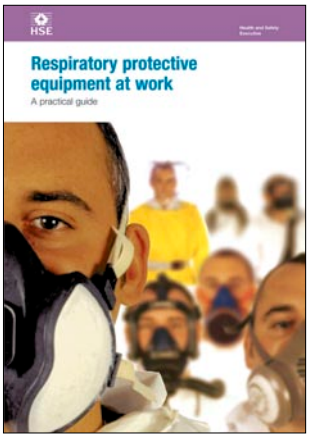
Respiratory protective equipment at work

A practical guide



This is a free-to-download, web-friendly version of HSG53 (third edition, published 2005).

It has been adapted for online use from HSE's current printed version (reprinted 2007, reprinted with amends 2010).

You can buy the book at www.hsebooks.co.uk and bookshops.

ISBN 978 0 7176 2904 6
Price £10.95

This book provides essential guidance for the correct selection and use of 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. This helps you to decide the right level of protection for a given hazardous substance and how to select the right RPE for the particular wearer and the work environment. This is done using the RPE Selector, and its use is illustrated by worked examples. It also describes significant misuses of RPE, and how to prevent them. It also has advice on how to ensure that the selected RPE keeps working effectively.

First published 1990

Second edition 1998
Third edition 2005

Reprinted 2007
Reprinted with amends 2010, 2012

ISBN 978 0 7176 2904 6

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory 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 as illustrating good practice.

Grateful acknowledgement to BNFL for the use of the photograph on page 39.

Contents

Introduction

1 This guide is for employers and the self-employed. Those responsible for managing staff health and safety, safety representatives, health and safety specialists, manufacturers and suppliers of respiratory protective equipment **(RPE)** will find this guide useful.

2 The law requires you to prevent or control the exposure of employees and others to **hazardous substances** at work.

3 Before using RPE, exposure should be controlled by **reasonably practicable measures** other than the use of personal protective equipment **(PPE)**. So you should use PPE only as a last line of protection to control the exposure.

4 Use this guide if you are at the point of wanting to provide RPE as a last line for controlling exposure to hazardous substances.

5 To select the right RPE you will have to take account of the properties of the hazardous substances, the needs of the wearer, the work and workplace conditions. This guide will help you to do that. It follows a step-by-step approach to deciding the minimum level of protection you need from the RPE. The decision is based upon the severity of the health hazard of the substance, the amount of substance your employees are exposed to and how easily they can breathe it in. The choice of correct RPE is based on the wearer and workplace requirements. Other issues you will need to consider when using RPE are also described.

6 The stepwise approach can be used for many hazardous chemicals (eg paints, solvents, dusts). It complements the approach used in **COSHH essentials**. However, if you want to, you can use other methods for selecting the correct RPE. RPE for radioactive substances and biological agents are covered separately in Appendices 1 and 2, respectively.

Hazardous substance:
Any substance or a mixture or solution of two or more substances that presents a potential to cause injury or ill health to an individual if it is inhaled, ingested or come into contact with or absorbed through the skin. For more details see paragraphs 23-28.

Reasonably practicable measures:
Where the cost in money, time and trouble is not grossly disproportionate to the improvement achieved in protecting of your employees' health and safety. Ultimately, the courts would decide whether you have taken all reasonably practicable measures.

PPE:
Any equipment which is to be worn or held by a person at work that is designed to protect that person against one or more risks to their health or safety and includes any addition or accessory, which is designed to help protect the person wearing the PPE.

COSHH essentials:[1]
This publication provides a step-by-step approach for identifying the right engineering control solutions to reduce inhalation exposure to many hazardous chemicals. It supports the Control of Substances Hazardous to Health Regulations (COSHH).[2] You can use COSHH essentials at www.coshh-essentials.org.uk.

If you have people working under your control and direction who are treated as self-employed for tax and national insurance (NI) purposes, they are nevertheless treated as your employees for health and safety purposes.

Part 1: Selection and use of respiratory protective equipment

What is RPE?

7 RPE is a particular type of PPE. It is designed to protect the wearer against inhalation of hazardous substances in the workplace air. Typical examples are shown in Figure 1. RPE is divided into two main types:

- **Respirator (filtering device)**. This uses filters to remove contaminants in the workplace air. They should never be used for protection in situations with reduced oxygen levels (see paragraphs 33-36).
- **Breathing apparatus (BA)**. This needs a supply of breathing quality air from an independent source (eg air cylinder or air compressor).

8 Both types of RPE are available with a range of different facepieces, but there are some important limitations:

- Masks. These are tight-fitting facepieces (filtering facepieces, half and full facemasks). They rely on having a good seal with the wearer's face. They can be part of both respirators or BA.
- Hoods, helmets, visors, blouses, suits. These are loose-fitting facepieces which rely on enough clean air being provided to the wearer to prevent contaminant leaking in. They are only used on fan-powered respirators and/or air-fed equipment.

9 Further details on different types of RPE, filters, and 'Dos and Don'ts', are covered in Part 2. The quality requirements for breathing air are covered in Appendix 3.

10 This guide is concerned with all types of RPE used at work, except underwater BA and escape devices.

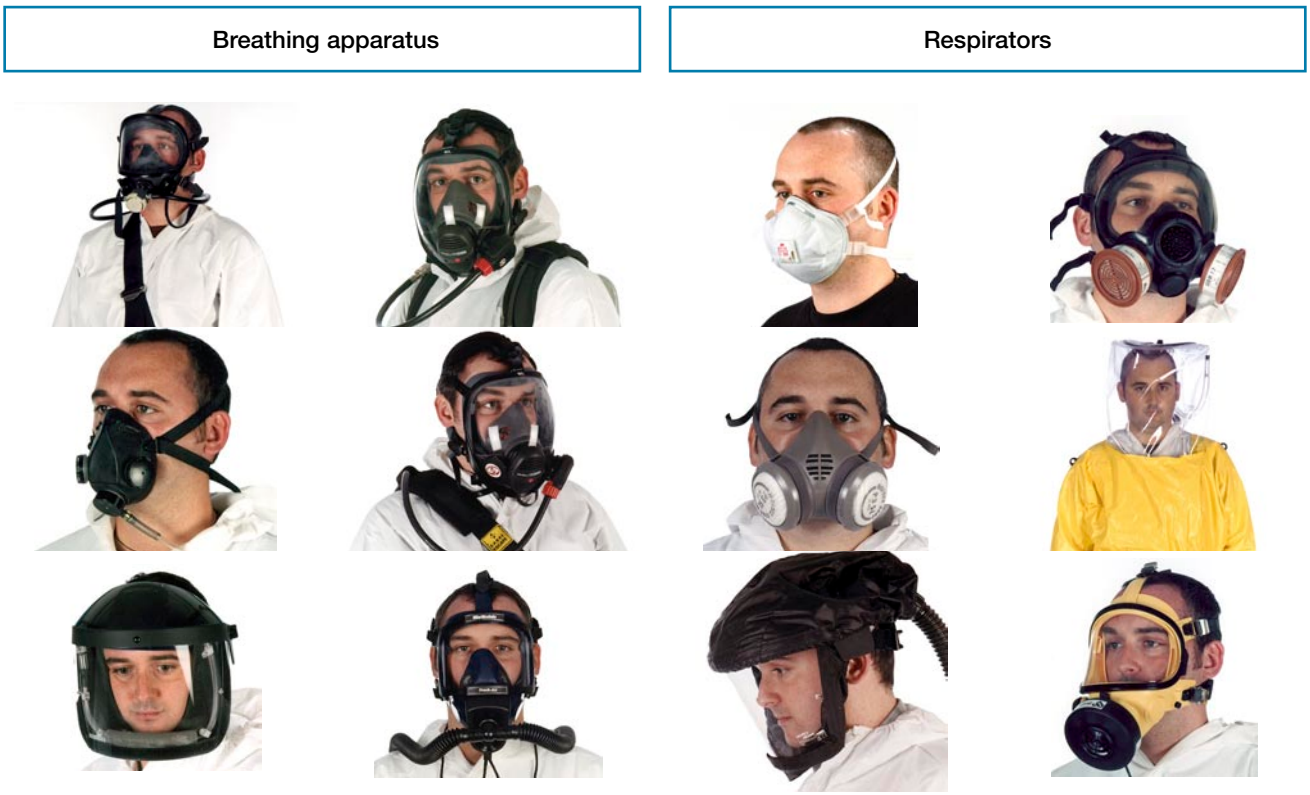


Figure 1 Types of respiratory protective equipment

Legal requirements

Regulations

11 The Health and Safety at Work etc Act (HSWA)[3] and the Management of Health and Safety at Work Regulations (MHSWR)[4] require you to ensure that you have a safe working environment. They set out the basic requirements for you to follow. These are the principal health and safety regulations from which all others follow.

12 The law governing the use of RPE is contained in:

- The Control of Substances Hazardous to Health Regulations (COSHH);[2]
- The Control of Asbestos at Work Regulations (CAW);[5]
- The Control of Lead at Work Regulations (CLAW);[6]
- The Ionising Radiations Regulations (IRR);[7]
- The Confined Spaces Regulations (CSR).[8]

13 These regulations are supported by Approved Codes of Practice (ACOPs).[2,4,5,6,7,8] The Health and Safety Commission (HSC) approve these. ACOPs 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.

14 This guide on RPE supports the ACOPs to the regulations listed in paragraph 12. If you use other PPE (eg helmet, eye protection) in addition to RPE then you will also have to work according to the Personal Protective Equipment at Work Regulations.[9]

Consulting employees and safety representatives

15 When implementing health and safety measures, which includes the selection and use of RPE, you must consult either:

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

Guidance on this matter can be found in the free HSE leaflet *Consulting employees on health and safety: A guide to the law*.[10]

Specific requirements for RPE use

16 The law says that RPE used at work must:

- be **adequate** and provide the wearer with effective protection;
- be **suitable** for the intended use;
- be 'CE'-marked;
- be selected, used and maintained by properly trained people;
- be correctly maintained, examined and tested;
- be correctly stored.

In addition, you will need to keep records of selection, maintenance and testing.

Adequate:
RPE is considered adequate if it can provide a level of protection required to reduce the exposure to comply with the law.

Suitable:
RPE is considered suitable if it is adequate and is matched to the wearer, the task and the working environment, such that the wearer can work with minimum impediment and without additional risks due to the protective equipment.

CE marking

17 If you use RPE for protection against hazardous substances then you will have to use CE-marked equipment.[2,4,5,6,7,8] This requirement is modified for RPE manufactured before 1 July 1995. If your RPE is more than nine years old, consult the RPE manufacturer or contact the HSE Infoline (see details at the end of the reference section).

18 The CE mark on RPE tells you that the equipment has met the minimum requirements laid down in the law for its design and manufacture.[11] This marking appears as the letters 'CE' and a four-digit code that identifies the body responsible for checking manufacturing quality. CE marking does not indicate that it is automatically suitable for your use in your workplace. It is your responsibility to select the correct RPE to meet the requirements in paragraph 16.

Accidents involving RPE

19 You should report accidents involving RPE and diseases resulting from exposure to hazardous substances to HSE via the Incident Contact Centre (www.riddor.gov.uk). You should consult the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)[12] for specific details.

Why RPE is a last resort

20 Under the law,[2,4,5,6,7,8] PPE, including RPE, is the last line of protection. The reasons for this include:

- RPE can only protect the wearer. Control measures at source protect all those in the area.
- If RPE is used incorrectly, or is badly maintained, the wearer is unlikely to receive adequate protection.
- RPE is uncomfortable to wear and is an intrusion into normal activities.
- RPE may interfere with work.

When can RPE be used?

21 RPE should only be selected and used after a justification has been made in the risk assessment required by law. It can be used in the following situations:

- where an inhalation exposure risk remains after you have put in place other reasonable controls (residual risk);
- short-term or infrequent exposures where you decide that other controls at source are not reasonably practicable;
- while you are putting in place other control measures (interim measures);
- emergency escape – you need to provide RPE for safe exit from an area where hazardous substances may be released suddenly in the event of control systems failures;
- emergency work or temporary failure of controls where other means of controls are not reasonably practicable;
- emergency rescue by trained personnel is necessary.

22 However, there may be circumstances where you may consider it prudent to issue PPE including RPE, not because other control measures are inadequate on their own, but to provide additional protection if any of the control measures fail to operate. In this type of situation, it is prudent to seek specialist support (eg an occupational hygienist).

Hazardous substances

23 Basic understanding of hazardous substances, their forms, and the way people can be exposed to them, is essential for the selection of adequate and suitable RPE. Paragraphs 24-36 provide help.

Forms of substance

24 Substances can exist as solids, liquids or gases. Under certain conditions, they can exist in more than one form at the same time (eg during paint spraying).

25 Particulate **solids** include aerosols, dusts, fibres, smokes and fume. Dusts and fibres are fine particles that are released into the air. Fumes are generated by vaporisation of solids and condensation into fine particles. Smokes are formed by the incomplete combustion of materials. If the solid particulates are very fine, they can behave like gases and vapours and move with air currents. In this way, they can be transported quite a long way from the source of emission.

26 **Liquids** can exist as droplets or as finer sprays and mists in air or other gases.

27 **Gases** are like air and behave in the same way. **Vapours** are the gaseous forms of substances, which normally exist as a solid or liquid at room temperature. These are sometimes wrongly referred to as fumes, and this terminology is not used in this guidance. Table 1 provides a few examples relevant to RPE selection.

Solids	Liquids	Gases/vapours
Asbestos dust	Sprayed droplets	Ammonia
Engine exhaust particles	■ paints	Carbon monoxide
Lead dust and fume	■ pesticides	Carbon dioxide
Silica dust	■ powder coating mix	Freons
Welding fume	■ liquid jetting	Helium
Shot blasting dust	■ sewage water	Nitrogen
Wood dust		Mercury vapour
Smoke	Mists	Solvent vapours
Fungal spores	■ chrome acid	Engine exhaust gases
Bacteria	■ cutting fluids	
Virus	■ oil mist	
Parasites		

Table 1 Examples of the different forms of hazardous substances

Defining a hazardous substance

28 A substance or a product is hazardous to health if it is described by recognised pictograms, R-number **risk phrases** and classified as:

- very toxic;
- toxic;
- harmful;
- corrosive; or
- irritant;
- or is listed as a:
  - **mutagen;**
  - **teratogen;**
  - **carcinogen;**
  - **sensitiser;**
  - **radioactive substance;**
- or has an occupational exposure standard or maximum exposure limit published in **EH40**;[13]
- or is a **biological agent**;
- or is a dust of any kind with an airborne concentration of more than 4mg/m^3 as respirable dust or more than 10mg/m^3 for inhalable dust;[13]
- or is a substance that could have any of the above properties;
- or has any other hazardous properties capable of causing harm to health.


very toxic
toxic


irritant
harmful


corrosive


radioactive substance


biological agent

Risk phrases (R-phrases) are specified and defined and appear in HSE's *Approved Supply List*.[14] For a given substance, product or preparation these are assigned by the manufacturer/supplier of the substance (eg R23 - Toxic by inhalation).

Mutagen can cause genetic damage, which can be inherited. **Teratogen** can cause damage to the unborn child. **Carcinogen** can cause cancer. **Sensitiser** can cause changes to the functioning of the immune system so that further exposure to the same substance triggers an allergic reaction.

Radioactive substance can be hazardous due to their radioactivity or have other hazardous properties, which can cause ill health.

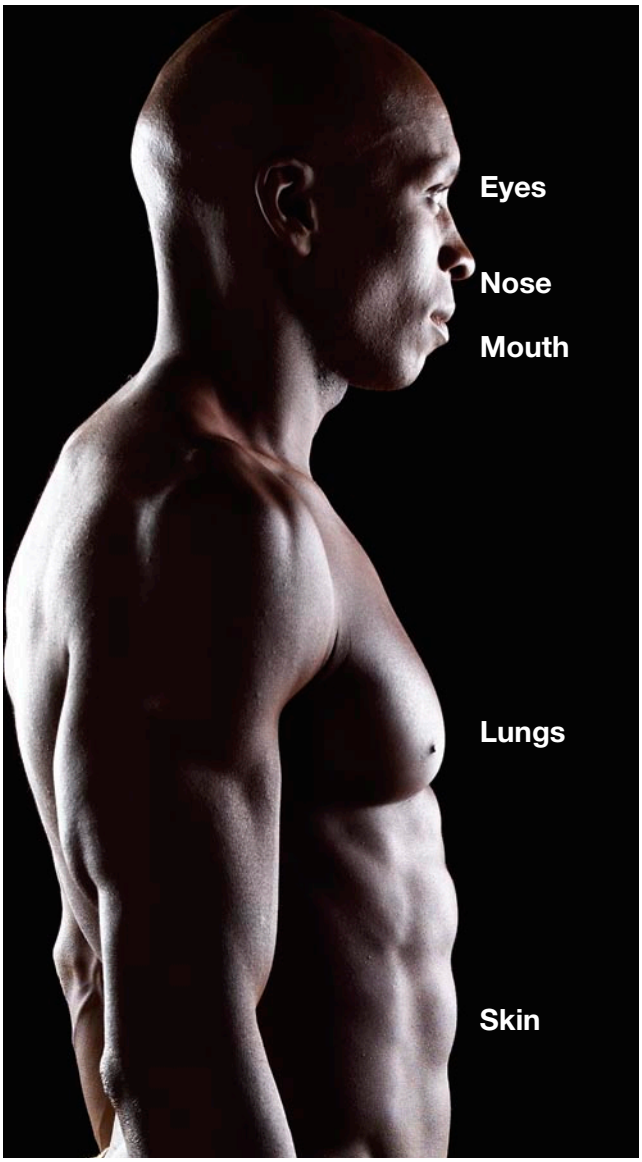
Biological agents are fungi, bacteria, viruses, cell cultures or parasites which can cause any infection, allergy, toxicity or adverse effect to human health.

EH40 is the HSE list of substances that have an occupational exposure limit approved by HSC.

Routes of entry

29 Substances can enter the body through the lungs by inhalation or through the skin or eyes or mouth (see Figure 2). Each of these routes of entry may require protection in their own right. You should consider all routes of entry when selecting PPE, including RPE.

Figure 2 Routes of entry



Effects on the body

30 Substances can cause:

- long-term (chronic) damage;
- short-term (acute) damage; or
- they can act together to be more potent than alone (synergistic).

31 For example, cadmium can cause long-term effects of severe organ damage to the kidney and lungs. Less well known are the short-term effects of sore throat and flu-like symptoms. Substances can have multiple effects, causing local damage at the point of entry and systemic damage to other organs in the body, or sensitising the skin or causing asthma. The effects of polyurethane spray paints are a good example of sensitisation of the respiratory system as well as other organ damage due to solvents.

Other hazardous situations

32 The hazardous substances we have covered so far are hazardous by nature; it is inherent in their properties. There are also inhalation hazards that are not due wholly to the properties of a particular substance.

Oxygen deficiency

33 The air we breathe is made up primarily of nitrogen (78%) and oxygen (20.8%) and the amount of oxygen is critical to life. The level of oxygen in air can be reduced by chemicals (eg when something is burning), biological agents (eg in metabolism) and **asphyxiants** (when they dilute the air). These situations can be dangerous to your life.

34 If you find that the oxygen level in the air that you breathe is (or is likely to be) below 20.8%, this is indicative of poor ventilation or some other problem (see Table 2 and Figure 3 for examples). Below 19% oxygen, the atmosphere is considered to be oxygen-deficient. However, any deviation from 20.8% should be investigated and appropriate action taken.

Asphyxiants are substances that are not necessarily hazardous themselves, but cause a hazard by reducing the amount of oxygen available to breathe.

Oxygen enrichment

35 In some processes and environments (eg oxy-gas welding), it is possible to have raised levels of oxygen (more than 20.8%), which in turn lead to increased dangers of fire, explosion or chemical reaction, making it more hazardous to work. In these cases you should take appropriate action to ensure safe working. Never use pure oxygen to 'sweeten' an atmosphere (eg to rectify oxygen deficiency or 'kill off' unwanted smells).

Confined spaces

36 A confined space is a substantially enclosed space such as a chamber, tank, vat, silo, pit, trench, pipe, sewer, flue, well or small room with limited access and inadequate air exchange. A confined space may not necessarily be enclosed on all sides. This space can create a life-threatening situation due to:

- a sudden release of high concentrations of hazardous substances; or
- an oxygen deficiency due to the build-up of asphyxiants; or
- the simple act of breathing.

All work in confined spaces must comply with the Confined Spaces Regulations.[8]

Figure 3 Examples of processes/situations where oxygen deficiency may be encountered

Situation or process	Hazard caused by:
Bio-processes: ■ brewing plants ■ fermenting ■ sewage works/systems	Consumption of oxygen and release of carbon dioxide and other gases by living organisms
Chemical reactions: ■ rusting ■ tarnishing ■ oxidation ■ liberation/outgassing	Loss of oxygen or liberation of other gases by incidental or deliberate chemical reactions
Maintenance activities: ■ tank cleaning ■ sludge removal/disturbance ■ freezer/cold room repairs	Sudden release of high concentrations of hazardous substances - solvent vapours, trapped process gases, refrigerant vapours. These cause oxygen deficiency. High concentration often leads to anaesthetic effects
Process atmospheres: ■ purging ■ gas freeing ■ inerting ■ solvent degreasing	Deliberate creation of high concentrations of gases/ vapours, leading to oxygen deficiency, eg inert gases, argon, nitrogen, carbon dioxide, solvent vapours
Activity-generated atmospheres: ■ welding ■ spraying ■ pipe freezing	Build-up of gases, vapours or particles directly caused by the work process being undertaken, eg welding fume, carbon dioxide, carbon monoxide, shield gases, chromium compounds, solvents, isocyanates, refrigerant gases

Table 2 Examples of hazardous situations and confined spaces

Selecting respiratory protective equipment

37 You should only use PPE, including RPE, after all other reasonably practicable control measures have been taken. Before deciding to select RPE, you should ensure that the specific requirements for using RPE are satisfied (see paragraphs 21-22). Your decision to use PPE, including RPE, should be justified in a risk assessment. If you employ five or more employees the risk assessment should be recorded.[1]

38 A step-by-step process for selecting RPE is described here. It is a generic approach and has been specifically designed to help small and medium-sized enterprises. Following this approach is not compulsory, and you can use alternative approaches to comply with the law.

39 This stepwise approach should apply in the majority of cases:

- where health risk R-phrases are available;
- where specific advice is given in Table 3.

In all other circumstances, you should ensure that you are competent to select correct RPE; otherwise you are advised to seek specialist help from:

- occupational hygiene/safety professionals;
- RPE manufacturers/suppliers;
- trade associations.

40 Figure 4 describes a summary of the process. You can use this process in three ways:

- You can do it yourself. Write down the answers to the questions in the RPE selector (Figure 5). Using your answers and information in Part 2 of this guide you can decide the correct types of RPE for each wearer. Then contact the RPE manufacturer or supplier to purchase the equipment you have selected.
- You can fill out the RPE selector in consultation with the RPE supplier or manufacturer or send them a completed RPE selector and relevant safety data sheets. Based on the information you provide, they may then recommend RPE that matches your information.
- You may employ an occupational hygiene/health and safety professional to do the job for you.

Whichever route you choose, the ultimate responsibility for health and safety in your workplace remains with you.

41 Paragraphs 42-60 of this document tell you how to implement RPE use in the workplace. The complete process is described in Figure 4.

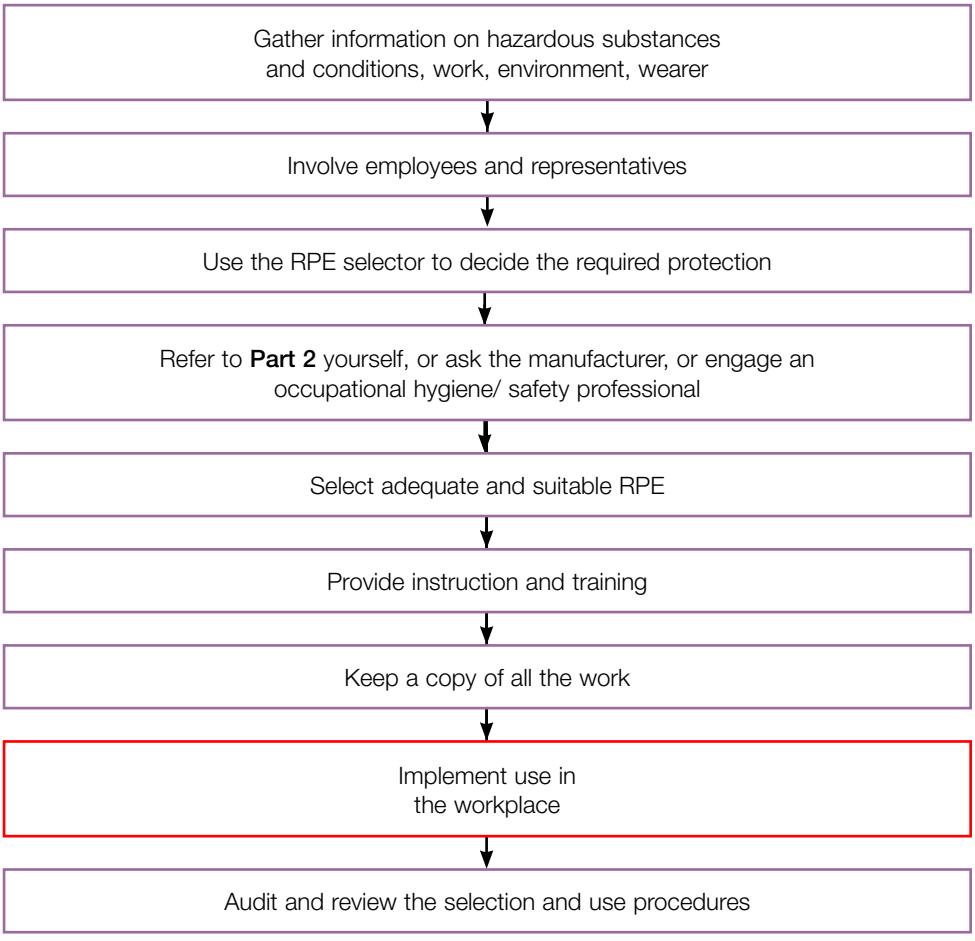
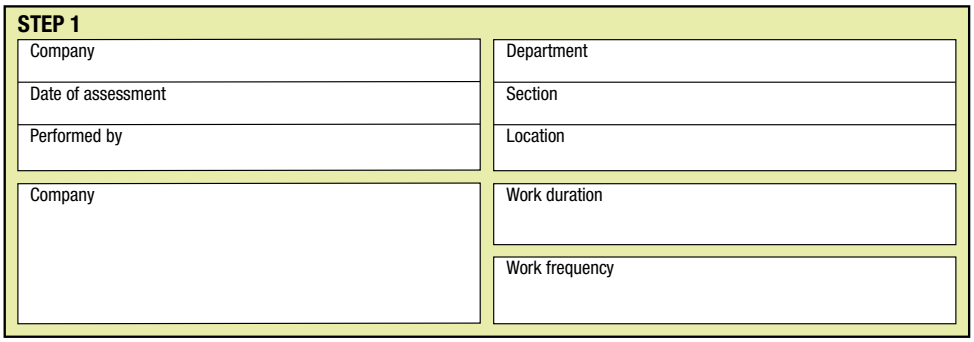


Figure 4 Stages of selection and use

Filling out the RPE selector

Step 1

Fill in the basic details about the **company** and the **work environment**. The boxes on work details should describe the type of work being carried out. **The work duration** and the **work frequency** should detail for how long and how often the work occurs.



Step 2

The control measures box should list the measures that are currently in place and in use for complying with the law. Examples of control measures include totally enclosed process and handling systems; local exhaust ventilation (LEV); partial enclosure with LEV; general ventilation; bunds to limit the spread if leak occurs. For details on hierarchy of control measures see COSHH regulations.[2] Tick the appropriate reason for wanting to use RPE using the following definitions.

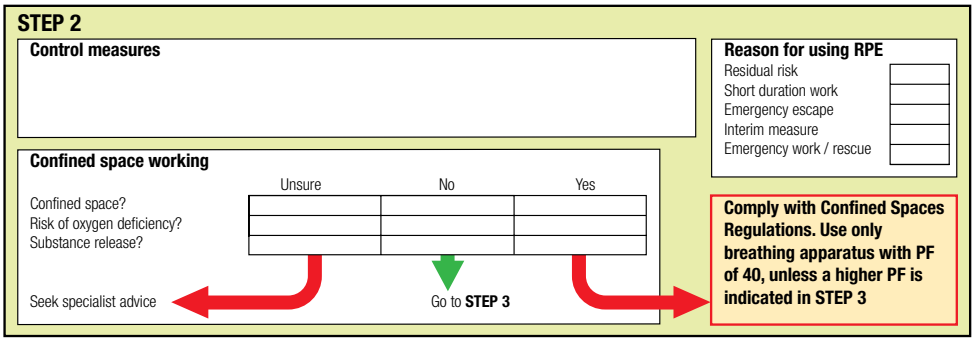
- **Residual risk**. You consider that there is still an inhalation risk after all other reasonable control measures have been put in place.
- **Short duration work**. You consider that other controls are not reasonably practicable. For example, an infrequent task that takes less than one hour to complete or is a task that is carried out infrequently at different locations.
- **Emergency escape**. You need to provide RPE for a safe exit from an area where hazardous substances may be released suddenly due to control systems failures. This RPE is for use in leaving the work area under emergency conditions.
- **Interim measure**. You want to provide RPE while you are installing other control measures.
- **Emergency work/rescue**. You consider that this work is needed before other control measures can be put into place. Alternatively, an emergency situation has been created by a temporary failure of control measures.

Confined space working. Answer all the questions in the box.

- **Confined space**. Tick ***yes*** if the working area is substantially enclosed, eg a chamber, tank, vat, silo, pit, trench, pipe, sewer, flue, well, small room with limited access and inadequate air exchange. A confined space may not necessarily be enclosed on all sides. Now, answer the other two questions.
- **Risk of oxygen deficiency**. Tick ***yes*** if this is the case or there is a likelihood of an oxygen level below 20.8% in the working area, as a result of chemical or biological action, or asphyxiants reducing/likely to reduce the amount of oxygen present.
- **Substance release**. Tick ***yes*** if it is possible that there could be a sudden release of hazardous substances and/or asphyxiants in the confined working area.

A ***yes*** tick in one or more boxes means that you should consider whether the confined spaces regulations apply.[8] Always remember, the law requires you to do work from outside the confined spaces, if this is reasonably practicable. If you demonstrate by a risk assessment that it is not reasonably practicable to do the work without entering the confined space then use BA with a protection factor of 40, unless a higher protection factor (PF) is indicated in **Step 3**.

A tick in one or more ***unsure*** boxes means you are advised to seek specialist help.



Step 3

In this step you will determine the health hazard group of the substance/preparation in use during the work described in Step 1, and determine what level of protection is needed from RPE. To complete this step you will need a copy of the safety data sheet(s) (SDS) for the relevant substances/preparations.

- For those substances/preparations bought-in, contact your suppliers – they have a legal duty to provide the SDS.[16]
- If you manufacture, then you will have to generate your own SDS following the criteria given in The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 ('the CHIP Regulations').[15]
- For a selected number of chemicals and process-generated substances, help is provided in Table 3. To select RPE for protection against asbestos fibres refer to the HSE guidance *Asbestos: The licensed contractors' guide*.[17]
- For all other substances you are advised to seek specialist help, or you may assume Health Hazard Group E.

Complete the following:

- In the **substance box** – write down the names of all the substances/ preparations, as described in the SDS, or Table 3 as appropriate.
- In the **risk phrases** box – write down the corresponding R-phrases as described in the SDS. For process-generated substances you can ignore this box.
- In the **HHG** (health hazard group) box – allocate the highest health hazard group for each of the listed substances/preparations, using Table 4 and the R-phrases in the risk phrases box. If there are a number of R-phrases which appear in different groups from A-E, always choose the higher group and write it down in the **HHG** box. For process-generated substances, use the recommendations in Table 3. For all other substances, seek specialist advice or assume HHG E.
- In the **Amount** box – describe the category using Table 5, based on the total amount used or handled.
- In the **Dust/Vol** (volatility) box – describe the category using Table 6 (dustiness) of solids or Figure 6 (volatility graph) for liquids. Gases are always placed in the 'high volatility' category.
- For each of the listed substances, now determine the protection factor (PF) needed using the Required Protection Factor Table 7, and enter it in the **PF** column.
- Now pick the highest protection factor from those listed in the PF column and write it down in the **highest PF required** box.
- Now complete **Step 4**.

An example of a completed RPE selector is given in Figure 8. Further worked examples of choosing the right protection factor (Steps 1-3 above) are given in Appendix 4.

STEP 3

Substance	Risk phrase	HHG	Amount	Dust/Vol	PF
			Highest PF required		

STEP 1

Company	Department
Date of assessment	Section
Performed by	Location
Work details	Work duration
	Work frequency

STEP 2

Control measures

Reason for using RPE

- Residual risk
- Short duration work
- Emergency escape
- Interim measure
- Emergency work/rescue

Confined space working

	Unsure	No	Yes
Confined space?			
Risk of oxygen deficiency?			
Substance release?			

Seek specialist advice

Go to **STEP 3**

Comply with Confined Spaces Regulations. Use only breathing apparatus with PF of 40, unless a higher PF is indicated in **STEP 3**

STEP 3

Substance	Risk phrase	HHG	Amount	Dust/Vol	PF
				Highest PF required	

STEP 4

Task related factors

- Work rate Heavy, Medium, Light
- Wear time > 1hr, < 1hr
- Abnormal temperature or humidity
- Power tools used, list below
- Clarity of vision critical
- Clarity of communication critical
- Congested work area
- Potentially explosive area
- Mobility critical

User's name _____

Wearer related factors

- Headgear (turban etc)
- Facial hair
- Facial markings
- Spectacles or contact lenses worn
- Eye, head, ear or facial protection
- Medical condition: seek medical advice

Select RPE using this information and **PART 2**, or show this form to your supplier/specialist advisor. Involve the wearer and provide a choice of RPE.

RPE selected BA type:
Respirator type: Filter:

STEP 5 Fit test tight fitting RPE, and implement RPE use in the workplace

Signature of assessor:

Figure 5 The RPE selector

Process/substance	For selecting RPE: Use Health Hazard Group	Health Hazard Group for *COSHH essentials* engineering control
Flour dust	A	E (CGS*)
Grain dust	A	E (Specialist advice)
Wood dust	A	E (CGS*)
Poultry house dust	A	E (Specialist advice)
Cotton dust	B	B
Wool process dust	A	A
Rubber process dust	B	E (CGS*)
Rubber fume	C	E (CGS*)
Chimney sweeping (domestic)	A	E (Specialist advice)
Mineral oil mist (except used engine oil)	B	B
Ferrous foundry dust	A	E (CGS*)
Welding/cutting: Mild steel	B	B
Welding/cutting: Stainless steel	D	D
Lead-based dust or fume (eg removal of lead paint)	D	D
Solder flux fume	D	E (CGS*)
CGS* = Control Guidance Sheet available		

Table 3 Process-generated substances

Health Hazard Group				
A	**B**	**C**	**D**	**E**
R36 R37 R38	R20 R20/21 R20/21/22 R20/22	R23 R23/24 R23/24/25 R23/25	R26 R26/27 R26/27/28 R26/28	R68 Muta cat 3
	R21 R21/22	R24 R24/25	R27 R27/28	R40
	R22	R25	R28	R42 R42/43
		R34		R45
		R35	R40 Carc cat 3	R46
		R36/37 R36/37/38	R48/23 R48/23/24 R48/23/24/25 R48/23/25 R48/24 R48/24/25 R48/25	R49
		R41	R60 R61 R62 R63	
		R43		
		R48/20 R48/20/21 R48/20/21/22 R48/20/22 R48/21 R48/21/22 R48/22		

Table 4 Health Hazard Groups A-E based on risk phrases

Amount of substance used	
Small	Grams or millilitres (a few ounces, around a cupful)
Medium	Kilograms or litres (1-100 kg, up to 55 gallon drums)
Large	Tonnes or cubic metres, tanker or lorry loads

Table 5 Amount of substance used

Dustiness of substance used	
Low	Pellets, waxy flakes and pill-like solids that do not break up easily. No dust cloud produced and little or no dust in the area
Medium	Crystalline granular solids and dust (visible, settles quickly). Fume or mist formed close to the task but dissipates very quickly
High	Fine powder, fume or mist. Dust cloud, fume or mist is formed and remains in the air for several minutes

Table 6 Dustiness

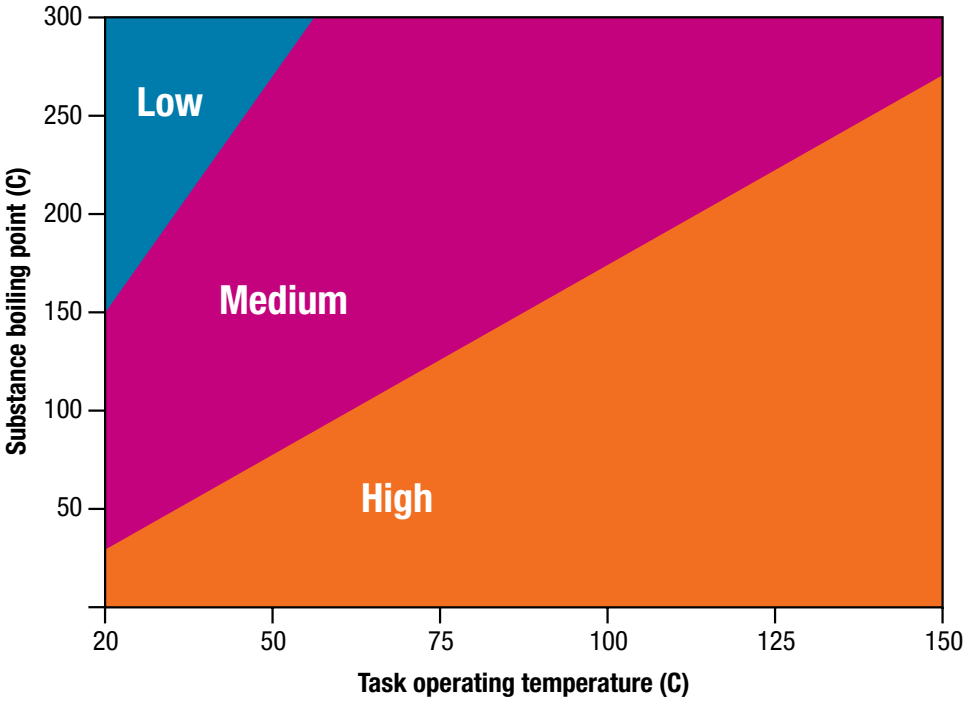


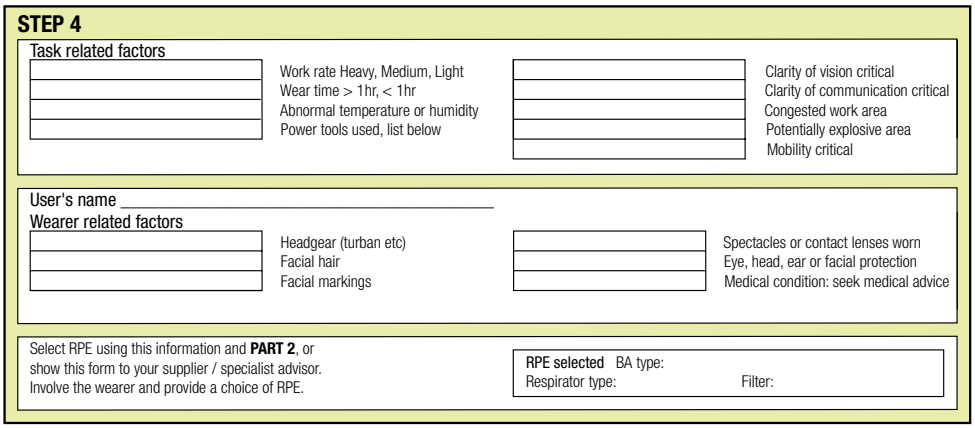
Figure 6 Volatility graph

Health Hazard Group	Amount	Dustiness/Volatility		
		Low	*Medium*	*High*
A	Small	-	-	-
	Medium	-	4	10
	Large	4	10	20
B	Small	-	4	4
	Medium	-	10	20
	Large	10	20	40
C	Small	-	4	4
	Medium	10	10	20
	Large	20	20	40
D	Small	10	20	40
	Medium	20	40	40
	Large	20	40	2000
E	Small	10	20	40
	Medium	20	40	40
	Large	20	40	2000

** PF in this table are based on those in BS EN 529[18]*

Table 7 Required protection factor*

Step 4
Complete this step for every RPE wearer. These factors affect the selection of RPE for individual wearers and are dependent upon the work carried out and the wearer. Most items are self-explanatory, requiring a yes/no (Y/N) answer. Explanations of these factors can be found on pages 24, 25 and 26. The answers you provide here will be used by the suppliers for recommending the right RPE. If you are doing the selection process you will need to consult Part 2 in this guide.



STEP 4

Task related factors

	Work rate Heavy, Medium, Light		Clarity of vision critical
	Wear time > 1hr, < 1hr		Clarity of communication critical
	Abnormal temperature or humidity		Congested work area
	Power tools used, list below		Potentially explosive area
			Mobility critical

User's name _____

Wearer related factors

	Headgear (turban etc)		Spectacles or contact lenses worn
	Facial hair		Eye, head, ear or facial protection
	Facial markings		Medical condition: seek medical advice

Select RPE using this information and **PART 2**, or show this form to your supplier / specialist advisor. Involve the wearer and provide a choice of RPE.

RPE selected BA type:
Respirator type: Filter:

Task-related factors

Work rate: Higher work rates are associated with increased breathing and sweating, which can affect the performance of some types of RPE and will influence the selection at Step 5. Increased breathing rate can cause contaminants to leak in, and sweating can cause facepieces to slip and leak. Work rate is classified as:

- light - sedentary working;
- medium - sustained hand and arm work or brisk walking;
- heavy - heavy manual work.

Part 2 of this guidance gives HSE's recommended maximum work rates for the different types of RPE.

Wear time: Tight-fitting masks become uncomfortable to wear for long periods (eg > 1 hour). Because of this, wearers may be tempted to loosen or remove RPE. Tight-fitting masks with fan-assisted or compressed air-supplied RPE, and loose-fitting facepieces will help minimise fatigue and discomfort. Classify wear time as:

< 1 hr – wear time up to 1 hour; or
> 1 hr – wear time greater than 1 hour.

Part 2 of this guidance indicates HSE's recommended maximum wear time on this basis for the different types of RPE.

Abnormal temperature or humidity: In hot and humid conditions, wearing RPE increases heat stress, sweating and discomfort. Using fan-assisted or compressed air-supplied BA would help to minimise the problems. Proprietary cooling devices are available from RPE manufacturers.

In conditions of extreme cold, air flow associated with fan-assisted or compressed air-supplied BA can cause chilling effects. Proprietary heating devices are available from RPE manufacturers.

You should be aware that proprietary heating/cooling devices using compressed air (vortex tubes) can place severe demand on the quantity of compressed air from supply systems.

Power tools used, list: If you are connecting air powered tools and your BA to the same air supply, ensure that your compressor can supply enough air for both at the same time.

You should ensure that air jets from power tools (pneumatic or electric) do not impact on RPE valves located in masks. If this happens, the protection provided by the RPE can be greatly reduced.

Clarity of vision: If you need to see fine details when wearing 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. In these cases, consider half-mask RPE, provide adequate lighting, or choose designs which resist scratching and internal misting. Fan-assisted or compressed air RPE are more resistant to misting. Some types include 'tear-off' consumable visors.

Clarity of 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.

Congested work area: If you cannot avoid working in a congested area, choose RPE which is less bulky or restrictive (eg smaller, lighter, and without trailing hoses).

Potentially explosive atmosphere: If you cannot avoid working in potentially explosive atmospheres, including oxygen-enriched (levels above 20.8%), you may require intrinsically safe, light-alloy free and antistatic RPE.

Mobility: Where mobility at different heights or over large areas is necessary to perform the work, certain types of RPE may cause safety hazards (eg those with trailing hoses which can drag, snag or be a trip hazard). If you can't avoid using trailing hoses, provide hose-support gantries or safe systems of work.

Wearer-related factors

Any items worn on the head for fashion, cosmetic or religious reasons can restrict the choice of RPE (eg incompatibility with face mask head harnesses). If they cannot be eliminated, a loose-fitting hood worn over the accessory may be acceptable, provided it gives the required level of protection.

Facial hair: Any beard, stubble, thick sideburns, long hair or moustache in the region where a face mask is intended to seal to the face will cause leakage. If this facial hair cannot be eliminated, you should consider the use of loose-fitting facepieces which do not rely on a tight seal in this region. Always remember, the law requires you to prevent exposure to hazardous substances. Before using RPE you should use other control measures.

Facial markings: Deep cuts or scars, wrinkles, moles, warts etc can affect the seal of masks to the face. If these are present in the face seal area, consider the use of loose-fitting facepieces.

Spectacles or contact lenses worn: Circle the relevant type, if used.

Spectacles with side arms are incompatible with full face masks because they break the face seal. RPE manufacturers can supply special frames, which fit inside their masks. Spectacles may also interfere with the fit of half-masks – contact lenses may be preferable. Careful consideration and additional training is needed for contact lens or spectacle wearers and those using full-face RPE (masks, hoods etc):

- if the lenses are dislodged, the wearer may remove the RPE to replace them while still in the hazardous area, leading to exposure;
- a dislodged lens may jam in one of the RPE valves, leading to loss of protection;
- contact lens wearers may be more susceptible to discomfort from the drying effects of air flows.

Eye, head, hearing or facial protection required? Circle as required. Different forms of head-worn PPE can potentially interfere to prevent one or more of the components from working correctly (eg goggles and half-masks, mask harnesses and safety helmets). Where possible, choose equipment where the different forms of protection required are integrally combined (eg eye, face, head and respiratory protection provided by a fan-assisted helmet respirator). For chemicals in **Group S** (see Table 8 Health Hazard Group Skin) you may require eye, facial, hand and body protection.

Relevant medical conditions: These include claustrophobia, heart disease, hearing defects, asthma and other respiratory illness. Also relevant are day-to-day coughs, colds and skin conditions. Pregnancy also falls under this heading.

Health Hazard Group S		
R20 R20/21 R20/21/22 R20/22	R34	R43 R42/23
R23 R23/24 R23/24/25 R23/25	R35	R48/21 R48/20/21 R48/20/21/22 R48/21/22
R27 R27/28 R26/27/28 R26/27	R36 R36/37 R36/38 R36/37/38	R48/24 R48/23/24 R48/23/24/25 R48/24/25
	R38 R37/38	Sk
	R41	

Table 8 Health Hazard Group: Skin

Explanation of the worked example in Figure 8

Step 1
Description of the work activity being considered, and who is doing the assessment.

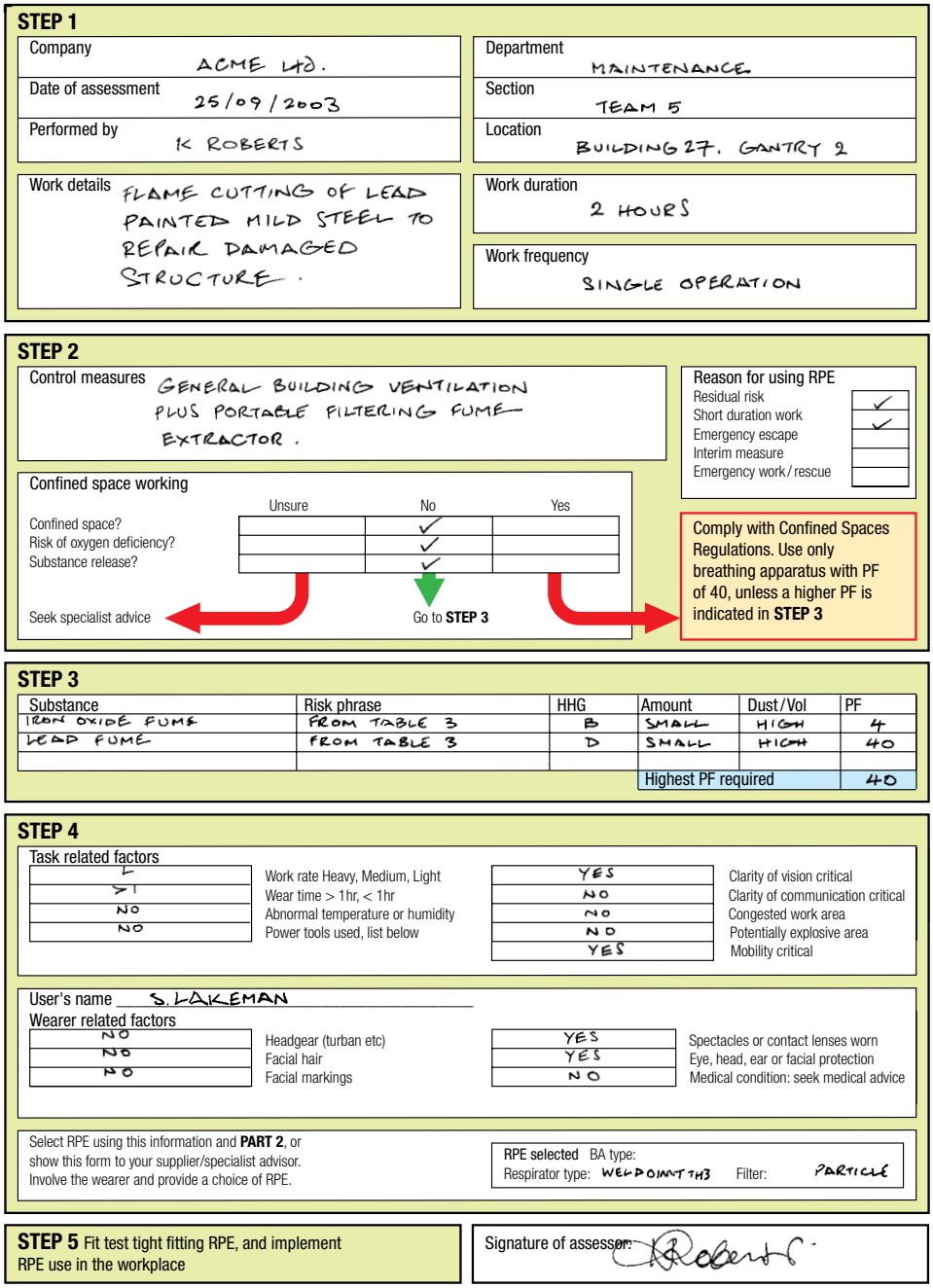
Step 2
The control measures already being applied before considering RPE are listed. RPE is needed in this case to cover residual risks. Because this is a short duration, one-off activity, it is not practicable to install extensive engineering controls. The work is being carried out in a well-ventilated building, without risk of oxygen depletion or major release of hazardous substances. Confined space considerations do not apply.

Step 3
Process-generated substances from the flame-cutting of steel are identified as iron oxide fume and lead fume from paint. Health Hazard Groups for these substances can both be found in Table 3; B for iron oxide and D for lead fume. The quantities of either material likely to be generated are small - a few grams at most, but the dustiness/volatility of the fume is high – very fine fume particles remain airborne for long periods. Entering these properties into Table 7 identifies that a protection factor of 4 is required against the iron oxide, but 40 is required against the lead fume. This is the value that must be used to select the right RPE. Either a filtering device (fitted with particle filters), or some form of BA, providing at least this level of protection, could be chosen. Looking at Table 10, possible RPE types include unpowered full-face masks, high-efficiency powered masks and hoods, and some forms of BA.

Step 4
Task-related factors which affect the final choice are the light work rate, the 2-hour wear period, the need for clear vision, and the need for mobility (the gantry to be repaired is not easily accessible, and there is no nearby source of breathable compressed air). Work rate does not limit the choice. Wear duration suggests that powered or air-supplied BA will be more acceptable. Whatever RPE is chosen must also allow good vision – wide rigid visors are better than small eye pieces or flexible visors in this respect. The absence of a convenient breathable air supply tends to rule out BA for this job.

Wearer factors affecting the choice are that the worker wears spectacles, and also needs head, eye and face protection because of the other hazards associated with this process and the general factory environment – heat, glare, molten metal spatter and head impact protection. While special spectacles can be fitted inside some full face masks, hood-type powered respirators can be used with conventional spectacles. Because protection against a variety of hazards is needed, an integrated approach would be better than sourcing separate items. Powered hoods which incorporate head, eye and face protection, and are specially designed for welding-type applications are available. One such device is selected here, and used with particle filters.

Step 5
See the next section of this book. This is not a tight-fitting mask, so no fit test is needed.



STEP 1

Company: ACME Ltd.	Department: MAINTENANCE
Date of assessment: 25/09/2003	Section: TEAM 5
Performed by: K ROBERTS	Location: BUILDING 27. GANTRY 2
Work details: FLAME CUTTING OF LEAD PAINTED MILD STEEL TO REPAIR DAMAGED STRUCTURE.	Work duration: 2 HOURS
	Work frequency: SINGLE OPERATION

STEP 2

Control measures: GENERAL BUILDING VENTILATION PLUS PORTABLE FILTERING FUME EXTRACTOR.

Reason for using RPE

Residual risk	
Short duration work	✓
Emergency escape	✓
Interim measure	
Emergency work / rescue	

Confined space working

	Unsure	No	Yes
Confined space?		✓	
Risk of oxygen deficiency?		✓	
Substance release?		✓	

Seek specialist advice — Go to **STEP 3**

Comply with Confined Spaces Regulations. Use only breathing apparatus with PF of 40, unless a higher PF is indicated in **STEP 3**

STEP 3

Substance	Risk phrase	HHG	Amount	Dust / Vol	PF
IRON OXIDE FUME	FROM TABLE 3	B	SMALL	HIGH	4
LEAD FUME	FROM TABLE 3	D	SMALL	HIGH	40
				Highest PF required	40

STEP 4

Task related factors

L	Work rate Heavy, Medium, Light	YES	Clarity of vision critical
>1	Wear time > 1hr, < 1hr	NO	Clarity of communication critical
NO	Abnormal temperature or humidity	NO	Congested work area
NO	Power tools used, list below	NO	Potentially explosive area
		YES	Mobility critical

User's name S. LAKEMAN

Wearer related factors

NO	Headgear (turban etc)	YES	Spectacles or contact lenses worn
NO	Facial hair	YES	Eye, head, ear or facial protection
NO	Facial markings	NO	Medical condition: seek medical advice

Select RPE using this information and **PART 2**, or show this form to your supplier/specialist advisor. Involve the wearer and provide a choice of RPE.

RPE selected — BA type: — Respirator type: WELDMATH3 — Filter: PARTICLE

STEP 5 Fit test tight fitting RPE, and implement RPE use in the workplace

Signature of assessor: K Roberts

Figure 8 Example of completed form

Implementing RPE use in the workplace

RPE use

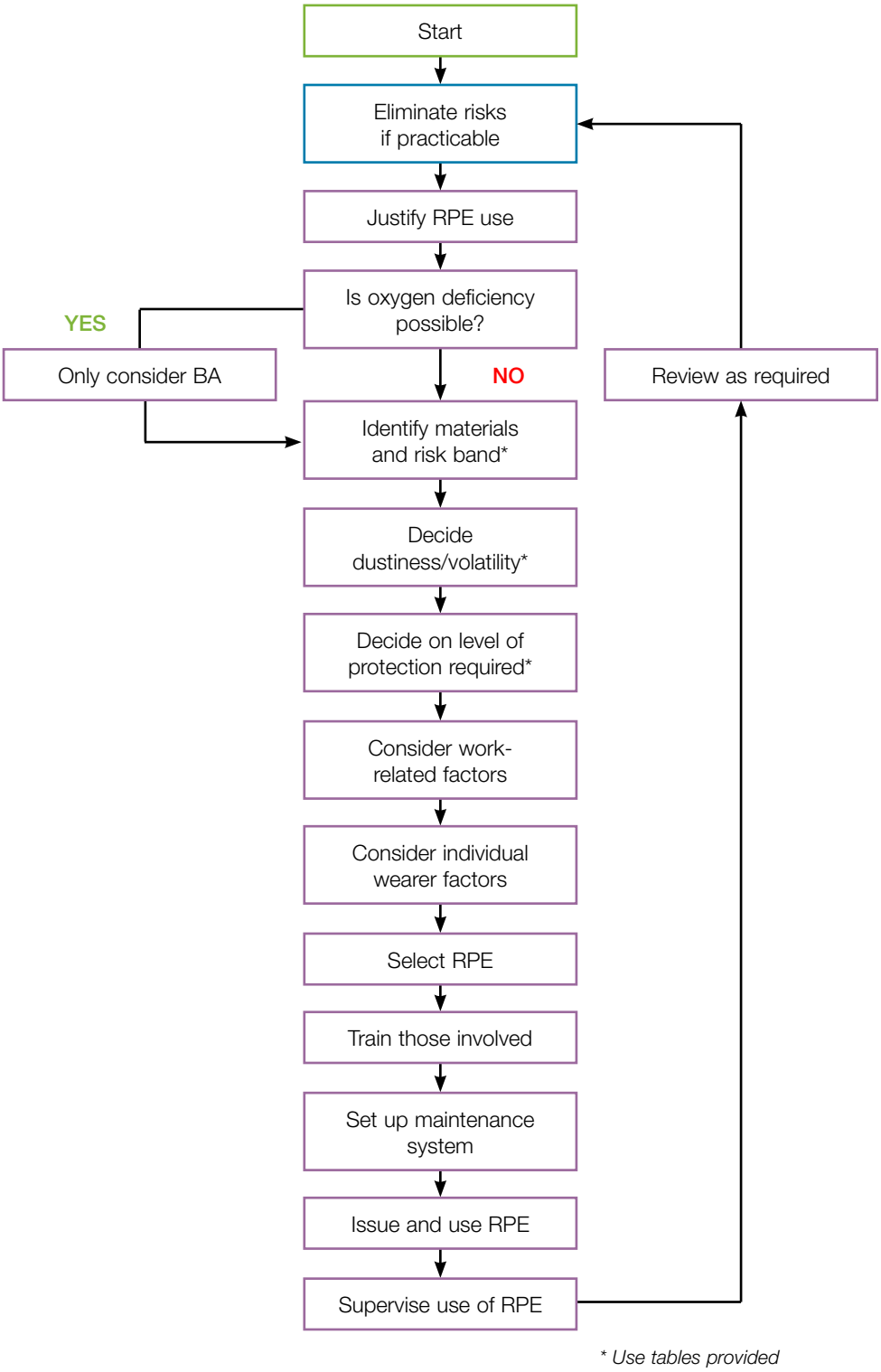


Figure 9 Key elements of successful PPE management

42 For RPE to be effective over the short and long term it must be integrated into normal workplace activities. You must ensure that control measures including RPE are properly used and are not made less effective by bad work practices or by improper use.

43 Your employees must use the control measures, including RPE, in the way they are intended to be used and as trained and instructed by you. It is often best to give a choice of several correctly specified types of RPE to wearers so they can choose the one they like.

Designated areas

44 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 if you have to comply with the CAW regulations.[4]

45 RPE use should fall within the general health and safety framework in your workplace. A good introduction to effective health and safety management is given in the HSE leaflet *Managing health and safety, five steps to success*.[19]

Management and supervision

46 You should ensure that you or a person delegated by you is responsible for the management and implementation of RPE use into your workplace. Ideally, the person should be the line manager of the 'hazardous process'. This person may be supported by either internal or external safety professionals.

Training

47 All people involved in the selection, wearing, storage and maintenance (if required) must be trained. The training programme should at least cover the following areas:

- Why is RPE needed?
- What are the hazards, the risks and the effects of exposure?
- What RPE is being provided?
- How does the RPE work?
- Why fit testing is required (if relevant).
- How do you wear and check it correctly?
- Fit checking before use.
- What maintenance is required and when?
- Where and how do you clean and store it?
- How do you report any problems?
- Employee and employer responsibilities.
- Use and misuse of RPE.

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

49 You may also want to raise awareness of health and safety issues by ensuring that they are covered first at all team and management meetings.

50 A good health and safety training primer is the HSE document *Health and safety training: What you need to know*.[20]

Medical fitness

51 You may need to consider the medical fitness of your employees. In certain circumstances, where you have very hazardous substances, ongoing medical surveillance may be required. Specific requirements are laid down in COSHH,[2] CAW,[5] CLAW[6] and IRR.[7]

Facepiece fit testing

52 You should ensure that the wearers of tight fitting facepieces have undergone facepiece fit testing.[2,5,6] This is needed to ensure that the selected facepiece can fit the wearer correctly. You could use facepiece fit testing as a training tool to show the consequences to performance of poor fitting and misuse. It is also a good tool for screening out incompatible RPE. The supplier of your RPE can suggest the most appropriate method. Detailed information can be found in the HSE document *Fit testing of respiratory protective equipment facepieces*.[21]

Air quality

53 Air supplied to BA should meet minimum quality requirements. These are given in British Standard BS EN 529.[18] Your RPE or air compressor supplier should be able to advise you of how to meet these requirements. Further guidance on compressed air quality is given in Appendix 3.

Awareness

54 You may want to consider publicising the use of RPE and wear levels on notice boards and other communication systems.

Storage

55 Remember that you must provide safe and clean storage facilities for all RPE. You should have procedures for people wearing RPE to have comfort, tea, meal and other breaks in safety.

Maintenance

56 All RPE should be checked for correct functioning before each use. The RPE manufacturer will tell you how to perform the relevant tests.

57 Maintenance is a requirement for all RPE, except for 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 made 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.

58 Only spare parts from the original manufacturer should be used during maintenance and repair of damaged RPE.

59 Records of examination and testing must be kept for five years as a general rule.

Disposal

60 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 upon the specific substances you are exposed to and the amounts generated. In some cases specific legislation may apply. If in doubt seek specialist help.

Part 2: Filters and types of RPE

Filters for respirators

61 There are three main types of filters:

- particle filters;
- gas/vapour filters;
- combined filters – particles and gases and vapours.

Particle filters

62 These 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 mists and droplets. However, particle filters do not trap gases or vapours including organic liquid mists and sprays, or give any protection against oxygen-deficient atmospheres.

63 Some manufacturers may recommend the use of pre-filters (coarse filters) to protect the main filters.

64 Particle filters will be marked with a 'P' sign and filtration efficiency number, 1, 2 or 3. If the filter is also usable with fan-assisted respirators then they will also carry the sign 'TH' or 'TM' and the filtration efficiency number (1, 2 or 3). If colour coding is used, the label will be WHITE.

When should you change particle filters?

65 The following is recommended:

- If you use an EN 149, EN 405 or EN 1827 device, then at least daily, unless the manufacturer can guarantee longer use.
- If you use one or more filters on EN 140 or EN 136 face masks, change them daily. If you want to use the filters for longer, seek the manufacturer's advice.
- 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.

66 The following additional information is provided to help you make decisions:

- 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.
- **P1: low efficiency**; use with PF4 respirators. Do not use against fume unless the manufacturer can guarantee protection.
- **P2: medium efficiency**; use with PF10 respirators. Do not use against fume unless the manufacturer can guarantee protection.
- **P3: high efficiency**; use with PF20 or PF40 respirators.

Gas/vapour filters

67 These filters are designed to remove gases or vapours as specified by the manufacturer. They do not protect against particles, or oxygen-deficient atmospheres.

68 They don't last forever - these filters have a limited capacity for removing gases/vapours, so after a time, the gas or vapour will pass straight through (an event known as breakthrough) to the RPE wearer's respiratory system.

69 Gas/vapour filters are usually divided according to the type of substance they can be used against, and the capacity of the filter. The filter or the mask it is built into will be marked with a letter (the type) and usually a number to indicate capacity, and a standard colour coding (eg A2 – brown). If the filter is also usable with powered respirators then they will also be marked 'TH' or 'TM'. Table 9 provides a guide to the different types of gas/vapour filters.

Note: *The capacity identification is not a good indicator of break through time of substances. Some substances can break through before the capacity of the filter is reached. This is due to the complications involved in trapping them.*

70 The classification of gas and vapour filters is based on how much of the specified contaminant they can hold in a laboratory test at set conditions.

- **Class 1:** low capacity.
- **Class 2:** medium capacity.
- **Class 3:** high capacity.

When to change gas/vapour filters

71 Filter life is very difficult to predict because it depends on a large number of factors. Based on practical tests, HSE recommends:

- **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 or a respiratory sensitiser or a substance carrying the risk phrase R40 or R42, change everyday or as instructed by the manufacturer.
- **Filter capacity 2:** Change at least once a week or as instructed by the manufacturer.
- **TM/TH type filters:** Change as instructed by the manufacturer.

Gas/vapour filters			
Filter type	**For use against**	**Colour code**	**Other information**
A	Organic gases and vapours, boiling point > 65ºC	**Brown**	EN 14387
B	Inorganic gases and vapours	**Grey**	EN 14387 Do not use against carbon monoxide
E	SO2 and other acid gases	**Yellow**	EN 14387
K	Ammonia and its organic derivatives	**Green**	EN 14387
Hg	Mercury	**Red and White**	EN 14387, includes P3 particle filter. Maximum use time 50 hours. No class number
NO	Oxides of nitrogen	**Blue and White**	EN 14387, includes P3 particle filter. Single use only. No class number
AX	Organic gases and vapours, boiling point < 65ºC	**Brown**	EN 14387. Single use only. No class number
SX	Substance as specified by the manufacturer	**Violet**	EN 14387

Table 9 Gas/vapour filters

72 The following additional information is provided to help you make decisions:

- Change filters as instructed by the manufacturer, eg 'single use only' (eg AX filters) or '50 hours' (eg Hg filters).
- 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.
- 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.

Multi-gas filters

73 A filter may be manufactured to contain filters for more than one type of gas or vapour. In this case, they will be marked with types of gas/vapour filters included (eg A1B2 – organic vapour with capacity class 1 and inorganic gases with capacity class 2).

Warning: *They are manufactured in this way to offer an easy choice for employers who are using different gases and vapours at their sites. They are more expensive to buy than single type filters, heavier, and harder to breathe through in use. If you use multi-type filters, you should take extreme care and 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 using BA.*

Combined filters

74 Filters are available for situations where protection is needed against both particles and specific gas or vapour. 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.

RPE types

75 Table 10 and the following sections of Part 2 describe the different types of RPE available. Information provided here matches up with the classifications for protection factor, work rate and wear time called up in the RPE selector. Use this section in conjunction with the information collected on the RPE selector to identify potentially suitable equipment for individual situations and users.

76 Look for the Minimum Protection Factor required by your completed selection form. Down the left hand side of Table 10, look for the Highest Protection Factor required in your completed RPE selector. Remember that you can always use equipment which provides higher protection than the minimum you need, as long as it is suitable for the work and the wearer. Read off the page references at the bottom of the table for the relevant equipment, and look at these pages to decide which type you will need.

77 Examples are shown in these pages to illustrate a typical appearance of the different types of equipment. Individual models from various manufacturers may differ in detail.

PF required	Respirators						Breathing apparatus		
	Half-mask, particle filters	Half-mask, gas filters	Full face mask, particle filters	Full face mask, gas filters	Powered (fan-assisted) masks	Powered (fan-assisted) hoods	Fresh air hose	Constant flow airline BA	Demand valve BA
4	FFP1, FMP1, P1		P1						
10	FFP2, FMP2, P2	FF gas, FM gas, Gas	P2		TM1	TH1		LDH1	
20	FFP3, FMP3, P3			Gas	TM2	TH2		LDH2, LDM1, LDM2, Half-mask	
40			P3		TM3	TH3	Full face mask, Hood	LDH3, LDM3, Hood, Full mask	
200								Suit	
2000									Airline, self-contained
See page:	36	37	38	39	40	41	42	43, 44	45

Table 10 Protection values for different classes of RPE, used for selection

Half-mask respirators against particles only

Classification of RPE and protection factor		
FFP1 - 4 **FFP2** - 10 **FFP3** - 20 Wear the mask the right way up. Adjust the nose bridge to obtain a good seal. Replace mask after each use.	**FMP1** - 4 **FMP2** - 10 **FMP3** - 20 Clean and store the mask properly – pay special attention to valves and straps. Change both filters on a two-filter mask together. Change filters at least every shift. Change mask at least weekly.	**P1** - 4 **P2** - 10 **P3** - 20 Change both filters on a two-filter mask together. Clean and store the mask properly – pay special attention to valves and straps.
Standards for equipment		
EN 149	EN 1827	EN 140 mask and EN 143 filter

General information which applies to all these types

Filter information: See paragraphs 61-66
Maximum work rate: Medium
Wear time: < 1 hr
Fit testing required? Yes; qualitative test acceptable

Dos:

- Always ensure the complete device is in good working order before putting it on, even when new.
- Always make sure the mask fits you before starting work.
- Always make sure the filters are the right ones for your work – replace when used or damaged.
- Always use all the straps provided, making sure they are correctly positioned and adjusted. Use the manufacturer's instructions.
- Always fit two identical filters to a twin filter mask.

Don'ts:

- Never use the mask to protect against lack of oxygen or gases/vapours.
- Never use if dirty, damaged or incomplete.
- Never leave the mask lying around in the workplace – dust will get inside and you will breathe it in next time you put it on.
- P1 and P2 filters are not recommended for fumes unless the manufacturer can guarantee protection.

Half-mask respirators against gases/vapours

Classification of RPE and protection factor		
FFgas - 10* Filters are not replaceable Mask not designed to be maintained Change whole mask at end of filter life	**FMgas** - 10* Change both filters on a twin filter mask together Change filters at least every shift Change mask at least weekly	**Gas** - 10* Change both filters on a twin filter mask together A1 filters - change at least every two days A2 filters - at least once a week
*Protection factor reduces to 4 if P1 particle filter incorporated		
Standards for equipment		
EN 405	EN 1827	EN 140 mask and EN 14387 filter

General information which applies to all these types

Filter information: See paragraphs 67-74
Maximum work rate: Medium
Wear time: < 1 hr
Fit testing required? Yes; qualitative test acceptable

Dos:

- Always ensure the complete device is in good working order before putting it on, even when new.
- Always make sure the mask fits you before starting work.
- Always make sure the filters are the right ones for your work – replace when used or damaged.
- Always use all the straps provided, making sure they are correctly positioned and adjusted. Use the manufacturer's instruction.
- Always fit two identical filters to a twin filter mask.
- Always clean and store the mask properly – pay special attention to the valves.

Don'ts:

- Never use the mask to protect against lack of oxygen.
- Never use it if it is dirty, damaged or incomplete.
- Never leave the mask lying around in the workplace – contaminant will get inside and you will breathe it in next time you put it on.
- Never use it to protect against particles, unless a particle filter is incorporated.

Full face mask respirators against particles only

Classification of RPE and protection factor
P1 - 4 P2 - 10 P3 - 40
Standards for equipment
EN 136 mask and EN 143 filter

General information which applies to all these types

Filter information: See paragraphs 61-66
Maximum work rate: Medium (all classes)
Wear time: < 1 hr
Fit testing required? Yes; quantitative test

Dos:

- Always ensure the complete device is in good working order before putting it on, even when it is new.
- Always make sure the mask fits you before starting work.
- Always make sure the filters are the right ones for your work – replace them when they are used or damaged.
- Always change both filters on a two-filter mask together.
- Always use all the straps provided, making sure they are correctly positioned and adjusted. Use the manufacturer's instruction.
- Always fit two identical filters to a twin filter mask.
- Always clean and store the mask properly – pay special attention to the valves.

Don'ts:

- Never use the mask to protect against lack of oxygen or gases/vapours.
- Never use if dirty, damaged or incomplete.
- Never leave the mask lying around in the workplace – dust will get inside and you will breathe it in the next time you put it on.

Full face mask respirators against gases/vapours

Classification of RPE and protection factor
Gas - 20* *Protection factor reduces to 4 if P1 particle filter incorporated, or 10 if P2 filter incorporated
Standards for equipment
EN 136 mask and EN 14387 filter

General information which applies to all these types

Filter information: See paragraphs 67-74
Maximum work rate: Medium
Wear time: < 1 hr
Fit testing required? Yes; quantitative test

Dos:

- Always ensure the complete device is in good working order before putting it on, even when new.
- Always make sure the mask fits you before starting work.
- Always make sure the filters are the right ones for your work – replace when used or damaged.
- Always change both filters on a two-filter mask together.
- Always use all the straps provided, making sure they are correctly positioned and adjusted. Use the manufacturer's instructions.
- Always fit two identical filters to a twin filter mask.
- Always clean and store the mask properly – pay special attention to the valves.

Don'ts:

- Never use the mask to protect against lack of oxygen.
- Never use to protect against particles unless a combined gas/vapour and particulate filter is incorporated.
- Never use if dirty, damaged or incomplete.
- Never leave the mask lying around in the workplace – contaminant will get inside and you will breathe it in the next time you put it on.
- Never use it to protect against particles, unless a particle filter is incorporated.

Powered (fan-assisted) respirators with masks

Classification of RPE and protection factor
TM1 - 10 **TM2** - 20 **TM3** - 40
Standards for equipment
EN 12942

General information which applies to all these types

Filter information:	See paragraphs 61-74
Maximum work rate:	Medium
Wear time:	> 1 hr
Fit testing required?	Yes; half mask - qualitative test acceptable; full face mask – quantitative test

Dos:

- Always ensure the complete device is in good working order before putting it on, even when new.
- Always check the fan is providing enough air flow before you use the device.
- Always fit the device carefully according to your training.
- Always make sure you have the right type and number of filters fitted.
- Always fit identical filters to a multi-filter unit.
- Always change all the filters on a multi-filter unit together.
- Always charge or change the battery after use.
- Always clean and store the mask properly – pay special attention to the valves.

Don’ts:

- Never use the mask to protect against lack of oxygen.
- Never use particulate only filters against gas/vapour, or gas/vapour only filters against particulates.
- Never use if dirty, damaged or incomplete, or not providing enough air.
- Never leave the mask lying around in the workplace – dust will get inside and you will breathe it in next time you put it on.
- Never keep working if the fan stops or the flow rate falls – leave the work area immediately.

Powered (fan-assisted) respirators with hoods

Classification of RPE and protection factor
TH1 - 10 **TH2** - 20 **TH3** - 40
Standards for equipment
EN 12941

General information which applies to all these types

Filter information: See paragraphs 61-74
Maximum work rate: Medium
Wear time: > 1 hr
Fit testing required? No

Dos:

- Always ensure the complete device is in good working order before putting it on, even when new.
- Always check the fan is providing enough air flow before you use the device.
- Always fit the device carefully according to your training.
- Always make sure you have the right type and number of filters fitted.
- Always fit identical filters to a multi-filter unit.
- Always change all the filters on a multi-filter unit together.
- Always charge or change the battery after use.
- Always clean and store the device properly – pay special attention to the valves.

Don’ts:

- Never use the hood to protect against lack of oxygen.
- Never use particulate only filters against gas/vapour, or gas/vapour only filters against particulates.
- Never use if dirty, damaged, incomplete, or not providing enough air.
- Never leave the hood lying around in the workplace – dust will get inside and you will breathe it in the next time you put it on.
- Never keep working if the fan stops or the flow rate falls – leave the work area immediately.

Fresh air hose (FAH) BA

Classification of RPE and protection factor		
Unassisted FAH full mask - 40 Maximum work rate: Medium Wear time < 1 hr Fit testing required? Yes; quantitive	**Fan-assisted FAH full mask** - 40 Maximum work rate: Heavy Wear time > 1 hr Fit testing required? Yes; quantitive	**Powered FAH hood** - 40 Maximum work rate: Heavy Wear time > 1hr Fit testing required? No
Standards for equipment		
EN 138	EN 138	EN 269

General information which applies to all these types

Breathing air quality information: See Appendix 3.

Dos:

- Always ensure the complete device is in good working order before putting it on, even when new.
- Always anchor the hose inlet in clean air.
- Always ensure you have an adequate supply of clean breathing air.
- Always fit the device carefully according to your training.
- Always look after your supply hose during use – your life may depend on it.
- Always clean and store the equipment properly – pay special attention to valves.

Don'ts:

- Never use if dirty, damaged or incomplete.
- Never use the equipment without the waist belt.
- Never leave the equipment lying around in the workplace – contamination will get inside and you will breathe it in the next time you use it.
- Never keep working if the flow rate drops – leave the work area immediately.
- Never place the inlet near to potential sources of contamination, eg vehicle exhausts.

Constant flow airline BA with a mask

Classification of RPE and protection factor	
LDM1 - 20 **LDM2** - 20 **LDM3** - 40 Maximum work rate Heavy Wear time > 1 hr	**Half-mask** - 20 **Full-mask** - 40 Maximum work rate Heavy Wear time > 1 hr
Standards for equipment	
EN 12419 light duty airline BA	EN 139 airline BA

General information which applies to all these types

Breathing air quality information: See Appendix 3

Fit testing required? Yes; half-masks – qualitative test acceptable
full masks – quantitative test

Dos:

- Always ensure the complete device is in good working order before putting it on, even when it is new.
- Always ensure you have an adequate supply of clean compressed breathing air before use.
- Always fit the device carefully according to your training.
- Always look after your supply tube during use – your life may depend on it.
- Always clean and store the mask properly – pay special attention to valves.

Don'ts:

- Never use if dirty, damaged or incomplete.
- Never use the equipment without the waist belt.
- Never leave the equipment lying around in the workplace – contamination will get inside and you will breathe it in next time you use it.
- Never keep working if the flow rate drops or any warning activates – leave the work area immediately.
- Never use light duty hoses for normal airline applications.

Constant flow airline BA with a hood

Classification of RPE and protection factor		
LDH1 - 10 **LDH2** - 20 **LDH3** - 40	**Hood** - 40	**Suit** - 200
Maximum work rate:		
LDH1 - Medium **LDH2** - Heavy **LDH3** - Heavy	Heavy	Heavy
Wear time > 1 hr	Wear time > 1 hr	Wear time > 1 hr
Standards for equipment		
EN 1835 light duty airline hood	EN 270 airline hood EN 271 blasting helmet	EN 1073-1 full suit

General information which applies to all these types

Breathing air quality information: See Appendix 3
Fit testing required? No

Dos:

- Always ensure the complete device is in good working order before putting it on, even when new.
- Always ensure you have an adequate supply of clean compressed breathing air before use.
- Always fit the device carefully according to your training.
- Always look after your supply tube during use – your life may depend on it.
- Always clean and store the equipment properly – pay special attention to the valves.

Don'ts:

- Never use if dirty, damaged or incomplete.
- Never use the equipment without the waist belt.
- Never leave the equipment lying around in the workplace – contamination will get inside and you will breathe it in next time you use it.
- Never keep working if the flow rate drops or any warning activates – leave the work area immediately.
- Never use light duty hoses for normal airline applications.

Demand valve BA

Classification of RPE and protection factor	
Demand airline BA - 2000 Always look after your supply tube – your life may depend on it Never use the equipment without the waist belt	**Self-contained demand BA** - 2000 Always plan your exit from the contaminated area so you don't run out of air
Maximum work rate:	
Heavy	Heavy
Standards for equipment	
EN 139 airline BA	EN 137 self-contained BA

General information which applies to all these types

Breathing air quality information: See Appendix 3
Fit testing required? Yes; quantitative (or equivalent method)

Dos:

- Always ensure the complete device is in good working order before putting it on, even when new.
- Always ensure you have an adequate supply of clean compressed breathing air before use.
- Always fit the device carefully according to your training.
- Always make sure the mask fits you.
- Always clean and store the equipment properly – pay special attention to the valves.
- Always plan for work breaks in situations requiring prolonged use – this allows users to drink and avoid dehydration effects.

Don'ts:

- Never use if dirty, damaged or incomplete.
- Never leave the equipment lying around in the workplace – contamination will get inside and you will breathe it in next time you use it.
- Never keep working if the flow rate drops or any warning activates – leave the work area immediately.
- Never forget that in high concentrations of contaminant, skin exposure can be a significant route of entry to the body – other controls may be necessary to prevent this.

Some common misuses of RPE

78 There have been serious accidents and fatalities due to incorrect selection or misuses of RPE. The examples and case studies in this section give information and warning. Incorrect selection and misuse invalidate the suitability of RPE and constitute a failure to comply with the law. Health and safety inspectors seek to secure compliance with the law. If they find any incorrect selection or misuse of RPE, including the examples given below, they will consider enforcement action.

Incorrect selection of RPE

79 Table 11 below provides examples of incorrect selection.

Misuse of RPE

80 Different types of misuse of RPE are listed in Table 12 and Figures 10-16. Some examples are illustrated overleaf; many other types of misuse exist.

Application	Type of RPE being used	Why is it incorrect?
Spray application of isocyanate-containing paints	Nuisance dust mask (NDM)	NDMs are designed to catch large particles, not those reaching your lungs. They are not 'CE'-marked and are not RPE. They should not be used for compliance with law. Spray paints contain isocyanates, organic solvents. NDM will not provide any protection.
Handling grain, wood dust	NDM	NDMs are designed to catch large particles, not those reaching your lungs. They are not 'CE'-marked and are not RPE. They should not be used for compliance with law. Most of the dust will go though the NDM and you may end up with respiratory sensitisation.
Welding fume	NDM or FFP1 type disposable respirators	NDMs are designed to catch large particles, not those reaching your lungs. They are not 'CE'-marked and are not RPE. Many FFP1 are made from electrically charged filter materials. Based on the information on efficacy, manufacturers may not recommend these.
Work with organic solvent - based products (eg painting, decanting, degreasing, glass re-enforced plastics manufacture, printing works etc)	NDM or particle filters (marked P1, P2 and P3)	NDMs are designed to catch large particles, not those reaching your lungs. They are not 'CE'-marked and are not RPE. Particle filters do not trap organic solvent vapours. For many applications Type A filters are suitable. Always seek manufacturers' advice before choosing a filter.
Work with ammonia	Type 'A' organic vapour filter	Organic vapour filters are inappropriate. 'K' type filters are needed.
Working in confined spaces (eg welding, degreasing, clearing organic solvent spills, painting, paint stripping)	Respirators	Respirators cannot provide protection against oxygen deficiency. Use suitable BA.
Entering confined spaces (eg sewers or tanks; ship hold where rusting iron or residual organic matter is present)	Respirators	Respirators will not provide protection against oxygen deficiency, and other toxic substances may be present in lethal concentrations. Use suitable BA.

Table 11 Examples of incorrect selection

Misuse factor	Facepiece type				Supply type	
	Any disposable mask	Any half-mask	Any full face mask	Any hood	Powered (fan-assisted)	BA
Wearer compatibility						
Tight-fitting facepieces and facial hair	*	*	*			
Lack of fit test pass	*	*	*			
Compatibility with other PPE	*	*				
Clash with goggles/spectacles			*			
Sidearm spectacles interfere with seal						
Maintenance and cleaning						
Sharing of dirty equipment	*	*	*	*	*	*
Dirt preventing valves working	*	*	*	*		
Perished valves/components	*	*	*	*	*	*
Broken/worn straps or drawstrings	*	*	*	*		
Deformed/missing components	*	*	*	*	*	*
Seals and o-rings missing		*	*	*	*	*
Incorrect assembly (eg visor inverted)		*	*	*	*	*
Filters incorrect/out of date/missing	*	*	*	*	*	
DIY modifications	*	*	*	*	*	*
Battery inadequately charged					*	
Training/supervision failure						
Nose bridge not formed	*					
Put on upside down	*	*				
Not all straps used	*	*	*			
Straps loosened or not tightened	*	*	*			
Lack of flow checks				*	*	*
Hose connections not secure		*	*	*	*	*
Air supply inadequate/poor quality				*	*	*

Table 12 Examples of RPE misuse, encountered by HSE during investigations

Figure 10 Loose head harness straps on a full face mask

Figure 11 Filtering facepiece fitted upside down, and using only one strap

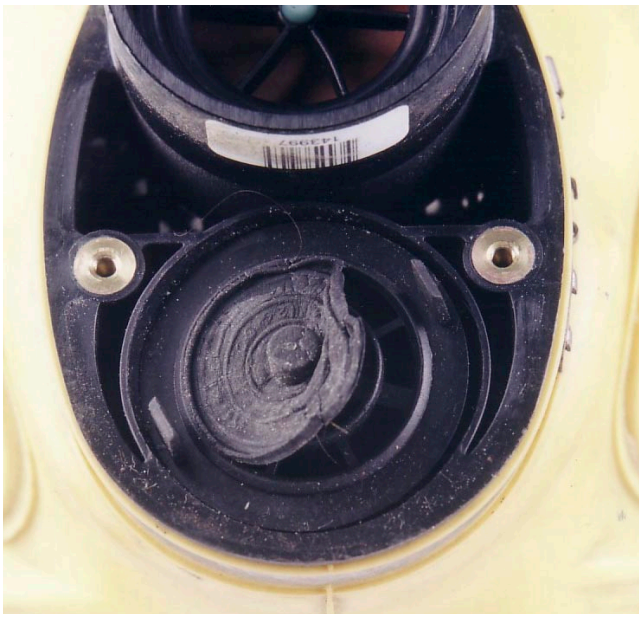


Figure 12 Badly perished and deformed exhalation valve, incapable of closing

Figure 14 Ordinary side-arm spectacles worn with a full face mask, disturbing the face seal

Figure 13 Face mask straps worn over coverall hood. Movement is likely to dislodge the mask

Figure 15 Filtering facepiece worn using only one strap.

Note: The clash between the mask and spectacles preventing the mask sealing to the face

Figure 16 Filtering facepiece fitted ineffectively, and with a strap over the headgear. No protection provided

Appendix 1: Special guidance relating to radioactive substances

Introduction

1 This appendix gives specific advice for situations where you need to provide RPE for the purpose of restricting exposure to airborne radioactive particles and gases for work covered by the **Ionising Radiations Regulations** (IRR).[7] Before starting any work with radioactive substances requiring use of RPE, you will need to consult a suitable Radiation Protection Adviser (RPA) about how to restrict exposure. The guidance in this document is not a substitute for the advice of your RPA.

2 As for work with other hazardous substances, the use of RPE and PPE is the last option you should consider for controlling exposure to radioactive substances. Under IRR you must first consider engineered means for reduction of doses to as low as reasonably practicable (ALARP), followed by supporting systems of work and, lastly, provision of personal protective equipment to further restrict exposure where this is reasonably practicable. You should be aware that in areas where RPE is necessary to protect against hazard from inhalation of radionuclides, it is possible that there is also a significant hazard due to external radiation dose rate that RPE alone cannot protect against.

Assessment of exposure risks and choice of RPE

3 Your assessment of the likely risks should be based on 'pessimistic' assumptions of possible surface and airborne contaminant concentrations during working activity. You should use this information in conjunction with **dose coefficients** for the radionuclides in question to estimate the radiation doses received by workers due to inhalation and/or ingestion of the radionuclide in question while working in the area. Choose RPE so that the resulting dose when RPE is used is restricted to a level which is ALARP. The total exposure for the whole year must always be ALARP, and in any case below the relevant limit set in IRR.

4 For certain types of work, particularly short duration tasks, it may not be reasonably practicable to use RPE with the highest levels of protection. Lower levels of protection may be tolerated for short periods provided that:

- you have carried out a suitable risk assessment before starting work;
- based on the risk assessment, you have implemented measures to restrict radiation exposure during the work to a level which is as low as reasonably practicable and in any case below the limit set in IRR.

5 You should follow the same basic principles for selecting suitable RPE as for non-radioactive materials, taking account of all the potential hazards. If there is a risk of skin or clothing contamination, then suitable PPE may need to be worn in addition to RPE (you should consult your RPA about this). Alternatively, PPE which incorporates suitable RPE may be worn (eg a fully enclosing air-fed suit). Give special consideration to exposures to tritium, owing to its ability to penetrate many materials and also the skin.

Guidance on IRR[7]
This is given in the Approved Code of Practice (ACOP) and guidance: *Work with Ionising Radiation*. Of particular relevance are regulations 7 (Prior risk assessment), 8 (Restriction of exposure (ALARP)) and 14 (Training). The ACOP contains information on these topics in paragraphs 114-118, 139, 163-164 and 177-180.

Dose coefficients
The following sources give information on the radiation dose per unit intake of radionuclide:

Dose coefficients for intakes of radionuclides by workers.[22]

Standards for intakes of radionuclides.[23]

Issue and use of RPE

6 Areas where RPE is worn to restrict exposure to airborne radioactivity will usually be part of a **controlled area**, required by IRR where certain dose levels are likely to be exceeded. You are required to have established written local rules for these areas, that should identify the key working instructions intended to restrict any exposure in that controlled area, and contingency plans (see IRR regulation 17 and ACOP L121, paragraphs 272-295). These local rules should specify that entry will only be permitted to trained people wearing suitable RPE, and that a formal system of recording the types of equipment selected for each foreseeable situation will probably be needed. This is to ensure that the people responsible for the issue of RPE have a clear idea of the requirements for the area concerned. Where high levels of protection are required, a formal permit-to-work system may be the best method of ensuring control.

RPE for use against low radiological hazards

7 Some materials used in the workplace, such as zircon and baddeleyite sands, and zirconia, contain radioactivity in low concentrations. If these materials are involved in dusty processes, they may create an inhalation hazard. Examples of work which may require the use of suitable RPE because of the presence of radioactive dust are:

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

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.

Controlled area
A controlled area is one in which anyone required to enter it has to follow special procedures to restrict significant exposures (IRR regulation 16 and ACOP L121 paragraphs 248-271).

Training

8 The guidance given in the main text is appropriate.

Maintenance

9 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 and then monitored before maintenance or storage for reissue. If contamination cannot be removed from facepieces and internal surfaces of RPE, these items should be disposed of as radioactive waste.[24] You should ensure that appropriate systems, equipment and training are provided to restrict the exposure of employees involved in maintenance of contaminated RPE to a level which is ALARP. Disposable RPE and components should be monitored before disposal and if necessary treated as radioactive waste.

Records

10 You will need to ensure that records of examination and inspection of RPE are maintained. These records should usually identify each item of equipment, the results of any tests, the date of examination and the person who carried it out. IRR requires such records to be kept for at least two years. As an alternative, where large numbers of similar items of RPE are involved, employers may wish to adopt a batch-dating system that ensures that the date of the last examination is known, or can be worked out.

Appendix 2: Special guidance relating to biological agents

1 Biological agents are 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. Most biological agents harm you by causing an infection, but they can also cause allergies or be toxic or may cause harm in other ways. For more information, see COSHH and associated ACOPs[2] as well as other specific HSC/E publications, eg those produced by the Advisory Committee on Dangerous Pathogens.

2 Some micro-organisms are naturally infectious by the airborne route, eg the bacterium that causes tuberculosis and the bacterium that causes Legionnaires' disease. Other micro-organisms, if dispersed in air, whether as individual particles, attached to other particles, or contained in droplets of liquid, can contaminate mucous membranes in the nose and mouth, which may result in ill health. For example, blood-borne viruses such as hepatitis B can be transmitted through splashing of mucous membranes, although the far commoner route of infection is via a skin-penetrating injury.

Why do they need special consideration?

3 Unlike chemical substances, there are no recognised exposure limits for micro-organisms. In addition, if you become infected at work, you may be able to pass the infection on to your family or others.

How can I be exposed?

4 You may deliberately **work with micro-organisms** as part of your job, eg in the biotechnology industry, or in a research laboratory. However, you can come into contact with micro-organisms simply as a result of the kind of work you do, for example:

- working with people or animals that might be infectious (eg healthcare services or farming);
- handling waste material that may be contaminated with micro-organisms (eg refuse disposal); or
- working in an environment or with equipment (eg sewer maintenance) that could be contaminated with micro-organisms.

Work with micro-organisms
Schedule 3 of COSHH[2] requires that work with micro-organisms in Hazard Groups 2 and 3, that could create an infectious aerosol, must take place in a microbiological safety cabinet, isolator or other equivalent containment. All work with Hazard Group 4 micro-organisms has to be carried out in a cabinet (or other suitable containment). So, for those deliberately working with biological agents in a laboratory, the use of RPE is likely to be limited to emergency situations only – eg entering a laboratory after a spillage of infectious material to set up fumigation equipment.

Assessment of risk

5 As for work with other hazardous substances, the use of RPE is the last option to consider in controlling exposure.

Your general COSHH assessment needs to find out:

- what types of micro-organisms might be present in your workplace;
- **how they are transmitted**; and
- how your workers could come into **contact** with them.

If your assessment reveals that your workers come into contact with:

- people or animals that are infected with micro-organisms that are transmitted by the airborne route. For example, working with a patient infected with tuberculosis and carrying out procedures which involve contact with respiratory discharges, eg asking the patient to produce a sputum specimen; or
- micro-organisms that are transmitted by the airborne route in the form of an aerosol as a result of the type of work. For example cleaning an area that could be contaminated with micro-organisms, using a high pressure hose;

then RPE may be needed to control exposure.

6 There may be situations where workers could be exposed to other types of micro-organisms, such as those that are transmitted via hand to mouth contact or in the form of splashes, eg when manually cleaning down equipment at sewage treatment plants. A face visor may be sufficient to control exposure in such situations. But, if workers are likely to be exposed to such micro-organisms in the form of an aerosol (or dust), then RPE may be more appropriate to control exposure.

How they are transmitted
Infection at work can occur via:

- the mouth, from contaminated hands and fingers;
- breathing in infectious aerosols/droplets from the air, eg respiratory discharges such as coughs and sneezes from infected people or animals, contaminated dust, spray from a cooling tower;
- splashes of blood and other body fluids into the eye and other mucous membranes such as the nose and the mouth;
- broken skin, if it comes into direct contact with the micro-organism (or a source of micro-organisms);
- a skin penetrating injury, eg via a contaminated needle or other sharp object or a through a bite by an infected animal or insect.

Contact
Although workers may come into direct physical contact with an infected person or animal as part of their job, many micro-organisms in the workplace will be there as a result of contamination with human and/or animal waste/body fluids. For example soiled dressings/linen in hospitals may be contaminated with blood-borne viruses such as HIV; pigeon droppings in gutters may contain bacteria that cause psittacosis.

Choice of RPE

7 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 (P3) to control exposure down to the lowest levels.

8 In consultation with users, manufacturers and suppliers, choose which model of RPE is most suitable for the person and the job by following the procedure in Step 4 of the selection process in Part 1 of this guide. Consider in particular the work rate, the length of time that your workers will need to wear the RPE, and the environment where the work will be carried out. For example:

- Because of the length of time for the task, those carrying out post-mortem examinations on people infected with tuberculosis may choose to wear a powered respirator in addition to using general extraction in the room to control exposure.
- Those cleaning cooling towers using high pressure hoses may prefer to wear powered respirators with full face pieces or hoods or blouses to control exposure to legionella bacteria, because of the associated work rate and wet conditions.

You should also think about possible contamination by skin contact or splash (hoods, blouses and suits may be preferable if this is a significant problem). At the same time, consider the need for protection against chemicals, gases/vapours, oxygen deficiency, physical hazards and humid and hot environments. This will help to identify what other PPE should be compatible or integral with the chosen RPE and help to control secondary risks.

9 There may be situations where BA is required because of other hazards in the work environment. For example possible oxygen deficiency when carrying out work in confined areas in waste water treatment plants. Rarely, BA may be used in emergency situations involving micro-organisms, for example during a major incident.

Training

10 You need to make sure that those using RPE to control exposure to micro-organisms are given specific information about the cleaning, maintenance, storage and disposal of such equipment. This is in addition to the guidance given in the main text. They need to be aware of:

- what micro-organisms they may be exposed to and the effects they could have if infected;
- the general good hygiene precautions that should be used to control infection;
- emergency procedures in the event of contamination.

Maintenance, storage and disposal

11 All used equipment must be treated as contaminated. Reusable equipment should be thoroughly cleaned and disinfected before maintenance or storage. 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). Maintenance staff must be provided with adequate protection for the handling of contaminated equipment.

12 These aspects will all increase the maintenance/servicing/running costs of RPE, when used against micro-organisms.

Appendix 3: Quality of air for BA

Air quality

1 Air supplied to BA should be clean and safe to breathe. The COSHH ACOP[2] requires that the quality of air supplied to BA should be assured.

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. As the BA wearer's life and health depends on the air supplied by the compressor, you should ensure that the air supplied meets the quality requirements in Table A3.1, which is based on recommendations in BS EN 12021,[25] and the air flow rate requirements of the BA manufacturer. Compressors which are moved from site to site, such as those used by the emergency services, 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.

Substance	Requirement
Oxygen	20.8% by volume ± 1%
Carbon monoxide	< 5 ml/m^3 (< 5 ppm by volume)
Carbon dioxide	< 500 ml/m^3 (< 500 ppm by volume)
Oil mist	< 0.5 mg/m^3
Other contaminants	None present at > 10% of the relevant exposure limit
Odour/taste	No significant odour or taste
Liquid water	None present
Water vapour	Air up to 40 bar: Pressure dew point 5ºC below minimum storage temperature if known, or < -11ºC if unknown Air from 40 to 200 bar: < 50 mg/m^3 Air > 200 bar: < 35 mg/m^3 Air for filling cylinders: < 25 mg/m^3

Table 13 Compressed air quality requirements

Periodic testing of air quality

4 The purpose of periodic tests of air quality is to ensure that the control measures you have put in place are delivering air quality as indicated in Table 13. The frequency of such tests should be based on a risk assessment, but the COSHH ACOP[2] recommends that periodic tests should be carried out at least every three months, and more often when the quality of air cannot be assured to these levels. 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.

5 The supplier of your compressor or BA should be able to advise you on the best method for you. Records of air quality tests must be kept for five years.

Continuous monitoring

6 Compressors are available which include purifiers with automatic self-monitoring systems. These may be used as a substitute for periodic testing of the quality of breathable air if:

- they can remove and effectively monitor for contaminants listed in BS EN 12021,[25] including foreseeable substances identified in your risk assessment. If the system cannot monitor for all these contaminants, then you will have to have additional procedures in place to ensure that the air delivered is suitable for breathing;
- it has been shown to be reliable for the substances being monitored;
- the air quality monitoring takes place at a suitable point in the supply line;
- safety systems are in place to cope with possible malfunctions of the self-monitoring system.

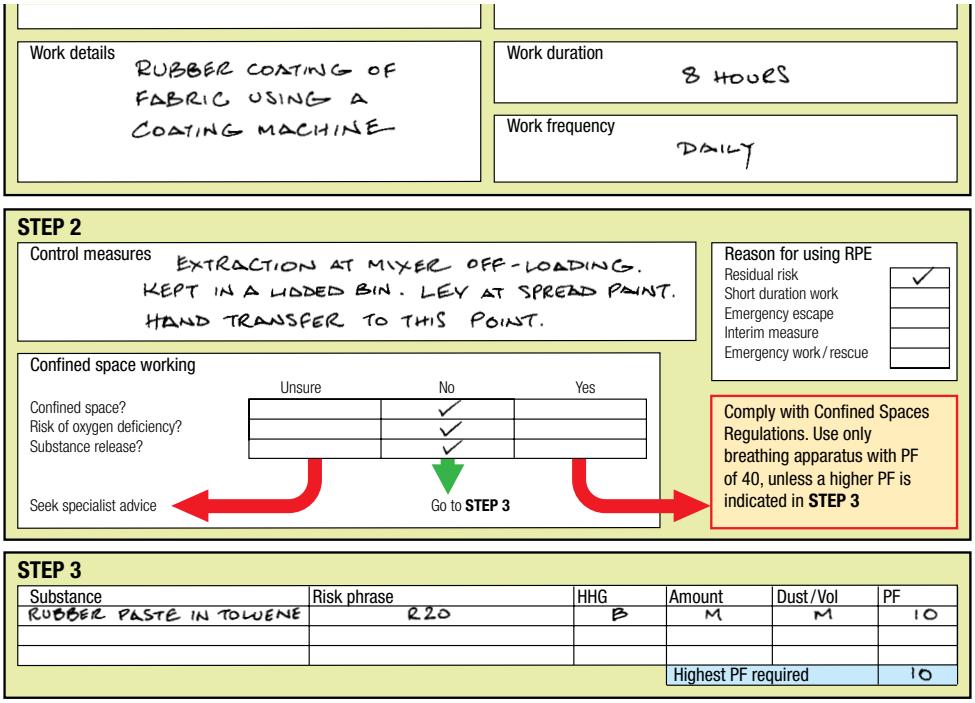
7 If such a system is fitted and used, the need for quarterly (or more frequent) periodic testing of air quality may be removed. However, it will not be possible to dispense with periodic testing of air quality altogether. The compressor and purifier is an ‘engineering control system’, for which thorough examination and testing is still required by COSHH (typically at a maximum interval of 14 months). This thorough examination should include tests of the air quality produced by the system.

Appendix 4: Further worked examples for selection of the required protection factor for RPE

1 The following worked examples are given in the form of extracts from the completed RPE selector.

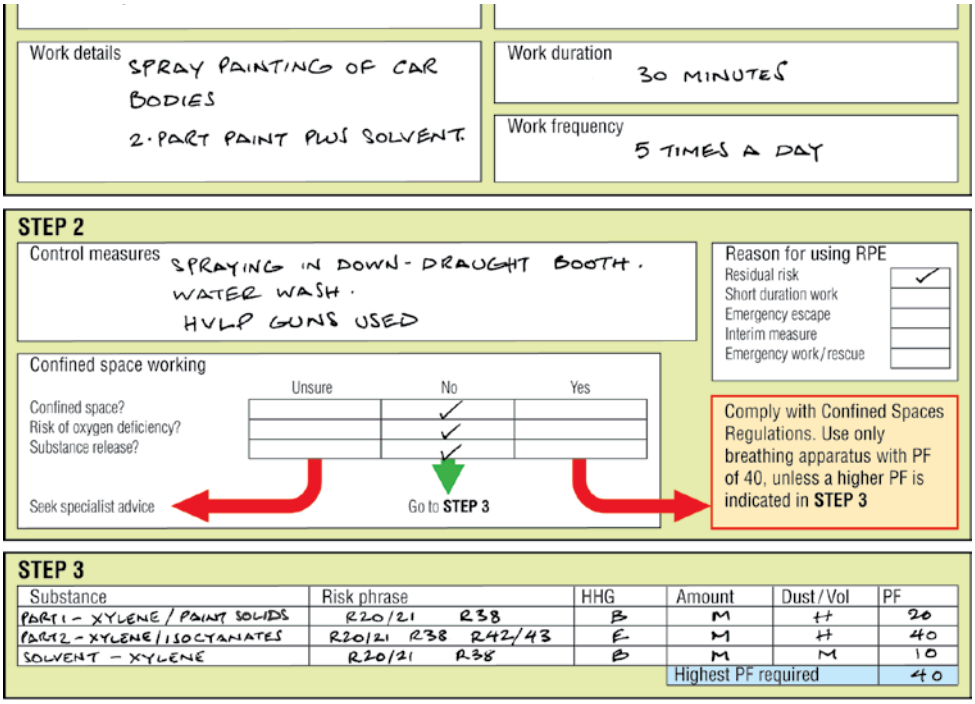
Rubber coating

2 RPE is required to control the residual risk associated with hand transfer of coating mix, when other controls are in place. The hazard is exposure to toluene vapour from 35 kg of mix handled in a day. Risk phrases identify toluene as Health Hazard Group B (Table 4). The quantity handled is Medium (Table 5), and the volatility is Medium (Figure 8, with a process temperature of 25ºC and boiling point for toluene of 110ºC). Table 7 calls for a protection factor of 10. (If filtering RPE with this level of protection is chosen, the appropriate type of filter for toluene is type A – organic vapours with a boiling point greater than 65ºC.)



Spray painting

3 RPE is required to control the residual risk associated with paint spraying of car body panels with 2-part isocyanate paint, and associated solvent dilution, when other controls are in place. The hazards are xylene, paint solids and isocyanates, and ~3 kg of paint is used in a day. The medium quantities and high 'dustiness' of the sprayed isocyanate (Health Hazard Group E) require a protection factor of 40 in Table 7.



Work details: SPRAY PAINTING OF CAR BODIES
2-PART PAINT PLUS SOLVENT

Work duration: 30 MINUTES

Work frequency: 5 TIMES A DAY

STEP 2

Control measures: SPRAYING IN DOWN-DRAUGHT BOOTH.
WATER WASH.
HVLP GUNS USED

Reason for using RPE

Residual risk	✓
Short duration work	
Emergency escape	
Interim measure	
Emergency work/rescue	

Confined space working

	Unsure	No	Yes
Confined space?		✓	
Risk of oxygen deficiency?		✓	
Substance release?		✓	

Seek specialist advice — Go to **STEP 3**

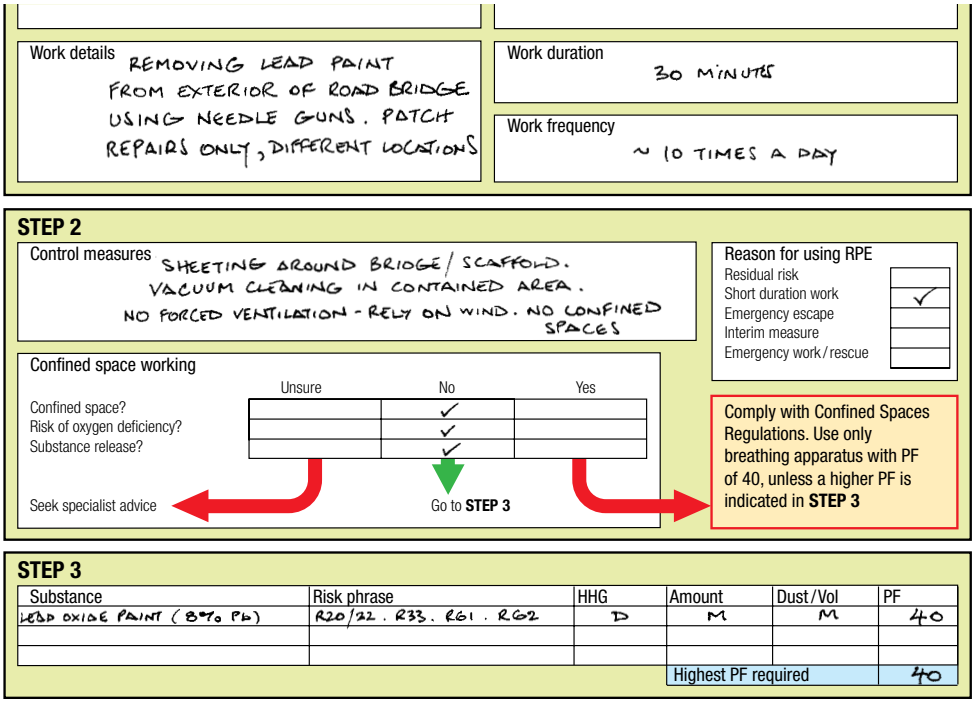
Comply with Confined Spaces Regulations. Use only breathing apparatus with PF of 40, unless a higher PF is indicated in **STEP 3**

STEP 3

Substance	Risk phrase	HHG	Amount	Dust / Vol	PF
PART 1 - XYLENE / PAINT SOLIDS	R20/21 R38	B	M	H	20
PART 2 - XYLENE / ISOCYANATES	R20/21 R38 R42/43	E	M	H	40
SOLVENT - XYLENE	R20/21 R38	B	M	M	10
			Highest PF required		40

Lead paint stripping

4 RPE is required for control of exposure in this situation because the work locations are relatively small and widely dispersed over a large structure – short-term work in different locations. Risk phrases and Table 3 identify the Health Hazard Group as D, and kilogram quantities of fairly coarse dust are produced. Table 7 requires a protection factor of 40. If filtering RPE with this level of protection is selected, only particle filters are required. (If large areas of the bridge in a single location were to be stripped, it would be worth considering installing further engineering controls, such as better enclosure and local exhaust ventilation.)



Work details: REMOVING LEAD PAINT FROM EXTERIOR OF ROAD BRIDGE USING NEEDLE GUNS. PATCH REPAIRS ONLY, DIFFERENT LOCATIONS

Work duration: 30 MINUTES

Work frequency: ~ 10 TIMES A DAY

STEP 2

Control measures: SHEETING AROUND BRIDGE / SCAFFOLD. VACUUM CLEANING IN CONTAINED AREA. NO FORCED VENTILATION - RELY ON WIND. NO CONFINED SPACES

Reason for using RPE

Residual risk	
Short duration work	✓
Emergency escape	
Interim measure	
Emergency work / rescue	

Confined space working

	Unsure	No	Yes
Confined space?		✓	
Risk of oxygen deficiency?		✓	
Substance release?		✓	

Seek specialist advice

Go to **STEP 3**

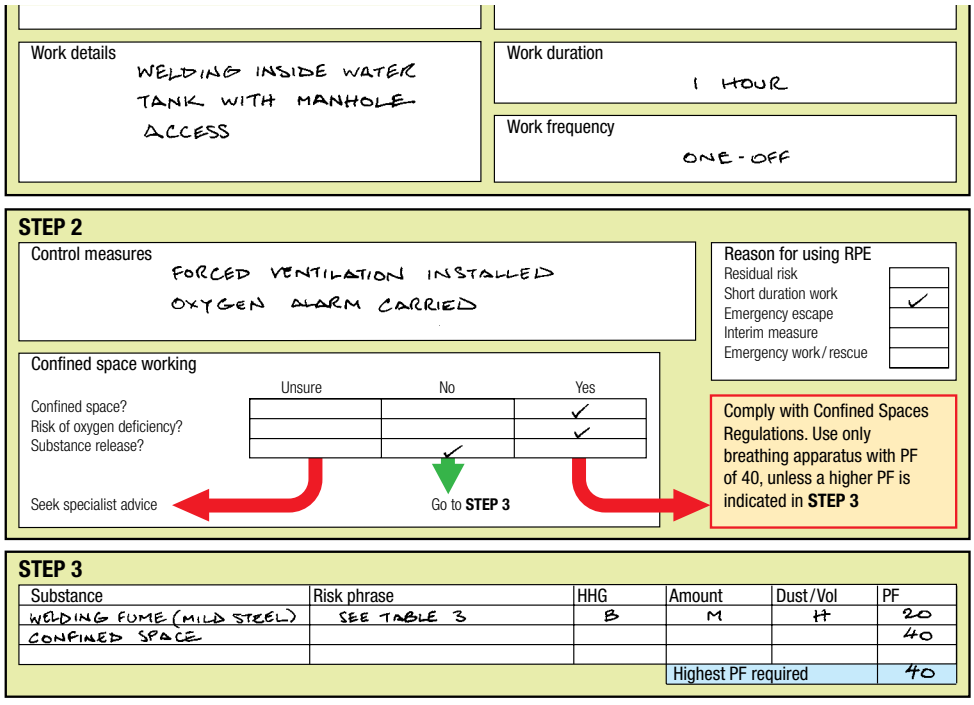
Comply with Confined Spaces Regulations. Use only breathing apparatus with PF of 40, unless a higher PF is indicated in **STEP 3**

STEP 3

Substance	Risk phrase	HHG	Amount	Dust / Vol	PF
LEAD OXIDE PAINT (8% Pb)	R20/22 . R33 . R61 . R62	D	M	M	40
			Highest PF required		40

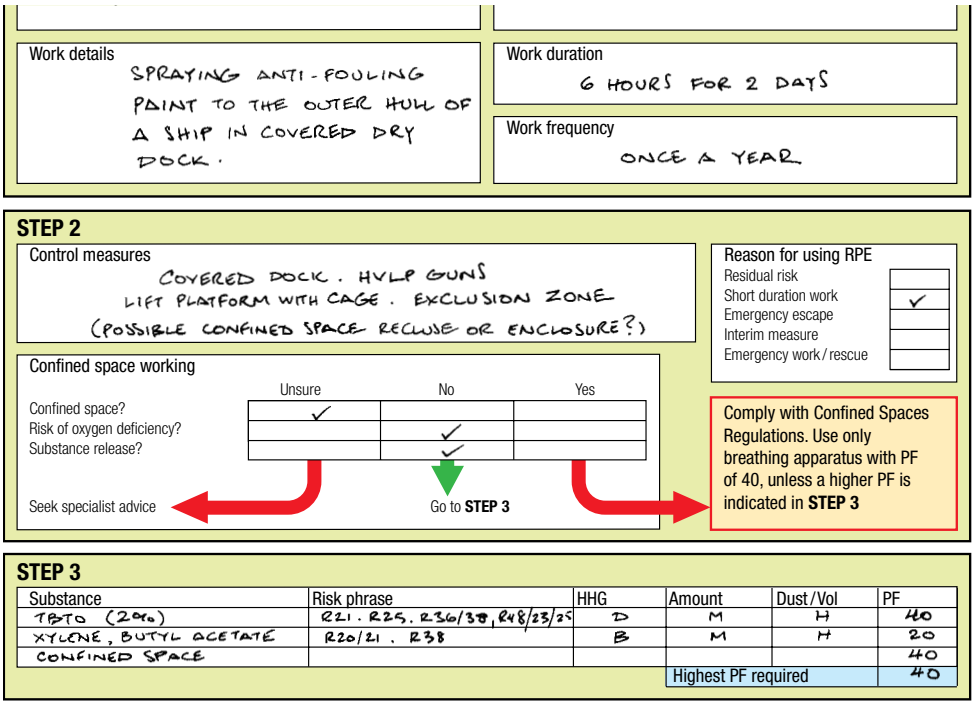
Tank welding

5 Welding inside a mild steel water tank presents two problems – the hazardous materials generated by the welding process, and the possibility of oxygen deficiency within this confined space. Table 3 gives HHG B for mild steel welding, and medium quantity/high dustiness require a protection factor of 20 in Table 7. However, the possibility of oxygen deficiency inside the tank requires BA with at least 40, which also adequately controls the exposure to welding fume.



Anti-fouling paint

6 Spraying a ship's hull with paint containing an anti-fouling agent is carried out infrequently in a covered dry dock. Well-designed spray guns and lift platforms are used, and other workers are excluded from the area during this activity. Risk phrases identify the anti-fouling agent as having a higher HHG than the solvents used, and the quantities and 'dustiness' require a protection factor of 40 for adequate control of exposure. Because of the enclosure of the dry dock, and the difficulty of egress, the work area could be considered a confined space – specialist advice is obtained, and recommends that the situation is so treated. BA with a protection factor of 40 is also required to control this risk.



References

1 *COSHH essentials: Easy steps to control chemicals. Control of Substances Hazardous to Health Regulations* HSG193 (Second edition) HSE Books 2003 ISBN 0 7176 2737 3 **(Out of print)**

2 *Control of substances hazardous to health (Fifth edition). The Control of Substances Hazardous to Health Regulations 2002 (as amended). Approved Code of Practice and guidance* L5 (Fifth edition) HSE Books 2005 ISBN 978 0 7176 2981 7 www.hse.gov.uk/pubns/books/l5.htm

3 *Health and Safety at Work etc Act 1974 Ch37* The Stationery Office 1974 ISBN 978 0 10 543774 1

4 *Management of health and safety at work. Management of Health and Safety at Work Regulations 1999. Approved Code of Practice and guidance* L21 (Second edition) HSE Books 2000 ISBN 978 0 7176 2488 1 www.hse.gov.uk/pubns/books/l21.htm

5 *Work with materials containing asbestos. Control of Asbestos Regulations 2006. Approved Code of Practice and guidance* L143 HSE Books 2006 ISBN 978 0 7176 6206 7 www.hse.gov.uk/pubns/books/l143.htm

6 *Control of lead at work. Control of Lead at Work Regulations 2002. Approved Code of Practice and guidance* L132 (Third edition) HSE Books 2002 ISBN 978 0 7176 2565 9 www.hse.gov.uk/pubns/books/l132.htm

7 *Work with ionising radiation. Ionising Radiations Regulations 1999. Approved Code of Practice and guidance* L121 HSE Books 2000 ISBN 978 0 7176 1746 3 www.hse.gov.uk/pubns/books/l121.htm

8 *Safe work in confined spaces. Confined Spaces Regulations 1997. Approved Code of Practice, Regulations and guidance* L101 HSE Books 2009 ISBN 978 0 7176 6233 3 www.hse.gov.uk/pubns/books/l101.htm

9 *The Personal Protective Equipment Regulations 2002* SI 2002/1144 The Stationery Office 2002

10 *Consulting employees on health and safety: A brief guide to the law INDG232(rev1)* HSE Books 2008 (single copy free or priced packs of 15 ISBN 978 0 7176 6312 5) www.hse.gov.uk/pubns/indg232.pdf

11 Council Directive 89/686/EEC published in the Official Journal L399 30.12.89, as amended by Directive 93/68/EEC (OJ L220 30.8.93), Directive 93/95 EEC (OJ L276 9.11.93) and Directive 96/58/EC (OJ L236 18.9.96), and enacted in the UK law by reference 9

12 *A guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 L73 (Third edition)* HSE Books 2008 ISBN 978 0 7176 6290 6 www.hse.gov.uk/pubns/books/l73.htm

13 *EH40/2005 Workplace exposure limits: Containing the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations 2002 (as amended)* Environmental Hygiene Guidance Note EH40 HSE Books 2005 ISBN 978 0 7176 2977 0

14 *Approved supply list (Eighth edition). Information approved for the classification and labelling of substances and preparations dangerous for supply. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (as amended)* L142 HSE Books 2005 ISBN 978 0 7176 6138 1 **(Out of print)** See European chemicals agency website http://ecb.jrc.ec.europa.eu/

15 *The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002* SI 2002/1689 The Stationery Office 2002

16 *The compilation of safety data sheets. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. Approved Code of Practice* L130 (Third edition) HSE Books 2002 ISBN 978 0 7176 2371 6

17 *Asbestos: The licensed contractors' guide* HSG247 HSE Books 2006 ISBN 978 0 7176 2874 2

18 BS EN 529:2005 *Respiratory protective devices. Recommendations for selection, use, care and maintenance, Guidance document* British Standards Institution

19 *Managing health and safety: Five steps to success* Leaflet INDG275 HSE Books 1998 (single copy free or priced packs of 10 ISBN 978 0 7176 2170 5)

20 *Health and safety training: What you need to know* Leaflet INDG345 HSE Books 2001 (single copy free or priced packs of 15 ISBN 978 0 7176 2137 8) www.hse.gov.uk/pubns/indg345.pdf

21 *Fit testing of respiratory protective equipment facepieces* OC 282/28 HSE 2003 revised 2010 www.hse.gov.uk/foi/internalops

22 *ICRP publication 68: Dose coefficients for intakes of radionuclides by workers* Pergamon Press Inc 1995 ISBN 978 0 08 042 651 8

23 *Standards for intakes of radionuclides* National Radiolological Protection Board 1999 ISBN 978 0 85951 424 8

24 *Radioactive Substances Act 1993* Ch12 The Stationery Office 1993 ISBN 978 0 10 541293 9

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

Equipment standards

BS EN 136:1998 *Respiratory protective devices. Full face masks. Requirements, testing, marking* British Standards Institution

BS EN 137:2006 *Respiratory protective devices: Self-contained open-circuit compressed air breathing apparatus with full facemask. Requirements, testing, marking* British Standards Institution

BS EN 138:1994 *Respiratory protective devices. Specification for fresh air hose breathing apparatus for use with full face mask, half mask or mouthpiece assembly* British Standards Institution

BS EN 14593-1:2005 *Respiratory protective devices. Compressed airline breathing apparatus with demand valve. Apparatus with a full mask. Requirements, testing, marking* British Standards Institution

BS EN 14593-2:2005 *Respiratory protective devices. Compressed airline breathing apparatus with demand valve. Apparatus with a half mask at positive pressure. Requirements, testing, marking* British Standards Institution

BS EN 14594:2005 *Respiratory protective devices. Continuous flow compressed airline breathing apparatus. Requirements, testing, marking* British Standards Institution

BS EN 140:1999 *Respiratory protective devices. Half masks and quarter masks. Requirements, testing, marking* British Standards Institution

BS EN 14387:2004 *Respiratory protective devices. Gas filter(s) and combined filter(s). Requirements, testing, marking* British Standards Institution

BS EN 143:2000 *Respiratory protective devices. Particle filters. Requirements, testing, marking* British Standards Institution

BS EN 149:2001 *Respiratory protective devices. Filtering half masks to protect against particles. Requirements, testing, marking* British Standards Institution

BS EN 269:1995 *Respiratory protective devices. Specification for powered fresh air hose breathing apparatus incorporating a hood* British Standards Institution

BS EN 405:2002 *Respiratory protective devices. Valved filtering half masks to protect against gases or gases and particles. Requirements, testing, marking* British Standards Institution

BS 1073-1:1998 *Protective clothing against radioactive contamination. Requirements and test methods for ventilated protective clothing against particulate radioactive contamination* British Standards Institution

BS EN 1827:1999 *Respiratory protective devices. Half masks without inhalation valves and with separable filters to protect against gases or gases and particles or particles only. Requirements, testing, marking* British Standards Institution

BS EN 12941:1999 *Respiratory protective devices. Powered filtering devices incorporating a helmet or a hood. Requirements, testing, marking* British Standards Institution

BS EN 12942:1999 *Respiratory protective devices. Power assisted filtering devices incorporating full face masks, half masks or quarter masks. Requirements, testing, marking* British Standards Institution

Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

British Standards can be obtained in PDF or hard copy formats from BSI: http://shop.bsigroup.com or by contacting BSI Customer Services for hard copies only Tel: 020 8996 9001 email: cservices@bsigroup.com.

The Stationery Office publications are available from The Stationery Office, PO Box 29, Norwich NR3 1GN Tel: 0870 600 5522 Fax: 0870 600 5533 email: customer.services@tso.co.uk Website: www.tsoshop.co.uk/ (They are also available from bookshops.) Statutory Instruments can be viewed free of charge at www.legislation.gov.uk/.