.	D	H	H
Site Management			
5. Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	H	H	H
6. Make the complaints log available to the local authority when asked.	H	H	H
7. Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.	H	H	H
8. Hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.	N	N	H
Monitoring			
9. Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary, with cleaning to be provided if necessary.	D	D	H
10. Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked	H	H	H
11. Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	H	H	H
12. Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.	N	H	H
Preparing and maintaining the site			
13. Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H	H	H
14. Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	H	H	H
15. Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period	D	H	H
16. Avoid site runoff of water or mud.	H	H	H
17. Keep site fencing, barriers and scaffolding clean using wet methods.	D	H	H

Mitigation measure	Low Risk	Medium Risk	High Risk
18. Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.	D	H	H
19. Cover, seed or fence stockpiles to prevent wind whipping.	D	H	H
Operating vehicle/machinery and sustainable travel			
20. Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable	H	H	H
21. Ensure all vehicles switch off engines when stationary - no idling vehicles.	H	H	H
22. Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	H	H	H
23. Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)	D	D	H
24. Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	N	H	H
25. Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)	N	D	H
Operations			
26. Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	H	H	H
27. Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	H	H	H
28. Use enclosed chutes and conveyors and covered skips.	H	H	H
29. Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	H	H	H
30. Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	D	H	H
Waste management			
31. Avoid bonfires and burning of waste materials.	H	H	H

Measures specific to demolition

Mitigation measure	Low Risk	Medium Risk	High Risk
32. Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	D	D	H
33. Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	H	H	H
34. Avoid explosive blasting, using appropriate manual or mechanical alternatives.	H	H	H
35. Bag and remove any biological debris or damp down such material before demolition.	H	H	H

Measures specific to earthworks

Mitigation measure	Low Risk	Medium Risk	High Risk
36. Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable..	N	D	H
37. Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable	N	D	H
38. Only remove the cover in small areas during work and not all at once	N	D	H

Measures specific to construction

Mitigation measure	Low Risk	Medium Risk	High Risk
39. Avoid scabbling (roughening of concrete surfaces) if possible	D	D	H
40. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	D	H	H
41. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	N	D	H
42. For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.	N	D	D

Measures specific to trackout

Mitigation measure	Low Risk	Medium Risk	High Risk
43. Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.	D	H	H
44. Avoid dry sweeping of large areas.	D	H	H
45. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	D	H	H
46. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	N	H	H
47. Record all inspections of haul routes and any subsequent action in a site log book.	D	H	H
48. Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	N	H	H
49. Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	D	H	H
50. Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	N	H	H
51. Access gates to be located at least 10 m from receptors where possible.	N	H	H

9. STEP 4: Determine Significant Effects

9.1 Introduction

Traditionally, Environmental Impact Assessments (EIAs) have evaluated the significance of adverse effects prior to mitigation and re-evaluated them post mitigation following a consideration of the anticipated effectiveness of the proposed mitigation measures. Research by the Institute of Environmental Management & Assessment (IEMA) has found that many UK EIA practitioners no longer adopt this approach because EIA influences the design process, and any significant adverse environmental effects are either avoided or reduced through design before the proposal is finalised, and thus the pre-mitigation impacts are not relevant[20]. Instead, just the residual effects are reported. This approach assumes that all actions to avoid or reduce the environmental effects are an inherent part of the proposed development. Furthermore, in the case of demolition / construction it is assumed that mitigation (secured by planning conditions, legal requirements or required by regulations) will ensure that a potential significant adverse effect will not occur, so the residual effect will normally be 'not significant' .

The Highways Agency has adopted this approach for road schemes in England, but thus far not in Scotland and Wales[21]. The key to such an approach is that it assumes that the "Overseeing Organisation/Competent Authority" will ensure all mitigation measures are successfully implemented. For other types of developments, the IEMA report suggests that rigorous systems to check that post-consent mitigation is delivered may not exist.

IAQM recommends that significance is only assigned to the effect after considering the construction activity with mitigation. It is, therefore, important that the mitigation measures are defined in a form suitable for implementation by way of a planning condition or legal obligation within a section 106 agreement, and are included in a DMP or a more general Code of Construction Practice or Construction Environmental Management Plan.

Even with a rigorous DMP in place, it is not possible to guarantee that the dust mitigation measures will be effective all the time, and if, for example, dust emissions occur under adverse weather conditions, or there is an interruption to the water supply used for dust suppression, the local community may experience occasional, short-term dust annoyance. The likely scale of this would not normally be considered sufficient to change the conclusion that with mitigation the effects will be 'not significant'.

When completing dust assessments for EIA chapters the Environmental Statement Co-ordinator may request the magnitude of effects without mitigation. For the reasons given above, this is not considered appropriate.

9.2 Determining whether significant effects are likely

Once the risk of dust impacts has been determined in **STEP 2C** and the appropriate dust mitigation measures identified in **STEP 3** the final step is to determine whether there are significant effects arising from the construction phase of a proposed development.

For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'.

There may be cases where, for example, there is inadequate access to water for dust suppression to be effective, and even with other mitigation measures in place there may be a significant effect. Therefore, it is important to consider the specific characteristics of the site and the surrounding area to ensure that the conclusion of no significant effect is robust.

[20] Special Report – State of the Environmental Impact Assessment Practice in the UK, Institute of Environmental Management & Assessment, June 2011

[21] Design Manual for Roads and Bridges, Volume 11, Section 2, Part 5, HA 205/08, Highways Agency, August 2008

10. STEP 5: Dust Assessment Report

Whilst the detailed content of a Dust Assessment Report should be determined by its author(s) it is important that there is sufficient descriptive text for a third party to determine how the emission magnitude and sensitivity of the area surrounding the site, and hence the site risk, have been determined.

This text could usefully be accompanied by **Table 1**, **Table 5** and **Table 10** to show the dust emission magnitude, the sensitivity of the area and the risk of impacts without mitigation respectively.

There should be a section of the report detailing the mitigation that is required to ensure that there is no significant effect. This should be site-specific and should detail why particular choices have been made.

In addition, the report should describe the mechanism for ensuring that the appropriate level of mitigation will be implemented, e.g. through a planning condition.

▼ **Photo credit: Roger Barrowcliffe**

11. Professional Judgement

Throughout this document reference is made to the use of professional judgement. This is necessary, because the diverse range of projects that are likely to be subject to dust impact assessment means that it is not possible to be prescriptive as to how to assess the impacts. Also a wide range of factors affect the amount of dust that may arise, and these are not readily quantified. This document provides a framework to ensure that assessments are more consistent and consider the full range of potential impacts.

These impacts are often considered to be relatively unimportant compared to assessments of the operational air quality impacts. However, IAQM considers that it requires a level of experience and skill to produce a fit for purpose assessment, and therefore it should be undertaken by, or under the close supervision of, an experienced practitioner. Those who are making the professional judgment must be able to demonstrate technical competency in the assessment of dust impacts. For example, a person with Full Membership of IAQM and with experience of assessing dust impacts for a minimum of 10 diverse projects, including some complex multi-phase projects and similar projects to that being assessed, is likely to be technically competent. The IAQM is the only UK professional body specifically for air quality practitioners although there are a number of more general environmental professional organisations, whose members may also be competent.

Where possible the name of the assessor and/or supervisor should be included in the assessment report, with a brief summary of their relevant qualifications and experience.

▲ **Photo credit: Roger Barrowcliffe**

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