Practical Guidance on Work-Related and Ergonomic factors in Selection of
Respiratory Protective Equipment
Introduction

With a wide scope of Respiratory Protective Equipment (RPE) available industrially, sometimes the expansive selection of equipment available can be bewildering. There are important choices to be made when successfully selecting RPE and not all of these are obvious. Key manufacturers include 3M, Scott Safety, Draeger Safety, MSA, Wilson, Interspiro, Helmet Integrated Systems to name a few.

Most manufacturers will produce a range of RPE - it is important to understand the uses and limitations of the different types of RPE, the type and standard it conforms to, and its reliability if a suitable selection is to be made.

RPE broadly speaking breaks down in to two different types:

- Respirators (filtering devices). These will have a some form of filtering media, either built into the mask or in detachable filter cartridges
- Breathing Apparatus (uses an independent air source). This equipment supplies breathable air or oxygen from an independent environment so there is no filtration from source to wearer. Typically this equipment will offer higher levels of protection and the most common type uses compressed air.
There are 2 considerations that must be taken into account when assessing suitability of RPE:

1. The level of protection required
2. Work and Human related factors

It is the second of these points that this document primarily addresses

1. **The level of protection required**

Very briefly, the first of these 2 points we should consider what the hazardous substance is, the environmental concentration of the hazardous substance, and the exposure limit for the substance which will be documented in the document produced by the Health and Safety Executive called EH40. It may be necessary to conduct an industrial hygiene monitoring survey to establish this accurately. Once we know the airborne concentration of the substance a suitable range of RPE can start to be investigated. In very simple terms if we know the airborne exposure to the substance is 100mg/m3 and the exposure limit for the substance outlined in EH40 is 10 mg/m3 for an 8 hour period then we need an item of RPE which will have an Assigned Protection Factor of no less than 10 (it will reduce the exposure to the wearer to a 10\textsuperscript{th} of the concentration outside the mask). This typically would give borderline protection so we would normally look for equipment with higher levels of protection to incorporate an adequate safety factor also. RPE must be CE marked and conform to the relevant standard to be used in European countries.

A look at the selection of RPE below shows 4 types of equipment which would be suitable for the application described above, so it is necessary now to establish which of these is likely to be appropriate for the task.
2. Work and Human Related Factors

Face Fit and seal to the face

Disposable masks, orinasel masks and full face masks rely on a tight seal to the face – the wearer must be fit tested if he is wearing one of these types. However, in the case of a power assisted respirator (which consists of a battery/blower unit mounted on the waist), if it has a ‘loose-fitting seal’, it will not require face fit testing – this avoids the logistical problems encountered with fit testing operators and trying to control use to respirators to fit tested operators. If there are operators that have facial hair in the sealing area and are not prepared to shave, then power loose fitting respirators may be the only option. Loose fitting powered RPE will be less prone to fitting issues which vary from operator to operator. Disposables may be chosen for a task, but once fit testing has been carried out an operator who cannot use a disposable due to failed fit testing, may require a powered respirator, for example.
Cost

Disposable masks will cost as little as £1.00 depending on type and quality, half masks from £10.00-£25.00, full face masks from £65.00-£125.00, and power assisted respirators from £350.00-£850.00. Naturally, cost will be part of the decision as to which type, make or model of equipment to select, but it is important to be aware of some hidden costs: disposables are expensive in use – typically 4 or 5 masks will be used if the wearer is using for 4 hours or more in a working day – multiply this up by number of days and number of workers and the costs can be prohibitive. However, they require little outlay by comparison to a power assisted respirator which can be expensive initially for a work force. Not only does the cost of the equipment need to be considered but cost of maintenance – with disposables, there is no maintenance but with reusable respirators they must be inspected once a month by a competent person.

Service and Maintenance

Disposable respirators do not need servicing and therefore avoid costs, the need of labour to do this, the control of equipment and associated record keeping. With reusable respirators, maintenance is required under the COSHH 2002 Regulations (and other legislation such as Control of Asbestos at Work), at least once a month, and where conditions are severe more regularly. Additionally, legislation puts a responsibility on the employer to maintain equipment in accordance with the manufacturer’s requirements. Compressed Air Breathing Apparatus will be relatively expensive to maintain because of the rigorous service schedules that are required for this equipment.

Medical Fitness of the wearer and individual sensitisation

Consideration should be taken into account for wearers who have respiratory conditions such as asthma - all RPE will require more lung effort, but a powered respirator for example will create much less breathing resistance than a negative pressure mask. Some individuals may have specific individual sensitivity to the hazardous product and will need an enhanced level of protection because of this, while others may feel claustrophobic in more enclosed masks.

Thermal Strain

As previously mentioned, wearing RPE will involve more lung effort and can affect the ability of a wearer to loose heat effectively especially in hot conditions. This heat strain must be taken in to account when looking at the task involving the use of the RPE, and it may require selection accordingly.
Compatibility with other PPE

Other PPE may be required for the task, in which instance compatibility becomes important. Goggles/safety eyewear never goes together well with a disposable or half mask – there is a danger of compromising fit around the nose and eyewear may steam up with exhaled breath. Likewise safety helmets will potentially interfere with the seal of a full face mask in the brow area, and often it is difficult to keep a helmet on the head when a full face mask is in place.

Work Related Factors

Length of time for which RPE needs to be worn and physical work rate

If RPE is worn for long periods then it will be a temptation to remove or re-position which may compromise protection. Typically, disposable masks become damp with exhaled moisture in use, and may collapse causing failure to protect adequately. Resistance to breathing will reduce capacity to work so in the interests of efficiency powered RPE is more appropriate.

Some RPE will be heavier to carry which will impede work, positive pressure RPE will be less of a strain on breathing so will help where heavy work rates are required.

Care needs to be taken looking at different manufacturers equipment, for example one manufacturer’s equipment may let water into the visor in a water jetting application whilst another’s will not. An easily removable battery on a powered air respirator may mean that equipment can be utilized shift to shift rather than being redundant whilst on charge.

Mobility

Compressed air supplied equipment will restrict mobility because of airlines which are used (these in turn may become a trip or snagging hazard)

The physical size of other equipment may impede mobility in confined work areas.

Visibility

It may be important to have good peripheral vision retained with RPE, especially in high traffic areas, or it may be important to see fine detail. Consider also in-use deterioration such as misting to the visor or for example, if there is a peel off visor overlay for painting applications to maintain visibility if paint gets on the visor.

Communication
Depending on the work required in the RPE, good communication may be critical. Equipment which incorporates a speech diaphragm will amplify speech and some RPE will have the ability to add radio communication equipment.

Chemical, Physical and Biological hazards

The materials from which RPE is made, should be resistant to the hazards it is exposed to. Chemical (liquid, gas etc), Physical (heat, impact, cold) and Biological (contamination) will need adequate consideration. Take into account not just the exposure during work but the ease of cleaning afterwards, when exposed to a contaminating substance. Equipment used in flammable atmospheres will need also to be intrinsically safe and have Atex Approval.

Disposal

With increasing awareness of the environmental impact of what we do at work, reusable RPE will reduce disposal requirements – and bear in mind contaminated product disposal.

Use of other work equipment

RPE needs to work in harmony with other equipment. Equipment creating draughts may interfere with powered RPE. Powered respirators may not be suitable for someone driving a vehicle.

Perceptive and Aesthetic considerations

If an item of equipment is liked by the operator and is pleasing to the eye, it is more likely to be accepted, appreciated, worn effectively in use and cared for in time, than less preferable equipment. Therefore, an operator’s choice is an important consideration in choosing items of RPE to ensure that an effective Respiratory Protective Equipment Programme is implemented. It is always best to trial equipment before making a choice, giving users an opportunity to voice their concerns and preferences and coordinating this in a logical manner with documented feedback.

Impartial Advice

It is always difficult to assess if you receive impartial advice when looking at equipment. Manufacturers will sell their own equipment and advice on their range, whereas distributors will have access to a range of manufacturer’s equipment, and are likely to have more experience with the end users of equipment. Even so, if you are receiving advice from a distributor of equipment it is important to have confidence in their technical expertise, and it
is key to pick up their experience. For example 2 types of powered respirator may be considered and both may seem on a parallel, but if you can find and experienced distributor who may know of some battery recharging issues from experience with one of the units, this could save a traumatic experience involving high stakes on time and cost.

Typically, a distributor who also hires equipment, actually has experience of it in use either with their own hire equipment or with other clients, and also provides consultancy work, will probably offer the best level of impartial advice on selection.

User trials

It is important to minimise risk of selecting inferior or unsuitable equipment, so a user trial is always recommended. This may be as little as donning respirators in an office environment, but we would recommend that more substantial work trials are conducted, which gives a truer appreciation and highlights potential pitfalls. For example, 2 similar looking hoods from 2 different manufacturers may be tested in a work environment – it is only then after several hours use that it becomes clear that one of them has an irritable face seal.

Summary

It is clear that many considerations come in to play when selecting RPE, ensuring that equipment will give sufficient protection is the initial part of the process, which cannot be overlooked. However, if a selection of RPE is to be successful, then it is critical that adequate time is spent analysing work-related and human factors. Taking time initially to make the right choices will save awkward experiences with staff and management, time and extra costs.

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