Control of dust from construction and demolition activities

Vina Kukadia, Stuart Upton, David Hall

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Executive summary

This Guidance is intended to assist with the control of nuisance dust and fine particle (PM_{10}) emissions from construction and demolition activities. It gives a background on the effects of these emissions on health and the environment and also legislation related to regulating dust and fine particle emissions into the atmosphere, exposure of the general populace and protection of the workforce.

Control measures for dust and fine particles are given for specific processes, such as the movement of vehicles and construction plant, materials handling and storage, cutting, grinding, grouting, grit blasting, concrete batching and pouring. The Guidance also gives advice on pre-project planning, implementation and site management, together with checklists for use by the industry.

The control measures given are generic and based on current best practice. They may be applied to construction-related activity of any size and type and from the individual operator to the multi-million pound project with multiple operators. The measures have not been tested for effectiveness and therefore must be used with care and, wherever possible, by personnel with the appropriate qualifications, training and experience.

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Every effort has been made to ensure that the information given herein is accurate but no legal responsibility can be accepted by BRE, Envirobods Ltd and their contractors for any errors, omissions or misleading statements. The dust control measures have not been formally tested for effectiveness and therefore must be used with care.

Vina Kukadia, Stuart Upton
BRE Environment

and

David Hall
Envirobods Ltd

Contents

Overview

Scope of the Guidance

This Guidance is intended to assist with the control of nuisance dust and fine particle (PM_{10}) emissions from construction and demolition activities. It covers the following major phases:

- site preparation and restoration after completion
- demolition
- construction and fabrication processes
- internal and external finishes and refurbishment.

Users of the Guidance

The Guidance is intended for use by, and as a source of information for, the following applications and groups of people:

On the site:

- project managers
- foremen and supervisors
- contractors and operators
- individual operators.

On the design and pre-construction side:

- clients and developers
- building designers and architects
- construction planners
- project managers and directors.

On the regulatory side:

- Local Authorities
- Government Departments.

On the suppliers side:

- construction plant and equipment manufacturers
- producers and suppliers of construction materials.

Other:

- fleet operators
- relevant education and training establishments
- workers and the representative unions
- interested members of the public.

How to use the Guidance

The Guidance has been presented in three main sections, as follows.

Section 1

Introduction

- This covers briefly why it is important to control dust and fine particle emission from construction and demolition activities.

Section 2

Guidance on dust control methods

- This gives comprehensive guidance on current best practice for controlling particle generation from different construction and demolition activities.

Section 3

Managing site operations for dust minimisation

- This gives guidance on pre-project planning, implementation and site management for controlling dust generation.

Further details and references are given in the Appendices.

1 Introduction

The importance of controlling dust and fine particle emissions from construction and demolition is addressed in this section

Introduction

1.1 BACKGROUND

Nuisance dust emissions from construction and other civil engineering activities are a common and well-recognised problem. Fine particles (less than 10 μm in diameter, known as PM_{10}) from these sources are now recognised as significant causes of pollution. Owing to their small size, they can be carried from sites even in light winds and may therefore have an adverse effect on the local environment and on the health of local residents, as well as on those working on the site.

Under Part IV of the Environment Act, (1995) and the UK Air Quality Strategy, Local Authorities are required to work towards achieving national air quality objectives. Construction site operators will therefore need to demonstrate that both nuisance dust and fine particle emissions from their sites are adequately controlled and are within acceptable limits.

This section gives a brief explanation of the health and environmental effects of particles, the benefits of an environmentally friendly site and the relevant legislation relating to the control of particles from construction and demolition activity.

1.2 HEALTH EFFECTS

Dusts from various construction processes contain a wide range of particle sizes and material types (eg silica) and can cause both minor and serious health problems. They can also cause discomfort to the eyes, nose, mouth, respiratory tract and skin. The potential impact is summarised in Table 1.1.

The larger particles, usually termed 'dust', tend to settle out of the air quickly and are mostly a health hazard to the operators of plant and equipment and those in the immediate area. They enter the nose and mouth during breathing and settle in the upper airways. The smaller particles, known as PM_{10} are usually invisible and may not seem to be an obvious hazard. However, they can be carried much further in the air and can cause health hazards both to workers on the site and to people living and working outside the site boundary in the local neighbourhood. They penetrate much further into the airways, down to the alveoli in the deep lung areas.

Health effects from particles and fibres from certain materials are immediate while those from other types of materials may take many years to develop. It is therefore essential that exposure to all forms and sizes of particle pollution is kept to a minimum, both for workers on site and for other people living and working outside the site boundary.

Table 1.1 Potential effects of particles on people and the environment

People/resources affected	Potential effects
People	
People at home, workplaces, community facilities, schools, hospitals etc	■ Health effects from particles of dust getting into eyes and mouth, falling onto the skin, hair and lips and smaller particles getting into the respiratory tract. ■ Nuisance through surface soiling.
Environmental resources	
Landscape	■ Loss of visual amenity through deposition.
Nature conservation	■ Covering of the leaf surface, resulting in shading and consequently reduction in net photosynthesis, altered pigment levels and/or reduced productivity. ■ Blocking of stomatal pores to prevent them from fully functioning. ■ Alteration of leaf surface chemistry that may affect disease resistance. ■ Addition of nutrients from the dust that may lead to increased growth and/or deficiencies. ■ Changes in pH levels over time if the dust has different pH conditions to surrounding soils. ■ Soil pollution via deposition from the air or water run-off. ■ Creation of a surface film on still water bodies.
Water environment	■ Increase in suspended and dissolved material in water courses with knock-on effects on aquatic ecology.
Air quality	■ Increased atmospheric particle concentrations.
Cultural heritage	■ Surface soiling and damage during cleaning.

Source: Adapted from Land Use Consultants, 1998

1.3 ENVIRONMENTAL AND NUISANCE EFFECTS

Dust emissions arising from construction activities can cause nuisance both within the site and outside the site boundary (Table 1.1). Within the site, dust can cause mechanical or electrical faults to equipment, such as computers, and will increase abrasion of moving parts in plant and clogging of filters. In the surrounding environment, it can cause annoyance to neighbours by the soiling of property, in particular, windows, cars and also of washed clothes that have been hung out to dry.

Claims from farmers for dust damage to crops are common. Even very low concentrations of dust can affect plant and fruit growth. Plant growth is especially susceptible to dusts that are highly alkaline, for example, limestone and cement dusts.

1.4 BENEFITS OF AN ENVIRONMENTALLY FRIENDLY SITE

An environmentally friendly site will help to establish good relationships between the contractors, regulators, local residents and others in the construction process, thereby helping projects to run smoothly. Benefits will be felt at both corporate and project levels and include:

- lessening of the impact on local air quality
- reduction in the soiling of property, thereby reducing the costs of cleaning
- reduction in the level of complaint from local residents
- reduction in the number of environmental offences and hence prosecutions by Local Authorities
- less time and money wasted in defending prosecutions and repairing environmental damage
- demonstration of improved margins
- reduction in the site engineer's workload by avoiding conflicts
- potential for increased future business
- enjoyment of the benefits of increased profit.

1.5 LEGISLATION

Many of the materials produced during construction have been subject to investigation and control, mainly with regard to occupational hygiene and the protection of the workforce. More limited attention has been given to regulating the exposure of the general populace to these materials when they cross the site boundary. There are some exceptions to this generalisation, asbestos for example is covered by specific regulations. Producing acceptable workplace conditions does not necessarily create acceptable conditions for the general populace beyond the site. It is normal for much lower exposure levels to be required for the general populace since it includes the more vulnerable groups (eg the very young, very old and infirm) and the less tolerant (because they do not benefit directly from the construction activity).

The following sections give details of current legislation at the time of writing. However, most legislation and regulations are subject to review and change. Therefore, it is advised that the latest information is referred to when using this Guidance.

1.5.1 Legislation relating to health and the environment

Environment Act (1995) and the UK Air Quality Strategy (2000)

Under Part IV of the Environment Act, the UK Air Quality Strategy defines a standard of 50 μg m^{-3}, for ambient concentrations of PM_{10} as a running 24-hour mean. This value has been set to be achieved by 31 December 2004. This limit is for the exposure of the general populace and must not be exceeded more than 35 times in the year in the UK as a whole and no more than 7 times in Scotland. Therefore, following completion of an assessment process, if a Local Authority believes that this (or any other) air quality objective will not be met, it is obliged to declare an Air Quality Management Area within which the aim is to work towards the attainment of that objective.

In addition to these, proposed objectives, intended to be achieved by 31 December 2010 and which are not currently in the Regulations, state that a standard of 50 μg m^{-3} for PM_{10} must not be exceeded more than 10 times in the year in London and no more than 7 times in the rest of England and Wales. These particle objectives may be set in the Regulations once the EU has decided on its new limit value. However, local authorities are urged to begin applying these proposed objectives (Air Quality Management, 2002).

Environmental Protection Act (EPA) (1990)

Under Part I of the Environmental Protection Act (EPA), (1990), the following two systems for pollution control have been established.

- Integrated Pollution Control (IPC) for the most seriously polluting processes known as Schedule A processes. These are regulated by the Environment Agency.
- Local Authority Air Pollution Control (LAAPC) for those processes (Schedule B) which are less polluting than Schedule A processes but still require authorisation. Local Authorities are responsible for regulating these processes for the purpose of minimising atmospheric pollution.

In general, certain activities carried out on construction sites fall under Schedule B processes. There is a range of specific processes prescribed for air pollution control by local enforcing authorities. These are covered individually by the then Department of Environment, now the Department for Environment, Food and Rural Affairs (DEFRA), the Scottish Office & Welsh Office Secretary of State's Process Guidance (PG) notes. These notes give guidance to local enforcing authorities on the techniques appropriate for the control of air pollution, relating to the specific processes.

The following are relevant to the construction industry.

- Asbestos PG3/13/(95)
- Plaster Processes PG3/12(95)
- Quarry Processes PG3/8(96)
- Blending, Packing and Use of Bulk Cement PG3/1(95)
- Mobile Crushing and Screening Processes PG 3/16(96)
- Aggregates PG 3/8(96)

The EPA (1990), under Section 79, states that where a statutory nuisance is shown to exist, the Local Authority must serve an abatement notice. Statutory nuisances are defined as:

- any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance
- any accumulation or deposit which is prejudicial to health or a nuisance.

Failure to comply with an abatement notice is an offence and, if necessary, the Local Authority may abate the nuisance and recover expenses.

Clean Air Act (1993)

Under the Clean Air Act (1993), open fires are not recommended on site since emissions of dark smoke are prohibited from any 'industrial or trade premises' (eg construction or demolition sites). However, the burning of timber and other waste resulting from the demolition of a building is exempt from this. The following conditions, however, are essential for the exemption to apply.

- There must be no other reasonably safe and practicable method of disposal.
- The emission of dark smoke must be minimised.
- The burning must be carried out under direct and continuous supervision.

The use of small incinerators is more acceptable since they greatly reduce the production of smoke and other secondary products of combustion and can reduce particle emissions. However, the incinerator would have to be an approved appliance, under Section 21 of the Clean Air Act (1993).

1.5.2 Legislation relating to occupational exposure

Health and Safety at Work Act (1974)

This is the principal statute for reducing health and safety risks and protecting people during workplace activities. It is a criminal statute and does not give rise to any civil liability.

Health and Safety Executive (HSE) Guidance Notes

The Health and Safety Executive (HSE) issues a series of Guidance Notes relating to safe operating procedures for working with certain materials or processes. The following HSE Guidance Notes are relevant to materials and processes used on construction sites.

- Working with asbestos cement and board — HSG 189/1 & HSG 189/2
- Dust: General principles of protection — EH 44
- Respirable crystalline silica — EH 59
- Man-made mineral fibres — EH 46
- Ventilation of the workplace — EH 22
- Assessment of exposure to fume from welding and allied processes — EH 54
- The control of exposure to fume from welding, brazing and similar processes — EH 55
- Occupational Exposure Limits — EH 40

The Control of Substances Hazardous to Health (COSHH) Regulations, (1994)

Under COSHH Regulation 2, one of the definitions of substances regarded as hazardous to health includes: 'dust of any kind, when present in substantial concentration in the air'. The COSHH Approved Code of Practice states that: 'substantial concentration' should be taken as 10 mg m^{-3} (8 hr Time Weighted Average (TWA)) of 'total inhalable' dust

or 4 mg m^{-3} (8 hr TWA) of 'respirable' dust. 'Total inhalable dust' corresponds to the size fraction of airborne material that enters the nose and mouth during breathing and a fraction of which deposits in the respiratory tract. 'Respirable dust' corresponds to the smaller size fraction that penetrates to the gas exchange region of the lung. Therefore, all particles can be subject to these COSHH limits if exposure levels are sufficiently high. There are specific lower levels of exposure set for some materials that are additionally toxic or harmful in some way.

Personal protective equipment

Under COSHH Regulation 7, it is stated that the provision of secondary protective measures, such as personal protective equipment (PPE) is the precaution of the last resort, and that hazardous emissions of materials should be controlled at source.

> ***"So far as is reasonably practicable, the prevention or adequate control of exposure of employees to a substance hazardous to health shall be secured by measures other than the provision of personal protective equipment."***

When the provision of respiratory protective equipment is necessary, it is required to be both suitable for the purpose for which it is to be used and to be either of a type approved by HSE or to conform to a standard approved by HSE (Regulation 7 (6)). The responsibility for use of any such control measures is placed on both employer and employee alike, under Regulation 8.

Emission of substances 'Beyond the Factory Gate'

The COSHH Regulations also place a duty on employers in respect of persons not at work, who may be affected by the work conducted by them. This effectively covers emissions of hazardous materials 'beyond the factory gate', although COSHH does not place on the employer any duty to such persons in respect of monitoring exposure, health surveillance or information and training. However, Regulation 3 (1) states:

> ***"Where any duty is placed by these Regulations on an employer in respect of his employees, he shall, as far as is reasonably practicable, be under a like duty in respect of any other person, whether at work or not, who may be affected by the work carried on by the employer."***

Exposure levels and limits

Under COSHH, two types of occupational exposure limits for hazardous substances are mentioned:

- Maximum Exposure Limits (MELs)
- Occupational Exposure Standards (OESs).

Both types of limits apply to the concentration of the hazardous substances in the air, averaged over a specified period of time referred to as a time weighted average (TWA). Two time periods have been used: long-term (8 hours) and short-term (15 minutes). HSE publishes annually a list of Occupational Exposure Limits (EH40), specifying the current limit values for a wide range of different chemicals and materials.

Tables 1.2 and 1.3 give the Maximum Exposure Limits (MEL) and Occupational Exposure Standards (OES) currently in place for particle materials likely to be commonly produced during construction processes.

Table 1.2 Construction materials with a Maximum Exposure Limit (MEL)

Material	Long-term exposure limit (8 hr TWA) mg m^{-3}	Notes
Hardwood dust	5.0	Sensitiser*
Softwood dust	5.0	Sensitiser*
Silica (respirable crystalline)	0.3	
Man-made mineral fibre (MMF)**	5.0	

**Substances capable of causing respiratory sensitisation.*
***Also has a MEL of 2 fibres per ml of air (8 hr TWA).*

Table 1.3. Construction materials with an Occupational Exposure Standard (OES)

Material	Fraction (Total Inhalable or Respirable)	Long Term Exposure Limit (8 hr TWA), (mg m^{-3})
Calcium Carbonate	Total Inhalable	10
	Respirable	4
Calcium Silicate	Total Inhalable	10
	Respirable	4
Coal Dust	Respirable	2
Emery	Total Inhalable	10
	Respirable	4
Gypsum	Total Inhalable	10
	Respirable	4
Limestone	Total Inhalable	10
	Respirable	4
Marble	Total Inhalable	10
	Respirable	4
Mica	Total Inhalable	10
	Respirable	0.8
Plaster of Paris	Total Inhalable	10
	Respirable	4
Portland Cement	Total Inhalable	10
	Respirable	4
Ground Granulated Blastfurnace Slag (GGBS)	Total Inhalable	10
	Respirable	4
Pulverised Fuel Ash (PFA)	Total Inhalable	10
	Respirable	4
Silica (crystalline)	Total Inhalable	6
	Respirable	2.4
Silica (fused)	Respirable	0.8
Silicon Carbide	Total Inhalable	10
	Respirable	4

Control of Asbestos at Work Regulations (1987) as amended

Asbestos, including asbestos fibres, is treated as a 'special' material under all types of regulation and as such has its own exposure limits. It is subject to high levels of regulation and control, for example through the Control of Asbestos at Work Regulations (1987) as amended. It is essential that these regulations are followed for controlling asbestos emissions.

Dust control measures 2

This section gives advice on control methods to minimise the emission of dust and fine particles from construction-related phases and activities.

Dust control measures

2.1 BACKGROUND

Dust and fine particle generation from construction and demolition activities can be substantially reduced through carefully selected mitigation techniques and effective management. Once particles are airborne, it is very difficult to prevent them from dispersing into the surrounding area. The most effective technique is to control dust at source and prevent it from becoming airborne, since suppression is virtually impossible once it has become airborne.

The control guidance given in the following sections sets out techniques and methods currently used by industry, with many of the methods applicable to a variety of dust and particle problems. They have not been validated under controlled conditions and therefore have yet to be subject to independent verification.

Consequential risks, such as those related to water (eg slips, skids, chemical reactions, electrical hazards and contamination/blockage of water services) or dust explosion in contaminated areas are outside the scope of this document and have not been dealt with.

2.2 HAULAGE ROUTES, VEHICLES AND CONSTRUCTION PLANT

2.2.1 Roads, surfaces and public highways

During dry and windy weather conditions, dust and mud from roads and haulage routes can become airborne through movement of vehicles, both on and outside the site (Figure 2.1). Relevant control measures should be taken to minimise this problem by drawing on the guidance given in Table 2.1 as appropriate.

Since many of the techniques given in Table 2.1 rely on washing and damping down, it is important that the run-off water does not itself become a source of water pollution.

Figure 2.1 Vehicle-raised particles from an unpaved roadway (Source: Midwest Research Institute, USA www.mriresearch.org)

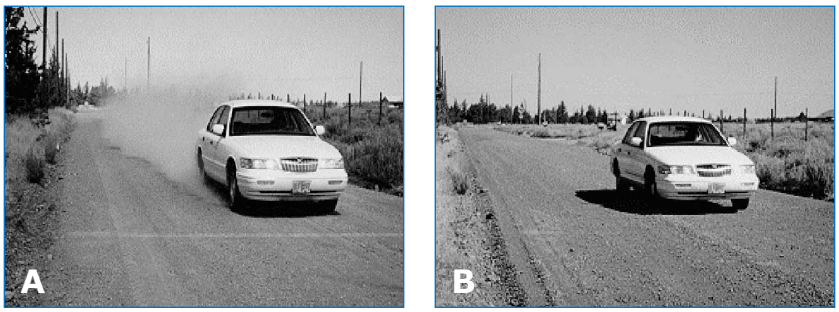

Figure 2.2 Road surface (A) without dust control and (B) with dust control (Source: www.brooksnsw.com.au)

Table 2.1 Dust control guidance for roads, surfaces and highways

Potential dust source		Dust control guidance
Major haul roads and traffic routes		■ Install permanent surfaces with regular inspection and maintenance (Figure 2.2). ■ Plan routes to be away from residents and other sensitive receptors, such as schools and hospitals.
Construction and maintenance of unsurfaced roads and verges		■ Grade fine materials from unsurfaced haul roads. ■ Keep in compacted condition using static sprinklers, bowsers, commercially available additives and binders (subject to Environment Agency (EA), Scottish Environment Protection Agency (SEPA) requirements).
Public roads		■ Clean regularly subject to Local Authority or Highway Authority approval.
Edges of roads and footpaths		■ Clean by using hand broom with damping, as necessary.
High level walkways and surfaces (scaffold planking and other surfaces)		■ Clean regularly using wet methods and not dry sweeping.
Vehicle waiting areas and hard standings		■ Regularly inspect and keep clean by brushing or vacuum sweeping. ■ Spray regularly with water to maintain surface moisture if needed.
Vehicle and wheel washing		■ Washing facilities, such as hose-pipes and ample water supply should be provided at site exits, including mechanical wheel spinners where practicable. ■ If necessary, all vehicles should be washed down before exiting the site (Figure 2.3).
Site traffic	– management	■ Restrict general site traffic to watered or treated haul roads. ■ Keep vehicle movements to a minimum.
	– speed control	■ Limit vehicle speeds – the slower the vehicle speeds, the lower the dust generation. Typical recommendations are: – 20 mph or less for surfaced roads – 5 mph for unmade surfaces.
Road cleaning		■ Approved mechanical road sweeper should be readily available, with circular brush commonly fitted to side for cleaning kerbs, removed. ■ Frequency of cleaning will depend on site size, location and operation. However, cleaning should be carried out on a daily basis (working day) or more frequently if required.

Figure 2.3 Wheel washing of lorry prior to exiting site

2.2.2 Static and mobile combustion plant emissions

Engine exhaust emissions, especially from those operating on diesel fuel, can be a significant source of fine particle generation from construction sites. As the particles are small, they can easily be transported to beyond the site boundary and affect the local environmental air quality and health. Control guidance for these types of emissions are given in Table 2.2.

Table 2.2 Dust control guidance for static and mobile combustion plant

Potential dust source	Dust control guidance
Visible exhaust smoke	■ Vehicles and equipment should not emit black smoke from exhaust systems except during ignition at start-up.
Maintenance	■ Engines and exhaust systems should be maintained so that exhaust emissions do not breach statutory emission limits set for the vehicle/equipment type and mode of operation.
Servicing	■ This should be routinely scheduled, rather than just following breakdowns.
Operating time	■ Internal combustion plant should not be left running unnecessarily.
Exhaust direction	■ Vehicle exhausts should be directed away from the ground and other surfaces and preferably upwards to avoid road dust being re-suspended to the air.
Exhaust heights	■ Exhausts should be positioned at a sufficient height to ensure adequate local dispersal of emissions.
Location of plant and equipment	■ Plant and equipment should be operated away from residential areas or sensitive receptors near to the site.

2.2.3 Tarmac laying, bitumen surfacing and coating

It is difficult to avoid the production of black smoke particles with the types of hot bitumen processes commonly used in construction, although it can be minimised (Table 2.3).

Table 2.3 Dust control guidance for emissions from tarmac laying, bitumen surfacing and coating

Potential dust source	Dust control guidance
Bitumen over-heating	■ Do not overheat bitumen, but use minimum acceptable temperature. ■ Measure temperature directly, especially on large heating plant. ■ Avoid if possible, heating with open flame burners.
Fume production	■ Cover pots or tanks containing hot bitumen.
Small accidental fires	■ Extinguish immediately.
Spillage	■ Minimise spillages, especially any likely to contact open flames.
Direct application of open flames ('torching')	■ Use great care. ■ Avoid overheating the surface.

2.3 MATERIALS HANDLING, STORAGE, STOCKPILING, SPILLAGE, AND DISPOSAL

2.3.1 Handling, storage, stockpiling and spillage of dusty materials

Method statements and procedures for the storage and handling of fine, powdery and dry materials should be established and agreed at the planning stage of the project (see Section 3 for further details).

Previously settled dust has the potential to become airborne during windy weather conditions. Solid fencing or hoarding can provide shelter from the wind and reduce the possibility of dust suspension from the ground. However, any improvement will occur only in the region of the fence.

Sheltering efficiency can be improved by using porous fences. Fence porosities (the fraction of the fence area that is open) up to ~50% are best. The porosity can be achieved by vertical or horizontal slatting or by a mesh structure, as long as the element size is no more than about a fifth of the fence height. Hedges typically have the same properties. Areas of the site that are expected to be strong local sources of dust generation can be fenced in this way. In general, fences around for example stockpiles, need to be of the same approximate size as the object being protected or slightly larger, if they are to be effective.

Wet material is likely to dry out during periods of hot weather and more frequent damping will be required. Advice and approval from the Environment Agency may be required on how to control the run-off of slurry when dusty material is damped down using water.

Table 2.4 Dust control guidance for emissions from handling of materials

Potential dust source	Dust control guidance
Material handling operations	■ Always keep the number of handling operations to a minimum by ensuring that dusty material isn't moved or handled unnecessarily.
Transport of fine powdery materials	■ Use closed tankers.
Transport of dusty materials and aggregates	■ Use enclosed or sheeted vehicles.
Handling areas	■ Keep clean and free from dust.
Vehicle loading	■ Use material handling methods that minimise the generation of airborne dust. ■ Damp down using water.
Loading materials onto vehicles and conveyors (Figure 2.4)	■ Drop heights must be kept to a minimum and enclosed wherever possible. ■ Damp down with water.
Chutes, skips and conveyor transfer points	■ Drop heights must be kept to a minimum and enclosed wherever possible (Figure 2.5). ■ Damp down with water.
Conveyor loads	■ Damp down wherever possible.
Dust dispersing over the site boundary	■ Use static sprinklers, bowsers, hand held hoses and other watering methods, as necessary.

Table 2.5 Dust control guidance for emissions from storage of powder material

Potential dust source	Dust control guidance
Bulk cement, bentonite and similar materials	■ Delivered by tanker and stored in silos
Silos	■ Ventilators should be fitted with particle filters.
Accidental spillages when filling or operating silos	■ Methods and equipment for cleaning should be in place. If necessary, include the use of audible and visual alarm systems.
Fine, dry materials (less than ~3 mm in particle size)	■ Store inside buildings or enclosures or with adequate protection from the wind eg by using sheeting.
Dry materials (greater than ~3 mm in particle size diameter)	■ Store materials in bunded areas.
Storage location	■ Store materials away from the site boundary and sensitive areas, wherever possible.

Figure 2.4 Dump truck filling
(Source: Midwest Research Institute, USA www.mriresearch.org)

Figure 2.5 Material dropped into skips
(Source: BRE Archive)

Table 2.6 Dust control guidance for emissions from stockpiles

Potential dust source	Dust control guidance
Stockpile location	■ Stockpiles should be located away from sensitive receptors eg residential, commercial and educational buildings, places of public access or other features, such as watercourses.
Building stockpiles	■ Ensure slopes of stockpiles, tips and mounds are at an angle not greater than the natural angle of repose of the material. ■ Avoid sharp changes of shape.
Small and short-term stockpiles – protecting from wind erosion	■ Where possible, ensure stockpiles are kept enclosed or under sheeting. ■ Dusty materials can be damped down using suitable and sufficient water sprays. ■ Wind barriers (protective fences) of similar size and height to the stockpile may be used.
Larger and long-term stockpiles – protecting from wind erosion	■ Shrouding, wind shielding using screens, watering and controlled spraying of the surface with chemical bonding agents, should be carried out (subject to necessary approval from the Environment Agency). ■ Wind barriers (protective fences) of similar size and height to the stockpile may be used. ■ Long-term stockpiles can be capped or grassed over.

Table 2.7 Dust control guidance for emissions from spillages

Potential dust source	Dust control guidance
Cleaning up	■ Methods and equipment should be in place for immediate clean-up of spillages of dusty or potentially dusty materials.
Inspection	■ Regularly inspect site for spillages.
Cement powder (and similar)	■ Clean up spillages using wet handling methods.

2.3.2 Burning of waste materials and uprooted foliage

Under the Clean Air Act (1993), open fires (Figure 2.6) are not recommended on site (see Section 1.5.1). The use of small incinerators is regarded as being more acceptable but would need to be approved, under Section 21 of the Clean Air Act (1993).

Many waste timbers from construction sites (especially roofing timbers) are often impregnated with treatments to prevent bacterial, fungal and insect attack or, painted with lead-based paint. Some of these materials, either in their original form or as partial products of combustion, are toxic. Roofing timbers, for example, have been commonly treated with arsenic-based compounds to prevent insect attack. Therefore, arsenical compounds are released in the fire plume if they are burned. It is therefore advised that such timbers are not burned on site.

It is recommended that building materials which are not contaminated are reclaimed and reused wherever possible.

Table 2.8 Dust control guidance on disposal of waste material from construction

Potential dust source	Dust control guidance
Disposal method	■ Use alternative disposal method to burning, if possible.
Combustion method	■ Use an incinerator and not open fires.
Incinerator	■ Must be an approved appliance (under the Clean Air Act 1993).
Supervision	■ Any fires or incineration must be supervised at all times.
Treated timbers	■ Timbers treated chemically to resist rotting, insects etc should not be burned.

Figure 2.6 Open bonfire (Source: Envirobods Ltd)

2.4 SITE PREPARATION AND RESTORATION AFTER COMPLETION

Earthworks, excavation, soil stripping, earthmoving and landscaping can be significant sources of particle generation, especially during dry weather periods and, in particular, if followed by high winds. Surfaces should always be disturbed as little as possible, and stabilised as soon as possible afterwards.

Table 2.9 Dust control guidance for emissions during site preparation and restoration

Potential dust source	Dust control guidance
Earthworks, excavation and digging	■ Vegetation and cover should be removed in discrete sections and not all at once. ■ Earthworks, excavation and digging activities should be kept damp and, if possible, be avoided during exceptionally dry weather periods.
Completed earthworks	■ Stabilise surfaces and/or re-vegetate as soon as possible.
Storage mounds	■ Seal surfaces by seeding or surface with vegetation that has previously been removed from the site. For example, turfing which has been removed may be stored and reused. ■ Alternatively, cover with correctly secured tarpaulins.
Landscaping	■ Soils may be landscaped into suitable shapes for secondary functions, such as visual screening.
Transitory soil mounds	■ Soil mounds should be treated with surface binding agents to reduce wind erosion. ■ Consultation with the Environment Agency is necessary before employing any binding agent.
Processing aggregates, crushing and screening	■ Crushers should be sited as far away as possible from sensitive receptors. ■ Mobile plant for crushing, screening and grading of materials may require authorisation (under the Environmental Protection Act, 1990) by the appropriate Local Authority in whose area the operating company's registered office is situated.

2.5 DEMOLITION

Dust from demolition processes can often have a profound effect on neighbouring areas. If dust is likely to spread into areas beyond the site, as it may do in unfavourable wind conditions, steps should be taken to assess the risk and to devise appropriate measures, (Guidance is given in Table 2.10, page 22). For example, hand or mechanical, rather than explosive methods, will help to reduce the exposure to members of the public, but this may increase the exposure to operatives. Therefore, a balance will need to be struck between the method used and its overall effect. It is possible that in some cases overall dust exposure may be less with explosive methods.

It is essential that potential dust hazards are assessed during the preparation of demolition method statements. Guidance on appropriate health and safety measures is contained in a series of HSE Guidance Notes (see Section 1.5.2) and in BS 6187 Code of Practice for Demolition.

Figure 2.7 Water sprays used to control dust emission during demolition

2.6 CONSTRUCTION AND FABRICATION PROCESSES

Operations such as cutting, grinding and sand-blasting can be major sources of airborne particles (Figures 2.8 and 2.9). If cutting and grinding operations are carried out on site, equipment and techniques incorporating the best available dust suppression measures should be used to keep dust emissions to a minimum. (Guidance is given in Table 2.11, page 23.) Plant hire companies should be consulted for information on the best equipment currently available. Regular improvements in dust control technology often occur and hence new equipment becomes available to the market.

Figure 2.8 Dust generation from disc cutting (Source: BRE Archive)

Figure 2.9 Dust generation from sand-blasting (Source: AD Murray, Hynburn BC)

Table 2.10 Dust control guidance for emissions during demolition activities

Potential dust source	Dust control guidance
Blasting using explosives	■ Blasting should be avoided and other methods used wherever possible.
Sheeting/screening	■ Buildings should be screened with suitable debris screens and sheets.
Biological materials	■ Bird droppings and other biological material should be removed prior to demolition. ■ Care must be taken that the material does not become airborne, but is sufficiently contained.
Asbestos	■ Asbestos must be removed by a registered specialist contractor prior to demolition.
Water sprays	■ Suitable and sufficient water sprays must be used. ■ Spraying should be carried out prior to and during demolition (Figure 2.7).
Chutes for dropping demolition materials to ground level	■ Enclose chutes and skips. Regular water spraying should be carried out. ■ Material drop heights should be minimised.
Burning of waste materials, foliage etc	■ Burning should be avoided if possible. If unavoidable, use incinerators rather than bonfires (see Section 2.3.2).
Removal of materials from site	■ Materials should be removed from the site as soon as is practical. Prolonged storage of debris on site or exposure to wind should be avoided.
Transport of materials	■ Vehicles removing demolition materials must have their loads effectively sheeted.
Vehicle routes	■ As far as practical, routes should be located away from residential and commercial properties.
Crushing of material for reuse, transportation or disposal	■ Crushers should be sited as far away as possible from sensitive receptors. ■ Mobile plant, eg crushing, screening and roadstone coating plant, will require authorisation by the Local Authority in whose area the operating company's registered office is situated.

Table 2.11 Dust control guidance for emissions from cutting, grinding and drilling

Potential particle source	Control guidance
Cutting, grinding, drilling, sawing, trimming, planing, sanding	■ Cutting on site should be avoided by using prefabrication whenever possible. ■ Avoid cutting out errors and re-bars. ■ Employ equipment and techniques that minimise dust emissions, using best available dust suppression measures. ■ Use water sprays to minimise dust from cutting equipment. ■ Local exhaust ventilation should be used where possible. ■ Fans and filters should be serviced and maintained to ensure correct operation. ■ Design to fill wherever feasible rather than cutting back oversized work.
Cutting roadways, pavements, blocks etc	■ Use a diamond bladed floor saw with water pumped through to suppress dust. ■ Standard angle grinders and disk cutters with no dust control should not be used for this purpose.
Raking out mortar/pointing	■ Standard angle grinders and disk cutters with no dust control should not be used. ■ A mortar raking kit, fitted on to a standard 5” angle grinder can be used on soft mortar. For hard mortar, a super-saw with oscillating blades can be used.
Angle grinders and disk cutters	■ Dust extraction/minimisation systems should always be used.

Table 2.12 Dust control guidance for emissions from scabbling, sand and grit blasting and façade cleaning

Potential particle source	Control guidance
Scabbling	If possible, scabbling should be avoided altogether. Alternative strategies include: ■ designing tolerances for infilling rather than cutting back oversize work ■ increasing the size of concrete pours to reduce the need for scabbling ■ the use of bonding agents ■ designing the concrete components themselves to affect interfaces ■ the use of wet grit blasting for outside work. If scabbling cannot be avoided then the dust emission risk should be assessed, including the size of area to be scabbled, material used, amount of dust likely to be emitted etc If necessary, the following control procedures should be used: ■ fit tools with dust bags ■ pre-wash work surfaces ■ screen off areas to be scabbled to limit the spread of dust ■ vacuum up, rather than sweep away residual dust as this can generate more dust than the scabbling operation itself.
Sand, grit or shot blasting and façade cleaning	■ Silica-free material should be used for abrasive cleaning, since the inhalation of silica dust is harmful. ■ Wet processes should be used wherever possible. These introduce water into the air/grit stream, greatly reducing the dust hazard to both building occupiers and the general public. ■ Ensure that slurries do not dry out. If dry grit blasting is unavoidable: ■ assess the emission of dust (especially respirable dust) ■ sheet all work areas before commencement of operations ■ seal all windows and openings in the structure with polyethylene sheeting ■ use local exhaust extraction and filtering, if possible.

Table 2.13 Dust control guidance for emissions from mixing processes

Potential particle source	Control guidance
Mixing and granular materials	■ The use of pre-mixed plasters and masonry compounds is recommended. ■ The mixing of concrete or bentonite slurries should take place in enclosed or shielded areas. ■ Fine materials should be palletised and shrink wrapped where possible.

Table 2.14 Dust control guidance for emissions from welding and soldering processes

Potential particle source	Control guidance
Welding and soldering (Figure 2.10)	■ Assessment and control of exposure to fume from welding and allied processes are documented in Health and Safety Guidance Notes (see Section 1.5).

Figure 2.10 Local exhaust ventilation system for welding and soldering purposes
(Source: www.dce.co.uk)

2.7 INTERNAL AND EXTERNAL FINISHING AND REFURBISHMENT

Finishing processes such as painting, decorating, fitting out, grouting and cleaning all have a potential for generating dust and fine particles and the following control is recommended.

Table 2.15 Dust control guidance for emissions from internal and external finishing and refurbishment

Potential particle source	Control guidance
Painting and decorating	■ Sanding and cutting machinery should be fitted with dust suppression or collection equipment. ■ Vacuum cleaning should be used wherever possible.
Fitting out – plastering, rendering, decorative finishing, furniture fitting	■ Cutting and sanding machinery should be fitted with dust suppression/collection equipment. ■ Vacuum cleaning should be used whenever possible.
Installation of electrical systems and plumbing – chasing of walls, soffits and floors	■ Cutting and sanding machinery should be be fitted with dust suppression/collection equipment. ■ Vacuum cleaning should be used whenever possible.
Installation of fire proofing and insulation (usually from man-made mineral fibres, such as mineral wools, special purpose and continuous filament fibres)	■ Dust suppressants should be used when blowing fibres into voids and spaces. ■ Local exhaust ventilation should be used when handling and cutting fibrous insulating materials.
Cleaning processes	■ Dry sweeping should be avoided and only carried out with vacuum extraction methods attached. ■ Damp sweeping using fine mist should be used. ■ Washing and damping down should be carried out whenever necessary.

Managing site operations for dust minimisation

3

This section covers guidance on pre-project and management issues which are an essential requirement before the start of any project

Managing site operations for dust minimisation

3.1 PRE-PROJECT PLANNING

3.1.1 Identifying dust generating activities

Before the start of a project, it is important to identify which construction activities are likely to generate dust and to draw up action plans to minimise emissions into the atmosphere. To help with identification of the activities that will require dust control methods to be in place for a particular project before it starts, an example checklist is given in Appendix A. This list will also enable the identification of those activities that are likely to be the most significant in generating dust.

It is advised that this list be used to identify the activities that are likely to generate dust, recommend control procedures and identify personnel responsible for implementation and follow up. It is intended for use by:

- environmental consultant for the project
- planning officer
- on-site safety advisor
- environmental health officer (EHO).

3.1.2 Environmental risk assessments

Environmental risk assessments should be prepared for all dust generating processes and activities. CDM Regulations impose upon the designer a duty to ensure that, so far as is reasonably practicable, any design will conform with the following hierarchy of risk control:

- to avoid altogether, if possible, risks to the health and safety of any person at work on building, maintaining, repairing or carrying out cleaning work on a structure
- to combat at source risks to such persons
- to give priority to measures which protect the whole workforce over those which protect only the individual.

Designers and contractors should work together to evaluate the hazards and risks likely to occur for each activity taking place on the construction site and find ways of avoiding or reducing them within the design. It is not enough to rely only upon common methods of control which contractors may employ. Designers should recommend methods to eliminate or reduce the risk before the contractors begin their work, eg prefabrication wherever possible.

In assessing the risks associated with dust generation from construction and demolition activities and the need for dust control measures, it is important that the following issues are considered:

- the nature of the activities to be carried out
- any dangerous or toxic materials (eg asbestos) likely to be encountered during demolition or refurbishment
- the weather conditions that are likely to prevail during dust generating operations
- the proximity of dust-sensitive receptors such as nearby schools, hospitals and residential, commercial and industrial areas
- the effects on the general public and road users
- any restrictions placed on the site by the client or facility manager.

Dust emissions from construction sites will mainly be the sum of a large number of small activities. Therefore, attention to detail is a critical feature of effective management of the total site emissions.

3.1.3 Method statements

Methods of dust prevention and suppression should be discussed and agreed at the environmental risk assessment stage or at the earliest opportunity during the design stage. They should always be prepared well in advance of works starting on site.
A comprehensive method statement detailing the methods to be used should be drawn up for all relevant personnel to use. It is also necessary to have a management procedure to ensure that the appropriate parts of the method statement are communicated to the people who will be required to apply them.

It is recommended that the method statement covers the following:

- methods and materials that should be used to ensure that dust generation is minimised
- the use of prefabricated materials wherever possible
- optimum site layout as follows:
  - dust generating activities to be located away from sensitive receptors
  - there must be an adequate supply of water for damping down dust with sufficient hoses to reach all parts of the site
  - water supply should be conveniently located if possible, for example, near dust generating activities and site exits
- good site housekeeping and management.

Dust control equipment should be readily available on site from the commencement of works. The choice of plant and equipment and the method of work should reflect the necessity to employ best practicable means in the control of dust. Generally, where alternative methods exist, intrinsically dusty operations, such as dry sweeping or dry sandblasting should not be used.

3.1.4 Action and reporting – allocating responsibilities

It is important that all personnel on any construction or demolition site understand their responsibility for ensuring that the generation of particles is minimised. Responsibilities need to be allocated to specified personnel to ensure that dust generation is effectively controlled.

3.1.5 Training

Training for relevant personnel on how to control dust emissions from construction and demolition activities is essential. It is therefore recommended that before the start of any project, appropriate training is given to all levels of personnel on site. Training in respect of dust control may form part of the site safety induction and is likely to include:

- the effect of dust on health and the environment
- benefits of reducing dust generation
- methods to minimise dust generation
- action plans on what should be done if dust emissions breach the guideline that has been set for the particular site
- content and requirements of method statements
- the importance of effective communication between relevant personnel.

3.1.6 Satisfying planning requirements

It is important that an effective dialogue, to determine which planning requirements need to be satisfied, occurs between the Local Authority (both planning and environmental departments), the main site contractor and other relevant parties at the earliest possible stage in any project. It is recommended that dust control measures are considered during the initial stages of a project and are included in planning applications at the Environmental Impact Assessment stage.

The Town and Country Planning Act enables local authorities to attach planning conditions to planning permissions. By raising the issue of dust control either at the pre-planning or the planning stage, the use, and cost, of dust control can be incorporated into any relevant tender documents.

It is possible that the Local Authority may look for a planning condition requiring a method statement. It should include monitoring and control of particle emissions and be based around current best practice. It is therefore advised that discussions with the Local Authority Environmental Health Department are carried out at an early stage during pre-project planning to negotiate the requirements.

The authorisation of construction sites should consider the nature of the works that are being undertaken, the duration of use, the size of the site and the locality. A higher degree of control is generally expected from large, long-term sites or sites handling contaminated soils.

3.2 IMPLEMENTATION AND ON-SITE MANAGEMENT

3.2.1 Handling public relations

It is recommended that the site hoarding displays the following information:

- site programme
- telephone contacts for receipt of complaints and enquiries
- the name of the site representative who should be contacted.

The specified phone must be attended at all operational hours by persons with the appropriate authority to act to resolve any problems that may occur. Specific activities with the potential of causing dust problems should be notified to the Environmental Health Officer (EHO) and the residents likely to be affected, so that appropriate safeguards can be adopted before any activity takes place. Details of all complaints should also be notified to the local EHO for verification purposes.

3.2.2 Controlling site traffic and setting up access routes

At the project planning stage it will be extremely important to consider the positioning of any site entrances, exits and haul roads in relation to the surrounding area. If possible, these should be positioned to route vehicles, on and off the site, away from sensitive receptors, such as residential areas, schools and hospitals. The possible positioning of exits should also consider the need and practicability of installing vehicle washing facilities where it is appropriate to do so.

The imposition and enforcement of site speed limits should also be considered at an early stage. If vehicles are to use unsurfaced temporary haul roads, a limit of 5 mph should be imposed. Otherwise, on properly surfaced and maintained roads, a limit of no more than 20 mph should be set.

3.2.3 Fine particle and nuisance dust emission monitoring

An assessment of the need for particle emission monitoring should consider the nature of the works that are undertaken, the duration of works, the size of the site and the locality. Discussions with the relevant Local Authority should take place at an early stage of the project to determine what, if any, monitoring is required to meet the aims of the UK Air Quality Strategy. It is possible that specialist advice on dust monitoring may also be required for complex sites.

Sites that are likely to require particle monitoring to be carried out include:

- large sites in proximity to sensitive receptors
- longer term sites in proximity to sensitive receptors
- sites containing any contaminated soils
- projects involving large scale demolition and/or earthworks
- sites situated within sensitive areas, ie within an existing or proposed Local Authority Air Quality Management Area (AQMA), in which air pollution levels are already high.

If implemented, ambient particle monitoring can serve a number of purposes, as follows:

- providing an objective measure of particle concentrations at the construction site
- providing information on the success of abatement strategies
- allowing attribution of particle concentrations to individual sources, processes or events which may be required in the case of disputes.

Details on different types of monitoring are given in Appendix B.

3.2.4 Managing housekeeping

Good housekeeping is essential in running a safe site. Site supervision of a high standard and a supportive attitude towards health and safety and the environment is also very important. Site management staff are responsible for ensuring that equipment is used appropriately, and maintained effectively. Plant that is used badly, or dust suppression equipment that is used inappropriately or poorly maintained will not be effective at controlling dust. Examples include:

- missing or corroded wind boards on conveyors
- missing or corroded sheeting enclosing crushing plant
- poorly maintained pumps or fans
- torn or missing fabric bag filters in dust control/filtration units
- blocked water sprays or water bowser jets
- infrequent watering of haul road surfaces
- failure to enforce site management practices, such as speed restrictions, use of wheel washers or sheeting of loads carried by road licensed vehicles
- lack of frost protection during winter months for water-based dust suppression systems.

Preventative measures should be taken to minimise the formation and spread of dust. Site managers need to ensure that dust suppression measures are applied promptly and effectively as required. For example, by ensuring that:

- an adequate supply of water is available with sufficient hoses to reach all parts of the site
- service and repair contracts are in place to deal with the maintenance and breakdown of pollution control equipment
- provision is made, before it is required, for the disposal of wastewater
- a site log book is provided as part of the dust management regime.

3.3 FINAL CHECKLIST

A final checklist has been given in Appendix C to help with ensuring that all aspects relating to the control of dust emissions have been considered.

This checklist together with that given in Appendix A can be used for the following:

- to carry out pre-project planning by designer and project managers
- to carry out audits by project environmental managers
- to check that all environmental aspects associated with dust have been considered by Local Authority Environmental Health Officers.

HAULAGE ROUTES, VEHICLES AND CONSTRUCTION PLANT

Roads, surfaces and public highways

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Major haul roads and traffic routes				
Vehicle waiting areas and hard standings				
Vehicle and wheel washing				
Construction and maintenance of unsurfaced roads and verges				
Site traffic – management				
– speed control				
Public roads				
Edges of roads and footpaths				
Road cleaning				
High level walkways and surfaces (scaffold planking and other surfaces)				

HAULAGE ROUTES, VEHICLES AND CONSTRUCTION PLANT

Static and mobile combustion plant emissions

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Visible exhaust smoke				
– Maintenance				
– Servicing				
– Operating time				
– Exhaust direction				
– Exhaust heights				
– Location of plant and equipment				

HAULAGE ROUTES, VEHICLES AND CONSTRUCTION PLANT

Tarmac laying, bitumen surfacing and coating

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Bitumen over-heating				
Fume production				
Small accidental fires				
Housekeeping				
Direct application of open flames ('torching')				

MATERIALS HANDLING, STORAGE, SPILLAGE AND DISPOSAL

Handling of materials

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Material handling operations				
Transport of fine powdery materials				
Transport of dusty materials and aggregates				
Handling areas				
Vehicle loading				
Loading materials onto vehicles and conveyors				
Chutes, skips and conveyor transfer points				
Conveyor loads				
Reducing/preventing dust dispersing over the site boundary				

MATERIALS HANDLING, STORAGE, SPILLAGE AND DISPOSAL

Storage of powder material

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Bulk cement, bentonite and similar materials				
Silos				
Accidental spillages when filling or operating silos				
Fine, dry materials (less than ~3 mm in particle size)				
Dry materials (greater than ~3 mm in particle size diameter)				
Storage location				

MATERIALS HANDLING, STORAGE, SPILLAGE AND DISPOSAL

Stockpiles

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Stockpile location				
Building stockpiles				
Small and short-term stockpiles – protecting from wind erosion				
Larger and long-term stockpiles – protecting from wind erosion				

MATERIALS HANDLING, STORAGE, SPILLAGE AND DISPOSAL

Spillages

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Cleaning up				
Inspection				
Cement powder (and similar)				

MATERIALS HANDLING, STORAGE, SPILLAGE AND DISPOSAL

Burning of waste materials and uprooted foliage

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Disposal method				
Combustion method				
Incinerator				
Supervision				
Treated timbers				

SITE PREPARATION AND RESTORATION AFTER COMPLETION

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Earthworks, excavation and digging				
Completed earthworks				
Storage mounds				
Landscaping				
Transitory soil mounds				
Processing aggregates, crushing and screening				

DEMOLITION

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Blasting using explosives				
Sheeting/screening				
Biological materials				
Asbestos				
Water sprays				
Chutes for dropping demolition materials to ground level				
Burning of waste materials, foliage etc				
Removal of materials from site				
Transport of materials				
Vehicle routes				
Crushing of material for reuse, transportation or disposal				

CONSTRUCTION AND FABRICATION PROCESSES

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Cutting, grinding, drilling, sawing, trimming, planing, sanding				
Dust control – exhaust ventilation				
Design – filling joints etc				
Cutting roadways, pavements, blocks etc				
Raking out mortar/pointing				
Angle grinders/disk cutters				
Scabbling				
Sand, grit or shot blasting and façade cleaning				
Mixing and granular materials				
Welding and soldering				

INTERNAL AND EXTERNAL FINISHING AND REFURBISHMENT

Potential dust source	Significance (high, low, medium)	Control measure	Responsibility for implementation	Observed closed out
Painting and decorating				
Fitting out – plastering, rendering, decorative finishing, furniture fitting				
Installation of electrical systems and plumbing – chasing of walls, soffits and floors				
Installation of fire proofing and insulation (usually from man-made mineral fibres eg mineral wools, ceramic, special purpose and continuous filament fibres)				
Cleaning processes				

Monitoring of airborne particles

Monitoring airborne particle levels

It is not possible to give general advice on particle monitoring since each site is individual in its own right. Therefore specialist advice may be required. However, the following gives an overview of the type of monitoring that may be required.

Types of monitoring

There are two major categories of monitoring.

- Monitoring for health effects. This requires sampling of ambient concentrations of defined particle size fractions (such as PM_{10}).
- Monitoring for nuisance. This can be done in a number of ways, including sampling of ambient concentrations as above, or of deposition, flux or surface soiling.

Monitoring is discussed only briefly in this Appendix, since the subject is too wide-ranging and complex for full treatment here.

Background concentrations of particles

Particles emitted from construction sites will add to the existing 'background' concentration around the site. Thus, any monitoring strategy should ideally monitor local 'background' concentrations as well as the contributions from the site. This can be done by monitoring before site operations begin, during lulls in site activities or by the use of directional sampling. Another option may be to obtain local background concentration data from any nearby National Network or Local Authority PM_{10} monitoring stations. PM_{10} data from the national network monitoring sites are published annually for DEFRA (formally DETR Air and Environment Division) and are also available on the internet at http://www.aeat.co.uk. Dust deposition, the main traditional means of assessing nuisance, is no longer routinely measured. However, the figures in Table B1 are broadly typical of dust deposition rates found in different areas within the UK.

Table B1.Mean levels of deposited dust

Measurement location	Mean dust deposition ($mg\ m^{-2}\ day^{-1}$)
Open country	39
Outskirts of towns	59
Industrial areas	127

Monitoring for health effects

This is normally achieved through using reference standard commercial instruments to measure the concentrations of specific particle size fractions. The PM_{10} size fraction, which represents particles that penetrate past the larynx, is the most common measurement currently made, although there are other size fractions that can be of interest. There are two types of instrument.

- Simple pumped samplers that collect particles on a filter for later weighing or chemical analysis (these sample for relatively long periods, days or weeks, and are relatively cheap).
- Continuous sampling instruments to provide rapid response on-line information on particle concentrations at low mass levels (eg TEOMs, light scattering detectors and Beta-gauges). Though expensive, they have the advantage of allowing the attribution of high levels of particles to specific events at specific times.

Monitoring for nuisance

Nuisance is often initially assessed through the soiling of surfaces by dust deposition. Measurement is conducted mainly by using deposition or flux gauges, the soiling of surfaces using glass slides, or by measurement of total ambient concentration. Most methods are of uncertain accuracy and usually they under-sample.

Dust deposition gauges (eg BS 1747 Part I 1969: Methods for the measurement of air pollution – Deposit gauges, and 'frisbee' gauges) can monitor the rate of dust deposition to the ground (grams m^{-2} day^{-1}). They are placed in areas where nuisance is likely to be of concern, so they would be of little use on the construction site itself. The flux of dust is the quantity of dust carried out of the site by the wind. Flux gauges are available in various forms (eg BS 1747: Part V 1972: Methods for the measurement of air pollution – Directional dust gauges (sticky cylinders) and a wedge shaped design by Hall et al – Designs for a Deposition Gauge and for a Flux Gauge for Measuring Ambient Dust (1994)).

Surface soiling is measured using glass slides or sticky pads placed on surfaces. These are analysed for reflectance or surface covering. They are susceptible to being affected by rain or other precipitation, although in practice they mimic what is happening to a surface such as a car or window ledge. They are cheap and inconspicuous and allow monitoring at a large number of locations.

A great deal can also be learned from analysing dust samples under a microscope or chemically, since this can allow the attribution of sources, for example through distinguishing between wood dust, cement and mineral fibres.

Directional sampling

This is a powerful technique for monitoring the relative contribution of a site to the local environment. There are normally two samplers in operation: One operates when the wind is coming from the direction of the site and the other for either the rest of the time or, runs all the time. A pair of directional samplers on opposite sides of a site will provide very effective evidence of the site's contribution to the local ambient particle level and can be more effective than a number of conventional samplers spread around a large site.

Monitoring strategies

It is important to devise an effective monitoring strategy for the project. Intermittently collecting data is far less valuable than starting ahead of the project and continuing until at least briefly after its completion. The strategy should be agreed in advance with the Local Authority and other interested parties and should be aimed at satisfying the needs outlined for health or nuisance related monitoring. There is some advice on dust monitoring strategies in DoE The Environmental Effects of Dust from Surface Mineral Workings (1995).

The choice of monitoring methods and their siting needs to be considered carefully, usually in agreement with the Local Authority. It will also be necessary to agree the assessment criteria to apply to the monitoring results, and any actions following incidents of exceedences of the criteria.

Summary checklist

Action	Yes/No	Responsible personnel	Observed closed out
Have the Local Authority Environmental Health and Planning Departments been contacted and involved?			
Do other regulators like the Environment Agency, HSE etc need to be involved (eg for water run-off)?			
Have environmental risk assessments been conducted?			
Are method statements for dust control agreed and in place?			
Is the site in a Local Authority Air Quality Management Area (AQMA)?			
Is dust monitoring required, and what type?			
Are dust emission limits to be agreed or imposed?			
Will breaches of emission limits shut down activities or the complete site?			
Are the costs of shutdown known by everyone?			
Have positions of site entrances, haul roads, and speed limits been considered?			
Have low dust-producing materials and techniques been specified?			
Have costs of dust control equipment and operation been incorporated into project specification and tenders?			
Is the specified dust control equipment available on site for immediate use?			
Are dust control 'champions' to be appointed?			
Have they been given sufficient time and level of responsibility for the task ?			
Are procedures for site logging of dust generating activities and control measures in place?			
Are public relations and information systems in place?			
Have the site management team and contractors been trained and informed?			
What incentives or penalties are to be in place for staff/contractors?			

Appendix

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