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Whilst written principally in a UK context, for the most part, the principles and concepts discussed within this publication hold equal international relevance.

Acknowledgements

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Welcome to OPERC

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Dust in its many forms is a significant workplace hazard that can present a variety of health, safety and welfare risks to those workers exposed to it. Dust in the workplace can equally represent a hazard to others, such as the general public or people living near to its source. It can also be detrimental to the environment, able to affect plant or crop growth, change soil pH levels or contaminate open water.

Some health effects of dust exposure may take many years to present, often in the form of irreversible medical conditions such as mesothelioma, chronic obstructive pulmonary disease or lung cancer. Certain dusts are particularly prone to generating disease, for example respirable crystalline silica, exposure to which results in silicosis; others bring with them very specific risks due to their chemical or biological content. In many ways the problems are somewhat ‘hidden’ – ironically, the less you can see dust (i.e. the smaller the particulate), then the more dangerous it usually is.

In view of the serious risks associated with workplace dust, this guide aims to provide a comprehensive overview of the subject including discussion of what dust is and how it is generated, brief description of the health risks from exposure, details of some relevant legislation and discussion of how the risks from exposure may be minimised or removed.

The target audience is predominantly those engaged in building, civil engineering and demolition, although the principles presented hold fast for most sectors of industry.

OPERC presents this health and safety guidance in the hope that it will encourage awareness of the subject and as a result help workers to avoid exposure to this harmful workplace agent.
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Commonly Used Acronyms

BS  British Standard
H&S  Health and Safety
HEPA  High Efficiency Particle Air (filter)
HSE  [The] Health and Safety Executive
OPERC  [The] Off-highway Plant and Equipment Research Centre
PM_{10}  Suspended particulate matter ≤ 10 µm in diameter
This is a guide to the subject of dust at work, the overriding aim of which is to highlight that workplace dust can represent a significant occupational (and environmental) hazard. The guide serves as a source of educational reference on the subject but in particular, it sets about encouraging greater awareness among all workers of the health and safety issues relating to dust at work.

The guidance is intended to be ‘universal’ insofar as it deals with fundamental principles regardless of, for example, any particular work sector. This is in contrast to much existing health and safety literature on dust at work, that tends to either deal with the subject in terms of specific types of airborne hazard, such as asbestos, stone dust, grain dust, flour dust, cement and so forth (HSE, 2003; 2001A; 2006A; 2006B; 1999; 2002A) or offers advice in terms of specific work settings, for example dust on farms, dust at potteries, dust in logistics and handling, dust at rubber mixing and milling, etc. (HSE, 2006C; 2002B; 1997A; 1996).

The guide first presents an overview of what dust is and how it is formed; it then proceeds to explain the risks associated with its production. This is followed, after brief reference to relevant legislation, by guidance on how to work more safely in situations that generate (or otherwise contain) dust. The guide’s intended readership is principally those involved with managing health and safety at work, although it is envisaged that all who might be exposed to dust hazards may benefit from its contents.

Specifically, the guide will:

- consider some definitions of what constitutes dust and look at how dust is created;
- identify and discuss the risks associated with dust at work, both in environmental and health and safety contexts;
- make reference to relevant legislation; and
- offer broad guidance on how to control the risks from exposure to dust at work, both in terms of removal and mitigation.

Sources of information used in the guide’s compilation are cited in Harvard style1. The resulting list of bibliographic references provided at the end of the guide represents a repository of further and more detailed knowledge on many of the key issues discussed.

Although the guide is written principally in a British context, most of the principles presented retain international relevance.

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1 Comprising: author(s) family name(s), year of publication and if appropriate, page or section no(s) e.g. (Black and White, 2006, p2).
What is Dust?
Within this guide, the term ‘dust’ refers to solid particles of matter, that although sometimes slightly heavier than air, remain ‘suspended’ within it for a period of time (cf. Hughes and Ferret, 2003 p246). Dust can also take the form of ‘deposited’ dust, that is, the result of suspended solid particles of matter having settled onto a horizontal (or horizontally inclined) surface over time. However, in a workplace health and safety context, suspended dust generally presents a greater hazard than deposited dust, because it can be carried about within air and is more easily ingested or inhaled by anyone who comes into contact with it.

According to the Control of Substances Harmful to Health Regulations (COSHH, 2002), two broad definitions of dust are:

- inhalable dust – this being airborne material that is capable of entering the nose and mouth of a person during breathing as defined by BS EN 481 (BSI, 1993); and
- respirable dust – which is airborne material that is capable of entering the nose and mouth and then penetrating to the gas exchange region of the lung (also as defined by the former standard).

These two COSHH definitions are referred to again later in this guide, when discussing the issue of when dust actually becomes a substance that is ‘hazardous to health’.

Dust Generation
Workplace dust may originate from a variety of materials, some examples of which include:

- quartz materials such as some kinds of rock, shale and gravel which may contain crystalline silica;
- metals of various types;
- powdered foodstuffs such as flour;
- sand, cement and other loose (dry) raw materials;
- coal and other mined materials;
- wood;
- man-made wood-based products such as fibreboard and MDF;
- rubber;
The Properties of Dust

- dry soil; and
- animal feedstuffs.

The term dust is also sometimes ‘loosely’ used to include other airborne materials (pollutants) such as welding fumes, vapours from chemicals, mould spores, and isocyanates (cf. Speedy, 2007). Accordingly, work sectors that will most likely be associated with the generation of dust include:

- civil engineering and building (especially in dry weather);
- demolition;
- foundry works;
- agriculture;
- mining and quarrying;
- textiles and mills;
- bakeries; and
- wood machining.

Numerous other industrial sectors that use an equally large variety of raw materials can also generate workplace dust. Some examples of dust generating work activities include:

- cutting, drilling and sanding of raw materials or manufactured components;
- sweeping-up, especially of dust and waste products produced from the former activities;
- vacuuming of dust with equipment that exhausts non filtered air (all filters should be of HEPA type);
- filling up containers, bags, skips etc., with loose or fine granular materials;
- breaking, crushing, screening or sieving of raw or recovered materials;
- moving, conveying, weighing, treating, handling or otherwise disturbing loose or dry materials; and
- dealing with emergencies or accidents such as material spillages (cf. HSE, 1997B).
In addition to these specific examples of dust generating work activities, dust can also result from:

- mechanised work processes – such as when sawing a raw material with an abrasive disc cutter (see Figure 1) or sanding a manufactured component with an abrasive pad;
- physical or explosive work activities – such as when moving stockpiles of raw materials with mobile plant or when demolishing buildings with explosive charges; and
- the process of particulate matter being picked up by action of air – such as by wind blowing through a dusty workshop or dry soil being blown about on a road building project.

For a given work sector, some dust generating work activities can be much more dangerous than others. For example, activities that generate silica dust are particularly harmful, especially when the dust is hot, as tends to happen when it is produced by an abrasive process (the friction from the abrasion causing the hot dust to be released). Operators of these sort of processes are therefore in a position of increased risk. Indeed, within construction, the cutting of stone or concrete products using cut-off saws is considered so hazardous that in 2007 the HSE launched an initiative, the aim of which is to identify practicable interventions that might reduce or eliminate the risk of respiratory disease from carrying out such work activities (HSE, 2007A).
The Effect of Dust Particle Size

The size of dust particles can vary (both within a dust cloud and from time-to-time from a particular source) dependent upon what material the dust comprises (for example, flour dust compared to soil dust) and the way the dust is created.

In objective terms, size will typically range from ‘fine’ dust at circa 0.4 µm, to ‘coarse’ dust at circa 10 µm, although dust has previously been defined as any airborne solid matter up to about 2mm in size (CIRIA, 2005 p12) and more recently as all particulate matter up to 75 µm in diameter (GLA et. al., 2006).

The notation ‘PM10’ is sometimes used when discussing suspended particulate matter. This is a metric that represents such matter with a diameter of 10 microns or less, i.e. ≤ 10 µm (GLA et. al., 2006, p2). The notation was adopted because PM10 represents the size of dust particles that are most likely to be inhaled by people and has become an accepted standard measure of atmospheric particulate matter, both within the UK and Europe (NAEI, 2007).

Particulates within PM10 of size 10 µm down to 2.5 µm diameter evolve mainly from non-combustion sources. The remaining smaller dust particles (being less than or equal to 2.5 µm in diameter) may evolve from combustion sources; they may also result from a chemical reaction of primary emissions of gases being formed within the atmosphere (GLA et. al., 2006).

Broadly speaking, ‘finer’ dusts, such as cement dust and flour dust, are generally taken to be more dangerous to health than ‘coarser’ dusts. This is firstly because coarse dust particles are often too large to be inhaled (GLA et. al., 2006). Secondly, it is because finer dust, once inhaled, can penetrate deeper into the lungs and once it has done so has more of a tendency to stay there and cause disease (Hughes and Ferret, 2003 p246). Thirdly, when finer dust particulate is released into the environment, it has the ability to remain suspended in the air for longer and to travel further than coarser dust; hence it has the potential to affect more people over a larger geographical area (cf. GLA et. al., 2006, p2).

In certain circumstances dust may also be considered as a chemical or biological ‘agent’ and this aspect will be discussed in more detail when considering the risks of dust exposure in the following chapter.
Environmental Risks

The generation of dust can present significant risks to the environment at large. The Environmental Protection Act (1990) defines pollution of the environment as being due to:

“…the release (into any environmental medium) from any process of substances which are capable of causing harm to man or any other living organisms supported by the environment” (EPA, 1990).

Within this definition, reference to:

- ‘any process’ includes work and work activities;
- ‘substances which are capable of causing harm’ includes dust; and
- ‘any environmental medium’ includes air, water and land; the medium of air includes the air within buildings and the air within other natural or man-made structures above or below ground.

The Committee on the Medical Effects of Air Pollutants (COMEAP)\(^2\) has highlighted that the condition of health observed among the general population can be directly influenced by the concentrations of pollutants contained in outdoor air. Increased levels of air pollutants mean that increased hospital admissions for heart and lung disease are witnessed along with an increased number of deaths (COMEAP, 2004).

The Committee has also underlined that exposure to increases in air pollution results as much from exposure indoors as from exposure outdoors. This is due to the fact that although indoor dust levels are generally lower, we spend as much as 80 per cent of our time indoors (ibid., p3).

Clearly, the importance of environmental risks to the local population from a dust source acting as an air pollutant is evident. Consider one practical example of particulate matter and dust being generated from construction and / or demolition activities. This will not only pollute outdoor air in the vicinity, but will ultimately have an impact on the quality of indoor air in the neighbouring area as well (cf. GLA et. al., 2006, p2).

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\(^2\) COMEAP is a committee of experts whose terms of reference include to advise UK Health Departments on the effects on health of both outdoor and indoor air pollutants.
The Building Research Establishment has also identified that construction and civil engineering activities in particular may produce fine dust particles that, if moved on the wind, can yield unfavourable effects on the local environment (Kukadia, et. al., 2003). The Construction Industry Research and Information Association, in their definition of dust, suggest that (together with noise and odour) “…dust is probably the most common form of nuisance” in environmental terms (CIRIA, 2005, p12).

Any aspect of the environment might be prone to damage from dust coming into contact or settling upon it, but soil, plant life and water are particularly at risk. In sensitive geographical areas such as sites of Special Scientific Interest the environmental risks are exacerbated (GLA et. al., 2006, p3).

Some environmental aspects of the risks presented by dust are summarised in Table 1.

### Table 1  Some Environmental Aspects of Dust

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Associated Factors</th>
</tr>
</thead>
</table>
| People living or working near to source | Contamination – for example, from dust settling on washing, windows of buildings, vehicles, and so on  
Unsightly – for example, dust clouds generated and carried by winds |
| Farms and associated land or crops | Negative impact on crop growth – particularly from alkaline dusts  
Contamination of crops – for example, on the edible skins of soft fruits |
| Ecological issues             | Negative impact on wild plants and their growth  
Contamination of exposed water or watercourses  
Artificial adjustment of natural pH levels of soils |
| The industrial activities at source | Restrictions on work activities – for example, during times of higher wind speeds  
Increased costs - through implementation of dust control and negative impact on work programme  
Negative impact on mechanical plant and equipment - dust may block filters and can act as an abrasive if carried in fluids such as oil or water. |
Personal (Health, Safety and Welfare) Risks

It has been asserted that dust is one of the biggest occupational killers that has either caused misery to and / or shortened the lives of hundreds of thousands of workers (TUC, 2007A).

As Health and Safety Executive key statistics confirm, 1,964 people died in 2004 from mesothelioma, a pleural cancer associated with exposure to asbestos dust, while thousands of other workers died from other occupational cancers including lung disease (HSE, 2007B).

It is not just asbestos dust that is dangerous. The health, safety and welfare of workers can be put at risk in a variety of ways as a result of exposure to almost any kind of dust at work. These include:

- illness resulting from physical contact, or ingestion of dust;
- respiratory diseases, resulting from breathing dust; and
- other forms of risk – such as where dust contains a chemical agent or microbes, or where there is a risk of a dust explosion.

Risks from Physical Contact with Dust

Some dusts can be hazardous if they come into physical contact with the skin. For example, this may be from contact with the hands during manual handling of raw materials or from touching or handling any other contaminated surface, such as dusty work clothing. In addition to contact with the skin, contact with the eyes can be particularly hazardous. Dust particles can produce eye irritation or in extreme cases may even cause eye damage (HSE, 1997B).

One example of a dust that can be harmful upon contact is cement (or any other dust generated from material that contains cement). Cement dust can bring about ‘contact dermatitis’, a medical condition causing inflammation which is characterised by scaly, cracked skin that is reddened and sore (HSE, 2002A). ‘Irritant dermatitis’ results from the skin being irritated or abraded by cement mechanically, while ‘allergic dermatitis’ results from sensitivity to chromate in the cement powder (ibid.).

Dermatitis may also invoke eczema, another form of skin disease that is similar to dermatitis but which is additionally characterised by blister formations. Note also that cement dust, if inhaled, can prove very harmful to health (see section on respiratory risks below).

In addition to dermatitis, there are several other types of skin disease that can result from contact with certain chemicals or materials contained in dust and these are briefly summarised in Table 2.
Table 2  Types of Skin Disease that can Result from Physical Contact with Dust

<table>
<thead>
<tr>
<th>Disease</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Dermatitis</td>
<td>Inflammation of the skin through exposure to an allergen or irritant, which can lead to redness, swelling, blistering, flaking and cracking.</td>
</tr>
<tr>
<td>Contact Urticaria</td>
<td>Immediate contact adverse reaction characterised by any combination of itchiness, rash, swelling, tingling or burning symptoms</td>
</tr>
<tr>
<td>Acne</td>
<td>Various types of inflammatory disorder that produce skin eruptions</td>
</tr>
<tr>
<td>Pigmentary Disorder</td>
<td>Skin discolouration resulting from contact with certain chemicals (can also result from U.V. and X-ray exposure)</td>
</tr>
<tr>
<td>Skin Cancer</td>
<td>Cancer on the skin due to contact with certain workplace chemicals</td>
</tr>
</tbody>
</table>

Respiratory Risks from Breathing Dust

Some of the respiratory diseases that can result from breathing dust include asthma, asbestosis, mesothelioma, chronic obstructive pulmonary disease, silicosis and cancer. We will briefly consider each of these medical conditions.

Asthma

Asthma is essentially a condition characterised by attacks of breathlessness and its symptoms may include wheezing, coughing and a feeling of having a tight chest. In a workplace context there are basically two types of asthma, which are occupational asthma and work-related asthma.

‘Occupational asthma’ can be brought on as a reaction to airborne particulates such as flour dust, wood dust or fumes, which act as ‘sensitisers’ (otherwise known as asthmagens³). The sensitiser causes an immune reaction by the body that, given any further exposure to it, can bring on an asthma attack (TUC, 2007B). The HSE (2007D) state that anywhere between 1,500 and 3,000 workers within Great Britain will develop occupational asthma each year.

‘Work-related asthma’ is essentially a pre-existing asthma condition that is made worse by exposure to airborne irritants such as dust, but may also be brought on by exposure to cold air. The total number of workers suffering from occupational and work-related asthma combined is approximately 7,000 per year (ibid.).

³ For a complete listing of asthmagens see HSE (2001B).
Asbestosis
Asbestosis results from the inhalation of asbestos fibres suspended within air. It is caused by an accumulation of these fibres in the lungs (which tend to become lodged there due to their ‘needle like’ shape and structure) and the subsequent natural reaction of the body to produce an acid to try and dissolve, and hence rid itself of, these fibres. Unfortunately, this acid does little to dissolve the fibres but instead scars the surrounding lung tissue and in so doing severely damages the function of the lungs.

Asbestosis has a long latency period (i.e. the time between exposure and the onset of disease). It can typically take between 15 to 60 years before the condition becomes noticeable and there is no cure. There were approximately 1,900 new cases of asbestosis diagnosed within Great Britain under the Industrial Injuries Scheme in 2004 (later statistics remain provisional at the time of writing).

Mesothelioma
Mesothelioma is a cancer of the outer lining of the lung (or stomach) and is also caused by exposure to (i.e. from breathing in) asbestos fibres in the air. In general, the condition can take up to 30 years to present, before becoming noticeable. By the time it is diagnosed, it is almost always fatal. There were approximately 1,960 deaths due to mesothelioma within Great Britain in 2004.

Chronic Obstructive Pulmonary Disease (COPD)
COPD is the fourth leading cause of death throughout the world (HSE, 2007E) and within Great Britain there are approximately 25,000 COPD related deaths each year, of which approximately 4,000 are directly attributable to occupational exposure to dust and other airborne particulates. There is no cure for this irreversible progressive condition of the lungs, although its effects may be slowed down if the harmful exposure is removed (stopping smoking can also help).

Silicosis
Silicosis is also a condition that takes years to develop and it results from ongoing exposure to respirable crystalline silica (which is toxic to the lining of the lungs). Dust types that might contain crystalline silica are generally those from different rock types, such as sandstone, granite and slate.

Cancer
Cancer, in respiratory terms, is a malignant tumour of the bronchi covering that invades breathing passages. Some dusts can increase the possibility of cells being created that can lead to cancer (Speedy, 2007, p6) and the risk of nasal or lung cancer is increased significantly by smoking. As with mesothelioma, the effects of this condition can take up to 30 years or more to become noticeable.
It should be appreciated that the above discussion does not represent a complete list of all possible respirable diseases and comprises but broad descriptions of those referred to. Note also that only key statistics regarding their prevalence have been given in some cases.

Figure 2 demonstrates the upward trend for the diagnosis of asbestosis (and other forms of pneumoconiosis) under the Industrial Injuries Scheme, along with the number of deaths attributable to mesothelioma within Great Britain over the last ten years or so. Note however, that due to the long latency period required for these diseases to present, the statistics underlining Figure 2 tend to represent workers who received their exposures many years ago.

**Figure 2**  
Trend Statistics for Diagnosis of Asbestosis (and other forms of Pneumoconiosis) under the Industrial Injuries Scheme and Numbers of Deaths Attributable to Mesothelioma

![Bar chart](chart.png)  
- **asbestosis**  
- **mesothelioma**

**Other Forms of Risk from Dust**

In addition to causing a reaction upon contact with skin, due to abrasive or chemical content, dust might also contain microbes (microorganisms too small to be seen by the human eye alone such as bacteria or fungi) that, if breathed in, can equally cause reaction and illness. The HSE (2005A) highlighted one such instance where a tree surgeon, upon disturbing a pile of wood-chips, created a dust cloud containing microbes which in turn harboured endotoxins (poisonous substances found within bacteria). These caused an immune system response in the worker leading to fever symptoms.

Other risks from dust exposure can relate to precise work activities, giving rise to work-specific dust exposure illnesses, defined by their own name. Some examples include:
- farmer’s lung – a reaction to spores that have been released into the air from mouldy hay, straw and grain;
- bird fancier’s lung – an allergic response to dust from avian feathers and faeces;
- mushroom worker’s lung – allergic response to microorganisms in mushroom compost and sometimes mushroom spores themselves; and
- maltworker’s lung – again due to an allergic response to spores (HSE, 2006C; Anon, 2007A).

Dust that is ingested can represent a health hazard too. In such circumstances the dust, having been breathed in, gets trapped within the mucus which lines the respiratory region. If this mucus is swallowed, the dust can then get into the digestive system where it may cause irritation or lead to other gastrointestinal effects. If any ingested dust is eventually absorbed into the bloodstream it can subsequently find its way around the body and possibly affect organs and tissues (HSE, 1997B §13).

Dust can also present a significant risk of an entirely different nature – the risk of fire or explosion. Some types of dust are explosive when contained in air at given concentrations, for example dust composed of coal, wood, grain, sugar, certain metals or synthetic organic chemicals (HSE, 2007F). Dust might present a fire risk where, for example, it accumulates on a hot surface or within hot equipment (e.g. a dryer) or where a risk of self heating and spontaneous combustion might occur (cf. BRE, 2007).

The main factor in determining whether a dust cloud might ignite, and the extent of any resulting explosion, is dust particle size. As a rule-of-thumb, the smaller particle sizes are the more hazardous, while particle sizes in excess of 500 µm will not form explosive atmospheres (Pritchard, 2004, p9). Other factors include (but are not limited to) the concentration of dust (normally expressed as dust weight/m³ of air), the source of ignition (which must be of sufficient energy to ignite the cloud), the temperature of the air (i.e. within the dust cloud) and its oxygen content (ibid.).

Dust clouds contained within ‘sealed’ work areas can be particularly hazardous in terms of explosive risk and this has obvious ramifications for work undertaken in a dusty atmosphere or for work in confined spaces that might generate dust. In such cases, safe work methods must be designed and appropriate techniques be employed, such as dust extraction or suppression (these kind of techniques are discussed later).

Basic preventative ‘good housekeeping’ measures (such as regular vacuum cleaning) can also help in these circumstances, thereby minimising the possibility of dust build-up to the point where a dust explosion could occur. Such measures could translate to the difference between a company needing to classify a work area as an ATEX zone⁴ or not, the latter potentially saving investment in compliant equipment.

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⁴ ATEX Directive 99/92/EC – referring to health and safety of workers that might be at risk from explosive atmospheres. Classifies hazardous areas into zones which for dust range from zone 20 (combustible dust present continuously or for long periods); through zone 21 (combustible dust likely occasionally); to zone 22 (combustible dust not likely to occur or, only for a short period).
Key Legislation Relating to Workplace Dust

Context

Due to the comprehensive nature of health and safety legislation and the way it can apply to an almost infinite range of workplace scenarios, it is not possible for a guide of this nature to discuss in detail the legislation relating to dust or cover all legislation of relevance. Hence, what follows is an indication of the most relevant legislation (both environmental and health and safety) that can impact upon the legal aspects of workplace dust.

Additional general information might be obtained by considering any of the statutory instruments referred to in isolation and these may be observed on the Office of Public Sector Information website (see: http://www.opsi.gov.uk). Only qualified persons can give definitive advice on such important issues as law, so readers should consult with legal experts or similar, where more detailed or specialist direction on this aspect is required.

Key Environmental Legislation

Three pieces of relevant environmental legislation are The Environmental Protection Act (EPA, 1990), The Clean Air Act (CAA, 1993) and The Water Resources Act (WRA, 1991). Let us consider these in turn.

The Environmental Protection Act (1990)

Hughes and Ferret (2003) contend that the Environmental Protection Act (the ‘EPA’) is the ‘centrepiece’ of environmental protection legislation within the UK. The EPA is far reaching, its nine parts dealing amongst other things with issues such as waste on land, litter, radioactive substances and nature conservation. Part 3 of the EPA deals with ‘statutory nuisances’ and clean air. Included on the list of statutory nuisances are:

- smoke;
- fumes;
- gases;
- dust; and
- any other accumulation or deposit that may be prejudicial to health.

The Act requires that local authorities inspect their geographical area from time to time for the existence of statutory nuisances and additionally, that they take reasonably practicable steps to investigate any complaints of such nuisances.
If a statutory nuisance (such as dust) is found, then a local authority can serve an abatement order on those responsible for it. The abatement order will either require the nuisance to be lessened or reduced (i.e. abated), prohibit the nuisance or require works to be carried out to abate, restrict or remove it (EA, 2007A). It is a criminal offence not to comply with an abatement notice.

The largest polluting processes are regulated by way of what is defined as Integrated Pollution Control (IPC), which is described in part 1(A) of the EPA and is administered by the Environment Agency.

The Water Resources Act (1991)
It is an offence to contaminate surface water (such as rivers, lakes or watercourses) or groundwater (water in the ground and below the water table) by allowing any poisonous, noxious or other polluting matter to enter into it (EA, 2007B). For example, such instances may include where surface water run off becomes contaminated by dust or where rain water becomes contaminated by collecting settled particulate matter from roofs and so forth.

Where any contaminated water (i.e. water other than clean, uncontaminated surface water) is required to discharge into surface water or groundwater, then authorisation will be required to do so, normally in the form of a ‘discharge consent’ (ibid.).

Under the Water Resources Act the Environment Agency can issue an enforcement notice in circumstances such as where the conditions attached to a discharge consent are not being complied with. Alternatively, or subsequently, non-compliance may also lead to prosecution.

The Clean Air Act (1993)
Part I of the Clean Air Act prohibits the emission of dark smoke (scientifically defined within the Act) from chimneys and from industrial or trade premises. This includes dark smoke pollution from activities such as the burning of bonfires, although there are some exceptions such as where to move infected waste (rather than burn it ‘in-situ’) might cause cross-infection (cf. GLA et. al., 2006 p43).

Part II of the Act deals with smoke, grit, dust and fumes, requiring that furnaces shall be, so far as reasonably practicable, smokeless and (inter-alia) that they comply with prescribed limits on emissions of grit and dust from their chimneys.

Other aspects of the Clean Air Act include smoke control areas, air pollution control and information about air pollution.
Key Health and Safety Legislation

There is a significant amount of health and safety legislation that can relate in some way to dust exposure at work, the following of which is very relevant.

Many parts of this act (HASWA, 1974) are influential on exposure to dust at work. Two parts of particular influence are:

- **Section 2 (2)a** which states that employers must provide and maintain plant and systems of work that are, so far as is reasonably practicable, safe and without risks to health. This has direct relevance to workers’ exposure to dust while at work and the control (risk removal, risk mitigation) of such possible exposure.

- **Section 3** makes it a duty of every employer to conduct their undertaking in such a way as to ensure, so far as is reasonably practicable, that persons not in their employment are not exposed to risks to their health or safety. This could, for example, have relevance to dust emissions that by their composition might be injurious to the health of the general public nearby.

Section 9 of HASWA identifies that employers cannot charge employees for things provided to them “...in pursuance of any specific requirement of the relevant statutory provisions”, which in this case relates to personal protective equipment (PPE).

The Management of Health and Safety at Work Regulations (1999)
These regulations (MHSWR, 1999) emphasise the ambition of proactive health and safety management, that is, to identify risks and remove (or otherwise) control them before workers’ health and safety can be negatively affected. For example:

- **Regulation 3** requires that every employer makes a “suitable and sufficient” assessment of the health and safety risks to employees (i.e. risks to which they might be exposed whilst they are performing their work) and of similar risks that might be presented to any other person (i.e. including non-employees) that may result from the employer’s work activities.

- **Regulation 4** makes reference to ‘principles of prevention’ that must steer employers’ efforts to control identified workplace risks (i.e. to remove, or if they cannot be removed, minimise them). These principles of prevention include combating risks at source, adapting work to the individual employee, replacing dangerous activities with non- or less-dangerous ones, giving priority to collective vis-à-vis individual protective measures and ensuring employees receive appropriate training and instruction.

- **Regulation 6** calls for employers to ensure that their workers are afforded “appropriate” health surveillance, taking due account of the specific risks to their health and safety as identified by the risk assessment.
With regard to dust at work this means that hazards from such dust must first be identified and appropriately risk assessed, for example by asking questions regarding when the exposure to dust might occur and to whom, the type of dust and the level of risk that might occur from such exposure. Based on the extent of risk identified, suitable controls must then be designed; these might involve local exhaust ventilation systems, suppression techniques and / or respiratory protective protection (much more detailed discussion of risk assessment and risk controls follows in the next chapter).

Workers must also be given information about any identified dust risks and how the risk controls have been designed to help protect them. This could involve informing employees of what they must and must not do to conform with the control. Note that Regulation 14 requires that employees comply with such instruction or training and inform their employer of any work situation they consider a danger to themselves or any other person. Employees also have a duty to comply with any health surveillance programme to which they are assigned, which, after all, is a means of offering them further protection against developing dust related illness or ill-health.

The Control of Substances Hazardous to Health Regulations (2002)
These regulations (COSHH, 2002) are arguably the most relevant to dust exposure at work, at least so far as defining when dust actually becomes a substance that is hazardous to health. COSHH states that this occurs when dust is present at a concentration in air equal to, or greater than:

- ten milligrams per cubic metre (10 mg/m\(^3\)) as a time-weighted average over an 8-hour period, of inhalable dust; or
- 4 mg/m\(^3\), as a time-weighted average over an 8-hour period, of respirable dust.

The COSHH definitions of inhalable and respirable dust were given earlier in this guide.

Some particular types of dust are also expressed as being hazardous to health because of their nature (e.g. chemical) and resultantly, are subject to defined workplace exposure limits (known as ‘WELS’). A full list of WELS may be observed in the HSE guidance document EH40 (HSE, 2005B).

Some principal regulations within COSHH relating to dust include the following:

- Regulation 6 defines the need for a risk assessment of hazardous substances along similar rationale to that described for the Management of Health and Safety at Work Regulations. Note however, that there is not necessarily a need to perform two
separate risk assessments (i.e. one for each set of regulations), so long as the demands of each set are satisfied. In practice, a risk assessment under the former regulations should take account of hazardous substances where they exist, but where this is not the case (e.g. where a hazardous substance has only recently been introduced), then that specific risk must additionally be assessed in order to satisfy the requirements of COSHH.

Regulation 7 calls for prevention of employees’ exposure to hazardous substances, or for adequate controls where this cannot be achieved. In implementing controls, COSHH emphasises a preference for ‘substitution’, that is, substituting the use of hazardous substances with those that eliminate or reduce the risks from exposure. The COSHH ‘hierarchy of controls’ is fully explained later.

The COSHH regulations also relate to the need for controls to be properly used and maintained, for employees to be provided with appropriate instruction and training (for example, on hazardous materials and corresponding risk controls) and the need for use of health surveillance where “…it is appropriate for the protection of the health of employees who are, or are liable to be, exposed to a substance hazardous to health”. More advice on health surveillance may be viewed on the Safe and Healthy Working website (Anon, 2007B).

**Other Relevant Legislation**

In addition to the above key legislation, Table 3 lists further acts and regulations that may be of interest in this respect.

**Table 3**  Some Additional Relevant Legislation

<table>
<thead>
<tr>
<th>Title of Legislation</th>
<th>Additional Info.</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Environment Act (1995)</td>
<td>1995 Chapter 25</td>
<td>Environment Agency functions (Part I) and air quality (Part IV)</td>
</tr>
<tr>
<td>The Control of Asbestos in the Air Regulations (1990)</td>
<td>S.I. 1990 No. 556</td>
<td>Prescribes a limit value for discharge of asbestos into the air</td>
</tr>
<tr>
<td>The Construction (Design and Management) Regulations (2007)</td>
<td>S.I. 2007 No. 320</td>
<td>Management of all aspects of health and safety relating to construction and demolition works</td>
</tr>
<tr>
<td>The Personal Protective Equipment Regulations (1992)</td>
<td>S.I. 1992 No. 2966</td>
<td>All aspects relating to PPE</td>
</tr>
</tbody>
</table>
Risk Identification and Assessment

The effective management of a health and safety hazard like dust, requires that before any controls can be decided upon, the risks must first be carefully identified and adequately assessed.

As stated by the Health and Safety Executive in their guidance on principles of protection, employees should not be exposed to any dust at work unless their employer has made a “suitable and sufficient” assessment of associated risks and subsequently taken the necessary precautions to meet the requirements of COSHH (HSE, 1997B, §17). Before discussing methods of control, we should firstly therefore consider the methodology of risk assessment.

Risk Assessment Method

The following four definitions are important in risk assessments:

- **hazard** – this is anything in the workplace that could potentially cause harm;
- **risk** – this is the extent to which it is perceived the hazard might actually cause harm;
- **probability** – being the likelihood ‘of occurrence’ or ‘of injury’ related to the risk; and
- **severity** – being a term often used to describe a risk in terms of ‘severity of possible outcome’.

In the context of this guide therefore, we might say that a dust cloud is a *hazard*, that the *risk* from it is injury to health (e.g. from breathing in that dust), that the *probability* of the risk causing injury is higher the more frequent is a worker’s exposure to the dust and that the *severity* of the outcome would (typically) be lower where coarse dust is suspended in air in small concentrations, compared to respiratory dust suspended in higher concentrations. Although somewhat contrived, this does demonstrate the relationship of these terms in the context of performing risk assessments.

In developing a risk assessment – from initial hazard identification through to estimation of severity of possible outcome – the method as shown in Figure 3 is a generally accepted one. If required, employers may use the services of consultants to help in risk assessments, for example, to take and analyse air samples or use other specialist equipment. Organisations
like the Building Research Establishment can offer consultancy services on dust at the workplace, including dust hazard classification and dust explosion analysis and prevention (BRE, 2007).

**Figure 3  Risk Assessment Method**

1. **Identify the Hazards**
   - What activities generate dust?
   - What other sources of dust are there?
   - To what extent is dust generated? (may involve measurement)
   - What is the dust? (e.g. size / composition)

2. **Decide who might be harmed and how**
   - Who performs dusty work activities?
   - Who else might come into contact with the dust?
   - To what extent are people exposed?
   - Do additional specific risks exist? (e.g. hazardous chemicals or microbes)

3. **Evaluate risks and design controls**
   - Quantitative evaluation using numbers (e.g. risk x probability = severity)
   - Qualitative (e.g. experiential) evaluation
   - Risk classification (e.g. high, medium, low)
   - Controls designed commensurate with risk classifications derived

4. **Record findings and put controls in place**
   - Record and file risk assessment findings
   - Disseminate findings as appropriate (e.g. safety committee, representatives)
   - Apply controls by way of a structured (time-to-implement) plan
   - Give necessary information / training on dust risk controls to workers

5. **Review and update the assessment as appropriate**
   - Cyclic review
   - Update assessment to take account of (e.g.) new dust emitting work activities
   - Implement stages (3) and (4) above based on any new findings

Estimating the overall severity of risk outcome may employ a quantitative or qualitative approach. When adopting a quantitative approach the risk can be assigned a number, say on a scale of 1 to 5, where 1 represents low risk and 5 represents high risk. Likewise, the probability of the risk causing injury, or the anticipated severity of injury, may also be assigned a number on a similar scale; by multiplying these two numbers together, the overall severity of outcome may be quantified as a metric ranging (in this instance) from \((1 \times 1 = )\) 1 to \((5 \times 5 = )\) 25.

Using this regime, we might further decide that severity of outcome scores of 4 or below are 'low risk', scores greater than 4 but below 16 are 'medium risk' and scores above 15 are 'very high risk'. A risk assessment matrix based on this model is shown in Figure 4 and it can be seen that overall risk severity scores have been colour coded; yellow denotes low risk severity scores, orange denotes medium risk and red denotes very high risk. Note that the scales used and the boundaries of low, medium and very high risk are purely arbitrary and may differ in practice to the example given here.

Figure 4  Risk Assessment Matrix

<table>
<thead>
<tr>
<th></th>
<th>Low risk</th>
<th>High risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low Probability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
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<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td><strong>High Probability</strong></td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

Risk = extent to which it is perceived the hazard might actually cause harm. 
Probability = perceived likelihood / extent of injury.

Example: A risk assessor might score a 'moderate' concentration of respirable dust in air as quite high risk (4) and its likelihood of injury (due to its chemical composition) as high probability (5). When multiplied together this achieves an overall severity score of \(4 \times 5 = 20\). From the matrix we can see that this is a 'very high risk' thus requiring urgent risk control action.
A qualitative risk assessment must be performed by a suitably competent person (or persons) who, based upon their qualifications and experiential judgement, will be able to classify the risk as being (for example) low, medium or very high. Those risks scoring highest under the quantitative method or being classified as very high risk under the qualitative approach will require controls to be put in place more urgently, than those scoring, or being classified, as low risk.

**COSHH ‘Compliance’ and Hierarchy of Controls**

To comply with the Control of Substances Hazardous to Health Regulations, the HSE suggest an eight-stage process (HSE, 2005C). The first five stages of this process are:

- **Stage 1:** Assess the risks (in this context, from dust exposure).
- **Stage 2:** Decide on necessary precautions (risk controls).
- **Stage 3:** Control the exposure.
- **Stage 4:** Ensure controls are maintained and complied with.
- **Stage 5:** Monitor (review) the exposure(s).

Note that these five stages are in harmony with those suggested for carrying out a risk assessment in the last section (refer to Figure 3). Indeed, Hughes and Ferret (2003, p 259) confirm that a COSHH assessment is similar to a risk assessment other than that the former applies specifically to a hazardous substance. So, where a ‘suitable and sufficient’ risk assessment for dust exposure has been satisfactorily carried out at the workplace, then these first five COSHH compliance stages will have essentially been satisfied.

However, to fully comply with COSHH, an additional three stages should be considered by employers and may be relevant to varying extents given the specific circumstances of the workplace. These three additional stages are:

- **Stage 6:** Implement a health surveillance regime.
  This will embrace those workers who it is deemed necessary to survey either as a result of the risk assessment findings or where specific substances listed in COSHH, or associated with certain diseases, are encountered by workers.

- **Stage 7:** Design emergency procedures.
  This is where, if an emergency were to occur (such as release into the air of a particular dust type), the resulting risks would be ‘well beyond’ those associated with ‘normal work’. The emergency procedures to deal with such must be designed and communicated to relevant people.
Stage 8: Ensure appropriate ongoing training and supervision. This will include for example, information about the types of dust to which workers could be exposed, the resulting risks (as determined from the risk assessment) and the risk controls that the workers must comply with (ibid, pp9-10).

Having carried out the risk assessment stages discussed earlier, the implementation of risk controls should be organised according to a hierarchy, in order to best comply with the guidance for satisfying the requirements of the COSHH regulations.

The hierarchy of dust exposure preventative methods may be stated as follows, with the most preferred method at the top of the list:

- eliminate;
- substitute;
- enclose;
- control (Anon, 2007C; HSE, 2007G).

Note that personal protective equipment (PPE), or respiratory protective protection (RPE) in the case of dust, is the least favoured method and should not be considered a control method per-se, but rather, as a last line of defence. We will now consider these exposure prevention methods.

**Dust Elimination**

The underlying rationale is that it is far more beneficial to eliminate the dust (i.e. remove the hazard), than to leave it in place and use other measures to mitigate the health and safety risks from it. That is, if the hazard no longer exists, then neither will the risks, so this is the most effective way to protect workers’ health and safety. A practical example might be as follows.

*Elimination Example – Hazard Scenario*

A paving company uses a petrol driven abrasive disc cutter to cut moulded concrete paving blocks to a desired shape, when fitting these blocks to the edges of paved areas. The disc cutter generates a significant amount of hot, fine dust in the immediate area of its operator, that then spreads to cause exposure to other workers nearby, through suspension in the air. The dust contains crystalline silica and for all these reasons combined, the scenario represents a significant dust exposure hazard.
Elimination Example – Solution
By changing the work process this dust can be eliminated altogether, that is, by opting to cut the concrete blocks with a hand-operated hydraulic guillotine instead. This solution also yields other benefits including cost savings from the fuel and consumables required for the disc cutter, removal of the hazard of flying debris being generated at the edge of the cutting disc and removal of the operator’s exposure to hand-arm vibration generated by the cutter’s combustion engine.

Substitution of Hazardous Materials
By substituting the hazardous material for a non-hazardous (or less hazardous) one, the risk may not be eliminated altogether, but it might be significantly reduced. The HSE publication EH40 (HSE, 2005B) lists workplace exposure limits for substances that are hazardous to health and this would be a useful starting point in this respect.

Where any doubt may exist as to the exact make up of a (dust or) dusty atmosphere then employers will need to consult professional advice as appropriate, normally to enable the air to be sampled as a means of determining quantitatively the exact risks present, based upon for example, chemical, biological or explosive content. When the nature of the exposure hazard is fully understood, then suppliers might help in suggesting alternative materials that can act as safer substitutes (for example, base materials from which the dust is created during a manufacturing process).

Enclosure of Dusty Work Processes
Where a dusty work process might also be hazardous in the definition of COSHH, then it might be appropriate to enclose that process as a way of reducing the potential exposure of workers. The aim is to segregate people from the work activity in terms of placing a ‘barrier’ between the two.

The enclosure might be done on a small scale, where for example, a dusty grinding process is performed within a sealed area of the machine that does the work, or it may be carried out on a larger scale where for example, a particular dusty process such as sanding timber components, is only performed in a purpose made sealed booth constructed on a factory shop floor.

In the latter case, any workers within that dusty booth would need adequate protection which in such a dusty environment would probably involve dust extraction and / or forced ventilation and / or protective clothing and / or full-face breathing apparatus (see later).
Engineering and Procedural Controls

Engineering controls relate to physical interventions that are designed to remove or reduce dust levels, while procedural controls relate to organising the way that workers actually carry out their work.

Local Exhaust Ventilation (LEV)

Local exhaust ventilation (LEV) involves the installation of a dust removal system near to the source, so that hazardous dust is extracted before it can contaminate the local workplace atmosphere. Four broad classifications of LEV are:

- fixed installations;
- temporary centralised vacuum systems;
- mobile complementary systems; and
- mobile on-tool LEV systems.

Let us consider each classification briefly in turn.

There are certain typical characteristics of a fixed LEV system installed within a factory. Extraction booths (or hoods) enclose the dusty work processes, as far as practically possible, and to each of these is connected an extraction duct. The ducts join together into larger ducts, so that contaminated air is ultimately pulled along these larger ducts into a centralised vacuum producer. This contaminated air is usually filtered before it enters the vacuum producer, after which time it is then discharged safely. This is but a ‘simple’ description of a fixed LEV system; they may be much larger or complex than this in practice, depending on factors such as the nature of the work processes carried out in the factory, the required amount of extraction, the composition of the contaminated air and its resulting necessary filtering system.

A temporary centralised vacuum system is similar in concept to a fixed installation, except that it is a temporary arrangement. It uses a centralised vacuum producer so that workers are able to ‘dock’ into this vacuum system local to their place of work. This approach is particularly favourable in Scandinavia where it is often used in place of several mobile vacuum units.

Mobile complementary systems usually make use of a high-efficiency particulate air (HEPA) filter unit, as a complement to other systems (such as mobile on-tool systems) and / or are used in areas where dust is prevalent and more difficult to control at source. These complementary systems might also be employed as negative pressure units, to encourage dust containment or exclusion from particular areas.

Figure 5 shows images of various components of fixed and complementary local exhaust ventilation systems in a range of workplace settings.
Figure 5  Typical Components of Local Exhaust Ventilation Systems

(a) Fixed local exhaust ventilation fitted to a belt sanding machine in a joinery shop (vertical extraction duct)

(b) Close-up showing flexible duct and suction housing at point of dust emission on a joinery machine

(c) Ducts from LEV intakes carrying contaminated air to filter and vacuum producer

(d) Filters and vacuum producer on a larger fixed type LEV system

(e) Hand-held sander connected to a centralised fixed LEV system

(f) Complementary local exhaust ventilation: Dustcontrol’s “AirCube” (image supplied by Dustcontrol UK Ltd.)
The smaller kind of *mobile 'on-tool' LEV system* can be fixed to hand-held dust generating mechanical tools and in such cases, the dust is normally collected within a suction housing (for example, fitted around the blade of an abrasive wheel cutter). This housing connects to a flexible hose, which in turn fits to a vacuum producer containing a series of filters to clean the contaminated air in a similar way to that described above. Various examples of mobile on-tool dust extraction systems fitted to dust creating tools are shown in Figure 6.

**Figure 6** Mobile LEV Dust Extraction Systems Fitted to Hand-held Tools

(a) To a wall chaser  
(b) To a small abrasive disc grinder  
(c) To a large abrasive disc cutter
In short, a fixed system is a more ‘permanent’ system used for a specific work activity (or series of activities), whereas LEV systems that are used with hand-held tools are designed to be ‘mobile’ between work tasks and interchangeable between similar types of tools. Whatever type of LEV extraction system is employed, the design of the extraction housing or hood and its associated ductwork must always be such, that it is installed as near as possible to the point where the dust is created. This is because the velocity of air into the duct reduces drastically with distance from it and hence, its extractive effectiveness is quickly reduced as distance from the point of work increases. See Figure 7.

**Figure 7** Diagram Showing that Air Velocity Decreases Rapidly with Distance from LEV Inlet
Dust Suppression

The creation of dust may also be avoided by employing suppression techniques, which often use water to ‘damp down’ the dust before it can become suspended in air. For example, in hot and dry weather conditions, water bowsers can be towed and used to spray construction or quarrying haulage routes, in order to suppress dust that would otherwise be created by transport (such as lorries, dump trucks and excavators). Similar water spraying techniques can also be used in demolition situations. It has been suggested that wherever possible, the economic and environmental benefits of using groundwater for these kinds of purpose (in contrast to drinking water) should be considered (GLA et. al., 2006, p18). Under some conditions (such as for ground dewatering), an abstraction licence will be required in accordance with the Water Act 2003.

The same principles of suppression can be applied to mechanical tools, especially grinding or cutting tools, which can be fitted with a water suppression system to minimise the amount of dust that is generated when the tool is in use (HSE, 2006E). Figure 8 shows an abrasive disc cutter fitted with this type of dust suppression system. The hose supplying the water to the tool can clearly be seen.

Figure 8 Dust Suppression System Fitted to an Abrasive Disc Cutter

*The water supply is clearly seen as a green hose connected to the cutter. The water then travels along the clear pipe to be delivered to the cutting face of the diamond abrasive disc. (This is a staged photograph for demonstration purposes - the loose bricks are purely being used to prop the cutter up and the timber is holding the hose in view – these would be removed before use!)*
The main disadvantage of dust suppression using water is that things obviously get wet, such as the haulage roads or materials being worked upon in the earlier examples. These things will require drying out at some stage. Furthermore, the problems of slurry build up can occur, slurry being a mixture of dust and water. However, it is also generally accepted that water suppression systems can be less expensive in use than LEV systems.

Procedural Controls

Procedural controls relate to managing the way that workers are allowed to do (or not do) things. They include putting into effect rules or restraints such as:

- maximum time exposures to particular dusty atmospheres or work tasks;
- limits on the number of workers who can do a task or enter a particular work area;
- use of designated work areas or designated rest areas; and
- restrictions on tool use.

Permit-to-work systems and work carried out strictly in accordance with pre-agreed method statements are also ways in which procedural controls might be strictly administered. The underlying requirement of effective procedural controls is effective management and supervision.

Personal and Respiratory Protective Equipment

Personal protective equipment (PPE) and respiratory protective equipment (RPE) should only be considered a 'last line of defence' to help mitigate any remaining dust hazard, after all other forms of control have been considered as far as practically possible. Types of personal protective equipment to guard against dust include:

- protective clothing such as disposable one-piece suits;
- gloves available in a variety of materials (barrier creams may also be appropriate);
- eye protection such as goggles or face visors; and
- RPE of various kinds.

There are several types of RPE available and each type offers varying degrees of protection, the two basic types are:

- respirators, that filter air as it is breathed in through a filter or system of filters; and
- breathing apparatus, which provide the user with a source of clean breathable air (Hughes and Ferret, 2003, p 269).
The most basic type of respirator is a disposable ‘nuisance’ dust mask but this does not offer any significant protection against dust hazards. A half face mask is more effective and this may be of a disposable kind or it may have detachable, disposable filters that must be removed once they are spent. It is important that the type of filter(s) used with the mask matches the exposure hazard, for example, a dedicated dust-only filter will offer little protection against a vapour or fume hazard.

The filter manufacturer will normally dictate the replacement time for a filter (often defined as a maximum usage time), but the ‘rule-of-thumb’ is to replace a filter if breathing through it becomes more difficult, or if the user begins to ‘smell’ or ‘taste’ the dust through it. Figure 9 shows the components of a typical half face twin filter respirator, while Figure 10 shows these components assembled and the respirator ready for use.

A full face respirator is similar to that described for a half face with the exception of a visor that covers the eyes, whilst a powered respirator is able to deliver filtered air via a battery powered filter system.

**Figure 9  Half Mask Twin Filter Respirator Components**

*Detachable valve (A) unscrews from the rear of the replaceable filter and is passed through hole (B) from the inside of half mask (C), before being screwed back into the rear of filter (D) to connect the filter to the mask. Second filter (E) is fitted in a similar way.*
Breathing apparatus are either self contained systems that provide the wearer with a supply of air from a compressed air cylinder, or may be of a type that uses a supply from an air line which is clipped to a regulator and hose attached to the face mask.

Some important general considerations regarding the use of PPE (and RPE) are as follows:

- it must be stored appropriately when not in use and kept secure for easy access when needed;
- it should be used by the person to whom it is issued at all relevant times (it is not usual to share items of PPE) and in full accordance with any instruction or training given relating to that use;
- it must be replaced at designated intervals if disposable, or otherwise regularly checked by the user and / or a competent person for serviceability;
- suspect PPE should never be used, but be replaced immediately;
- it should be maintained in optimum condition;
- items of PPE worn simultaneously should not conflict in any such way that the wearing of one item will reduce the effectiveness of another; and
- information for appropriate and safe use of PPE, RPE and any other form of dust control should be included in employees’ training programmes.
Concluding Summary

The term dust generally refers to solid particles of matter, that although sometimes heavier than air, will remain suspended within it for some time. The term may also embrace other contaminants such as vapours, fumes and gases.

The two main types of dust are inhalable dust, which is capable of entering the nose and mouth, and respirable dust, which is the more dangerous type and capable of entering the gas exchange regions of the lungs.

Dust can originate from a variety of workplace materials, including wood, metal, rubber and foodstuffs, and a variety of work activities, including mechanical work, materials bagging and movement of raw materials.

In health and safety terms, dust particle size is of particular importance. In general, the finer the dust, or the smaller its particulate size, the more dangerous it will be. Sometimes the notation PM₁₀ is used to define dust of a size capable of being breathed in and hence, this notation has become an accepted standard measure of breathable particulate matter within air.

Dust can also be made more hazardous by virtue of its chemical or biological composition.

The risks from dust can broadly be expressed in terms of environmental risks and health and safety risks.

Environmental risks include those to people living or otherwise near to the dust source, risks to wild and farmed plants and crops, other ecological effects such as upon soil pH and particularly risk to contamination of open water sources.

The health and safety risks are generally: risks from physical contact with dust which can lead to problems of the skin such as dermatitis or problems of the eyes; respiratory diseases as a result of dust being breathed in; and other forms of risk including fire, explosion and contamination resulting from dust composition.

Respiratory risks are probably the most recognised in terms of dust exposure and diseases here include asbestosis, mesothelioma, chronic obstructive pulmonary disease, silicosis and cancer.

There is a lot of legislation pertaining to dust at work. Some key environmental legislation is the Environmental Protection Act 1990, generally accepted as the centrepiece of environmental law, the Water Resources Act 1991 that protects water and the Clean Air Act 1993 that prohibits the release of dark smoke into the atmosphere.
Key health and safety legislation includes the Management of Health and Safety at Work Regulations 1999, which emphasise risk assessment and subsequent risk removal, and the Control of Substances Hazardous to Health Regulations 2002 (COSHH) which define the concentrations of dust in air that represent a hazard to health. COSHH also defines other hazardous types of dust.

In controlling the risks from dust, the overriding aim is to first identify and sufficiently assess the risks in order that appropriate controls can be decided upon and put into place.

The risk assessment may take the form of a qualitative or quantitative approach and sometimes may involve the use of experts to scientifically sample air and accurately define its composition.

To comply with the requirements of COSHH there are generally eight stages of compliance, the first five of which relate closely to the risk assessment process. These are to assess exposure risks; decide on necessary precautions; control exposures; ensure controls are complied with; and monitor any ongoing exposures.

The remaining three stages of compliance where workers are exposed to dust are: to implement a health surveillance regime on workers who are exposed or at increased risk for any other reason; to design emergency procedures if release of a dust would create risks well beyond ‘normal’; and to ensure workers receive adequate ongoing information and training on all related health and safety aspects.

Regarding risk controls, the COSHH regulations define a hierarchy where dust elimination is top priority. That is, (i) try and remove the hazard altogether rather than try and control it; followed by (ii) the substitution of hazardous dusts or materials with those that are not hazardous; (iii) the enclosure of dusty work processes; and finally, (iv) engineering and procedural controls.

Engineering controls relate to physical removal, dilution or suppression of dust, while procedural controls relate to defining the way people act in their work.

‘Good housekeeping’ such as regularly vacuuming dust and using complementary mobile LEV systems can help mitigate risk, but all filter systems should be of the HEPA type. Non-filtered air should not exhaust into the workplace.
The final line of risk defence is by way of using PPE, such as one piece suits, eye protection and gloves. RPE may also be considered and this may involve the use of respirators to filter dusty air before it is breathed or breathing apparatus to supply clean air in contaminated environments.

It is important the PPE and RPE are used in accordance with instruction and kept in optimum working condition and / or replaced at appropriate intervals.
References


References


