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DRAFT London Best Practice Guide

The control of dust and emissions from construction and demolition

2005

Produced in partnership by the Greater London Authority, London boroughs and the Association of London Government.

With valuable assistance from the Building Research Establishment and the PRECIS Working Group. (Partnership in Reducing Emissions from Construction Industry Sites).

1. Introduction

Like other major cities in the World, London suffers from high levels of air pollution. Poor air quality can damage health and impact upon quality of life. It has been estimated that each year in London, 1600 deaths are accelerated and over 1500 hospital admissions can be attributed to poor air quality[1]. Dust and emissions from demolition and construction work can worsen air quality, but through careful planning and good management, these impacts can be reduced.

The Mayor of London produced his Air Quality Strategy in September 2002, which contains a number of policies and proposals to reduce air quality in London towards the government's health based air quality targets, which are set out in its National Air Quality Strategy[2]. Specifically, Policy 22 and proposal 47 state that the Mayor will seek to develop specific best practice guidance to reduce emissions from construction and demolition sites in London.

As part of the Government's Air Quality Strategy, local authorities have a responsibility to review and assess air quality within their borough and work towards achieving the air quality targets. Concentrations of nitrogen dioxide (NO_2), and to a lesser extent, fine particles (PM_{10}) are predicted to be above these targets across most of London. Consequently, the majority of London authorities have declared Air Quality Management Areas (AQMAs) and developed action plans, outlining how they will work towards the targets.

The APPLE (Air Pollution Planning and the Local Environment) working group was set up by London boroughs to work towards presenting clear air quality management options for planning issues across London. As part of this work, this Best Practice Guide has been produced to outline best practice in terms of reducing dust and emissions from construction and demolition activities. APPLE has requested that the Mayor and the ALG adopt the Guide as a partnership document, to fulfil the Mayor's aim of producing London-wide guidance.

1.1 Impacts of construction and demolition sites on air pollution

There are a number of sources of dust and emissions from construction activities that can release a range of particulates. This document refers to the following particulates in a standard format throughout:
Dust – defined as all particulates up to 75 μm in diameter (according to BS6069) and comprising both suspended and deposited dust
PM_{10} – comprising *coarse* particles (2.5-10 μm in diameter) which are primarily from non-combustion sources, *fine* particles (<2.5 μm) and *ultrafine* particles (<1μm) from combustion processes.

Dust particles are too large to be inhaled but can cause eye, nose and throat irritation and lead to deposition on cars, windows and property. PM_{10} is of more concern to

[1] GLA 2002. The Mayor's Air Quality Strategy: Cleaning London's Air
[2] Defra 2002. Air Quality for England, Wales and Northern Ireland.

human health as the particles can enter the lungs, causing breathing and respiratory problems, with long-term health effects dominated by cardiovascular rather than respiratory problems[3]. The detrimental health impacts of PM_{10} are not confined to the construction site, it can travel further distances than coarser dust and so can affect the health of people living and working in the surrounding area of the site.

Recent scientific research has shown that PM_{10} particles are toxic, containing metals, such as iron zinc and copper and non-metals, such as sulphur, oxides of nitrogen and chlorine, on their surface. Once in the lung, these metals and non-metals combine with oxygen and cause the particle to become toxic. This toxic particle causes damage and injury to the lung tissue; which in turn causes inflammation of the lung tissue. In vulnerable people, such as the elderly, the very young or those with asthma; this can lead to more serious conditions, such as impaired lung function, increased bronchial hyper-activity and an increased risk of heart attack.

Dust and emissions from construction can also have an impact on indoor air quality in the neighbouring area; this issue could be exacerbated with the use of mechanical ventilation systems. The Committee on the Medical Effects of Air pollution (COMEAP), a Department of Health expert group, have stated that it must be recognised that the indoor environment is not free of air pollutants with many pollutants generated outdoors penetrating indoors[4].

Dust and PM_{10} emissions can arise from a number of sources. Not only do construction activities need to be considered, but also emissions from on-road vehicles associated with the construction site and on-site machinery (off-road emissions) – including both static and mobile non-road mobile machinery (NRMM).

The impacts of poor air quality can also be seen on flora and fauna. It is therefore important to consider the impact of dust on sensitive sites, such Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs) and non-statutory Wildlife Sites in the vicinity of a construction site. These site-specific issues are identified in the Air Pollution Risk Assessment (Chapter 2) and must be considered prior to the planning process, this is in line with the Habitats Directive (92/43/EEC) and Planning Policy Statement 9 (Biodiversity and Geological Conservation).

1.2 Benefits of London wide Best Practice

London's population is expanding and is expected to further increase to 8.1 million by 2016. The London Plan sets out the Mayor's vision to manage this increase, equivalent to absorbing the population of Leeds. London will experience the greatest amount of redevelopment of any UK city. The other demands for construction in London are for economic growth, investment in London's physical infrastructure, and repairs and maintenance of existing homes and buildings[5]. It has been estimated that there are as many as 10,000 active construction sites at any one time[6]; this figure takes account of all scales of development, from the minor house renovation to the

[3] Defra 2005. Air Quality Expert Group: Particulate Matter in the United Kingdom
[4] Comeap, Department of Health, 2004. Guidance on the Effects on Health of Indoor Air Pollutants
[5] GLA. 2005. London's Economy Today, Issue 32.
[6] Department of Environment. 1996. 3rd QUARG report. Airbourne particulate matter in the UK.

large area regeneration schemes that take years to be completed. The London Plan[7], published by the Mayor in 2004, sets out the strategic plan for the continued spatial development of London over the next 15-20 years. This document identifies that continued growth in population will be seen, and as a result a continued programme of redevelopment will need to continue, with recent commitments to build new housing and major transport infrastructure projects include Heathrow Terminal 5, Channel Tunnel Rail Link, Thames Gateway Bridge, Crossrail, along with regeneration of brownfield sites such as the Lower Lee Valley, Greenwich Peninsula/Millennium Village and Thameside developments (including Bankside and MORE London).

This Best Practice Guide complements the Mayor's Draft Supplementary Planning Guidance (SPG) on Sustainable Design and Construction. It supports the implementation of the London Plan and is applicable to all building types and associated spaces. The draft SPG gives advice on designing buildings to reduce their impact on the environment and making them pleasant places for people to live or work in. Advice includes reducing emissions of air pollutants and carbon dioxide as well using spaces to benefit London's flora and fauna.

Some local authorities already have their own Code of Practice for Construction that tend to deal with noise, vibration and land contamination concerns. As a result there are a number of different schemes currently in operation across London. It is envisaged that this London-wide best practice document will provide much needed continuity across all 33 boroughs.

Other commercially available guidance and organisations are available to assist in the control of dust and emissions specifically from construction, for example the following BRE Guidance offers good examples of current best practice:

- Control of dust from construction and demolition activity
- Controlling particles, vapour and noise pollution from construction sites

CIRIA also facilitate discussion through their construction stakeholder forum, which allows knowledge to be shared and disseminated, and also advertises best practice. However, due to the issues that London faces, it is apparent that there is a need for a common and more specific guidance to control pollution.

By following this Code of Practice, developers are identifying with good practice methods for construction and demolition. However, compliance with this document does not offer exemptions from prosecution under any one of a number of acts or regulations that impact upon construction and demolition.

1.3 Legislative Context

The planning system plays the key role in the application of good dust and emission management, Planning Policy Statement 23: Planning Pollution Control sets out the Government's policies on pollution control and planning. It identifies cases where planning conditions may be necessary to control pollution, such as from construction and demolition. However, there are a number of other regulatory and legislative

[7] GLA, 2004. The London Plan: Spatial Development Strategy for Greater London

mechanisms in place that need to be considered. The main legislative controls are identified below, further details are also provided in *Appendix 2: Relevant legislation and guidance*.

The Building Act 1984 and subsequent Building Regulations 2000, aim to ensure the safety of those in and about a building during works, and is the main mechanism for demolition. Under these regulations the local authority must grant a notice for demolition prior to work commencing. As part of this process Environmental Health Departments will be consulted, prior to a notice being issued. To ensure that effective dust management options are undertaken, conditions can be placed on the demolition notice - under Section 82(J) of the Building Act 1984. To facilitate a smooth application process, developers should consider management techniques for dust control during demolition prior to their application.

In Part III of the Environmental Protection Act (EPA) 1990, emission of dust from construction sites is identified as a statutory nuisance. Control of a statutory nuisance is contained within *section 80*. This provides that where a local authority is satisfied that a statutory nuisance exists, or is likely to occur or recur, it is under a mandatory duty to serve an abatement notice on the person responsible for the nuisance or, the owner or occupier of the premises on which the statutory nuisance is present[8].

Local Air Pollution Prevention and Control (LAPPC) regulations will have a bearing on some of the activities taking place on Construction and Demolition sites. This legislation regulates smaller industrial activities, such as cement batching or concrete crushing, known as Part B Installations. Local authorities, as the regulators, are responsible for setting conditions aimed at achieving a high level of protection for the environment as a whole. Conditions are based on Best Available Techniques (BAT) [9], which requires that the cost of applying a technique is not excessive in relation to the environmental protection it provides. The Secretary of State for Environment, Food and Rural Affairs has produced Process Guidance Notes, which form the statutory guidance on what constitutes BAT Part B installations for each process regulated[10]. If the regulator believes the operator has contravened, or is contravening, or is likely to contravene any permit conditions, enforcement action can be undertaken.

Developers should be aware that there is likely to be other Acts or legislation that are not covered in this document; also the acts and regulations that have been identified within the document were correct at time of publication, if new legislation is introduced that sets higher standards, then this should be taken into account.

By following this Best Practice Guide developers are identifying good practice methods for construction and demolition. However, compliance with this document does not offer exemptions from prosecution under any of the legislation impacting upon construction and demolition.

[8] Bell & McGillivray, 2000. *Environmental Law: 5th Edition*

[9] For further information on the Local Air Pollution Prevention and Control Regime and to get copies of the statutory guidance; http://www.defra.gov.uk/environment/airquality/lapc

[10] For copies of Process Guidance Notes of relevant industrial processes; http://www.defra.gov.uk/environment/airquality/lapc/pgnotes/default/htm

1.4 How this guidance should be used

This guide is designed to be used by developers, architects, environmental consultants, local authority officers and any parties involved in any aspect of the construction process (including demolition and other associated activities).

This Best Practice Guide builds on other guidance and augments individual local authorities code of construction practice documents. The experiences of local authority officers and best practice in London has been used to establish best practice that is relevant and achievable, with the overarching aim of protecting public health. It also aims to provide an overall mechanism to deal with the cumulative impacts of the many individual construction sites in each authority. This document will therefore compliment or replace individual borough's codes of practice where they exist and allows those boroughs who do not have their own Code of Practice for Construction to access guidance to ensure proper management of construction schemes.

The many forms and scales of construction that are taking place in London today preclude the use of a traditional generic template for all construction schemes. Officers recognise this and have incorporated the necessary flexibility required to deal with large scale high priority sites as well as the smaller scale sites. The guidance in this document may assist with the drafting of suitable planning conditions.

It is planned that this document will be reviewed regularly, specifically to provide an update outlining new best practice in dust and emissions management.

1.5 How the Best Practice Guide is Structured

This guidance aims to provide consistent best practice for demolition and construction sites across London, as well as providing an overall mechanism to deal with the cumulative impacts of the many individual construction sites in each authority. It guide looks to build on existing guidance and takes into account the latest best practice and new techniques, with particular regard to the issues below:

- Undertaking Air Pollution Risk Assessments.
- Local Authority notification.
- Emission standards for all off-road vehicle emission controls and information on after-treatment technologies.
- HGV emission standards and the proposed London Low Emission Zone.
- Monitoring protocol using a transect approach based on prevailing wind direction across the construction site.
- Requirement for no burning on any site.
- Demolition management.
- Waste and recycling management.
- Paving major haul routes used by HGVs.
- Trained, on-site staff member responsible for pollution issues.

This document has been developed through joint work with the construction, transport and fuel industries and regulatory agencies as part of the PRECIS group.

2. Risk Assessment

In order to successfully control construction activity, it is important to evaluate the risk from pollutants emitted from any construction site. At this stage, the site manager or contractor should prepare an Air Pollution Risk Assessment (APRA), completing the tables in the following pages. The risk assessment applies to all proposed construction activities, including site clearing, demolition and construction phases. To be of use, the risk assessment has to be conducted before any work activities begin on site.

It is essential to have effective dust and emission control measures in place for every dust generating activity carried out on site, to protect the health and safety of, not only the on-site workforce, but members of the public in the locality. It is also envisaged that the number of nuisance complaints will fall; the majority of which are dust and noise emitted from construction activities.

The APRA focuses on the surrounding area and the proposed site activities which impact on the local air quality and management of the construction site. It identifies susceptible receptors adjacent to the site and potential air polluting activities on the site and allocates a score. The APRA has 3 sections; Surrounding Environment, Development of the Site and Construction Activities. Each section asks a series of questions and a 'score' is given according to the answer. There is one score per question. The final scores of each section are then collated to evaluate the overall risk for that particular site (i.e. High, Medium or Low). Where developments are phased, a separate risk assessment should be carried out for each phase. This score sheet is based on Defra's risk assessment for polluting industries. Further background information on can be obtained from the GLA.

When a developer has determined the overall risk, they need to follow the best practice measures identified in Sections 4 and 5. Flow charts summarising some of these measures have also been provided.

2.1 Air Pollution Risk Assessment Score Sheet for Construction Activities[11;12].

Name of Assessor	**Company Name**
Address of Construction Site	**Expected Date for construction Activities:**

Surrounding Environment.

Surrounding Environment 1:		
	Possible scores	**Score given**
*Is the site >30m from an AQMA?	**5**	
*Is the site <30m from an AQMA?	**10**	
Is the site within an AQMA?	**15**	
**measured from site boundary to nearest AQMA.*		

Surrounding Environment 2:		
	Possible scores	**Score given**
Is the site between 20m-1km from a main road (>10,000vpd)?	**5**	
Is the site <20m from a main road (>10,000vpd)?	**10**	
Is the site within 20m of a busy road junction*?	**15**	
*busy road junction defined as a combined flow of >10,000vpd from all directions.		

Surrounding Environment 3:		
	Possible scores	**Score given**
Are there residents >5m from the site?	**5**	
Are there residents <5m from the site?	**10**	

Surrounding Environment 4:		
	Possible scores	**Score given**
Are there any sensitive receptors within 30m of		

[11] *The term 'construction activities' used in this document includes all demolition, construction and associated activities on that site.*

[12] *The Scoring method used is based on that used by Defra to risk assesses industrial processes (IPPC) (see web link http://www.defra.gov.uk/environment/ppc/risk-laippc/laippc-risk.pdf). Distances used are based on modelling scenarios following procedures in Defra's LAQM Technical Guidance LAQM.TG (03.*

the site? (i.e. schools, hospitals, care homes, SSSIs etc)		
Yes	**10**	
No	**0**	
Surrounding Environment 5:		
	Possible scores	**Score given**
Is there any other construction work >20m of the site at the same time?	**5**	
Is there any other construction work <20m of the site at the same time?	**10**	

Surrounding Environment Total Score:	

Development of site.
*Complete either 1,2 or 3 then continue onto 4.

Development of site 1:		
	Possible scores	**Score given**
Is the site to be developed for business use >1000m^2?		
Yes	**7**	
No	**0**	

Development of site 2:		
	Possible scores	**Score given**
Is the site to be developed for residential use >10 dwellings?		
Yes	**7**	
No	**0**	

Development of site 3:		
	Possible scores	**Score given**
Is the site to be developed for mixed use and is either >1000m^2 or >10 dwellings?		
Yes	**7**	
No	**0**	

Development of site 4:		
	Possible scores	**Score given**
Is the site to be developed* in autumn or spring?	**3**	
Is the site to be developed* in winter?	**5**	
Is the site to be developed* in summer?	**7**	
Autumn = Sept, Oct, Nov. Spring = Mar, Apr, May. Winter = Dec, Jan, Feb. Summer = Jun, Jul,		

Aug. **The term developed is taken to refer to the majority of dust producing activities e.g. demolition and remediation activities*		

Development of site 5:		
	Possible scores	**Score given**
Is the planned length of works <20 weeks?	**3**	
Is the planned length of works between 20 – 52 weeks?	**5**	
Is the planned length of works >52 weeks?	**7**	

Development of site 6:		
	Possible scores	**Score given**
Will solid barriers be erected along the site boundary?		
Yes	**0**	
No	**5**	
Do the site works involve remediation/ earth moving works?		
Yes	**5**	
No	**0**	
Do the site works involve demolition works (including digging up and removal of over site concrete)?		
Yes	**5**	
No	**0**	

Development of Site Total Score:	

<u>Construction Activities.</u>

Construction Activities 1:		
	Possible scores	**Score given**
Will construction traffic (lorry) movements be <5 / day?	**5**	
Will construction traffic (lorry) movements be 5–10 / day?	**10**	
Will construction traffic movements be >10 / day?	**15**	
One lorry movement is defined as entering and leaving the site.		

Construction Activities 2:		
	Possible scores	**Score given**
Will a concrete crusher be used on site?		
Yes	**5**	
No	**0**	
Is there to be cement batching on site?		

Yes	**5**	
No	**0**	
Is Non-road mobile machinery to be used on site?		
Yes	**5**	
No	**0**	
Will there be stockpiles of materials?		
Yes	**5**	
No	**2**	
Will tools such as cement mixers, brick/concrete cutters be used on site?		
Yes	**5**	
No	**0**	

Construction Activities Total Score:	

Surrounding Environment + Development of Site + Construction Activities Total Score:	**Range 33 to 141**	

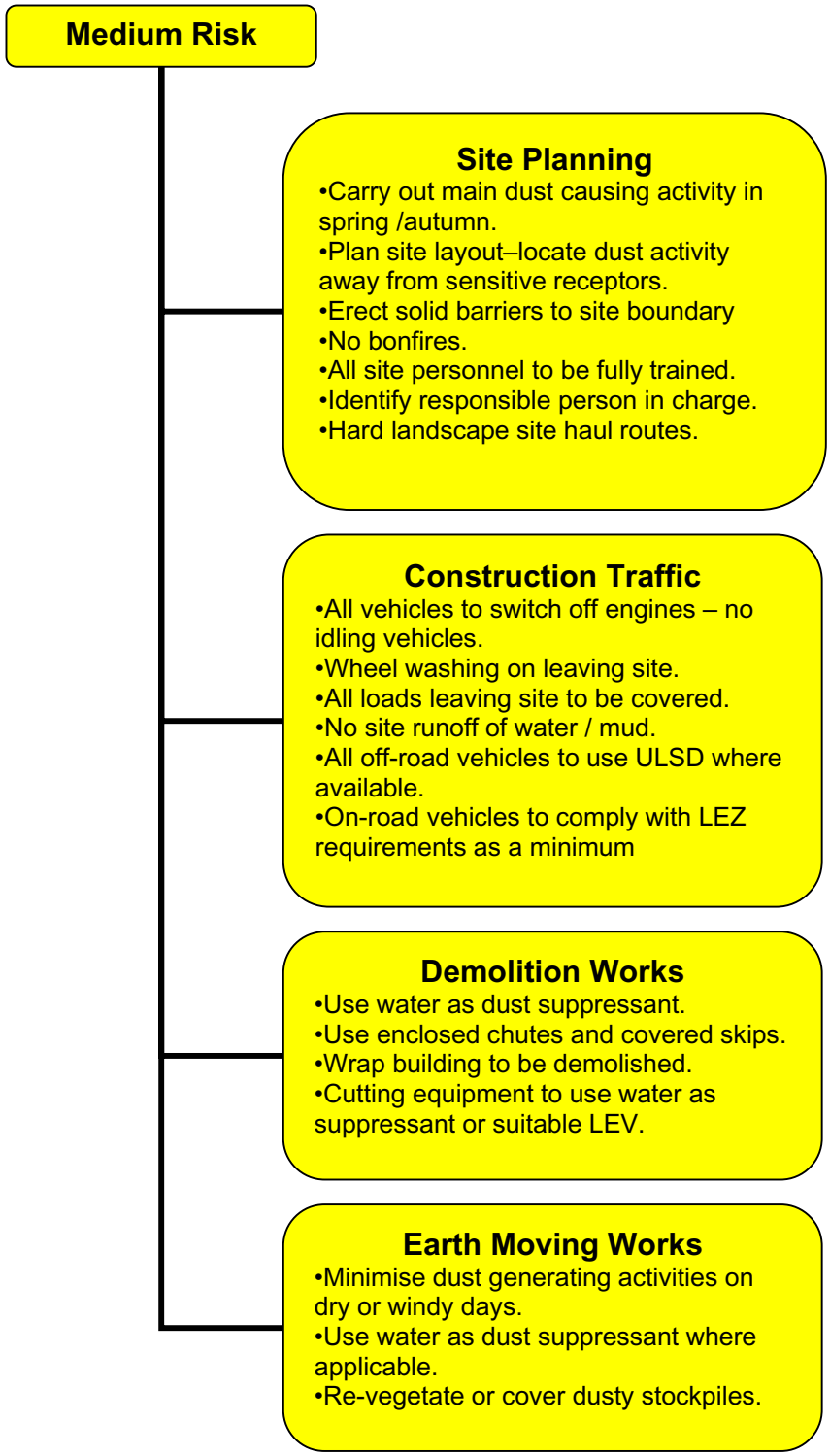
Risk Category: *High=score of >104,* *Medium=score of 71-103,* *Low=score of 33 – 70*	

2.2 Mitigation Measures for Low Risk sites:

Best Practice Measures such as:

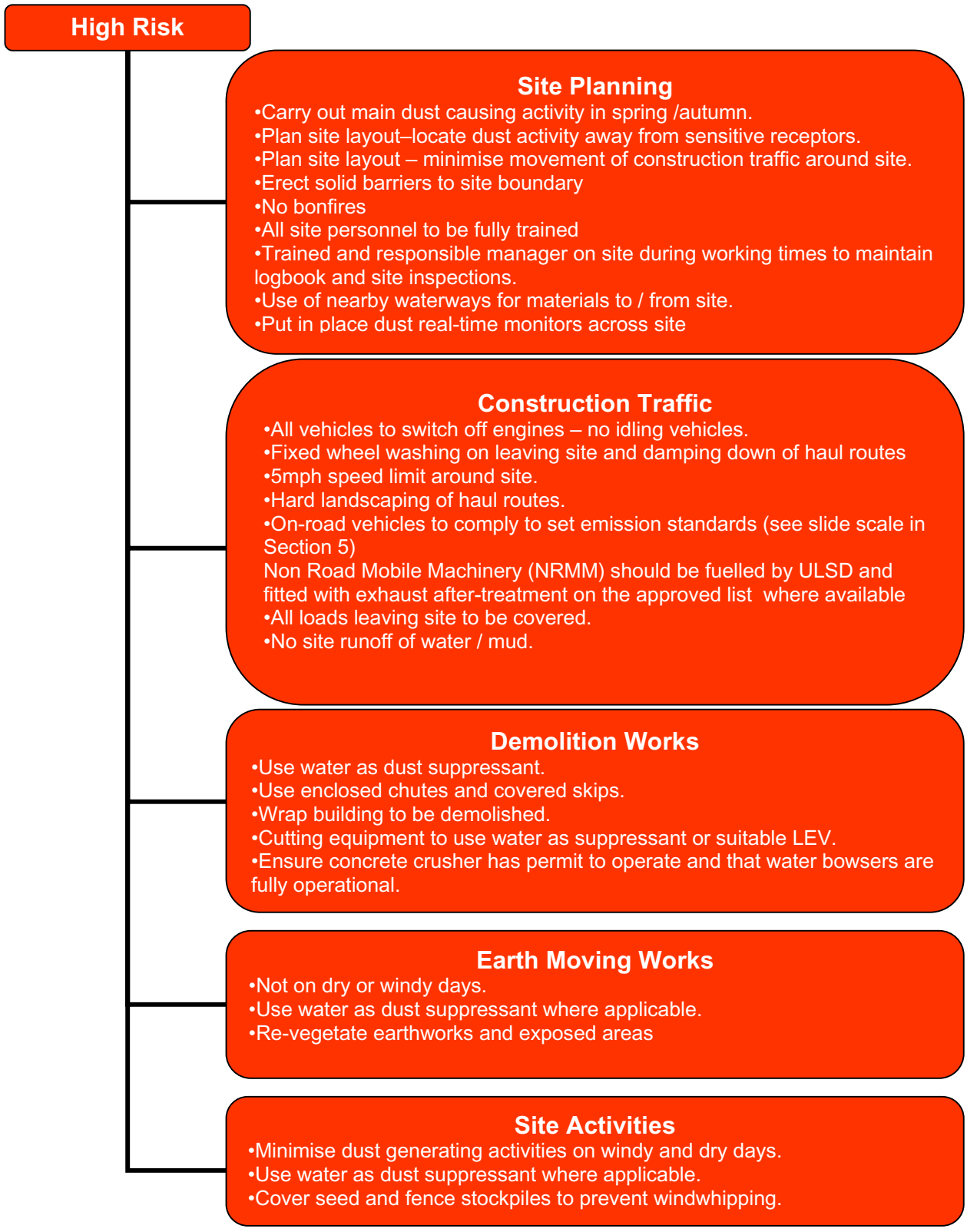
- No bonfires.
- Wheel Washing.
- Solid barriers to site boundary.
- Covered lorries leaving site.
- Cleaning road and footpath/pavement directly adjacent entrance to site.
- Water to be used as a suppressant for dust generating activities.

2.3 Mitigation Measures for Medium Risk sites:



Implementation of the suggested mitigation measures above will help reduce the impact of the construction activities to low risk.

2.4 Mitigation Measures for High Risk sites:



Implementation of the suggested mitigation measures above will help reduce the impact of the construction activities to medium; or even low risk.

3. Method Statement

A Method Statement should be submitted prior to any works being carried out. As well as the risk assessment, a method statement will include the proposed dust control measures and a timetable of dust generating activities. A method statement should cover all phases of the development and take into account all contractors or sub-contractors. A Method Statement could be required via a condition placed on the planning consent.

The content of a Method Statement will be determined by the risk assessment, but typical features to include are outlined below.

All sites:

- Summary of work to be carried out.
- Description of site layout and access – including proposed haul routes, location of site equipment including supply of water for damping down, source of water (wherever possible from recycled or grey water), drainage and enclosed areas.
- Inventory and timetable of all dust generating activities.
- List of all dust and emission control methods to be used.
- Timescale of dust producing activities.
- Details of any fuel stored on site.
- Identification of an authorised on-site responsible person. Ideally this person needs to have a knowledge of pollution control and vehicle emissions.
- Summary of monitoring protocols and agreed procedure of notification to the local authority nominated person (s).
- Details and procedure on using a site log book (to record information including exceptional incidents causing dust episodes and action taken, identification and details of vehicle washing, site inspections).

Additional information

Medium risk sites:

- List of chemicals to be added to water to improve dust suppression.
- If applicable, contact information for the main contractor and identification of a responsible person for all sub-contractors.

High risk sites:

- Inventory of all non-road mobile machinery (NRMM) to be used on site. Based on this list, appropriate after-treatment technology should be fitted to vehicles and plant, where applicable (see Appendix 5).
- Details of the contractor's workforce training in areas such as health and safety, best practice methods, site housekeeping, reporting procedures and communication. All staff should have brief training on site pollution policy, even if part of site induction.
- Provision of a detailed material handling plan.

Specific site issues:

Asbestos
For sites with potentially asbestos-containing materials, a separate method statement will need to be produced by a specialist asbestos treatment contractor. An independent professional should approve the statement to ensure that no person at work or member of public is exposed to a harmful release of asbestos during works. Further information on asbestos control is provided in Section 4.12 and the relevant regulations are outlined in Appendix 2.

Demolition
- Developers must notify the Building Control Team of the relevant local authority of any building demolition works under section 80 and 81 of the Building Act 1984. The local authority can then issue a counter notice.
- Developers should consider referring to the demolition protocol set up by the ICE (Institution of Civil Engineers) and CIWM (Institute of Waste Management)[13]. This protocol provides best practice on aspects such as building audits and use of recycled materials.

Contaminated Land
- The method statement may need to include contaminated land issues, in the context of identifying potential emissions to air.
- Details of specific control measures need to be provided for sites with potential contaminated land issues.
- Developers should refer to legislation and procedures such as EPA 1990, Building Regulations Approved Document C, PPS23 and CLR11 for more information.

[13] A report on the Demolition Protocol. ICE. (Commissioned by London Remade and prepared by EnviroCentre Ltd).

4. Dust control measures

Developers will need to ensure that all on-site contractors follow best practicable means (BPM) at all time to minimise dust and emissions. The following section identifies the activities that are most likely to produce dust and outlines BPM. Some of these measures are summarised in the flow diagrams in Section 2 and they are divided up according to the site risk. These measures have been intended to be stringent but achievable to deal with the specific pollution problems facing London.

4.1 Pre-site preparation

For all sites with areas of open ground that are close to receptors, contractors should follow best practice to prevent dust from being generated outside the boundary. The method statement is designed to ensure that machinery and dust generating activities are not located close (or in the direction of prevailing wind) to boundaries and sensitive receptors. For high risk sites, developers may need to carry out some monitoring before work begins to identify baseline dust levels. This information can be used to inform site design and layout.

4.2 Haul routes

4.2.1 Surface of roads:

Un-paved haul routes can account for a significant proportion of fugitive dust emissions, especially in dry or windy conditions, when the generation of dust through the movement of vehicles is exacerbated. It is recommended that to ensure good practice, contractors should ensure that hard surfaces or paving is used for all haul routes, even if routes are temporary.

Low Risk

- Use consolidated surfaces on roads near to residential areas.

Medium Risk

- Hard landscape (e.g. tarmac) all major haul routes through the site.
- Regularly inspect haul routes for integrity and repair if required.
- When the haul route changes, strip the tarmac off and re-use.

High Risk

- As for medium risk and lay roads to a camber to prevent puddles.

Example: Sweeper on tarmac haul road at Heathrow T5

4.2.2 Damping down:

Contractors will need to wash or damp down haul routes both within and outside the site. This is particularly important for sites close to residential properties or other

sensitive receptors. Contractors should consider the environmental and economic benefits of the use of water from groundwater sources on site, as opposed to bringing fresh drinking water onto site for the purpose of dust suppression. Where possible the source of water should be sustainable to maximise use and re-use of this resource. For example, water produced from dewatering can be used on site, as achieved as part of the CTRL contract at Stratford. The majority of water that is generated from dewatering is discharged into watercourses or soakaways. Under the Water Act 2003, dewatering processes now require an Abstraction Licence to ensure appropriate environmental management[14].

Low Risk

- Use approved wet methods or mechanical road sweepers on all roads during periods of dry weather.
- Clean road edges and pavements using wet methods.

Medium Risk

- Use approved wet methods or mechanical road sweepers on all roads at least once a day or consider using fixed or mobile sprinkler systems.
- Clean road edges and pavements using wet methods.
- Provide hardstanding areas for vehicles and regularly inspect and clean these areas.

High Risk

- Use fixed or mobile sprinkler systems to clean roads at least once a day.
- Where possible use sustainable sources of water, e.g. dewatering or extraction holes.
- Contact the Environment Agency to recycle any collected material or run-off water - according to legal requirements.
- Clean road edges and pavements using wet methods.
- Provide hardstanding areas for vehicles and regularly inspect and clean these areas.
- Consider requiring contractors to meet ENCAMS standard for detritus grading (e.g., Grade B)[15] - which essentially means that dust or debris deposited on public highways has to be removed.

Example: Mechanical Sweeper at CTRL

4.2.3 Vehicles:

To reduce dust created from vehicles (e.g. through contact of tyres on the road surface or dust blowing from materials carried), all contractors operating on medium or high-risk sites should carry out the following controls:

- Set site speed limits (5mph).

[14] www.environment-agency.gov.uk
[15] http://www.leq-bvpi.com/default.asp?Section=detritus

- Cover and secure any dusty material entirely with clean sheets.
- Wash vehicle wheels when leaving site – see section 4.3.

More information on controlling PM_{10} emissions from vehicle exhaust is provided in Section 5.

4.3 Site entrances/exits

Contractors should employ these control measures to help prevent dust being spread outside the site boundary by site vehicles at entrances and exits.

Low Risk
- None required if no nearby residents.
- Wheel-wash all vehicles entering and leaving the site close to residents.

Medium Risk
- Provide a control zone around the site boundary to protect residents (this could include an area of hardstanding).
- Provide wheel-washing facilities at the exits with hose pipes, adequate water supply and pressure and mechanical wheel spinners or brushes.

High Risk
- As for medium risk sites.
- Put in place procedures for effective cleaning of vehicles and inspection which should include total vehicle washing and ticketing of vehicles.
- Ensure that loading of materials is done with the lowest drop height.
- Vehicles carrying dusty materials should be securely covered before leaving the site.
- Enter all information, of vehicles entering/leaving site, in a log book.

Example: Washing facilities at entrance to Heathrow T5 site

4.4 Mobile crushing plant

This section only applies to construction sites that operate mobile crushing plant at some point. These are inherently dusty activities and will often be associated with other similar activities, so the sites will normally be classed as medium or high risk.

- Notify the local authority if a crusher is to be used (it has a duty to inspect the process). Mobile crushing plants are authorised as Part B processes, even if they are only temporary.

Example: CTRL, Kings Cross

- Refer to Process Guidance note PG 3/16 (04)[16] and use best available techniques (BAT) according to the guidance at all times (see Appendix 7).
- Keep a copy of the permit on-site.

4.5 Cement batching

As for mobile crushing plants, sites with cement batching plants will often be categorised as medium or high risk.

Developers following this guide should treat such plant as authorised Part B processes, even if temporary, and employ the same level of best practice as indicated below. Under EPA 1990, the local authority should be notified if a cement batcher is to be used as it has a duty to inspect the process:

- Refer to Process Guidance note PG 3/1 (04)[17] and carry out BAT (see Appendix 7).
- Wherever possible, these processes should be totally enclosed.

Example: Enclosed cement batching plant, Kings Cross Railway Lands

4.6 Excavation and earthworks

Excavation and earthworks activities can be a potential source of dust outside the site if they are not properly controlled, especially in dry and windy weather. If these activities are essential, then contractors need to act to minimise dust disturbance as much as possible.

Low risk

- All dusty activities should be damped down, especially during dry weather.
- Temporarily cover earthworks if possible.

Medium and High Risk

- As for Low Risk sites.
- Re-vegetate exposed areas to stabilise surfaces.

Example: Potential dust source from earthworking

[16] http://www.defra.gov.uk/environment/airquality/lapc/pgnotes/default.htm
[17] http://www.defra.gov.uk/environment/airquality/lapc/pgnotes/default.htm

- Only remove secure covers in small areas during work and not all at once.
- Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil.

4.7 Stockpiles and storage mounds

Contractors should avoid maintaining long-term stockpiles on site wherever possible. If necessary, the following measures should be in place:

Low Risk
- Make sure that stockpiles are maintained for the shortest possible time.
- Minimise drop heights to control the fall of materials.

Medium Risk
- As for Low Risk sites.
- Do not build steep sided stockpiles or mounds or those that have sharp changes in shape.
- Keep stockpiles or mounds away from the site boundary, sensitive receptors, watercourses and surface drains.
- Wherever possible, enclose stockpiles or keep them securely sheeted.

High Risk
- As for Low and Medium Risk sites.
- Take into account the predominant wind direction when siting stockpiles to reduce the likelihood of affecting sensitive receptors.
- Seed, re-vegetate or turf long term stockpiles to stabilise surfaces or use surface binding agents that have been approved by the Environment Agency.
- Re-use hard core material where possible to avoid unnecessary vehicle trips.

Example: Seeded stockpile at Heathrow T5

- Erect fences or use windbreaks (e.g. trees, hedges and earth-banks) of similar height and size to the stockpile to act as wind barriers and keep these clean using wet methods.
- Store fine or powdery material (under 3mm in size) inside buildings or enclosures.
- Contact the Environment Agency if you need to stockpile waste material, whose disposal is subject to the Waste Management Licensing Regulations (WMLR), 1994.
- Contact the Environment Agency to discuss potential flood risk issues, if the site is located in a floodplain.

4.8 Cutting, grinding and sawing

Ideally, these types of activities should not be conducted on site and pre-fabricated material should be brought in. In cases, where the work must take place, then the following techniques should be followed:

Low Risk
- All equipment should be fitted with water suppressant systems.

Medium and High Risk
- Use dust extraction techniques where available.
- All other equipment should be fitted with water suppressant systems.
- Use local exhaust ventilation.
- Service all fans and filters regularly to ensure they are maintained properly.

4.9 Chutes and skips

Low and Medium Risk
- Securely cover skips.
- Minimise drop heights.
- Regularly damp down surfaces with water.

High Risk
- As for Low and Medium Risk sites.
- Try to completely enclose skips whenever possible.
- Hard landscape areas where skips are stored.
- Reduce drop heights by using variable height conveyors or chutes.
- Regularly damp down surfaces with water.

4.10 Scabbling

Scabbling is the process of concrete grinding using a machine tipped with steel or carbide material to rapidly pound concrete. It is best practice to avoid scabbling on site and employ alternative strategies (see BRE guidance[18] for further information). However, if absolutely necessary, the following measures should be in place:
- Pre-wash work surfaces.
- Screen off work areas.
- Vacuum up all dusty residue rather than sweeping away.

4.11 Waste disposal/burning

Previous Government best-practice documents[17] state that under the Clean Air Act 1993, bonfires are not recommended on site and if unavoidable, they should be

[18] BRE 2004. Controlling particles, vapour and noise pollution from construction sites

supervised at all times. However, it is recognised across London that local authorities prefer to set conditions that prevent any bonfires on site. Taking into account the Clean Air Act 1993 and nuisance legislation (Environmental Protection Act 1990), this Best Practice Guide recommends that:

- No burning of any material is permitted on site.
- All excess material should not be wasted, but used or safely removed from site according to appropriate legislation.

High Risk

- In addition, the contractor should produce a waste or recycling plan following guidance from the Mayor's SPG on Sustainable Design and Construction[19]. Further information on waste plans is provided on the Environment Agency website[20] or in Appendix 2. The Environment Agency suggest that a waste plan includes the following best practice procedures:
    - Identify the waste types that are likely to be produced and aim to reduce the amount of waste as much as possible, i.e., identify routes to reuse or recycle materials.
    - Control access to storage to minimise risk of theft or damage.
    - Set up a dedicated store for timber, from which workers can re-use supplies.
    - Store any materials away from sensitive areas in fenced off areas.
    - Label all waste storage and skips, detailing the type of waste.
    - Employ a just–in-time policy to deliver materials in order to reduce the storage time on site.
    - Consider using recycled materials and recycle any materials used on site rather than disposing them (including timber, aggregates, soil, tarmac, bricks, masonry, concrete and glass). CIRIA provides lists of recycled materials that companies will accept[21].
    - If practicable, remove materials for recycling from buildings prior to demolition or from demolition spoil.

4.12 Dealing with spillages

For all sites, the following measures should be followed:

- Regularly inspect the site area for spillages.
- Clean spillages using wet handling methods.
- Vacuum or sweep regularly to prevent build up of fine waste dust.
- Material that is spilled on the site that is designated as waste (i.e. no longer fit for use) should be dealt with in accordance with WMLR, 1994.
- Inform the Environment Agency, London Fire and Emergency Planning Authority (LFEPA) or the Health Protection Agency (HPA) if harmful substances are spilled.

More information is provided by the Environment Agency in Pollution Prevention Guideline 6.

[19] GLA 2005. Draft SPG on Sustainable Design and Construction. The London Plan
[20] http://www.environment-agency.gov.uk/
[21] http://www.ciria.org.uk

4.13 Demolition activities

Potential dust hazards can be assessed according to the standard BS 6187: Code of Practice for Demolition[22] which includes all aspects of project development and management from demolition techniques to re-using or recycling materials. The demolition of buildings will result in a site being classified as medium or high risk during this activity.

Any asbestos must be dealt with by a registered contractor at all times and removed according to appropriate regulations (see Appendix 2) and approved codes of practice/HSE guidance such as EH10 and EH13 and MDHS100. Developers must carry out a Type 3 asbestos survey and undertake the following tasks:

- Notify the Health and Safety Executive of any work.
- Always employ competent and licensed contractors.
- Clearly identify the location of asbestos containing materials before starting work.
- Put in place procedures to sample and analyse suspect materials.
- Carry out independent air sampling to ensure standards are met.
- Dispose asbestos–containing materials to licensed waste sites according to HSE guidelines before the demolition company is given access.

Other examples of best practice in demolition are provided below:

- Sheet and screen buildings with suitable material and where possible strip inside buildings before demolition begins.
- Ensure that any asbestos is removed by a specialist contractor before demolition (see section 4.14).
- Materials should be removed from site as soon as possible. If stored, techniques covered in section 4.7 should be followed.
- Avoid explosive blasting where possible and consider using appropriate hand or mechanical alternatives.
- Bag and remove any biological debris or damp down before demolition.

Developers should refer to Sections 80-82 of the Building Act 1984 and the ICE Demolition Protocol.

4.14 Hazardous or contaminated materials

Under the Control of Substances Hazardous to Health (COSHH) regulations, 2002, developers must ensure that they take into account risks to the workforce from exposure to any harmful substances generated by work activities. Construction sites are also often associated with activities that emit volatile organic compounds (VOCs), such as use of paints, adhesives, bitumen products and concrete and timber treatments. Employ similar techniques according to appropriate legislation (Appendix 2) and always use low emission products that comply with the new EU Paints Directive[23].

[22] BS6187. 2000. Code of Practice for Demolition. BSI

[23] Paints Directive 2004/42/CE – consultation to transpose into UK regulations ended June 05

4.15 Other activities

Other activities that have the potential to generate dust without proper control include:

Sand, Grit and Shot Blasting
- Use wet processes, sheet areas and use silica-free material.

Planing and sanding
- Use fans and filters, dust suppression techniques and water sprays.

Fitting out
- Fit all machinery for activities such as plastering, sanding or rendering with dust suppression/collection equipment.
- Vacuum all waste material.

Welding and soldering
- Follow control measures in HSE guidance notes EH54 and EH55.

Example: Dust suppression at aggregate store, Heathrow T5

Tarmac laying and use of bitumen
- Do not overheat bitumen and cover pots.
- Use great care in all processes to prevent spillages and extinguish any accidental fires immediately.

5. Emission controls for vehicles and plant

Emissions from vehicles associated with construction sites can significantly add to levels of local air pollution, so it is important that best practical means of reducing vehicle emissions are adopted.

It is particularly important to note that diesel off-road vehicles and plant (known as non-road mobile machinery, NRMM) are not subject to as tight controls as road vehicles. Although they only make up a small proportion of total vehicles, emissions of oxides of nitrogen (NOx) and particulate matter (PM) can be significant. More work is needed to quantify this, but estimates in 1999 showed that UK NOx emissions from diesel NRMM were 71 kilo tonnes (approximately 8% of all road transport emissions) and 7 kilo tonnes of total PM emissions (16% of road transport emissions).[24]

Findings from the PRECIS working group showed that there was a case for early implementation of new European standards to control emissions from NRMM. This Best Practice Guide is committed to help achieve this by recommending minimum standards for both on-road and off-road vehicles associated with construction sites in London. These standards are explained in more detail below.

5.1 On-road vehicles

Low Risk

- If the London Low Emission Zone is implemented, then all commercial vehicles operating in London should meet the proposed emission standards, which are outlined in Appendix 6. In summary, all Heavy Goods Vehicles will need to meet Euro III PM10 emissions, as a minimum, in 2008. The standard would change to Euro IV for PM10 or the relevant particulate standard in force in 2010.

Medium and High Risk

- Up to 2008 and after a low emission zone is introduced, developers can voluntarily apply tighter emission standards to their vehicles and plant. This arrangement could be of benefit at sensitive locations and aid negotiations with the planning authority regarding operations on site.

5.2 Off-road vehicles and plant

Contractors can specify tax exempt 'red' diesel with a sulphur content equivalent to ultra low sulphur diesel (ULSD). This measure will automatically reduce particulate emissions by 30%. In addition to this, fitting diesel particulate filters can reduce the remaining particulates by at least 90%. As fine particulates are of great concern for health, this is therefore a very effective way of reducing any health impacts of workers and residents. For example, studies in the US have shown that workers and residents near construction sites near to NRMM not fitted with particulate filters were exposed to $PM_{2.5}$ exposure rates up to 16 times higher than at the site boundary. Similar results

[24] NETCEN. www.naei.org.uk

are seen in the UK, where monitoring at one construction site found 10 times more ultrafine particulates at the site boundary[25].

The use of exhaust after-treatment technologies such as particle filters is well documented over the last 30 years, particularly in other European countries (e.g. Sweden and Switzerland) where it is already a requirement to fit NRMM with exhaust emission controls. In Boston, USA – 200 plant were retrofitted with emission controls for the Big Dig project. A comprehensive range of exhaust after treatment systems (as a retrofit or as original equipment option) are now available for NRMM operating in London. More information on appropriate technologies is provided in Appendix 5 and details of emission controls for NRMM are given below:

Low and Medium Risk

- Where a bunkered fuel supply is available, all NRMM should use fuel equivalent to ultra low sulphur diesel (ULSD).

High Risk

- As for low and medium risk.
- All NRMM should comply with either the current or previous EU Directive Staged Emission Standards (97/68/EC, 2002/88/EC, 2004/26/EC) – recently transposed into UK regulations[26]. As new emission standards are introduced the acceptable standards will be updated to the previous and most current standard.
- NRMM with power outputs of over 37kW should be fitted with diesel particulate filters (DPF) conforming to a defined and demonstrated filtration efficiency (load/duty cycle permitting). This will start from the date that the accreditation system is in operation (see note (a)).
- The ongoing conformity of plant retrofitted with DPF, to a defined performance standard, should be ensured through a programme of on-site checks.

Note (a) – Details of appropriate types of machinery suitable for after-treatment and accredited diesel particulate filters will be found on the Energy Saving Trust website – www.est.org.uk .

5.3 Other controls

In addition to the emission standards specified above, the following measures should be put in place to reduce exhaust emissions.

Low Risk

- No vehicles or plant will be left idling unnecessarily.
- NRMM (vehicles and plant) should be well maintained. Should any emissions of dark smoke occur (except during start up) then the relevant machinery should be stopped immediately and any problem rectified.
- Engines and exhaust systems should be regularly serviced according to manufacturer's recommendations and maintained to meet statutory limits/opacity tests.

[25] PRECIS report of workshop on emissions from off-road vehicles, 2003
[26] The Non-Road Mobile Machinery (Emissions of Gaseous and Particulate Pollutants) (Amendment) Regulations 2005

- All vehicles should hold current MOT certificates where required.
- Vehicle exhausts should be directed away from the ground and positioned so they are not directed at site entrances.

Medium Risk
- As for low risk sites.
- Reduce number of vehicle movements e.g. Just-In-Time delivery of materials to ensure that only the materials needed for the job access the site.
- Set speed limits at 5mph on haul routes.
- Clearly label all vehicles associated with the contract.

High Risk
- As for low and medium risk sites.
- Where works on site occur near residential or sensitive areas near the site boundary, non-essential vehicles and machinery should not enter these areas.
- Clearly label all vehicles associated with the contract.
- Control of queuing or parked vehicles outside the site is required, both during and before the site opens.
- Avoid use of diesel or petrol powered generators by using mains electricity or battery powered equipment where possible and if safety concerns can be overcome.
- Encourage developers to use consolidation centres to manage their site deliveries. This will help reduce the number of vehicles entering the site, so will have both congestion and emission benefits.
- Locate plant away from the boundaries near to residential areas.

5.4 Use of rivers, canals or railways

Where construction sites are located near to waterways or railways it may be feasible for construction materials to be delivered or removed from the site using these means, other than by road. The obvious benefit of this is that it will reduce the number of trips made by HGVs on local roads – therefore reducing local emissions and disturbance to residents. This option is rarely used in London, so developers following this guide, should try to make use of the waterways wherever possible or investigate if there is spare capacity on nearby railways.

An example of this was done by the London Borough of Greenwich, which set a planning condition to use the River Thames for construction materials transported to the Millennium Dome site on the Greenwich Peninsula.

6. Site monitoring protocols

If best practicable means identified in Sections 4 and 5 are followed correctly, then formation of dust and harmful emissions from construction sites should be minimised as much as possible. However, continuous site monitoring is still an important way of helping contractors manage dust and PM_{10} emissions from construction and demolition. This section specifies monitoring protocols that should be followed according to the identified risk of the site.

Monitoring of PM_{10} particulates as well as dust deposition and soiling should be carried out to some extent on all sites. If possible developers should determine the baseline situation before construction begins. This will also help identify the risk level of the site.

As a rule, monitoring should be carried out along a transect (straight line) across the construction site, set up in the direction of the prevailing wind. This will allow the contractor to take into account background levels to determine the relative contribution that emissions and dust from the construction site.

6.1 Low risk sites

- Employ best practice methods at all times.
- Take into account the impact of dust and particulates on occupational exposure standards to minimise worker exposure and breaches of air quality objectives that may occur outside the site boundary.

6.2 Medium risk sites

- Determine the prevailing wind direction across the site from several months data from a nearby weather station.
- Set up a transect across the site according to the direction of the prevailing wind.
- Operate a minimum of two particulate monitors, such as light scattering devices to monitor PM_{10} levels at either end of the transect outside the site boundary. These instruments provide data that can be downloaded in real-time.
- If relevant, supplement monitoring with hand held monitors to get on the spot readings at selected points such as close to sensitive receptors.
- Monitor dust deposition and spoiling rates as these can be used to indicate nuisance (see Appendix 4).

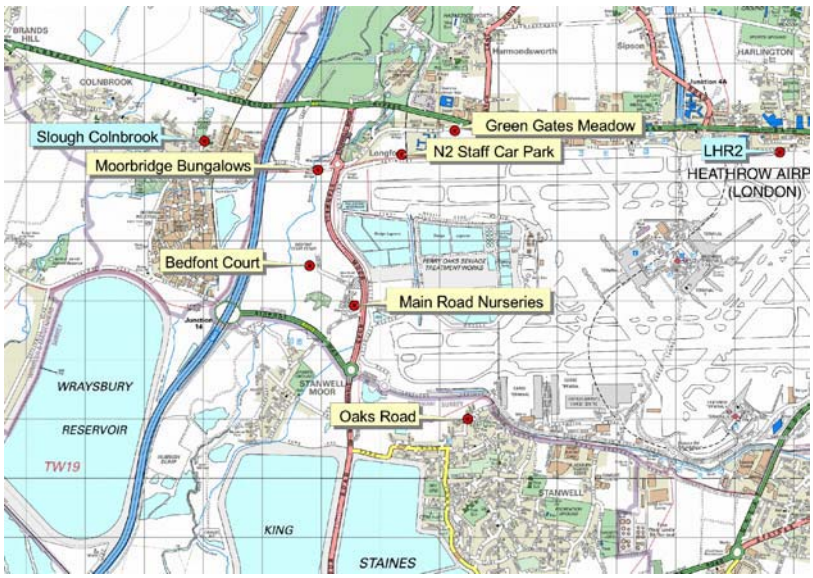
6.3 High risk sites

- Determine prevailing wind direction as for medium risk sites or by setting up a weather station on site to measure local wind direction and speed.
- Operate a minimum of 2 automatic particulate monitors (such as TEOMs or equivalent) along the transect line – both within and outside the site boundary.

- If applicable, supplement with low cost automatic monitors (such as light scattering monitors) or hand-held monitors, particularly focusing on any sensitive locations such as schools.
- Carry out dust deposition and spoiling rate assessments following recommended procedures (see Appendix 4).
- Carry out a visual inspection of site activities, dust controls and site conditions (i.e. a daily dust log).
- Identify an on-site person responsible for site monitoring that can access real-time PM_{10} data from automatic monitors (e.g., at hourly or 15 minute intervals). Ensure that adequate quality assurance/quality control is in place.
- Agree a procedure to notify the local authority, so that immediate and appropriate measures can be put in place to rectify the problem. Alert mechanisms could include email, texts or alarm systems. See section below.
- Set up 24 hour phone hotlines so that residents can complain about high dust or PM_{10} levels directly. Consider circulating summaries of monitoring results to the local community.

Example: Heathrow T5

Air quality is continuously monitored at seven automatic air quality monitoring stations located around the T5 construction site with PM_{10} and $PM_{2.5}$ measured at all locations, NOx concentrations at three of the sites, and CO, SO_2, O_3 and met data are collected at one location (see map). Dust soiling rates are also monitored at 19 locations, close to potentially sensitive receptors. Monitoring began 18 months prior to the commencement of the construction works to determine the background air quality and determine PM_{10} response threshold levels and site-specific dust action levels. The T5 Project Team is responsible for ensuring that PM_{10} concentrations remain below these thresholds or, if a response threshold is exceeded, implementing an action plan to reduce emissions.



Both air quality and dust monitoring data is disseminated to the Local Authorities via a secure website. The database that stores the monitoring results also compares each measurement against the relative action level and the T5 Project team is alerted by an automated e-mail if any action level is exceeded.

6.4 Site action levels

It is common procedure in other countries to set a maximum action level for PM_{10} concentrations at the boundary of a work site. For example, a limit of 150 $\mu g/m^3$ is typically set downwind of hazardous waste sites in the US. If this is exceeded, the contractor should monitor upwind and if this concentration is greater than 100 $\mu g/m^3$ above background and there is visible dust outside the site, additional controls should be put in place (e.g. personal protection for workers or suspending work if levels don't go down). In Hong Kong, two limits are set for dust from construction sites – 260 $\mu g/m^3$ over 24 hours (where the baseline is 200 $\mu g/m^3$ or above) and 500 $\mu g/m^3$ over 1 hour (where the baseline is 384 $\mu g/m^3$ or above). The one hour limit is designed to prevent any complaints.

Based on these procedures, this document recommends that developers should set a site action limit based on the risk assessment and background PM_{10} level and this should be agreed by the local authority in advance. For example, developers should consider setting a limit of ***250 $\mu g/m^3$ over 15 minutes (or 200 $\mu g/m^3$ for TEOM measurement)*** – especially important for high risk sites. If this site is breached despite BPM, then activities on the construction site may need to be halted until the situation improves.

7. Legal framework for the Best Practice Guide

It is accepted that all developers should take elements of this Best Practice Guide into account depending on the level of risk identified for the particular construction site. Where possible, best practice mitigation measures should be carried out at all times, although it may be impossible to fully comply with the guide for certain emergency works. In these cases, the developer should provide the local authority with as much notice as possible.

A list of relevant legislation and regulations that developers should refer to is given in Appendix 2. A brief explanation of these regulations is provided for information purposes and is not an authoritative statement of the law. There are also likely to be other relevant acts or legislation that are not covered in Appendix 2. This document does not supersede any new legislation that may be introduced.

Recent guidelines in PPS23 Annex 1 paragraph 1.48 regarding planning conditions states "*planning conditions could be used in respect of […] impacts such as noise, vibrations, odour, air pollutants and dust from certain phases of the development such as demolition and construction*". It is therefore appropriate to use this Best Practice Guide to inform planning conditions. Prior approval of the best practice guide using the planning system in this way should avoid the need to deal with enforcement issues under EPA 1990. However, it is up to the individual local authorities to decide whether a condition is appropriate and what level of enforcement is needed. However, it may be necessary for the local authority to set site-specific conditions for developments. More information on standard conditions can be found in the ALG Planning Guidance[27]. In order to achieve the aims of the Best Practice Guide it will be important to undertake negotiations early on in the planning process.

Example of a planning condition at LB Newham
All commercial road vehicles used on the construction project must meet the European Emission Standards (commonly known as Euro standards) of Euro 3 during any works that take place from the date of this consent and Euro 4 for any works that takes place from 1 January 2008. In the event of any new European Emission Standards being introduced after 2006 the standards shall be applied to all road vehicles serving the construction project within a period of 2 years after the date of introduction contained within the relevant EU Directive.

All non-road mobile vehicles with compression ignition engines used within the site must comply with emission standards set in EC directive 97/68/EC. Vehicles must meet Stage II limits from the start of contract and from I January 2012, meet Stage IIIa and b emission limits.

Exemptions to the above standards (for road and non-road vehicles) may be granted for specialist equipment or for equipment with alternative emission reduction equipment or run on alternative fuels. Such exemptions shall be applied for in writing to the LPA in advance of the use of such vehicles, detailing the reasons for the exemption being sought and clearly identifying the subject vehicles. Exemptions that are granted will be in writing and such vehicles must not be used until written exemption has been received by the applicant.

[27] Revised ALG Air Quality and Planning Technical guidance (draft), 2005

No vehicles or plant to which the above emission standards apply shall be on site, at any time, whether in use or not, unless it complies with the above standards, without the prior written consent of the local planning authority.

Any diesel powered machines used on, or otherwise serving the site, must be run on ultra low sulphur diesel (also known as ULSD 'cleaner diesel' or 'green diesel'). "Ultra low sulphur diesel" means fuel meeting the specification within BS EN 590.

Reasons: To protect the amenity of future occupants and/or neighbours and with regard to policy EQ45 of the London Borough of Newham Unitary Development Plan (adopted June 2001).

Appendix 1. Glossary

ALG	Association of London Government
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
BAT	Best Available Techniques
BPM	Best Practicable Means
BRE	Building Research Establishment
DPF	Diesel Particulate Filter
Dust	Particles with a diameter up to 75 μm
CIRIA	Construction Industry Research and Information Association
CIWM	Chartered Institute of Waste Management
COMEAP	Committee of Medical Effects of Air Pollution
CNG	Compressed Natural Gas
COSHH	Control of Substances Hazardous to Health
CTRL	Channel Tunnel Rail Link
DEFRA	Department of Environment, Food and Rural Affairs
DPF	Diesel Particulate Filter
EA	Environment Agency
EPA 1990	Environmental Protection Act (1990)
EST	Energy Saving Trust
GLA	Greater London Authority
GOL	Government Office for London
HGV	Heavy Goods Vehicle
HSE	Health and Safety Executive
HPA	Health Protection Agency

ICE	Institution of Civil Engineering
LAQM	Local Air Quality Management
LAPC	Local Air Pollution Control
LAPPC	Local Air Pollution and Prevention Control
LEZ	Low Emission Zone
LFEPA	London Fire and Emergency Planning Authority
LPG	Liquefied Petroleum Gas
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NRMM	Non Road Mobile Machinery
ODPM	Office of Deputy Prime Minister
PG	Process Guidance
$PM_{2.5}$	Fine particles with a diameter less than 2.5 micro-metres
PM_{10}	Particles with a diameter less than 10 micro-metres
PPS	Planning Policy Statement
RPC	Reduced Pollution Certificate
SAC	Special Area of Conservation (EU Habitats Directive)
SPA	Special Protection Area (EU Birds Directive)
SPG	Supplementary Planning Guidance
SSSI	Site of Special Scientific Interest
TEOM	Tapered Element Oscillating Monitor
TfL	Transport for London
TSP	Total Suspended Particles
ULSD	Ultra Low Sulphur Diesel
VOC	Volatile Organic Compounds

Appendix 2. Relevant legislation and guidance

UK Acts of Parliament

This section provides a summary of some of the major Acts of Parliament that local authorities can use to control dust and emissions from construction and demolition sites.

Environmental Protection Act (EPA) 1990 and Pollution Prevention and Control (England and Wales) Regulations 2000

Part 1 of the EPA 1990 contains two methods of pollution control

a) Integrated Pollution Control (IPC) – regulation of the larger polluting processes (Part A) by the Environment Agency
b) Local Air Pollution and Prevention Control (LAPPC) – regulation of smaller, less polluting processes (Part B)

From 1 August 2000, regulation of processes has been transferred to the Pollution Prevention and Control (England and Wales) Regulations 2000. Certain activities relevant to construction sites are regulated as Part B processes and have their own process guidance (PG) and/or additional guidance notes, including:

- Mobile Crushing and Screening Processes- PG 3/16 (04)- revised draft 2001
- Quarry Processes (Aggregates)- PG 3/8 (96) – revised draft 2001
- Blending, Packing, Loading and use of Bulk Cement- PG 3/1 (04)
- Asbestos- PG 3/13 (95) and AQ 3(96)
- Plaster Processes- PG 3/12 (95) – revised draft 2001
- Lime Processes – PG 3/14 (95) – revised draft 2001
- Cement Processes - AQ14 (92)
- Mobile Plant AQ 9(92)

Part II makes provisions relating to the management of waste duty of care for its proper disposal, for example Part 2 33(c) states that a person shall not treat, keep or dispose of controlled waste in a manner likely to cause pollution of the environment or harm to human health. Part III of the Act allows local authorities to take action to abate statutory nuisances such as dust, steam, smell, fumes from construction site that is deemed prejudicial to health or a nuisance. Dark smoke emissions are dealt with separately under the Clean Air Act 1993.

Greater London Authority Act 1999

This Act set up the Greater London Authority and functional bodies (Transport for London, Metropolitan Police Authority, London Fire and Emergency Planning Authority and the London Development Agency). The GLA is a unique form of strategic citywide government. It is made up of a directly elected Mayor and a separately elected Assembly. The Mayor has an executive role, making decisions on behalf of the GLA. The Mayor has published his statutory strategies on transport, spatial development, economic development and the environment. They contain policies to improve London's economy, infrastructure and environment and the most relevant to this Best Practice Guide are the London Plan, Mayor's Transport Strategy and Mayor's Air Quality Strategy.

Environment Act 1995 and Air Quality Regulations 2000
The Air Quality Strategy set standards and objectives for air pollutants under Part IV of the Environment Act 1995. Local authorities have a responsibility to carry out a process of Local Air Quality Management and work towards objectives set for seven pollutants in the Air Quality Regulations. Of these, the most relevant for construction sites is PM_{10}, for which a short term (24 hour) and long term (annual average) objective have been set.

Clean Air Act 1993
Under the Clean Air Act 1993, the burning of infected timber and waste is exempt in cases where transportation may have cross- infected wooden backed vehicles. However, emitting dark smoke from bonfires is an offence under this act.

Building Act 1984
Applies to demolition of buildings and requires prior notification to the local authority and production of a method statement before work begins. Sections 80-82 concern procedures to be carried out by the person who intends to undertake demolition. Under Section 80, the developer must notify Building Control at least 6 weeks before work begins. The local authority will often issue a counter notice that requires certain tasks to be carried out first.

Health and Safety at Work Act 1974
The purpose of this act is to secure the health, safety and welfare of person at work and to protect against risk to other persons from these activities. Under this act the Health and Safety Executive (HSE) issue sets of guidance notes, the most relevant to construction activities include:

- Working with asbestos cement and board- HSG189/1, HSG 189/2.
- Dust: general principles of protection-EH44.
- Respirable crystalline silica-EH59.
- Man-made mineral fibres-EH46.
- Ventilation of the workplace-EH22.
- Assessment of exposure to fumes from welding and allied processes-EH54
- The control of exposure to fumes from welding, brazing and similar processes-EH55.
- Occupational Exposure Limits-EH40.
  - Asbestos: exposure limits and measurements of airborne dust concentrations -EH10.
- Asbestos 1988-HS13.
- BS 6187:1982 Code of Practice for Demolition.

The following regulations and guidance are also important to consider when dealing with dust and emissions from construction sites:

Control of Substances Hazardous to Health Regulations (COSHH) 2002
These regulations apply to all “very toxic, toxic, harmful, corrosive or irritant” substances. This includes dust of any kind when present in the air. These regulations mean employers must protect their employees. This includes a requirement to comply with exposure limits in the HSE publication EH40, which is published annually[5] (see Table 1 and 2 that relate to materials from construction).

Control of Asbestos in the Air Regulations 1990
All scheduled asbestos works that involve the "use of asbestos" must meet an emission limit to the air of 0.1mg/m^3. These regulations require asbestos to be monitored at intervals of not less than 6 months.

Control of Asbestos at Work Regulations 2002
This regulation covers occupational exposure to asbestos by imposing duties on employers to protect employees who may be exposed to asbestos. HSE Guidance note EH10 provides exposure limits and information of the measurement of airborne dust concentrations.

Control of Lead at Work Regulations 2002
This regulation replaces the 1998 regulations and requires employers to assess risks from exposure to lead in the workplace and to take steps to prevent or reduce exposure.

The Control of Pollution (Special Waste) Regulations 1980 (amended 1988)
These regulations define a system to trace special or special waste from the point of origin to final disposal, including transfer, subdivision, and any other change.

Construction (Design and Management) Regulations 2000 – amended
These regulations are relevant to all stages and activities of construction and demolition work as they aim to improve the management and co-ordination of all health, safety and welfare aspects throughout construction projects to reduce the number of accidents.

Waste Management Licensing Regulations (WMLR) 1994. Schedule 3 and Special Waste Regulations 1996.
Procedures to manage contaminated and un-contaminated waste and deal with waste licenses.

The Non-Road Mobile Machinery (Emissions of Gaseous and Particulate Pollutants) Regulations 1999 and Amendment Regulations 2005
Transposes stringent requirements to reduce emissions from diesel engines of non-road mobile machinery in EU directives 97/68/EC, 2002/99/EC and 2004/26/EC. These regulations tighten the emission standards in two stages – Stage IIIA from 2006-8 and Stage IIIB from 2011-12 to reduce NOx, HC and particulate emissions.

Planning Guidance

The London Plan
The London Plan provides the framework for the Mayor to produce more detailed strategic guidance on issues which cannot be addressed in sufficient detail in the plan. To provide detailed advice on its policies, Supplementary Planning Guidance (SPG) and Best Practice Guidance (BPG) documents are being produced.

The Mayor is responsible for strategic planning in London. He has a wide range of duties and powers. The government has set out guidance and advice on the Mayor's

planning duties and powers. His duties include producing a Spatial Development Strategy for London – called the London Plan – and keeping it under review. The London Plan replaces existing strategic guidance, it forms the development plan for each borough together with the borough's development plan documents, which themselves must be in “general conformity” with the London Plan.

The Greater London Authority (GLA) Act 1999 requires that the London Plan deals only with matters that are of strategic importance to Greater London. The required content of the London Plan is set out in a government guidance note (Circular 1/2000). The GLA Act also requires that the London Plan takes account of three crosscutting themes:

- The health of Londoners.
- equality of opportunity.
- its contribution to sustainable development in the UK.

Draft Supplementary Planning Guidance Sustainable design and construction
This draft SPG has been produced to provide additional information to support the implementation of the London Plan - Policy 4B.6 relates to sustainable design and construction and sets the context for this SPG. This document cannot set new policy but it can be taken into account as a further material consideration so has weight as a formal supplement to the London Plan. The draft SPG is applicable to all building types and associated spaces, with specific information on different building types provided where relevant.

The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999
For major developments over certain thresholds (Schedule I and II applications), the developer must submit an environmental impact assessment (EIA) to the local authority before planning consent is granted. The EIA sets out the likely impacts on the environment of the proposed development (from all stages including demolition and construction) and must include measures to mitigate any significant negative effects.

Planning and Policy Statement 23 (PPS23): Planning and Pollution Control
This guidance sets out the government’s core policies on pollution control (air and water quality and contaminated land) with respect to land-use planning. PPS23 advises that air quality impacts arising from a development is capable of being a material planning consideration. Annex 1 Section 1.50 sets out cases where it is necessary to use planning conditions to control pollution, such as for construction and demolition phases or the need for planning agreements in situations where planning conditions are inappropriate.

NSCA guidance 2004: Development Control: Planning for Air Quality
This new guidance provides a framework for air quality considerations to be included in the development control process and provides a new approach to addressing air quality impacts. The document aims to improve communication between developers, planners and environmental health officers.

Environment Agency guidance:

Pollution Prevention Guidelines 1: General Guide to the Prevention of Pollution.
Pollution Prevention Guidelines 6: Working at Construction and Demolition Sites.
Pollution Prevention Guidelines 5: Works in, near or liable to affect watercourses.

Appendix 3. Standards and guidelines

Air quality objectives in the National Air Quality Strategy

Table 1 Air Quality Strategy Objectives in Air Quality Regulations

Pollutant	Air quality objective	Concentration measured as	Date
Fine particles (PM_{10})	No more than 35 days above 50 μg/m^3	Daily mean	31st Dec 04
	40 μg/m^3	Annual mean	31st Dec 04
	No more than 10 days above 50 μg/m^3	Daily mean	31st Dec 10*
	23 μg/m^3	Annual mean	31st Dec 10*
Nitrogen dioxide	No more than 18 hours above 200 μg/m^3	Hourly mean	31st Dec 05
	40 μg/m^3	Annual mean	31st Dec 05
Sulphur dioxide	No more than 24 hours above 350 μg/m^3	Hourly mean	31st Dec 04
	No more than 3 days above 125 μg/m^3	Daily mean	31st Dec 04
	No more than 35 times above 266 μg/m^3	15 minute mean	31st Dec 05
Carbon monoxide	Maximum 10 mg/m^3	Running 8 hour mean	31st Dec 03
Benzene	5 μg/m^3	Annual mean	31st Dec 10
1,3 butadiene	2.25 μg/m^3	Running annual mean	31st Dec 03
Lead	0.5μg/m^3 0.25 μg/m^3	Annual mean	31st Dec 04 31st Dec 08

*Not prescribed in regulations

Deposited dust guidelines for urban areas (based on monthly mean dustfall)[28]

Table 2. Examples of dust guideline levels

British standard gauge *(mg/m^2/d)*		Dry Frisbee gauge equiv *(mg/m^2/d)*	
Complaints possible (90th percentile)	Complaints likely (95th percentile)	Complaints possible	Complaints likely
150	190	200	260

Soiling rates

1) Sticky pads

Possible complaints: 0.5% Effective Area Coverage (EAC)/day (34 μg/m^3)

Serious complaints: 5% EAC/day (280 μg/m^3)[29]

[28] Vallack & Shillito. 1998. Atmospheric Environment 32, p2737-2744

[29] Beaman & Kingsbury 1981 Clean Air 11(2), p77-81

2) Glass slides
A level of 20-25 su/week, averaged over 4 weeks appears to be the boundary between acceptable and unacceptable dust levels[30]

Occupational health standards[31]:

Table 2 Maximum Exposure Limits (MEL) – substances that may cause most serious health effects for which "no adverse effect level" can be determined

Material	**Long term MEL (8h TWA) mg/m^3**
Hardwood dust	5
Softwood dust	5
Silica (Respirable crystalline)	0.3
Man-made mineral fibre	5

Table 3 Occupational Exposure Limits (OEL) – set at level where there is no indication of risk to health of workers

Material	**Fraction**	**Long term OEL (8h TWA) mg/m^3**
Calcium carbonate	Inhalable Respirable	10 4
Calcium silicate	Inhalable Respirable	10 4
Coal dust	Respirable	2
Emery	Inhalable Respirable	10 4
Gypsum	Inhalable Respirable	10 4
Limestone	Inhalable Respirable	10 4
Marble	Inhalable Respirable	10 4
Mica	Inhalable Respirable	10 4
Plaster of Paris	Inhalable Respirable	10 4
Portland Cement	Inhalable Respirable	10 4
Ground granulated blast furnace slag	Inhalable Respirable	10 4
Pulverised Fuel Ash	Inhalable Respirable	10 4
Silica (amporphous)	Inhalable Respirable	6 2.4
Silica (fused)	Respirable	0.08
Silicon carbide	Inhalable Respirable	10 4

[30] Moorcroft & Laxen. 1990 Assessment of dust nuisance Env Health, p215-217
[31] HSE. 2002 EH40. Occupational Exposure Limits

Appendix 4. Monitoring techniques

There is a wide range of sampling and detection methods available. Some of the main techniques are indicated below:

1. Automatic real-time point analyser methods
Provide high-resolution measurements (typically hourly or shorter time periods). In order to ensure that data is accurate and reliable, there needs to be a high standard of maintenance, calibration and QA/QC procedures in place. These types of monitors can measure different particulate fractions such as PM_{10} and $PM_{2.5}$ when fitted with designated inlet heads. Monitors such as TEOM or beta-attenuation analysers (with heated inlets) need to be corrected by a factor of 1.3, when comparing results with the AQS objectives, as these are based on a gravimetric standard.

2. Gravimetric monitoring
This monitoring method is considered to be the most accurate and produces concentrations equivalent to the EU reference samplers, which are used to set EU limit values. Such systems have designated inlet heads to measure different particulate fractions and a typical measurement is taken over 24 hours. The measurement system is time-consuming as filters need to be individually weighed and accurate filter weighing and conditioning facilities are required. This method can be used as a trigger system as it does not produce instantaneous readings.

3. Remote optical/long path analysers
These are relatively low-cost automatic analysers that have been developed specifically for portable or personal exposure applications. These tend to be battery or mains powered and use the light scattering principle to measure PM_{10} and other particulate fractions.

4. Hand-held monitors
Although these types of monitors are not as accurate as automatic monitors and cannot be used for long term studies, they are ideal for walk-over surveys of construction sites as they provide real time or instantaneous dust readings (every second). Such monitors can be set up to measure different particle sizes and can be used to assess short term peaks and breaches of set limits.

In measures 3 and 4, a factor is used to convert the measured number of particles in each size range to an overall mass concentration – which may not be accurate without a gravimetric filter backup.

In addition to the individual monitors, other site infrastructure is often required. This particularly refers to automatic monitors and can include equipment housing, air-conditioning or heating systems, electrical systems, telephone lines or modems and air sample inlet systems.

Automatic monitoring equipment should have had some independent verification of performance, such as the MCERTS scheme. Further information on siting requirements and equipment suppliers is available on the National Air Quality Information Archive at www.airquality.co.uk.

5. Dust assessment

Approaches to measure the amount of dust deposited on a surface tend to focus on either determining the soiling of a surface by a change in its properties or determining the quantity of dust deposited, by weight. These techniques are often used to determine nuisance and may be requested by a local authority in cases of complaint from sensitive receptors. Accepted methodologies include:

Deposit gauges: These are simple, but accurate methods to measure nuisance dust. Dust is collected onto a horizontally mounted capture container, or in the case of a Directional Dust Gauge, into four vertical tubes aligned in different directions. The dust collected can also be analysed to determine its composition.

Soiling Rate Measurement: This is used to determine changes in the soiling rates of surface over a period of time. The most popular method is the Sticky Pad system to measure the soiling on a white adhesive surface over a known period. This provides a measurement of the deposition (as percentage Effective Area Coverage per day) using a reflectometer. Alternatively, glass slides can be used which is exposed for a week before returning to the lab to measure changes in reflectance. Results are measured in soiling units (su) per week, whereby 20 su/week reflects a dusty activity.

Appendix 5. List of suitable after-treatment relative to equipment type

Appropriate lists are currently being developed by the Environmental Industries Council, the Society for Motor Manufacturers and Traders and the Construction Equipment Association, in conjunction with the Energy Saving Trust.

Unfortunately this information is not available at the time of printing, but it is proposed that further details will be made available on the Energy Saving Trust website in due course.

Appendix 6. Low Emission Zone for London

The Mayor of London has a statutory duty under the GLA Act to take steps towards achieving the national air quality objectives for London. In his Air Quality Strategy the Mayor proposed a feasibility study into a low emission zone (LEZ). He has subsequently instructed Transport for London (TfL) to set up a London-wide LEZ for 2008. London Local authorities are in general support of these proposals. The Mayor and Transport for London are currently taking the LEZ proposal forward and details will be included in revisions to the Mayor's Transport and Air Quality Strategies.

The primary objective of the proposed Low Emission Zone is to improve the health and quality of life of people who live and work in London, through improving air quality. A secondary objective is to move London closer to achieving its Air Quality Targets for 2010, in support of the Government's National Air Quality Strategy (NAQS). Under present circumstances there are significant areas of London that would fail to meet the targets for particulate matter (PM_{10}) and nitrogen dioxide (NO_2), which are the pollutants that impact most on human health. Indeed, exceedences of the PM_{10} objective already occur in London.

By reducing overall PM_{10} and NO_x (including NO_2) emissions emitted in London by diesel-engine vehicles, the LEZ would help to reduce the overall area of London that exceeds the NAQS targets. This in turn would have positive health benefits for the London community.

The proposed London LEZ would discourage the entry of the worst polluting vehicles into the Greater London area. The scheme would initially target Heavy Goods Vehicles (HGVs), buses and coaches based on their emission standards. TfL buses and taxis will already be compliant through contracts and licensing arrangements. The LEZ would be implemented from early 2008.

At the time of writing this document, TfL were undertaking consultation on the proposed scheme, including the emission standards. The Mayor proposes that by 2008 an emission standard of Euro III for PM10 will need to be met, i.e. pre Euro, Euro I or Euro II vehicles would be allowed entry if fitted with suitable abatement technology; a particulate trap would be suitable in many cases. Vehicles already meeting Euro III emission standards and above would already be compliant). This would change to Euro IV for PM10 or the relevant particulate standard in force in 2010. For 2010 the proposed standard would be Euro IV compliance level for PM_{10}. TfL will continue to investigate further the options for the proposed LEZ, including the additional option of Euro IV for NOx in 2010, and extending the LEZ to LGVs in 2010.

The likely implementation route for the proposed LEZ is via a Scheme Order, though alternative implementation mechanisms are also available. It would allow a charge to be imposed on operators wishing to bring vehicles into the zone that were not complaint with the LEZ emission standards. It is proposed that charges (per day) for entering the zone and for non-compliance would be set at a suitably high level to encourage the majority of operators to make an economic decision to comply with the emission criteria.

TfL have had series of engagement meetings with key stakeholders to give an update on the status of the LEZ project and to get initial feedback on the preliminary proposals. A statutory consultation with the London Assembly and GLA Functional Bodies (Metropolitan Police Authority, London Fire and Emergency Planning Authority and the London Development Agency) on proposed draft amendments to the Mayor's Transport and Air Quality Strategies has been undertaken. A public consultation on the revisions to the Mayor's Transport and Air Quality Strategies is due to commence in early 2006.

The LEZ will go someway to restrict on-road HGVs operating on construction sites within London from 2008 but as stated in Section 5.1, this is considered to be a minimum requirement and where appropriate, stricter Euro standards for construction vehicles should be considered. Although there will be a cost to operators to meet these standards - by buying new vehicles or retro-fitting existing vehicles, there can be long-term financial benefits if they choose certain alternative fuels (for example, LPG and CNG).

Appendix 7. Local Authority Pollution Prevention and Control

The tables below outline relevant best available techniques (BAT) according to Defra's Process Guidance Notes[32].

Mobile Crushing Plant

Sources of dust	Control technique
Loading and unloading of materials	Containment Suppression Reduce drop heights (through variable height conveyors or chutes)
Double handling transfer points	Site and process design
Stockpiles	Wind design management through fencing, bunding etc Suppression Covering
Crushing, grinding, screening	Containment Suppression Dust arrestment
Conveyors and transfer	Containment (wind boards) Appropriate siting away from receptors
Blending and packing	Containment Reduce drop height Dust arrestment (bag or cartridge filters)
External operations	Appropriate siting Wind design management
Vehicles	Wheel and under body washing

Taken from Process Guidance Note 3/16 (04)

Cement batching activities

Sources of dust	Control technique
Loading and unloading of materials • transfer of aggregate to bins • **transfer of dry batch to mixer** • transfer of dry batch to lorry	Containment Suppression (ring spray bars) Reduce drop heights (through variable height conveyors or chutes) Dust arrestment (loading area) using bag or cartridge filters
Double handling transfer points	Site and process design
Delivery from road tanker to silo	Various techniques
Silos	Dust arrestment (bag or cartridge filters)
Aggregate stockpiles	Wind design management through fencing, bunding etc

[32] http://www.defra.gov.uk/environment/airquality/lapc/pgnotes/default.htm

	Suppression (water and/or suppressants, well positioned spray guns and sufficient coverage by sprays) Covering
Conveyors and transfer	Containment (wind boards) Reduce drop heights Appropriate siting away from receptors
Blending and packing	Containment Designated areas Reduce drop height Dust arrestment (bag or cartridge filters)
External operations	Appropriate siting Wind design management
Vehicles	Wheel and under body washing Exhausts that do not point vertically down

Taken from Process Guidance Note 3/1 (04)

Appendix 8. Contributors credits

The document was produced by the APPLE working group, a sub-group of the London Air Quality Steering Group. The working group comprised of officers from the following London local authorities:

Bexley
Brent
Camden
Greenwich
Hillingdon
Hounslow
Islington
Kensington and Chelsea
Lewisham
Newham
Southwark
Tower Hamlets
Wandsworth
Waltham Forest

The group consulted on the draft document for a period of 6 weeks in June and July 2005. All of the comments received have been discussed by the group and incorporated into the document where appropriate.

The following organisations responded to the consultation:

Local authorities (officer responses):

- Barnet
- Brent
- Camden
- Corporation of London
- Croydon
- Epping Forest
- Hammersmith & Fulham
- Islington
- Kensington and Chelsea
- Kingston
- Lambeth
- Lewisham
- Merton
- Redbridge
- Southwark
- Tower Hamlets
- Wandsworth
- South Bucks

Lubrizol
Western Tydens
HUSS DPF
Johnson Matthey
Environmental Industries Commission
UK Petroleum Industry Association
Construction Plant Association
Construction Equipment Association
Building Research Establishment
Greater London Authority
Transport for London
Casella Stanger
Heathrow T5 Environment
Environment Agency
Energy Saving Trust

Further information on responses to the consultation can be obtained from the GLA.