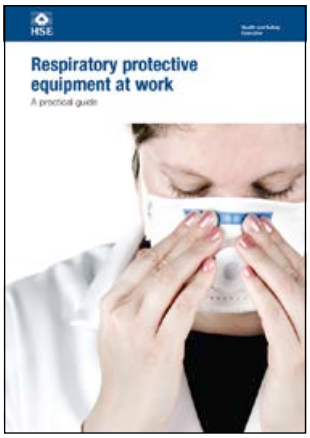
Respiratory protective equipment at work

A practical guide



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This book provides guidance on the selection and use of adequate and suitable respiratory protective equipment (RPE) in the workplace, in order to comply with the law.

It tells you when you can use RPE, using a simple step-by-step approach. It helps you to decide the adequate level of protection for a given hazardous substance and how to select RPE that is suitable for the particular wearer, task and work environment. It also contains advice on how to make sure that the selected RPE keeps working effectively.

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This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

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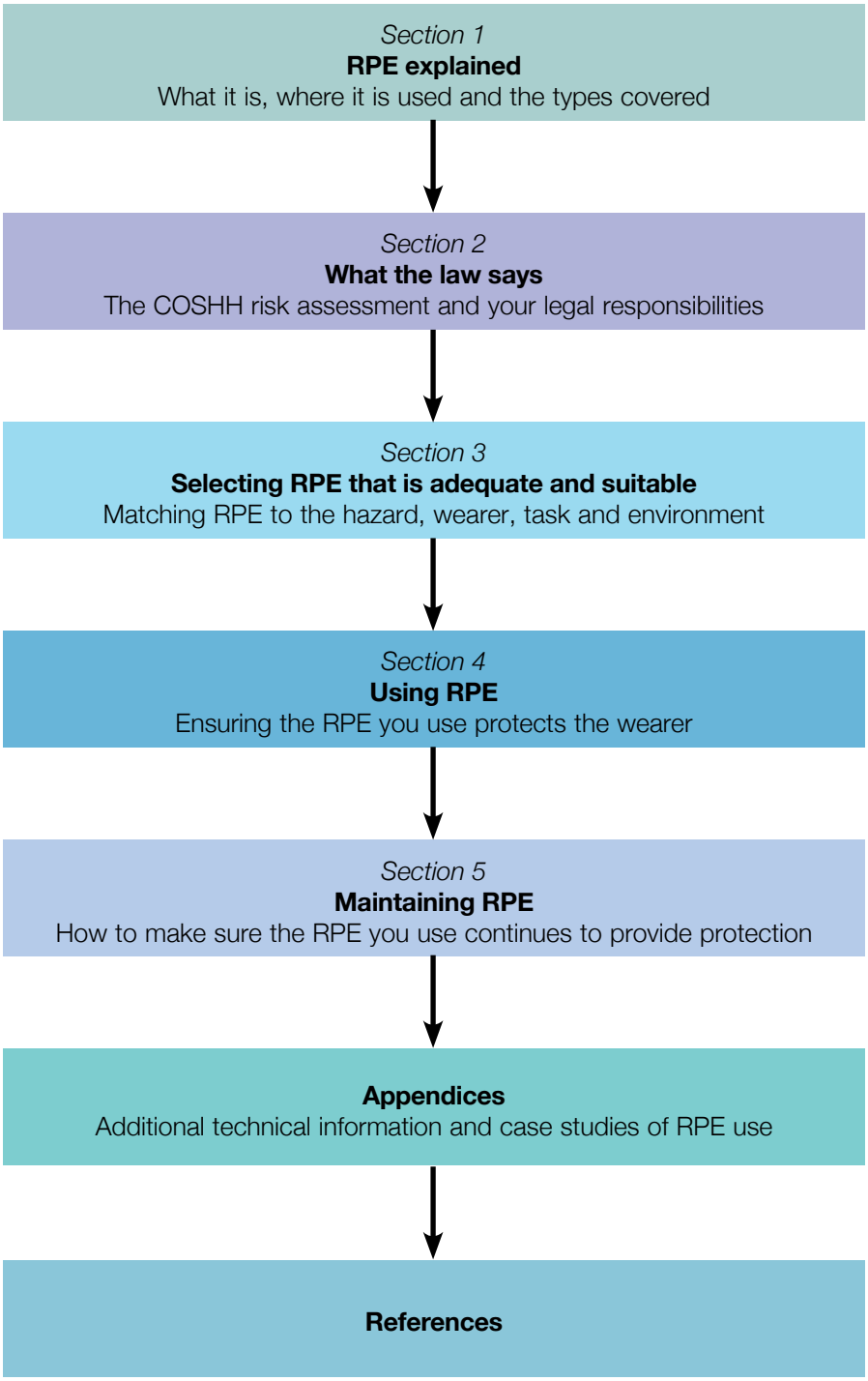

Introduction

1 Many workers wear respirators or breathing apparatus to protect their health in the workplace. These devices are collectively known as respiratory protective equipment (RPE). Respirators filter the air to remove harmful substances and breathing apparatus (BA) provides clean air for the worker to breathe.

2 This guide will help those who have responsibility for the use of RPE at work. You may be an employer or self-employed. It supports the Approved Code of Practice (ACOP) to the Regulations that apply (see paragraphs 36–39).

3 Those responsible for managing staff health and safety, safety representatives, health and safety specialists, manufacturers and suppliers of RPE will find this guide useful.

What is in this guide and how to use it

4 As an employer, you have a legal responsibility under all the Regulations listed in paragraphs 36–39 to control substances hazardous to health in your workplace, and to prevent and adequately control your employees' exposure to those substances. Provision of RPE may be necessary as part of your control regime.

5 The guide assumes you are considering the use of RPE based on your COSHH risk assessment (Control of Substances Hazardous to Health Regulations 2002).[1] The hazard and risk information gathered in your COSHH risk assessment is required to select the correct RPE.

6 The guide contains practical guidelines to help you select the correct RPE and manage its use in your workplace to ensure effective protection. The process of selection and management of RPE is split into key steps. The guide has been colour-coded to help direct you through the process (see 'Overview of this guide').

7 This guidance has been prepared by the Health and Safety Executive (HSE) in consultation with industry: employers, trade unions and trade associations.

Figure 1 RPE types

Section 1 RPE explained

8 Work activities may result in harmful substances contaminating the air in the form of dust, mist, vapour, gas or fume. For example, when:

- cutting a material such as stone or wood;
- using a product containing volatile solvents;
- handling a dusty powder;
- welding stainless steel.

9 Workers may also need to work in areas where oxygen levels are or may become low, for example:

- confined spaces, such as a trench, silo or tank.

10 RPE is a particular type of personal protective equipment (PPE) designed to protect the wearer from breathing in harmful substances or from oxygen-deficient atmospheres when other controls are either not possible or insufficient on their own.

RPE types

11 There are many different RPE types designed to:

- protect the wearer from a variety of hazards;
- suit a variety of work situations;
- match the specific requirements of the wearer.

Warning: Respirators **must not** be used in oxygen-deficient atmospheres. You will require suitable breathing apparatus and should seek professional advice. The HSE publication L101 *Safe work in confined spaces*[2] provides further information.

12 RPE is available in different sizes to allow for the facial differences of workers. Gender, ethnicity, build and many other factors mean that one size of facepiece will not fit everyone. Figure 1 shows some of the common types of RPE. Appendix 1 details the different types of available RPE.

13 RPE must be both adequate and suitable:

- **Adequate** – It is right for the hazard and reduces exposure to the level required to protect the wearer's health.
- **Suitable** – It is right for the wearer, task and environment, such that the wearer can work freely and without additional risks due to the RPE.

14 The two main types of RPE are respirators and breathing apparatus:

- **Respirators (filtering devices)** use filters to remove contaminants from the air being breathed in. They can be either:
  - non-powered respirators – relying on the wearer's breathing to draw air through the filter; or
  - powered respirators – using a motor to pass air through the filter to give a supply of clean air.

- **Breathing apparatus** needs a supply of breathing-quality air from an independent source (eg air cylinder or air compressor see Figure 2).

15 Respirators and BA are available in a range of styles, dividing into two main groups:

- **Tight-fitting facepieces (often referred to as masks)** rely on having a good seal with the wearer's face. These are available as both non-powered and powered respirators and BA. A face fit test should be carried out to ensure the RPE can protect the wearer (see paragraphs 71 and 72).
- **Loose-fitting facepieces** rely on enough clean air being provided to the wearer to prevent contaminant leaking in (only available as powered respirators or BA). Examples are hoods, helmets, visors, blouses and suits.

RPE filters

16 A key component of any respirator is the filter. Filters are available for solid or liquid particles, vapours and gases (see Table 1). They can be an intrinsic part of the device or come separately so they can be changed on a reusable respirator.

17 It is vital that you choose the correct filter, which will be effective against the hazard. Appendix 2 gives more detail on filter types.

Breathing apparatus

18 There are different types but all:

- will supply air from an independent source such as a compressed air cylinder or air compressor;
- can be used against a range of airborne hazards and in different atmospheres.

Figure 2 One type of breathing apparatus

Section 2 What the law says

Deciding to use RPE

19 The laws governing the control of harmful substances in the workplace, and their supporting ACOP, say that you should only use RPE after you have taken all other reasonably practicable measures to prevent or control exposure. By going through the risk assessment process required by these laws, you can determine whether the use of RPE is necessary in your workplace. If you write your justification for using RPE on your risk assessment record you should remember the reasons behind your chosen control regime and be able to adapt it in the future as necessary. If you have fewer than five employees you are not legally required to record your risk assessment.

20 You should only select and use RPE:

- where an inhalation exposure risk remains after you have put in place other reasonable controls (residual risk);
- while you are putting in place other control measures (interim measures);
- for emergency work or temporary failure of controls where other means of control are not reasonably practicable;
- for short-term or infrequent exposure, such as during maintenance work, where you decide that other controls at the source of the exposure are not reasonably practicable.

21 There are situations where specialist advice may be needed to select the right RPE. These include:

- emergency escape – where you need to provide RPE for safe exit from an area where hazardous substances may be released suddenly after control systems fail;
- emergency rescue.

22 Under the law, RPE is the last line of protection. Remember, RPE can protect **only** the wearer and if it is used incorrectly, or is poorly maintained, it is unlikely to provide the required protection. Note also that RPE can be uncomfortable to wear and may interfere with work, which can lead to incorrect use.

Consulting employees and safety representatives

23 When implementing health and safety measures, including the selection and use of RPE, you must consult either:

- safety representatives appointed by recognised trade unions;
- employees, either directly, or indirectly through elected representatives.

24 You will find helpful guidance in INDG232 *Consulting employees on health and safety: A brief guide to the law.*[3]

Specific requirements for RPE use

25 RPE at work should:

- adequately control inhalation exposure to provide the wearer with effective protection;
- be suitable for the intended use;
- be CE-marked (see paragraphs 33–35) or of an approved type/standard approved by HSE;
- be used by properly trained people who are supervised;
- be properly stored, cleaned and checked regularly to ensure it remains effective.

26 **Adequate** RPE is right for the hazard and reduces exposure to the level required to protect the wearer's health.

27 **Suitable** RPE is right for the wearer, task and environment, such that the wearer can work freely and without additional risks due to the RPE.

28 Employers should make sure the selected RPE is of the right size and can correctly fit the wearer. For tight-fitting facepieces the initial selection should include a fit test (see paragraphs 71 and 72).

29 In addition, you must ensure that reusable RPE undergoes thorough examination and, where appropriate, testing at suitable intervals. This should be monthly, or every three months if used less frequently. This will not only make sure the RPE protects the wearer but will also extend the life of the equipment and so maximise your investment.

30 You should record RPE examinations and tests – and, where appropriate, any repairs made – and retain them for at least five years. The records will help to keep track of the equipment's maintenance.

31 You should test the quality of air supplied to BA at least once every three months (see Appendix 3).

32 For RPE to be effective, you should integrate its use into normal workplace activities. You should also ensure that RPE is used according to the manufacturer's instructions, as poor working practices or improper use can significantly reduce its effectiveness.

Figure 3 Examples of CE marking

CE marking

33 RPE used at work must be manufactured in accordance with the Personal Protective Equipment Regulations 2002.[4] In practice, this means you need to use CE-marked equipment. The CE mark on RPE tells you that the equipment has met the minimum legal requirements for its design.

34 This marking appears as the letters 'CE' and a four-digit code that identifies the body responsible for checking manufacturing quality (see Figure 3).

35 CE marking does not indicate that an RPE device is automatically adequate and suitable for use in your workplace. It is your responsibility to select the correct RPE to meet your specific requirements.

The Regulations

36 The Health and Safety at Work etc Act 1974[5] and the Management of Health and Safety at Work Regulations 1999[6] require you to provide and maintain a safe working environment, so far as is reasonably practicable. They set out the basic requirements for you to follow.

37 In addition to the COSHH Regulations 2002, RPE may need to be used to satisfy requirements in the following pieces of legislation. You will need to consider whether any of these Regulations apply to you and comply with any specific requirements they contain on RPE:

- Control of Asbestos Regulations 2012;[7]
- Control of Lead at Work Regulations 2002;[8]
- Ionising Radiations Regulations 1999;[9]
- Confined Spaces Regulations 1997.

38 These Regulations are supported by Approved Codes of Practice. ACOPs give practical guidance on compliance and have a special status in law. If you are prosecuted for a breach of health and safety law, and it is proved that you did not follow the relevant provisions of the code, you will need to show that you have complied with the law in some other way or a court will find you at fault.

39 For RPE use that is not covered by any of the above Regulations, employers and employees have duties under the Personal Protective Equipment at Work Regulations 1992.

Accidents involving RPE

40 You should report accidents involving RPE and diseases resulting from exposure to hazardous substances by completing the appropriate online report form at www.hse.gov.uk/riddor. You should consult L73 *A guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995*[10] for specific details.

Section 3 Selecting RPE that is adequate and suitable

Introduction

41 This guide is for those who need to manage exposure where it cannot be avoided. Your risk assessment will help you decide if controls are required for airborne workplace hazards such as dust, mist, vapour, gas or fume. RPE may be required because there are no other suitable controls or if the controls are not sufficient on their own.

42 You will require RPE that is adequate and suitable to ensure the wearer is protected.

This means:

- **Adequate** – It is right for the hazard and reduces exposure to the level required to protect the wearer's health.
- **Suitable** – It is right for the wearer, task and environment, such that the wearer can work freely and without additional risks due to the RPE.

43 To select RPE that will protect the wearer you will need a basic understanding of:

- the hazardous substance and the amount in the air (exposure);
- the form of the substance in the air (eg gas, particle, vapour);
- the type of work being carried out;
- any specific wearer requirements, such as other PPE or a need for spectacles.

44 Figure 4 illustrates a process you can follow to gather this information and select the most suitable RPE options.

45 If there is a likelihood of the atmosphere in which the RPE will be used being deficient in oxygen, or if the concentration of substance in the air could be life-threatening, specialist BA is required. Only those with appropriate training should use this type of BA. The use of RPE in oxygen-deficient atmospheres is not covered in this guide and specialist advice may be needed.

Selecting RPE adequate against the hazard

Identifying the exposure hazard

46 You will have been through the COSHH risk assessment process to identify the hazardous substances in your workplace. As a reminder, there are two key areas to consider:

- Products you use at work that are hazardous substances will come with a safety data sheet (SDS) provided by the supplier. Any product classed as 'dangerous for supply' must come with this sheet by law and it should contain information on:
  - health hazards (product labelling);
  - forms of the substances contained in the product;
  - type of RPE necessary for its use.
- Work activities, such as cutting or heating materials, may generate harmful substances, which contaminate the air in the form of dusts, mists, gases or fumes. Further information on these substances is given in a series of *COSHH essentials* guidance sheets.[11]

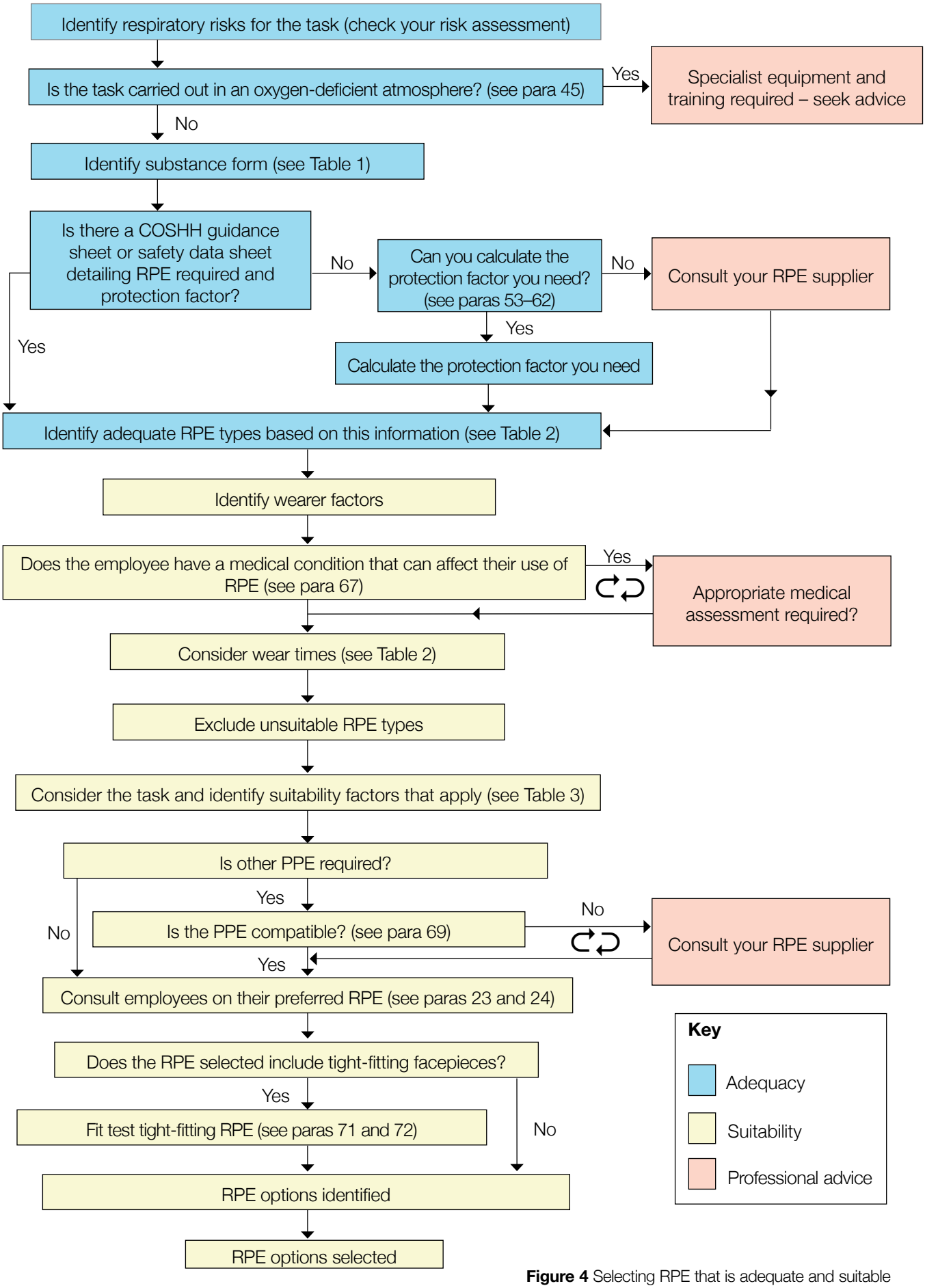

Figure 4 Selecting RPE that is adequate and suitable

Forms of substance

47 Hazardous substances can be present in the air as particles (solid or liquid), vapour or gas. Under certain conditions, they can exist in more than one form at the same time (eg during paint spraying). You need to identify the form of the hazardous substances in the air to select the right RPE (see Table 1). Note that:

- solid and liquid forms will be present as particles;
- fine sprays and mists are made up of liquid particles (droplets);
- fumes are very fine solid particles and not gas or vapour;
- smoke, fume and airborne liquids require RPE that is suitable for use against particles.

48 In addition to the above, volatile liquids may under certain conditions become airborne as both particles and vapour.

Table 1 Examples of the different forms of hazardous substances

Form	Properties	Examples
Solid particles	Particles of solid material, including aerosols, dusts, fibres, smokes and fume	Asbestos dust Engine exhaust particles and fume Lead dust and fume Stone dust Welding fume Wood dust Smoke Fungal spores and parasites Bacteria and viruses Flour
Liquid particles	Fine sprays, mists and aerosols made up of small droplets of liquid	Sprayed liquids: ■ paints ■ pesticides ■ powder coating mix ■ liquid jetting Mists: ■ chrome acid ■ cutting fluids ■ oil mist
Vapour	Gaseous forms of a solid or liquid	Solvent vapour Mercury vapour
Gas		Carbon monoxide Engine exhaust gases Sewer gas Chlorine

Matching filters to the substance and its form

49 There are various types of respirator and they all rely on filter material to remove the hazard. The filter material will be different depending on the hazardous substance and its form. There are two basic filter types available:

- particle filters;
- gas/vapour filters.

Remember that airborne liquids in the form of fine sprays and mists and solid materials, including dusts, fibres, smoke and fume, require a particle filter.

50 As air is breathed in, it passes through the filter(s), removing the contaminants before they reach the lungs. The respirator can either:

- be made of the filter material;
- have a filter(s) fitted to it; or
- use a motor to pass air through the filter(s) that may be separate from the facepiece.

51 Remember:

- Particle filters do not protect against gas or vapour.
- Gas/vapour filters do not protect against particles.
- Neither filter type can be used in oxygen-deficient atmospheres.

52 Some situations require a combination of filters suitable for the different substances or forms present. A full explanation is given in Appendix 2.

Deciding on the protection factor

53 You need to ensure that the RPE you select can protect the worker from the hazardous substance in the air around them. Your decision will depend on the amount in the air and its form (eg particles, vapour). There are various types of respirator and BA available. The protection they offer will be determined by a number of things, including the protection factor. In simple terms, this is the ratio of hazardous substance outside the RPE to the amount inside the RPE.

54 To help you, each RPE type and class is categorised by an assigned protection factor (APF). The APF is a number rating that indicates how much protection that RPE is capable of providing. For example, RPE with an APF of 10 will reduce the wearer's exposure by at least a factor of 10 if used properly, or, to put it another way, the wearer will only breathe in one-tenth or less of the amount of substance present in the air.

55 There are only a few number ratings used, so RPE APFs will be either: 4; 10; 20; 40; 200 or 2000. When calculating the protection factor, **always** choose an APF above the calculated value.

56 When choosing an RPE device with an APF capable of providing the wearer with adequate protection, check the following:

- Does the SDS provide advice on the required APF?
- Is there advice on the required APF in *COSHH essentials*?
- Does the substance have a prescribed workplace exposure limit (WEL)? If so, you need to make sure the wearer is protected to a level below the WEL (see EH40 *Workplace exposure limits*).[12]

57 In addition, for hazardous substances that are classed as carcinogens or mutagens, or are a potential cause of occupational asthma, exposure needs to be reduced to as low a level as is reasonably practicable. It is also important to remember that work activities involving micro-organisms may be high risk even with limited exposures. There is further specific guidance on RPE choice for biological agents in Appendix 6.

58 If there is no advice on the required APF in the SDS or in *COSHH essentials*, you can calculate the required protection factor using the WEL and the quantity of the substance in the air. Find out the amount of substance in the air by taking exposure measurements in your workplace. Figure 5 gives an example of how to calculate the required protection factor.

Substance – Toluene (a common solvent)

- Measured airborne toluene concentration: 350 ppm (parts per million) within an eight-hour time-weighted average (TWA).
- Toluene WEL: 50 ppm (from EH40).
- Required APF to reduce to WEL = 350/50 = 7.

Select RPE device with an APF above the required protection factor. In this case an APF of 10 will be required.

Figure 5 Example of a calculation to find required APF

59 If there is more than one hazard present, you will need to find out the protection factor for each and choose RPE based on the highest protection factor required.

60 If you are unable to take exposure measurements in your workplace, or if the substance does not have a WEL, your RPE supplier may be able to advise you on the required APF for your situation.

61 As an alternative, the Scottish Centre for Healthy Working Lives has developed an online tool, in conjunction with HSE, to assist you in selecting RPE, based on the same methods used to develop *COSHH essentials: Easy steps to control health risks from chemicals.*[13] There is a link to this tool on HSE's web pages: www.hse.gov.uk/respiratory-protective-equipment/resources.htm. A paper is also available, detailing the methodology.[14]

62 Now you have identified the hazardous substance(s) you need to protect your workers from, its form, and the required APF, you are in a position to consider what types of RPE device can provide them with adequate protection. Table 2 lists a range of types, but before you make your final choice you need to consider suitability factors, which are detailed in the next section: 'Selecting RPE suited to the wearer, task and environment'.

Table 2 RPE types

Adequacy/suitability	**Respirators**						
RPE type							
	Disposable half mask – particle filter*	**Reusable half mask – particle filter**	**Reusable half mask – gas/ vapour filter**	**Full face mask – particle filter**	**Full face mask – gas/vapour filter**	**Powered mask**	**Powered hoods/helmets**
Effective for particles	✔	✔	✘	✔	✘	✔ **	✔ **
Effective for gas/vapour	✘	✘	✔	✘	✔	✔ **	✔ **
Continuous wear time	Less than 1 hr	Less than 1 hr	Less than 1 hr	Less than 1 hr	Less than 1 hr	More than 1 hr	More than 1 hr
APF4 types	✔	✔	✘	✔	✘	✘	✘
APF10 types	✔	✔	✔	✔	✘	✔	✔
APF20 types	✔	✔	✘	✘	✔	✔	✔
APF40 types	✘	✘	✘	✔	✘	✔	✔
APF200 types	✘	✘	✘	✘	✘	✘	✘
APF2000 types	✘	✘	✘	✘	✘	✘	✘
Page reference	29	30	31	32	33	34	35

* Sometimes referred to as a filtering facepiece or orinasal respirator.

** Only protects against particle or gas/vapour when the appropriate filter is fitted.

Table 2 Continued

Adequacy/suitability	**Breathing apparatus**		
RPE type			
	Fresh air hose	**Constant flow airline**	**Demand valve**
Effective for particles	✔	✔	✔
Effective for gas/vapour	✔	✔	✔
Continuous wear time	Unassisted less than 1 hr Assisted/powered more than 1 hr	More than 1 hr	More than 1 hr
APF4 types	✘	✘	✘
APF10 types	✔	✔	✘
APF20 types	✘	✔	✘
APF40 types	✔	✔	✘
APF200 types	✘	✔	✘
APF2000 types	✘	✘	✔
Page reference	36	37–41	42

Selecting RPE suited to the wearer, task and environment

Suitability factors

63 In addition to making sure the RPE you use is adequate to control the hazards, you need to ensure it is suitable for:

- the individual wearer;
- the tasks they are doing;
- the environment in which they are working.

64 Table 3 gives some of the key suitability factors to consider and paragraphs 23 and 24 discuss consulting employees and safety representatives – involving the wearer in the choice will help you select the most appropriate RPE (see also paragraph 75). Appendix 1 gives a full list of RPE types.

65 For example, it is recommended that continuous wear time for tight-fitting (unpowered) RPE is less than an hour, after which the wearer should take a break. Otherwise, the RPE can become uncomfortable to wear, leading to loosening or removal of the mask in the work area. In these situations, where RPE is required to be worn continuously for long periods, powered respirators or airline BA, for example a loose-fitting facepiece such as a hood or helmet, are better options.

66 Other common factors about the **wearer** you need to consider are:

- Do they have facial hair or markings that could prevent a good seal between the wearer's face and the RPE?
- Do they have any pre-existing medical conditions?
- Do they wear spectacles or contact lenses?

67 It is important to know that some pre-existing medical conditions (examples include breathing disorders such as asthma, skin allergies, or even heart problems) may restrict or prevent some workers wearing any RPE, or certain types of RPE. You will need to ensure that workers are fit to wear the selected and required RPE. If unsure, you (the employer) should arrange for appropriate medical assessment.

68 There are a number of factors you need to consider for the **task**, including:

- work-rate;
- wear-time;
- vision requirements.

69 Other head-worn PPE can potentially interfere with RPE, preventing one or more of the components from working correctly (eg eye protection, ear protection and safety helmets – see Figure 6). Where possible, choose equipment where the different forms of protection required are combined (often referred to as integrated or combined PPE), eg eye, face, head and respiratory protection provided by a powered helmet respirator.

70 You also need to consider the workplace **environment**, for example temperature or humidity.

Carrying out a fit test

71 If you are considering RPE with a tight-fitting facepiece, you should make sure that each wearer undergoes a fit test. Remember, people come in different shapes and sizes, so facial differences will mean that one kind of RPE is unlikely to fit all. The differences are even more significant between men, women, and people of different ethnicity. If the RPE does not fit, it will **not** protect the wearer.

72 Facepiece fit testing is a method of checking that a tight-fitting facepiece matches the wearer's facial features and seals adequately to their face. It will also help to identify unsuitable facepieces that should not be used. Remember that tight-fitting RPE will only provide effective protection if the wearer is clean shaven, so they should also be clean shaven when fit tested.

Figure 6 Some head-worn PPE can potentially interfere with RPE and vice versa

You should carry out a fit test as part of the initial selection of the RPE – see Appendix 4 for further details. If RPE is used frequently it is good practice to ensure repeat fit testing is carried out on a regular basis.

Further information

73 Appendix 5 features some case studies that show how to choose adequate and suitable RPE. There is further specific guidance on choosing RPE for radioactive and biological hazards in Appendix 6. If you are still unsure, you should seek professional advice.

Table 3 Suitability factors to consider

Suitability factor	Why	Solution	
Work rate	Higher work rates may increase breathing and sweating, which can affect the performance of some types of RPE. Higher breathing rates can cause contaminants to leak in, and sweating can cause facepieces to slip and leak.	Light work rate	Sedentary work: assembly or sorting of light materials, arm and leg work, drilling. Most RPE would be suitable.
		Medium work rate	Sustained hand and arm work: sawing, planing or chiselling wood, plastering, filing, work with pneumatic breaker, intermittent handling or carrying moderately heavy material, shovelling, sledgehammer work, concrete block laying, pushing or pulling heavily laden hand-cart. Consider more comfortable RPE such as powered respirators or loose-fitting devices.
		Heavy work rate	Heavy manual work: shovelling or digging, climbing, ramps or ladders. Powered respirators or BA are recommended.
Wear time	Unpowered tight-fitting masks become uncomfortable to wear for long periods and wearers may be tempted to loosen or remove the RPE.	Wear time more than 1 hr	Using powered RPE with tight-fitting masks or loose-fitting facepieces will help minimise fatigue and discomfort.
Abnormal temperature or humidity	In hot and humid conditions, wearing RPE increases heat stress, sweating and discomfort.	Extreme heat	Using powered respirators or airline BA would help to minimise these problems. Proprietary cooling devices are available but consume a lot of compressed air.
	Airflow associated with powered respirators or airline BA can cause chilling effects.	Extreme cold	Proprietary heating devices are available but consume a lot of compressed air.
Facial hair and markings	Affects where a face mask seals to the face and will cause leakage.	1 Beard, stubble or any hair in the region where a face mask seals 2 Deep cuts or scars, wrinkles, moles, warts present in the face seal area	Consider the use of loose-fitting facepieces, which do not rely on a tight seal in this region.

Table 3 Continued

Suitability factors	Why	Solution
Spectacles	Spectacles with side arms are incompatible with full face masks as they break the face seal and they may also interfere with the fit of half masks.	RPE manufacturers can supply special frames, which fit inside their masks. It is the responsibility of the employer to find and provide an appropriate solution.
Vision	If you need to see fine details when wearing RPE, but don't need to protect the eyes from the airborne hazard, RPE types which include face protection (full face masks, visors, hoods) may not be ideal because they can be prone to scratching, misting and surface contamination.	Consider half mask RPE, provide adequate lighting, or choose designs that resist scratching and internal misting. Powered respirators or airline BA are more resistant to misting. Some types include 'tear-off' consumable visors.
Communication	All RPE affects your ability to communicate.	If your work requires clear and precise communication you should use RPE incorporating proprietary communication devices (ranging from simple speech diaphragms to complex radio intercom systems), or other suitable forms of communication.
Flammable or explosive atmospheres	RPE can be a source of ignition.	If you cannot avoid working in potentially flammable or explosive atmospheres, including oxygen-enriched atmospheres (levels above 21%), you may need to use intrinsically safe, light alloy-free and antistatic RPE.
Use of air power tools	Air jets from power tools (pneumatic or electric) can make RPE valves leak.	Shield tools or seek alternative design. Use RPE designs with valves remote from tool exhaust location.
	Connecting air-powered tools and your RPE to the same air supply will affect RPE performance.	Ensure that your compressor can supply enough air for both at the same time.
Contact lenses	Wearers may suffer discomfort or, if the lenses are dislodged, the wearer may remove the RPE to replace them while still in the hazardous area.*	Use spectacles (in mask if necessary) instead.
Mobility	Snagging and damage to trailing hoses. Added bulk of fan units/air cylinders in tight spaces.	Ensure adequate inspection regime and consider other RPE types.

* The lenses can also jam in the RPE valves, leading to loss of protection.

Section 4 Using RPE

74 For RPE to be effective, its use should be integrated into normal workplace activities. You need to make sure that control measures, including RPE, are properly used and are not made less effective by bad work practices, inadequate training or improper use.

75 Your employees need to use RPE in accordance with the manufacturer's instructions and the training and instruction you provide. If RPE is not worn properly, it will not provide the required protection. It is often best, if possible, to give a choice of several adequate and suitable RPE to wearers so they can choose the one they find most comfortable.

Management and supervision

76 Employers are responsible for implementing and managing RPE selection and use, or delegating that responsibility to another trained person. Support can be provided by internal or external health and safety professionals.

77 You should also ensure those wearing RPE follow the measures you put in place. These are some of the key factors for users of RPE to remember:

- Users of tight-fitting facepieces should have passed a fit test for the particular RPE device they are using.
- Hair, spectacles or other PPE can break the seal on tight-fitting facepieces, allowing the user to breathe in hazardous substances.
- Valves on reusable RPE need to be maintained and replaced.

78 In addition, users should remember that the RPE will only be effective if it is worn and used in accordance with the manufacturer's instructions.

79 Users should check their RPE every time they use it – this is known as a 'pre-use check'. The check will cover a variety of things, dependent on the type of RPE, so users should follow the manufacturer's instructions. Common things to look out for include making sure that:

- the nose bridge on disposable RPE is adjusted to ensure a proper seal;
- all the straps are used;
- any hoses are connected properly;
- battery-powered RPE is fully charged.

80 For RPE with tight-fitting facepieces, the user should carry out a 'fit check' of the seal when the device is first put on. For reusable masks this can be done by placing a hand over the filter or inlet valve(s) and breathing in. If there is a good seal, the user will experience the mask sucking in toward their face. The wearer should hold their breath for ten seconds and the facepiece should not loosen. If it does, the facepiece should be readjusted and the seal checked again. Do not use RPE if a good seal cannot be achieved. The RPE manufacturer's instructions will provide details of how to perform a fit check.

Training

81 All people involved in the selection, use, storage and maintenance (if required) of RPE require training. An appropriate training programme could cover the following areas:

- Why RPE is needed.
- The hazards, risks and effects of exposure.
- What RPE is being provided.
- How RPE works.
- Why fit testing is required (if relevant).
- How to wear and check the RPE correctly.
- Fit checking before use.
- What maintenance is required and when.
- Where and how it should be cleaned and stored.
- How to report/tackle any problems.
- Employee and employer responsibilities.
- Use and misuse of RPE.

82 The wearer needs to be clean-shaven around the face seal to achieve an effective fit when using tight-fitting facepieces. Training is a good opportunity to make employees aware of this. If workers have beards, or are unable to be clean-shaven, a tight-fitting device will not be suitable so an appropriate loose-fitting device should be chosen.

83 Your RPE supplier should provide information on the training required to use and maintain their products. Anybody selecting, using or maintaining RPE should be competent. You should be able to demonstrate this by reference to records of appropriate training.

Fit testing

84 If you are using RPE with tight-fitting facepieces you should make sure each wearer has a fit test (see paragraphs 71 and 72). This is needed to ensure the selected facepiece can fit the wearer correctly.

85 You can use the fit test as a training opportunity, as it allows you to highlight to the wearer the consequences of poor fit and improper use on the effectiveness of the RPE device.

86 It is also good practice to have a system to ensure repeat fit testing is carried out on a regular basis. This is especially important when RPE is used frequently as a primary means of exposure control, eg annual testing for workers involved in licensed asbestos removal. If there are any changes to a person's face through, for example, weight loss/gain, scars etc, a repeat fit test will be necessary.

Awareness

87 You may want to consider publicising the use of RPE in your workplace on notice boards and via other communication systems.

Designated areas

88 You may also want to designate areas where RPE is needed as 'RPE zones'. This will make it clear where RPE is required. You should note that designation of RPE zones is mandatory in certain circumstances under the Control of Asbestos Regulations 2012.

Dos and don’ts

89 General dos and don’ts are given in the following tables, to highlight key considerations for using RPE. These are reminders for the wearer but, as the employer, you should ensure that your employees follow good practice.

Table 4 Non-powered respirators

Dos	Don’ts
■ Always ensure the respirator is in good working order before putting it on, even when new. ■ Always use **all the straps** provided, making sure they are correctly positioned and adjusted. Follow the manufacturer’s instructions. ■ Always fit two identical filters to a twin-filter respirator. ■ Always clean and store the RPE properly, paying special attention to the valves on reusable RPE. ■ Change filters as instructed by the manufacturer. ■ Ensure the other PPE you need to wear is compatible with the respirator.	■ Never use in oxygen-deficient atmospheres. ■ Never use a particle filter to protect against gases/vapours or gas/vapour-only filters against particulates. ■ Never use if dirty, damaged or incomplete.

Table 5 Powered respirators

Dos	Don’ts
■ Always ensure the respirator is in good working order before putting it on, even when new. ■ Always use **all the straps** provided, making sure they are correctly positioned and adjusted. Follow the manufacturer’s instructions. ■ Always check the fan is providing enough airflow before you use the device. ■ Always fit identical filters to a multi-filter unit. ■ Always change all the filters on a multi-filter unit together. ■ Always clean and store the RPE properly, paying special attention to the valves. ■ Change filters as instructed by the manufacturer. ■ Ensure the other PPE you need to wear is compatible with the respirator.	■ Never use in oxygen-deficient atmospheres. ■ Never use particle-only filters against gas/vapour, or gas/vapour-only filters against particulates. ■ Never use if dirty, damaged or incomplete, or if not providing enough air. ■ Never keep working if the fan stops or the flow rate falls. Leave the work area immediately.

Table 6 Breathing apparatus

Dos	Don’ts
■ Always ensure the breathing apparatus is in good working order before putting it on, even when new. ■ Always look after your supply hose during use – your life may depend on it. ■ Always use **all the straps** provided, making sure they are correctly positioned and adjusted. Follow the manufacturer’s instructions. ■ Ensure that an adequate clean air supply is available for all users. ■ Ensure that the compressed air quality meets the minimum requirements of BS EN 12021.[15] ■ Always plan your exit from the contaminated area so you don't run out of air. ■ Ensure the other PPE you need to wear is compatible with the BA.	■ Never place the hose inlet near to potential sources of contamination, eg vehicle exhausts. ■ Never use the equipment without the waist belt. ■ Never use a light-duty airline hose where there is any potential for crushing by vehicles or passers-by etc. ■ Never keep working if the airflow rate drops or any warning devices are activated. Leave the work area immediately.

Section 5 Maintaining RPE

Maintenance

90 Maintenance is a requirement for all RPE, except for disposable (single use) RPE, and should be carried out by properly trained personnel. Thorough maintenance, examination and tests should be carried out at least once a month. However, if the RPE is used only occasionally, an examination and test should be carried out before use and, in any event, the interval should not exceed three months. Emergency escape-type RPE should be examined and tested in accordance with the manufacturer's instructions.

91 There are five key points you should follow when carrying out RPE maintenance:

- Follow the manufacturer's instructions.
- A competent person should carry out the work.
- Keep records (see Figure 7 for an example).
- Ensure the intervals for maintenance are appropriate.
- The maintenance programme should reflect the complexity of maintaining the RPE.

92 Ideally, any parts that require replacing will be sourced from the original manufacturer of the RPE. This will ensure any replacement parts continue to allow the equipment to operate as originally intended and perform to the standards that ensure the RPE offers the protection stated by the manufacturer.

93 You must keep records of examination and testing, and any repairs made, for at least five years.

94 Key maintenance tasks include:

- changing any replaceable filters;
- cleaning the device;
- valve maintenance and replacement;
- checking the straps for damage;
- checking the battery charge and flow rate for powered devices.

95 Filters only have a limited capacity, or can become clogged, making breathing difficult. Replaceable filters should be changed when necessary to make sure the RPE device can remain effective. See Appendix 2 for more information.

96 Cleaning a reusable facepiece is required to remove contamination, moisture build-up and microbes. The manufacturer should provide advice on cleaning and inspection of the RPE, including on the appropriate cleaning materials and disinfectants to use. The use of cleaning products other than those recommended by the manufacturer may cause problems with the RPE.

97 Cleaning and drying should be carried out in a clean area to avoid contamination of the RPE.

Disposal

98 Contaminated RPE, or components, or any of the materials used to clean or disinfect the RPE, may need to be considered as hazardous waste. This will depend on the specific substances and the amounts involved. In some cases, specific legislation may apply. If in doubt, seek specialist help.

Storage

99 Remember that all RPE requires clean storage facilities. The following is a general guide:

- RPE should be stored in accordance with the manufacturer's user instructions in order to prevent contamination, damage and deterioration.
- RPE should be cleaned before being stored to prevent the storage area becoming contaminated.
- Provide storage that is easily accessible so that RPE can be safely stored during breaks.

Air quality

100 Air supplied to BA should meet minimum quality requirements, in line with the latest British Standard. Your RPE or air compressor supplier should be able to advise you on how to meet these requirements. Further guidance on compressed air quality is given in Appendix 3.

Monthly Respiratory Protective Equipment Maintenance Record															
Company/section															
Make							**Model**								
Serial No							**Issued to**								
	FULL FACE MASK							**HALF FACE MASK**							
Date	Cleanliness	Filter check	Facepiece/seal	Visor	Head straps/buckles	Valves/seals		Cleanliness	Filter check	Facepiece/seal	Head straps/buckles	Valves/seals	Maintenance needed	Date action complete	Fit for use? Y/N	Signature
/ / 20XX																
/ / 20XX																

Figure 7 Example maintenance record

Appendix 1 RPE types

1 The following pages detail the different types of available RPE. By going through Section 3 of this guide, 'Selecting RPE that is adequate and suitable', you can find out which RPE is appropriate for your workplace.

2 You may find you have several options. Remember, you can also use equipment that provides higher protection than the minimum you need.

3 In some cases, more than one hazard and/or form of substance in your workplace requires the use of RPE and special consideration of the filter type for respirators is required in these cases (see 'Combined filters' section in Appendix 2).

4 Table 3 provides information on the suitability aspects relating to the wearer and task. Cross-reference these with the types of RPE you have identified as adequate. This will allow you to choose the most appropriate RPE for your individual situation – one that is both adequate and suitable. Again, you may find you have more than one adequate and suitable option; in that situation, the choice is yours. Involving the wearer will help you select the most appropriate RPE.

5 Each RPE type detailed on the following pages has photographs to illustrate its typical appearance. Individual models from various manufacturers may differ in style and detail.

Figure 8 Disposable half mask respirators

Classification of RPE	Protection factor
FFP1	4
FFP2	10
FFP3	20

Work rate	Medium (all classes)	
Continuous wear time	Less than 1 hour	
Effective against	Solid or liquid particles	
Fit testing required	Yes	
Fit testing options	**Qualitative**	**Quantitative**
	✔	✔
Applicable standards	BS EN 149	

Important information, which applies to all these types.

Dispose of masks marked NR (not reusable) after a single shift (8 hours).
P1 and P2 filters are not recommended for fumes unless stated. (See general dos and don'ts Tables 4–6.)

Figure 9 Reusable half mask respirators – particle filter

Classification of RPE	Protection factor
Half mask + P1 filter	4
Half mask + P2 filter	10
Half mask + P3 filter	20

Work rate	Medium (all classes)	
Continuous wear time	Less than 1 hour	
Effective against	Solid or liquid particles	
Fit testing required	Yes	
Fit testing options	**Qualitative**	**Quantitative**
	✔	✔
Applicable standards	BS EN 140 mask and BS EN 143 filter; BS EN 1827	

Important information, which applies to all these types.

P1 and P2 filters are not recommended for fumes unless stated. Always clean and store the mask properly – pay special attention to the valves. (See general dos and don'ts Tables 4–6.)

Figure 10 Reusable half mask respirators – gas/vapour filter

Classification of RPE	Protection factor
Gas	10
FFgas	10
FMgas	10

Work rate	Medium (all classes)	
Continuous wear time	Less than 1 hour	
Effective against	Gas or vapour	
Fit testing required	Yes	
Fit testing options	**Qualitative**	**Quantitative**
	✔	✔
Applicable standards	BS EN 140 and BS EN 14387; BS EN 405; BS EN 1827	

Important information, which applies to all these types.

Never use it to protect against particles, unless a particle filter is incorporated. If a P1 particle filter is incorporated the protection factor will be reduced to 4. (See general dos and don'ts Tables 4–6.)

Figure 11 Full face mask respirators – particle filter

Classification of RPE	Protection factor
P1	4
P2	10
P3	40

Work rate	Medium (all classes)	
Continuous wear time	Less than 1 hour	
Effective against	Solid or liquid particles only	
Fit testing required	Yes	
Fit testing options	**Qualitative**	**Quantitative**
	✘	✔
Applicable standards	BS EN 136 mask and BS EN 143 filter	

Important information, which applies to all these types.

Always clean and store the mask properly – pay special attention to the valves. Badly perished and deformed exhalation valves will be incapable of sealing. (See general dos and don'ts Tables 4–6.)

Figure 12 Full face mask respirators – gas/vapour filter

Classification of RPE	Protection factor
Gas	20

Work rate	Medium (all classes)	
Continuous wear time	Less than 1 hour	
Effective against	Gas or vapour	
Fit testing required	Yes	
Fit testing options	**Qualitative**	**Quantitative**
	✘	✔
Applicable standards	BS EN 136 mask and BS EN 14387 filter	

Important information, which applies to all these types.

Never use it to protect against particles, unless a particle filter is incorporated. If a particle filter is incorporated the protection factor will be reduced to 4 if P1 or 10 if P2. (See general dos and don'ts Tables 4–6.)

Figure 13 Powered respirators with masks

Classification of RPE	Protection factor
TM1	10
TM2	20
TM3	40

Work rate	Medium to heavy (all classes)	
Continuous wear time	More than 1 hour	
Effective against	Solid or liquid particles, gas or vapour depending on filter type	
Fit testing required	Yes	
Fit testing options	**Qualitative**	**Quantitative**
Half mask fit test option	✔	✔
Full face mask fit test option	✘	✔
Applicable standards	BS EN 12942	

Important information, which applies to all these types.

In the event of the fan failing, a degree of protection is still offered but the wearer should exit to a safe area. (See general dos and don'ts Tables 4–6.)

Figure 14 Powered respirators with hoods/helmets

Classification of RPE	Protection factor
TH1	10
TH2	20
TH3	40

Work rate	Medium (all classes)
Continuous wear time	More than 1 hour
Effective against	Solid or liquid particles, gas or vapour depending on filter type
Fit testing required	No
Applicable standards	BS EN 12941

Important information, which applies to all these types.

Never keep working if the fan stops or the flow rate falls – leave the work area immediately. (See general dos and don'ts Tables 4–6.)

Figure 15 Fresh air hose (FAH) breathing apparatus

Classification of RPE	Protection factor
Assisted FAH with half mask	10
Unassisted FAH with full face mask	40
Assisted/powered FAH with full face mask	40
Powered FAH with hood	40

Work rate	Unassisted – medium	
	Assisted/powered – heavy	
Continuous wear time	Unassisted – less than an hour	
	Assisted/powered – more than 1 hour	
Effective against	Solid or liquid particles, gas or vapour	
Fit testing required	Yes (except hood)	
Fit testing options	**Qualitative**	**Quantitative**
Half mask	✔	✔
Full face mask	✘	✔
Applicable standards	BS EN 138 and BS EN 269	

Important information, which applies to all these types.

Always anchor the hose inlet in clean air.
Much higher inhale and exhale resistance can be experienced with this type of mask and can lead to removal by the wearer due to the discomfort. (See general dos and don'ts Tables 4–6.)

Figure 16 Constant flow airline breathing apparatus with a mask – light duty

Classification of RPE	Protection factor
IA	10
2A	20
3A	20
4A (full face mask only)	40

Work rate	Medium to heavy (all classes)	
Continuous wear time	More than 1 hour	
Effective against	Solid or liquid particles, gas or vapour	
Fit testing required	Yes	
Fit testing options	**Qualitative**	**Quantitative**
Half mask fit test option	✔	✔
Full face mask fit test option	✘	✔
Applicable standards	BS EN 14594	

Important information, which applies to all these types.

Always clean and store the mask properly – pay special attention to the valves. Badly perished and deformed exhalation valves will be incapable of sealing. (See general dos and don'ts Tables 4–6.)

Figure 17 Constant flow airline breathing apparatus with a mask

Classification of RPE	Protection factor
IB	10
2B	20
3B	20
4B (full face mask only)	40

Work rate	Medium to heavy (all classes)	
Continuous wear time	More than 1 hour	
Effective against	Solid or liquid particles, gas or vapour	
Fit testing required	Yes	
Fit testing options	**Qualitative**	**Quantitative**
Half mask fit test option	✔	✔
Full face mask fit test option	✘	✔
Applicable standards	BS EN 14594	

Important information, which applies to all these types.

Always clean and store the mask properly – pay special attention to the valves. Badly perished and deformed exhalation valves will be incapable of sealing. Never use light duty supply tubes. (See general dos and don'ts Tables 4–6.)

Figure 18 Constant flow airline breathing apparatus with hoods/helmets – light duty

Classification of RPE	Protection factor
IA	10
2A	20
3A	40
4A	40

Work rate	Medium to heavy (all classes)
Continuous wear time	More than 1 hour
Effective against	Solid or liquid particles, gas or vapour
Fit testing required	No
Applicable standards	BS EN 14594

Important information, which applies to all these types.

Always ensure you have an adequate supply of clean compressed breathing air before use.
Always look after your supply tube during use – your life may depend on it. (See general dos and don'ts Tables 4–6.)

Figure 19 Constant flow airline breathing apparatus with hoods/helmets

Classification of RPE	Protection factor
IB	10
2B	20
3B	20
4B	40

Work rate	Medium to heavy (all classes)
Continuous wear time	More than 1 hour
Effective against	Solid or liquid particles, gas or vapour
Fit testing required	No
Applicable standards	BS EN 14594

Important information, which applies to all these types.

Always ensure you have an adequate supply of clean compressed breathing air before use.
Always look after your supply tube during use – your life may depend on it.
Never use light duty supply tubes for normal airline applications. (See general dos and don'ts Tables 4–6.)

Figure 20 Constant flow airline breathing apparatus with full suit

Classification of RPE	Protection factor
IA or 1B	10
2A or 2B	20
3A or 3B	20
4B	40
Classes 1, 2, 3, 4 and 5	200
Class 1C	200

Work rate	Medium to heavy (all classes)
Continuous wear time	More than 1 hour
Effective against	Solid or liquid particles, gas or vapour
Fit testing required	No
Applicable standards	BS EN 14594 (Class A and B); BS EN 1073-1 (Class 1 to 5); BS EN 943-1 (Class 1C)

Important information, which applies to all these types.

Always ensure you have an adequate supply of clean compressed breathing air before use.
Always look after your supply tube during use – your life may depend on it.
Never use light duty supply tubes for normal airline applications. (See general dos and don'ts Tables 4–6.)

Figure 21 Demand valve breathing apparatus

Classification of RPE	Protection factor
Positive pressure demand airline – full face mask	2000
Positive pressure self-contained demand – full face mask	2000

Work rate	Heavy (all classes)	
Continuous wear time	More than 1 hour	
Effective against	Solid or liquid particles, gas or vapour	
Fit testing required	Yes	
Fit testing options	**Qualitative**	**Quantitative**
Half mask fit test option	✔	✔
Full face mask fit test option	✘	✔
Applicable standards	BS EN 14593 (airline); BS EN 137 (self-contained)	

Important information, which applies to all these types.

Always make sure the mask fits you.
Always plan for work breaks in situations requiring prolonged use – this allows users to drink and avoid dehydration effects. (See general dos and don'ts Tables 4–6.)

Appendix 2 Filters

1 Filters are classified in relation to the form of the hazardous substance(s) they can be used against – either particles, gas/vapour, multi-gas or combined (particle and gas/vapour).

2 If the filter is also usable with powered respirators then they will also be marked 'TH' (turbo hood) for hood devices or 'TM' (turbo mask) for mask devices.

3 **Particle** filters do **not** trap gases or vapours, or give any protection against oxygen-deficient atmospheres.

4 **Gas/vapour** filters do **not** protect against particles, or give any protection against oxygen-deficient atmospheres.

5 Note that particle filters are not effective against mist or spray of organic solvents. Seek advice from the manufacturer.

Particle filters

6 Particle filters trap and hold particles (dust, mist, fume, smoke, micro-organisms) from the air flowing through them. Large particles are easier to trap than small ones. These filters can be used against both solid particles and liquid particles (mists, fine sprays and aerosols).

7 Particle filters are classified according to their efficiency. The filter (or the facepiece it is built into) will be marked with the letter P (for particle) and a number to indicate efficiency, or the level of protection provided:

- P1 = Low efficiency.*
- P2 = Medium efficiency.*
- P3 = High efficiency.

8 Filters are additionally marked:

- NR = Not reusable – Designed for a single work shift (eight hours) and must be disposed of safely at the end.
- R = Reusable.

* Do not use against fume unless specified by manufacturer.

Gas/vapour filters

9 These filters are designed to remove gases or vapours as specified by the manufacturer.

10 Gas/vapour filters are classified according to their capacity and the type of substance they can be used against.

11 Their capacity refers to how much of the specified contaminant they can hold (as measured in a laboratory test at set conditions):

- Class 1 = Low capacity.
- Class 2 = Medium capacity.
- Class 3 = High capacity.

Warning: The capacity identification on gas/vapour filters is not a good indicator of when substances are likely to break through (see Appendix 2, paragraph 19).

12 The filter (or the mask it is built into) will be marked with a number to indicate this capacity rating, and a letter to indicate the type of substance they are suitable for (see Table 7). Gas/vapour filters also have a standard colour coding. For example, a mask or filter marked as 'B2 – Grey' would protect against inorganic gases and vapours and have a medium capacity.

Multi-gas filters

13 A multi-gas filter is one that is suitable for more than one type of gas or vapour. They will be marked for the types of gases/vapours for which they are suitable (eg A1B2 = Organic vapour filter with capacity class 1 and inorganic gases filter with capacity class 2).

14 Multi-gas filters are an option for employers who have different gases and vapours at their sites. Multi-gas filters are more expensive to buy than single-type filters, and tend to be heavier.

Warning: If you use multi-gas filters, you should take extreme care – be certain that the use of this filter against mixtures of gases/vapours (either at the same time or one after the other) will not result in exposure. Always seek clear instructions from the manufacturer on how this filter may be used safely in your workplace and on replacement intervals. If performance against mixtures of gases is needed, it may be safer to consider BA.

Combined filters

15 Filters are available for situations where protection is needed against both particles and specific gases or vapours. This type of filter will carry markings for particles and vapours, eg A2P3 = Organic vapour filter with capacity class 2 and high-efficiency particle filter.

Table 7 Filter types

Filter types				
Colour code	**Type**	**For use against**	**Class**	**Other information**
White	P	Particles	1 2 3	European standard: EN 143
Brown	A	Organic gases and vapours, boiling point above 65 °C	1 2 3	European standard: EN 14387
Grey	B	Inorganic gases and vapours	1 2 3	European standard: EN 14387 Do not use against carbon monoxide
Yellow	E	SO_2 and other acid gases	1 2 3	European standard: EN 14387
Green	K	Ammonia and its organic derivatives	1 2 3	European standard: EN 14387
Red & **white**	Hg P3	Mercury	–	European standard: EN 14387 Includes P3 particle filter Maximum use time 50 hours No class number
Blue & **white**	NO P3	Oxides of nitrogen	–	European standard: EN 14387 Includes P3 particle filter Single use only No class number
Brown	AX	Organic gases and vapours, boiling point at or below 65 °C	–	European standard: EN 14387 Single use only No class number
Violet	SX	Substance as specified by the manufacturer	–	European standard: EN 14387

When to change filters

Particle filters

16 Particle filters will become clogged and make breathing difficult, possibly resulting in face seal leaks.

17 The following is recommended:

- For TH and TM type filters for fan-assisted respirators, change as instructed by the manufacturer.
- For replaceable filters, it would be good practice to mark the filter visibly with the date it was taken out of the packaging and fitted to the RPE; an in-house replacement date can be added to this marking.

18 Changing particle filters – **hints and tips**:

- Do not use if the shelf-life expiry date on the filters has passed.
- Change when filters are damaged or visibly contaminated.
- Change when they become harder to breathe through. This can happen quickly if the wearer is exposed to very high dust concentrations.

Gas/vapour filters

19 Gas/vapour filters have a limited capacity for removing gases/vapours, so after a time the gas or vapour will pass straight through. This is known as breakthrough. When breakthrough occurs, the RPE offers no protection.

20 Filter life is very difficult to predict because it depends on a large number of factors. They don't last forever.

21 The following is recommended:

- **Filter capacity 1** – Change at least every two days or as instructed by the manufacturer; but if the filter is used for protection against a:
  - carcinogen;
  - respiratory sensitiser;
  - potential carcinogen;
  - substance that may cause allergy or asthma symptoms or breathing difficulties if inhaled;

  change every day, or as instructed by the manufacturer.
- **Filter capacity 2** – Change at least once a week or as instructed by the manufacturer.
- For **capacity 3 and TM/TH type filters**, you should change as instructed by the manufacturer.
- For replaceable filters, it is good practice to mark the filter visibly with the date it was taken out of the packaging and fitted to the RPE; an in-house replacement date can be added to this marking.

22 Changing gas/vapour filters – **hints and tips**:

- Change filters as instructed by the manufacturer; for example, AX filters are single use only and mercury (Hg) filters have a maximum use time of 50 hours.
- Change before any expiry date marked on the filter.
- Do not use if the expiry date on the filters has passed.
- Change when damaged or visibly contaminated.
- Change before the contaminant can be smelled or tasted.
- Change before the filter life indicated in your risk assessment.

Appendix 3 Quality of air for breathing apparatus

Air quality

1 Air supplied to breathing apparatus (BA) should be clean and safe to breathe, whether it is supplied via a fresh air hose or a source of compressed air.

Fresh air hose

2 You should securely anchor the inlet for fresh air hose BA in an area that is free of contaminant. This can usually be achieved by siting the inlet well away from the work area (eg in free air outside the building), and upwind of any local sources of airborne contamination (eg vehicle exhaust).

Compressed air

3 Compressed air for BA normally originates from a compressor system. The maintenance, examination and testing of compressors should be carried out according to the manufacturer's instructions. The siting of air inlets to compressors should follow the same principles as for fresh air hose. However, because compressors themselves can generate and concentrate a wide range of contaminants, you should take extra care in assuring air quality.

4 As the BA wearer's life and health depend on the air supplied by the compressor, you should ensure that the air supplied meets the quality requirements in British Standard BS EN 12021 *Respiratory protective devices. Compressed air for breathing apparatus*,* in addition to the pressure and airflow rate requirements of the BA manufacturer.

5 Compressors which are moved from site to site, such as those used by the emergency services or on construction sites, will require a higher standard of maintenance and should be sited so that the quality of air they provide is not compromised by nearby contaminants.

* BS EN 12021 states: 'Compressed air for breathing apparatus shall not contain any contaminants at a concentration which can cause toxic or harmful effects. In any event all contaminants shall be kept to as low a level as possible and shall be far below the national exposure limit. Combination effects of more than one contaminant shall be taken into account.' (1999)

Periodic testing of air quality

6 The purpose of periodically testing air quality is to make sure that the control measures you have put in place are delivering the air quality required by BS EN 12021. You should base the frequency of such tests on a risk assessment, but they should take place at least every three months, and more often when the quality of air cannot be assured to these levels.

7 As part of the risk assessment, if a mobile compressor is being used consideration should be given as to how often the air supply should be checked when the compressor is moved. Testing for these components may be carried out using any appropriate method, eg:

- simple colour change tubes;
- on-line gas testers;
- sample collection for laboratory analysis elsewhere.

8 The supplier of your compressor or BA should be able to advise you on the best method for you. You should keep records of air quality tests for five years.

Appendix 4 Fit testing

1 Facepiece fit testing is a method of checking that a tight-fitting facepiece matches the wearer's facial features and seals adequately to their face. It will also help to identify unsuitable facepieces that should not be used. You should carry out a fit test as part of the initial selection of the RPE. Remember that tight-fitting RPE will only provide effective protection if the wearer is clean shaven, so they should also be clean shaven when fit tested.

2 The performance of tight-fitting facepieces depends on achieving a good contact between the wearer's skin and the face seal of the facepiece. People's faces vary significantly in shape and size so it is unlikely that one type or size of RPE facepiece will fit everyone. Inadequate fit will significantly reduce the protection provided to the wearer. Any reduction in protection can put the RPE wearer's life in danger or may lead to immediate or long-term ill health.

3 Fit testing can also serve as a useful training tool for teaching the wearer how to put on their facepiece correctly. Correct fitting of the facepiece at all times is vital to prevent exposure.

4 A fit test does not remove the need for correct and careful day-to-day fitting of the facepiece, which should always include a fit check (see paragraph 80).

5 A fit test should be carried out:

- as part of the initial selection of the RPE;
- where an untested facepiece is already in use.

6 It is good practice to have a system in place that ensures you carry out repeat fit testing of RPE on a regular basis. This is especially important when RPE is used frequently as a primary means of exposure control, eg annual testing for workers involved in licensed asbestos removal. You may find it useful to keep records of fit testing.

7 You should always conduct a repeat fit test if the wearer:

- loses or gains weight;
- undergoes any substantial dental work;
- develops any facial changes (scars, moles etc) around the face seal area.

8 Where facepieces are issued on an individual basis it is recommended that the wearer is fit tested using their 'own' facepiece. Where this is not practicable, or pooled equipment is used, then a test facepiece that exactly matches the wearer's 'own' facepiece (model, size and material) should be used.

9 When considering fit testing give thought to whether the wearer will need to use other PPE to ensure it is compatible and does not interfere with the protection offered by the RPE.

10 There are two basic types of RPE fit testing: qualitative and quantitative.

Qualitative fit testing

11 Qualitative fit testing is a pass/fail test based on the wearer's subjective assessment of any leakage from the face seal region, by sensing the introduction of a test agent. These tests are suitable for half masks. They are not suitable for full face masks. Examples of qualitative fit testing methods are:

- method based on bitter- or sweet-tasting aerosol;
- method based on odour compounds.

Quantitative fit testing

12 Quantitative fit testing provides a numerical measure of the fit, called a fit factor. These tests give an objective measure of face fit. They require specialised equipment and are more complicated to carry out than qualitative methods. Quantitative methods are suitable for full face masks (but can also be used for half masks). Examples of quantitative fit testing methods are:

- laboratory test chamber;
- portable fit test devices, such as a particle counting device.

Competence

13 RPE fit testing should be conducted by a competent person. Competence can be demonstrated through achieving accreditation under the Fit2Fit RPE Fit Test Providers' Accreditation scheme. This scheme has been developed by the British Safety Industry Federation (BSIF) together with industry stakeholders and is supported by HSE. The scheme is not compulsory and you are free to take other action to comply with the law.

14 Further details on fit testing are available on the HSE website and the Fit2Fit scheme can be found at: www.fit2fit.org.

Appendix 5 Selecting adequate and suitable RPE: Some case studies

Case study 1 Cutting kerbstones made of concrete for a new road section

(This case study makes use of* COSHH essentials *guidance.)

Work details

1 Kerbs are being laid on a 300-metre section of road. Traffic calming measures have been specified in the design, requiring the kerbs to be laid at different angles over short sections to create narrow sections with rights of way. Standard kerb will be supplied to site and cut to size.

2 Water suppression will be used to damp down the dust. There is no mains water available so water bottles with a pump will be used. The cutting will take approximately five minutes and will be intermittent.

Hazard

3 Cutting kerbs, paving or blocks can produce enormous amounts of dust (stone dust). The stone dust will contain some very fine dust called **respirable crystalline silica (RCS**). Exposure to RCS dust can cause serious health problems such as:

- silicosis;
- lung cancer;
- chronic obstructive pulmonary disease.

Information available

4 There is no safety data sheet (SDS) but COSHH guidance sheet CN6 *Cutting paving and kerbstones with rotary cutters*[16] has been identified.

5 It recommends respiratory protective equipment (RPE) with an assigned protection factor (APF) of 20. The RPE needs to be worn with other personal protective equipment (PPE) – goggles and hearing protection are required.

6 RPE that is **adequate** for this task (see Appendix 1) includes:

- disposable half mask respirator – protection factor of 20;
- reusable half mask respirator – particle filter with protection factor of 20.

Suitability

7 The masks available are tight-fitting facepieces. The two workers who will be undertaking the task are generally clean-shaven, have no facial markings and do not wear spectacles, so they can wear RPE of this type.

8 They do require other PPE and it is therefore essential that it is compatible. A hard hat with ear defenders attached so as not to interfere with the RPE device's straps, and eye protection that does not interfere with the device's nose bridge, are selected.

9 Due to the intermittent nature of the work and normal workplace temperature – given this is done in the open air – tight-fitting facepieces will suffice.

10 The workers should be fit tested for the RPE selected.

Decision

11 As the work is of short duration it is decided that the disposable half mask respirator will be used provided the two workers can get an adequate fit.

Case study 2 Printing factory switch to new adhesive for higher specification contract

(This case study makes use of the safety data sheet.)

Work details

12 A new contract has been won for high quality print. To achieve the quality of product a new screen-printable adhesive is being used.

13 The work requires a single operator to work on the machine producing the prints. Local exhaust ventilation (LEV) is being used to extract the harmful substance at its source. The operator will need to enter the capture zone of the LEV area for ten minutes every hour. Although the LEV will control vapour release within the work area the operator may receive some low-level exposure.

Hazard

14 The adhesive is supplied in containers with the following ingredients and labelling, as seen in Figure 22, below:

Ingredient CAS No	**% by Wt**
Copolymer of vinyl acetate and acrylic ester Trade Secret	40–70
Water 7732-18-5	15–40
Isopropyl alcohol 67-63-0	<0.3
Vinyl acetate 108-05-4	<0.2
Nonylphenoxypoly(oxyethylene)ethanol 9016-45-9	<0.1

Vinyl acetate 108-05-4 Grp 2B: Possible human carcinogen, International Agency for Research on Cancer.

Free vinyl acetate monomer is of concern for this task for those who enter the work area.

Figure 22 An actual example from a safety data sheet

Information available

15 SDS provides advice on RPE to be used with this product. It recommends using a half facepiece or full face filtering respirator with organic vapour filter cartridges.

16 RPE that is **adequate** for this task (see Appendix 1) includes:

- reusable half mask respirator – gas/vapour filter;
- full face mask respirator – gas/vapour filter.

Suitability

17 The masks available are tight-fitting facepieces. The workers who will be undertaking the task are generally clean-shaven, have no facial markings and do not wear spectacles, so they can wear RPE of this type.

18 Due to the intermittent nature of the work and normal workplace temperature, tight-fitting facepieces will suffice.

19 The workers should be fit tested for the RPE selected.

Decision

20 As the work is of short duration it is decided that the reusable half mask respirator with type A2 gas/vapour filter will be used provided the workers can get an adequate fit.

Case study 3 Small ferrous jobbing foundry casting metal products to order

(This case study makes use of exposure measurements.)

Work details

21 A small foundry supplies metal products to order. The products are produced from scrap metal. An important part of the process is the grinding off of the rough edges to get the finished product (fettling). The work usually requires four operators to work on the finished products with grinders.

22 LEV is being used and employees will be working for up to eight hours during this task. Although the LEV will reduce exposure within the work area the nature of the work will mean that high exposure levels of dust will always be present.

Hazard

23 The workers will be exposed to dust. This is identified as ferrous foundry particulate, which is a complex combination of silica and metal oxides. Because scrap metal is used the dust may contain heavy metals. Painted metal is not accepted by the plant to reduce the potential for lead exposure.

Information available

24 EH40[12] lists a workplace exposure limit (WEL) for ferrous foundry particulate as follows:

- Inhalable dust – 10 mg/m³.
- Respirable dust – 4 mg/m³.

25 Exposure measurements are routinely carried out by the company for this particular area of the plant. Exposures up to 45 mg/m³ have been measured.

26 The protection factor required for this type of task can be calculated as follows:

- Protection factor = Measured airborne concentration/WEL.
- Protection factor = 45/4 = 11.25.

27 An APF of greater than 11.25 is required, so an RPE device of APF20 should be used.

28 RPE that is **adequate** for this task (see Appendix 1) includes:

- Disposable half mask respirator – Protection factor of 20.
- Reusable half mask respirator – Particle filter with protection factor of 20.
- Powered (fan-assisted) respirator with mask – Particle filter with protection factor of 20.
- Powered (fan-assisted) respirators with hood – Particle filter with protection factor of 20.

29 COSHH guidance sheets are available for fettling operations for small and large castings. The work tends to be for larger type casting and the guidance sheet FD8 *Fettling large castings*[17] advises powered or constant flow airline breathing apparatus respirators for this type of work, with an APF of at least 40. However, the exposure measurements suggest this level of protection is not required.

Suitability

30 The workers who will be undertaking the task are generally clean-shaven, have no facial markings and do not wear spectacles, so they can wear any RPE type. However, the work is being carried out for more than one hour and is a heavy manual task so a powered respirator is most suitable.

Decision

31 Given the nature of the work, a powered respirator with hood and particle filter with protection factor of 20 is chosen to make the wearer as comfortable as possible. This RPE can also offer eye protection during the grinding activities if fitted with a suitable visor.

Appendix 6 Selecting RPE for radioactive or biological hazards

1 This appendix gives specific advice for situations where you need to provide respiratory protective equipment (RPE) to restrict exposure to:

- radioactive particles and gases for work covered by the Ionising Radiations Regulations 1999;[9]
- biological agents defined in COSHH as micro-organisms – bacteria, viruses, fungi, the agents causing transmissible spongiform encephalopathies, and other internal parasites – that create a hazard to human health.

Choosing RPE for radioactive substances

2 Some materials used in the workplace, such as zircon, baddeleyite sands and zirconia, are radioactive to low levels. If these materials are handled in such a way as to create dust, there may be an inhalation hazard.

3 Examples of work activities that might require the use of RPE because of the presence of radioactive dust are:

- handling/use of sands containing natural radionuclides in foundries and during the production of refractory products;
- production and machining of some thorium alloys;
- casting of lead/bismuth alloys;
- repointing of thoriated tungsten welding electrodes;
- handling of dusty ores of natural uranium and thorium.

4 The RPE you select should be capable of giving adequate protection both against the radioactivity and against other risks to health that these substances may pose.

Choosing RPE for biological agents

5 RPE may be needed to control exposure if your COSHH assessment reveals that your workers come into contact with:

- people or animals that are infected with micro-organisms transmitted by the airborne route, eg working with a patient infected with tuberculosis and carrying out procedures involving contact with respiratory discharges, such as producing a sputum specimen;
- micro-organisms transmitted by the airborne route via an aerosol as a result of the type of work, eg cleaning an area with a high-pressure hose that could be contaminated with micro-organisms.

6 When in an airborne state, micro-organisms can be classed as particles, so they can usually be removed by filter-type RPE. You should always use equipment fitted with the highest efficiency filter possible (protection factor of at least 20) to control exposure down to the lowest levels.

7 There are some tasks that may require the selection of different types of RPE:

- Due to the length of time the task can take, those carrying out post-mortem examinations on people infected with tuberculosis might find a powered respirator is most suitable, in addition to using general extraction in the room to control exposure.
- For those cleaning cooling towers using high-pressure hoses, a powered respirator with full facepiece or hood/blouse might be most suitable to control exposure to legionella bacteria, because of the associated work rate and wet conditions

Maintaining RPE

8 Treat all used RPE as potentially contaminated and keep it separate from other RPE until it has been monitored and, if necessary, decontaminated. Reusable equipment should normally be thoroughly decontaminated and cleaned.

9 You should provide appropriate systems, equipment and training to restrict the exposure of employees involved in maintenance of contaminated RPE.

10 For radioactive substances:

- If contamination cannot be removed from facepieces and internal surfaces of RPE, these items should be disposed of as radioactive waste.
- Disposable RPE and components should be monitored before disposal and, if necessary, treated as radioactive waste.

11 For biological agents:

- Manufacturers can tell you about compatible cleaning and disinfecting processes and materials for their equipment.
- If the equipment is stored in a dirty state, micro-organisms have the chance to grow on the equipment surface; this is especially true of used filters, which can act as a breeding ground for micro-organisms if stored in moist warm conditions, creating an exposure hazard the next time the equipment is handled or used.
- Non-reusable equipment should be disposed of as contaminated waste (eg by incineration, or sterilisation and disposal to a landfill).

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13 *COSHH essentials. Easy steps to control health risks from chemicals* www.hse.gov.uk/coshh/essentials/index.htm

14 Garrod ANI, Rajan-Sithamparanadarajah R and Vaughan N 'An innovative approach to respiratory hazard control' 2004 J Int Soc Respir **21** 103–113 (*Note*: The graph given in this reference on p106 is incorrect; refer instead to the technical basis for *COSHH essentials* available from the COSHH website)

15 BS EN 12021:1999 *Respiratory protective devices. Compressed air for breathing apparatus* British Standards Institution

16 *CN6 COSHH essentials in construction: Silica. Cutting paving and kerbstones with rotary cutters – Control approach R Respiratory Protective Equipment (RPE)* www.hse.gov.uk/pubns/guidance/cn6.pdf

17 *FD8 COSHH essentials for foundries: Silica. Fettling large castings – Control approach R Respiratory Protective Equipment (RPE)* www.hse.gov.uk/pubns/guidance/fd8.pdf

Further information

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