

APPENDIX 4 — LUNGS

RESPIRATORY PROTECTIVE EQUIPMENT

As with all PPE, RPE must only be considered as the last resort and must be used only when exposure cannot be adequately controlled by modification of the work process or through the use of engineered control measures— this is particularly relevant to RPE as it may be uncomfortable to wear, yet may need to be used in situations where there could be an immediate danger to life, or exposure to a substance which could lead to health problems later in life.

PPE only protects the user and does not afford protection to anyone else in the vicinity – this is one of the reasons that it is some way down the list in the hierarchy of control measures and is often used in conjunction with additional control measures.

If RPE is required, as for all PPE, the following factors must be considered:

- The RPE selected must be adequate and suitable for purpose.
- It must not compromise any other PPE or be compromised by other items of PPE or personal clothing (such as turbans or hejabs).
- It must be correctly used, stored and maintained.
- It must be fit tested for each user.
- All users must be fully trained to make pre-use checks, use, store, inspect and maintain the RPE —and record this.
- RPE **always** fails to danger.

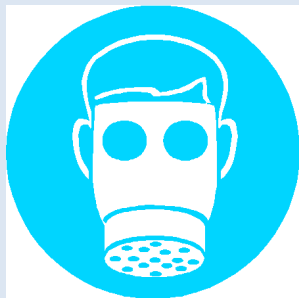
The range of available respiratory protective equipment reflects the range of substances able to enter the body (sometimes via the nose, mouth and eyes), and the severity of the effects of the exposure. The HSE Code of Practice “[HSG53, Respiratory Protective Equipment at Work](#)” (Fourth Edition, 2013), gives detailed information on the types, their suitability, limits, maintenance, and *whether or not face fit testing is required*. This document can be used for reference prior to any purchase of RPE, followed by clarification with the DSO, Campus or Faculty safety personnel.

In addition, the Manufacturer’s Safety Data Sheet (MSDS) for the chemical in question, may detail the PPE and RPE standards needed (see [Safety Department Guidance Note 52](#))

Examples of different forms of hazardous substances

From: HSG53 [Respiratory protective equipment at work](#)

Form	Properties	Examples
Solid particles	Particles of solid material, including aerosols, dusts, fibres, smokes and fume	<ul style="list-style-type: none"> • Allergens (insect, animal, plant etc) • Asbestos fibres • Engine exhaust particles and fume • Lead dust and fume, welding fume • Stone or wood dust • Smoke • Fungal spores and parasites, bacteria and viruses • Flour
Liquid particles	Fine sprays, mists and aerosols made up of small droplets of liquid	Sprayed liquids: <ul style="list-style-type: none"> • paints • pesticides • powder coating mix • liquid jetting • Pathogens in solution Mists: <ul style="list-style-type: none"> • chrome acid • cutting fluids • oil mist
Vapour	Gaseous forms of a solid or liquid	Solvent vapour Mercury vapour
Gas		<ul style="list-style-type: none"> • Carbon monoxide Engine exhaust gases • Sewer gas • Chlorine



AREAS WHERE RPE IS A REQUIREMENT

At the College there are a number of activities where despite all efforts, there remains some residual risk, and therefore respiratory protection has been identified as a requirement.

These activities include:

- Work with materials which may contain **nanoparticles** in certain workshops.
- **Formaldehyde fumigation** of Containment laboratories and equipment.

In both instances, please contact the Safety Department (Biological Safety Team), for further information.

- **CBS and Designated labs** where RPE is a requirement or for those individuals where RPE is a requirement, then health surveillance, training, and initial face fit testing is a pre-requisite and is conducted by the Occupational Health Department.

In this instance, see “**Arranging face-fit testing**” below and “face masks” and “respirators” on the guidance pages of the [College Occupational Health Department](#).

RPE FOR USE IN AN EMERGENCY

Face fit testing is essential to ensure the RPE fits the user correctly. For this reason, RPE designated for use in an emergency, **cannot** be shared— unless the same item of RPE has been fit-tested for all the relevant potential users, who are trained to don it correctly and to clean and maintain it correctly, with the appropriate records for inspection, training, maintenance and use logs.

Spillages

The default action to take in the event of a spill, must be to make the area safe if possible, and always to evacuate and isolate the area first, and perhaps informing Security to ask for their assistance in isolating the area. After this, one is at leisure to consider the next step—which in most cases will be to leave the substance to evaporate, rather than to clean up the spill. Such considerations must be part of the risk assessment.

WHAT IS RPE?

Respirators (filtering devices) use filters to remove contaminants from the air being breathed in. They can be either:

- **non-powered respirators** – relying on the wearer’s breathing to draw air through the filter; or
- **powered respirators** – using a motor to pass air through the filter to give a supply of clean air.
- **Breathing apparatus** needs a supply of breathing-quality air from an independent source (eg air cylinder or air compressor).

Each type is available in a range of styles, dividing into two main groups:

Tight-fitting facepieces (often referred to as masks) rely on having a good seal with the wearer’s face. These are available as both non-powered and powered respirators and BA. A face fit test is required to ensure the RPE can protect the wearer.

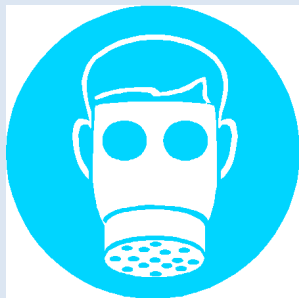
Loose-fitting facepieces rely on enough clean air being provided to the wearer to prevent contaminant leaking in (only available as powered respirators or BA). Examples are hoods, helmets, visors, blouses and suits.

Face masks are classified in 3 classes depending on the ability to separate airborne particles according to the FFP (Filtering Face Pieces):

Class	Separation ability (at 95 L/min airflow)	Allow leakage between mask and face
FFP1	Filter separates 80% of airborne particles.	< 22%
FFP2	Filter separates 94% of airborne particles.	< 8%
FFP3	Filter separates 99% of airborne particles.	< 2%

WHAT DOES RPE PROTECT AGAINST?

Solid Particles — Dusts or particulates, are classified according to which part of the body they can



penetrate; **inhalable** being the largest, penetrating to the nose and throat (potential for nasal and throat cancers and systemic effects), **thoracic** to the lungs, and **respirable**, the smallest, through the lungs/blood barrier into the bloodstream and rest of the body.

A range of health effects can result from exposure to different types of dust, include pneumoconioses, cancer, systemic poisoning, hard metal disease, irritation and inflammatory lung injuries, allergic responses (including asthma and extrinsic allergic alveolitis), infection, and effects on the skin.' (See www.who.int/occupational_health/publications/en/oehairbornedust3.pdf)

Nuisance dusts are those which were in the past not classified as being harmful; however, it has since been shown that even these "harmless" inert dusts can cause granulomas in the lungs if inhaled in sufficient quantity.

Liquid particles — In addition, RPE can protect against liquid particles (spray, mists, aerosols etc), fumes, gases, vapours etc, and full face RPE can also **protect the eyes** from splashes as well as irritant, toxic and corrosive etc volatiles.

ACQUIRING RESPIRATORY PROTECTIVE EQUIPMENT

The College's Purchasing Department has sourced a range of disposable masks, selected for comfort after a considerable amount of user input in conjunction with Occupational Health and the Safety Department. It also sources half-face respirators, full-face respirators and air-fed hoods "Turbo-visors".

Because of the range and nature of air-borne hazards at the College, including nanoparticles, potential users are advised to contact the Safety Department for advice, well in advance of first use (Occupational Health if this is for use for respiratory sensitizers), with details of why and what it is intended to be used for. They will advise you on the make and design of the RPE and give you information about mandatory face fit testing.

SELECTING THE CORRECT FILTER

It is essential to select the correct filter not just for the chemical, but for the *form* of the chemical or substance, the expected *concentration* levels and the expected *exposure* period. Filter selection tables in RPE catalogues give detailed information on these matters, and must be consulted prior to purchase.

Acids, organic solvents, formaldehyde for example etc will require different filters.

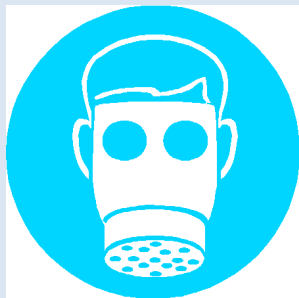
- Solid and liquid forms will be present as particles.
- Fine sprays and mists are made up of liquid particles (droplets).
- Fumes are very fine solid particles and not gas or vapour.
- Smoke, fume and airborne liquids require RPE that is suitable for use against particles.
- Volatile liquids may under certain conditions become airborne as both particles and vapour
- A vapour is the gaseous form of a solid or liquid (such as mercury).

FILTERS WITH "USE BY DATES"

Some filters have only a limited shelf and use life, particularly those which contain activated charcoal. Check the date on any you order and ensure that out of date filters are never used—they will not be effective. If the filter packet has been opened, then again, the filter(s) may not be effective as they will continue to absorb contaminants even when not in use.

RESPIRATOR DON'TS

- Never use a respirator if you have not been trained to do so—exposure to hazardous substances may impact on your life or health.
- Never use a respirator if you have not been face fit tested.
- Never use in oxygen-deficient atmospheres.
- Never use a particle filter to protect against gases/ vapours or gas/vapour-only filters against particulates.
- Never use if dirty, damaged or incomplete—or if the filter is out of date.



- Never allow the breathing zone to become contaminated (eg by poor storage/re-use of disposable masks).
- Never continue working if powered respirators begin to fail—leave the area immediately.
- If you are very short or long sighted and require spectacles all the time, a full-face respirator may not be practical as the visor and the spectacles can easily steam up.

ARRANGING FACE FIT TESTING

Face-fit testing for respiratory equipment is mandatory— prior to the first use - for everyone who uses RPE to protect them from hazardous substances. In addition, if there are any significant changes to the wearer's physical attributes, such as weight gain or loss, or growing stubble or a beard, the user should report this to the Responsible Person (e.g. a lab manager or PI) and then arrange for a repeat face-fit test.

To arrange face fit testing, contact College Safety Department safety.technician@imperial.ac.uk — **except** where *health surveillance* is also required (eg for CBS users), when face fit testing is conducted via [Occupational Health](#). Face fit testing takes about an hour to carry out, and involves an in-use simulation, whilst moving and reciting the “Rainbow Passage” - a standard script.

REASONABLE ADJUSTMENT

Some individuals may find it physically impossible to wear PPE for example people needing to wear corrective spectacles at all times or turban-wearing Sikhs or hejab wearers may not be able to wear a full-face respirator. Where reasonable adjustment cannot be made and where there is no alternative respiratory equipment, the line manager together with the individual will need to consider alternative work arrangements, with advice and input from the Safety Department and Occupational Health.

RECORD OF TRAINING, FACE-FIT TESTING, INSPECTION AND MAINTENANCE

For the full-face respirators required for formaldehyde fumigation, there are two College forms available to aid the recording of the steps taken to comply with the above requirements. These will be issued by the Safety Department (Biological Safety Team), who will also conduct training and face fit testing.

- **Form RPE1** to record user training and quantitative face-fit testing to be retained by each user.
- **Form RPE2** contains the inspection and maintenance records for the equipment itself and which will be associated with, and usually kept with, each respirator

Those persons responsible for the completion of each section, of each form, are identified at the relevant place. Users are also expected to read the manufacturer's instruction leaflets provided with the respirators and filters.

For other RPE, departments may wish to adopt the HSE a pro-forma for recording user checks etc (see overleaf).

Breathing Apparatus including face fit testing is covered separately in the College training programme (see Staff Learning and Development web site). The College training is very specific and covers the requirements in greater depth than is possible in the Code of Practice.

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