Commentary

Protecting Respiratory Health: What Should be the Constituents of an Effective RPE Programme?

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Although personal respiratory protection is widely recognized as having a lower priority than reduction of any risk at source, respiratory protective equipment (RPE) is a major part of risk management for many employers. We have identified the key elements of what constitutes an effective risk control programme involving RPE, through a 3-fold approach involving (i) a review of the published scientific literature, (ii) exploring the issue through >40 years of research publications from the Institute of Occupational Medicine (IOM) (in which the ergonomics of personal protection equipment has been a significant thread), and (iii) a series of interviews and discussions with IOM and Health and Safety Executive staff with experience in the testing, prescription, or use of RPE. We have used the findings to formulate a series of recommendations for the constituents of an effective RPE programme. The role of management is paramount in recognizing the need for and providing appropriate RPE, which is both technically and ergonomically effective. Only then does any focus on the role of the employee, in wearing the RPE correctly at the appropriate times, becomes viable.

Keywords: PPE; PPE usage; risk management; RPE

INTRODUCTION AND BACKGROUND

Analysis by the British Health and Safety Executive of the 2005 HSE FIT 3 workplace survey (Thompson and Wake, 2007) suggests ∼5.5 million employees in ∼224 000 workplaces in Great Britain could be at risk of respiratory disease. While the paramount priority of the reduction of risks at source must be acknowledged, it should also be recognized that respiratory protective equipment (RPE) is, and is likely to remain, a key element of many respiratory risk management programmes. Thompson and Wake reported that, of the employers specifically asked about the use of respirators, nearly half said that they have workers using RPE.

A recent report by Easterbrook (2009) examined aspects of RPE use in a survey of exposures to and control of respirable crystalline silica (RCS). Covering four sectors (brickmaking, construction, stonemasonry, and quarrying), it provided evidence suggestive of a general inadequacy of RPE programmes. As part of the project, ‘RPE Competency Descriptors’ were developed, using verbal descriptors to categorize sites on a scale ranging from 1 (no evidence of use or provision of suitable RPE) to 5 (evidence of exemplary RPE programme with only minor deviations from agreed practices and policies). The majority of sites visited for the survey were rated at ≤2 on this scale.

As part of an HSE initiative, aimed at reducing respiratory disease by promoting good practice in the selection, maintenance, supervision, and training for use of RPE, we conducted a review of research evidence on RPE and user behaviour. This resulted
in the identification of a series of key constituents of any RPE programme if it is to be effective in helping to safeguard respiratory health.

AIM AND APPROACH

The study aim was to identify the evidence base for the behavioural and attitudinal factors to be considered for an effective RPE programme as part of respiratory risk control in the workplace. Although the emphasis was on respiratory protection, we included all personal protection equipment (PPE) in identifying relevant evidence, on the basis that, although there will be equipment-specific issues, the underlying principles influencing the use of any PPE will be essentially the same as those specific to RPE.

Drawing on a variety of sources, the study gathered evidence relating to determinants for and barriers against proper RPE provision and use. Firstly, it searched the peer-reviewed literature for relevant studies. Secondly, Institute of Occupational Medicine (IOM) research reports published over the 40 years of the IOM’s existence were searched. Thirdly, IOM reports provided to consultancy clients over a 2-year period (2006–2008) were systematically reviewed, again for information relating to RPE use. Not all knowledge and information relating to RPE use (or non-use) is documented. Consequently, we carried out a series of interviews with IOM consultants with practical experience of RPE issues in a wide variety of contexts. Finally, drawing together evidence from these various sources, a workshop was held, attended by IOM and HSE personnel, at which a consensus was reached on a consistent evidence base. A comprehensive report (Graveling et al., 2009) presented methodological issues in some detail. This commentary provides an overview of the collated information, summarizes the main evidence base, and presents the key elements identified as likely to impact on the success of any RPE programme.

LITERATURE REVIEW

Outline method

We explored the peer-reviewed literature for papers which provided an overview of the factors (determinants for and barriers against) relating to proper RPE use to protect against exposure to respiratory hazards. It was not intended to conduct an exhaustive evidence-based review, such as might be conducted to establish the efficacy of an intervention. However, we intended the search strategy and subsequent selection of papers to provide a sufficiently comprehensive coverage of the literature to give confidence that all relevant issues had been identified and documented.

A formal process of establishing a search strategy and protocol, including screening candidate abstracts, was established and is documented in Graveling et al. (2009). This culminated in 20 papers being selected for inclusion in the review. These mostly derived from studies in the USA (16) and covered a wide range of industries and forms of PPE although most included either RPE or face masks. Users ranged from industrial painters to hospital nurses. Details of these papers can be found in our full report.

Overview

Of the identified studies, almost all (19) focused on compliance. Only one was found that formally evaluated the effect of an intervention programme, although some of the compliance studies did examine the influence of prior training. Fewer papers (five) were specifically concerned with the individual attitudes and behaviours of workers (relating to the use and non-use of PPE), although again several did include attitudinal factors in evaluating compliance. Studies on attitudes specifically relating to RPE were scarce in the literature.

The factors that appear to influence a worker’s decision whether or not to wear a respirator are complex and they are not homogenous between and within work environments. The emphasis placed on different factors did not always reflect what might be expected, given the industry and protective device in question. Thus, as might be expected, wearer discomfort was cited as a significant barrier among industrial spray painters wearing chemical cartridge respirators (White et al., 1989). However, the citation of physical discomfort as the main barrier to the use of simple surgical masks (Nickell et al., 2004) is perhaps less explicable.

The major determinants for the use of PPE reported in the literature review included risk of exposure and the employees’ knowledge of the consequence of such exposure. The major barriers to employees using PPE included: physical discomfort, lack of time, perception of low risk, and disbelief in its efficacy.

The relative importance of these factors varies with the work environment and sometimes with the specific PPE. In the case of RPE, usage factors are also possibly influenced by the type of equipment. However, the type of respirator used was not always
indicated in the reported studies, which makes it difficult to evaluate this factor properly.

Individual studies were generally restricted to a single employment sector. As a result, the absence of any consistency and comparability of approach between different studies mean that cross-sector comparisons of the relative influence of different factors should be treated with caution. Nevertheless, it is possible to derive some broad within-sector overviews of the relative importance of different issues.

The reviewed studies were grouped into three broad sectors: industrial workers, agricultural workers, and healthcare workers. Naturally, there was a degree of heterogeneity within each of these groups, especially the industrial workers. Within this particular group, physical discomfort (such as thermal problems and breathing difficulty) was identified as the main barrier for non-use of PPE, especially in those jobs demanding high physical activity (White et al., 1989; Laird et al., 1993; Akbar-Khanzadeh, 1998). Despite improvements in respirator fit or comfort (Campbell et al., 2001), recent studies have identified the same factors as barriers for RPE use (Salazar et al., 2001). The frequency with which it was necessary to wear respirators, respirator type, and individual worker’s experiences (e.g., health symptoms) were also found to influence workers’ behaviour towards the use of respirators (Salazar et al., 2001).

The main determinant for the use of PPE among agricultural and healthcare workers was perception of risk (Avery and Coggon, 1994; Murphy et al., 1996; Hwang et al., 2000; Mandel et al., 2000; Macfarlane et al., 2008), especially with health staff working in high-risk environments (Linn et al., 1990; Akduman et al., 1999; Ganczak and Szych, 2007). Perception of risk can become a barrier when workers perceive the risk as low because, in such circumstances, they are less convinced of the value of wearing PPE (DeJoy et al., 2000). One paper reported a pilot study which suggested that enhanced training to emphasize risk could improve subsequent uptake of RPE (Carrico et al., 2007).

Use of PPE has been positively associated with younger workers in the agricultural sector (McFarlane et al., 2008) and the healthcare sector (Helfgott et al., 1998), possibly signifying an age-related change in attitudes to risks. However, it is not clear from these studies whether this is due to younger people being more risk-averse or older workers being more reluctant to wear PPE for some reason.

Results from the studies reviewed suggest that an effective intervention should focus on several determinants and be specific to each workplace. The reviewed studies agreed that propaganda itself is not enough to promote wearing of PPE.

**IOM RESEARCH REPORTS**

**Outline method**

All previous IOM research reports (IOM Technical Memoranda and HSE Contract Research Reports) were scanned for information of interest, again considering all forms of PPE. Because of the relatively small number of reports, compared to the published literature, no initial computer search was carried out. However, a similar selection strategy was adopted. All IOM Technical Memoranda can be freely accessed via the IOM website (www.iomworld.org). Nine different major reports provided the main evidence base, although some others were excluded to avoid unnecessary repetition of findings. As with the published literature, these were not exclusively focused on RPE, and while devices such as powered helmet respirators were included, PPE studied included hearing protection, fall-arrest harnesses and other forms of PPE. While early studies concerned issues relating to PPE use by UK coal-miners, the body of research encompassed risks such as sheep dipping and isocyanate use.

**Overview of results**

A number of key themes were identified. Some of these (e.g., Hughson et al., 2002) relate directly to the effectiveness of RPE programmes in persuading employees to wear RPE. Others (e.g., Best et al., 1989) can be related more to its effectiveness once worn. Nevertheless, all seem to be of potential importance in achieving the overall aim of improved workplace protection.

Some of the factors are clearly interrelated and, to a certain extent, can be seen as reflecting different aspects of the same issue. It is important to recognize, however, that these factors have largely been identified from studies where RPE or PPE usage was not necessarily the main focus. The absence of any reference to other specific issues (e.g., management systems or the effectiveness of training) should not therefore be construed as necessarily suggesting that these are of lesser importance.

The first group of factors is related to the willingness of the employees to wear RPE in the first place. These include:

- hazard awareness;
- risk perception;
- perceived effectiveness of protection;
management attitudes and example;  
time and/or hassle involved with donning.

Once worn, a second series of factors, mainly relating to comfort and disability issues, were identified. These include:

- resistance to breathing;
- discomfort (e.g. pressure and/or chafing);
- thermal discomfort;
- impaired communication;
- other interactions/interference with work activities.

Many of these can be exacerbated by overprescription as many of the factors likely to adversely affect wearability; (e.g. weight, pressure against face, and size/bulk) are, to some extent, correlated with functional performance. Although not directly contributing to wearability; inadequate maintenance, cleaning, or replacement programmes can also influence overall effectiveness and, through factors such as increased respiratory resistance or reduced airflow, can also indirectly influence acceptability.

UNPUBLISHED WORK

Outline method

As part of the information-gathering process, all IOM occupational hygiene consultancy reports from the preceding 2 years (2006–2008) were examined by an experienced occupational hygienist. Selection from these was on the basis of a report containing material relating to the need for protection from respiratory hazards and some focus on the use of RPE as a part of that protection.

A total of 32 consultancy reports, covering 31 different industrial employers, were identified as containing material of relevance. Information was abstracted against a standardized proforma, which took account of the following:

- nature and size of the organization;
- nature of hazard;
- airborne concentrations in relation to exposure limits;
- type of RPE in use;
- face-fit testing (FFT);
- other control measures;
- information, instruction, and training (II&T) provided.

Overview of results

In the main, the surveys had been requested either because the organization was concerned about the level of exposure of its operators to a particular material or as a routine monitoring exercise. The reports covered mainly medium and large-sized companies although one small (<10 employees) company was also included.

As a general insight into the importance of RPE programmes, nine of the companies surveyed provided no other form of control for the risk in question other than RPE; this included many of the larger organizations.

All the surveys had been commissioned to measure total inhalable dust and/or respirable dust, although a small number also included measurement of vapours. The most common hazardous material measured was RCS, although surveys for metals and wood dust were also identified.

In all but two instances, the RPE in use on the day of the survey was considered by the consultant to be suitable at the airborne concentrations measured. In the two cases where the RPE was not appropriate, recommendations were made to assess the tasks and circumstances in question and to use this information for the selection of more appropriate RPE.

In 18 of 32 surveys, the airborne dust/vapour concentrations were found not to exceed the relevant British occupational exposure limit (the Workplace Exposure Limit or guideline limit) and the RPE was being used to further reduce any exposure risk. In the other surveys, at least one of the hazardous materials being monitored exceeded the relevant exposure limit. In all but one of these, Filtering Face-piece, Protection Level 2 (FFP2) respirators were being used as a minimum, with many companies supplying FFP3s [that is, FFP2 or FFP3; see European Standard EN149 (BSI, 2009)].

Across the 31 companies, of the 43 different types of respirators provided which relied on an effective face seal, employees reported having been face-fit tested for 14 of these. The data from the quarrying and stonemasonry companies in the sample suggested a more favourable picture than that recently reported by Easterbrook (2009) who indicated that a considerable majority of employers surveyed in the stonemasonry and quarrying sectors did not have FFT in place.

A total of 20 companies provided II&T to their employees in some form. Of these, 17 took the form of toolbox talks and three involved sessions delivered by the company health and safety advisor.

In addition to the monitoring carried out during the surveys, observations were made as to work methods and, in particular, the use of control measures, including RPE. The general awareness of those employees who had received advice through the
II&T sessions, regarding the nature of the hazard and the requirement to make full and proper use of any RPE provided, was apparent from the actions observed and recorded during the surveys.

Only eight of the companies provided any storage facilities for employee’s RPE; five had a system in place for cleaning respirators and five had established maintenance procedures. Those companies that had no storage facilities in place allowed disposable masks to be temporarily stored in the open, where they were at risk from contamination prior to use.

Among the 32 reports examined, detail about record keeping for RPE was limited. It appears that 13 of the companies kept no records regarding RPE while a further 12 companies had no information regarding record keeping. Of the remainder, five kept records on RPE training and two kept records of RPE issue. Those companies that had no information available on record keeping were all part of larger groups and, as such, had no direct control regarding the issue and selection of RPE.

On a positive note, it appears that most employers had made an appropriate selection of RPE in respect of the risks involved, although the basis of that selection is not known. There are, however, clear indications that, in many instances, significant management input stopped there and that many elements of a good RPE management programme were not in place in the majority of companies.

These results must be considered in the context that the companies in question had, for whatever reason, sought professional occupational hygiene advice. Two interpretations can be placed on this. The first is that they had issues which were bad enough to warrant seeking such advice. The second is that they were arguably more enlightened than many. This contextual information might impact on the extent to which the findings from this limited survey reflect the broader national picture. On balance, however, it would seem likely that, if anything, this sample underestimates any shortcomings among employers in general, suggesting considerable scope for improvement.

UNWRITTEN EVIDENCE

Outline method

In addition to the examination of written reports, summarized above, interviews were carried out with a number of IOM employees who worked with RPE in some context. These included PPE testing-laboratory staff, occupational hygiene specialists, and those involved in asbestos working, who observe the implementation of RPE requirements, mainly in industrial environments, on a regular basis.

Overview of results

The IOM PPE laboratory has United Kingdom Accreditation Service accreditation for FFT and provides this service to client companies. As with the occupational hygiene reports, the fact that the employers in question have seen fit to utilize this service indicates a certain mindset which might well not be representative of the broader pool of employers.

It was apparent that some of those attending for FFT had received little or no training or information before attending. For example, it was not unusual for employees to attend without any experience of fitting their RPE or for any effort to have been made by their employer to ensure that reasonably correctly fitting RPE had been provided.

In a number of instances, it was apparent that the mask was not being worn in the manner it would be in the workplace. For example, some men indicated that they had shaved their beard off for the testing and would regrow it immediately afterwards. Clearly, such comments create reservations about the quality of any training received, the perception of the risk involved, and the level of supervision and reinforcement that might be anticipated in the workplace.

Despite some reservations, the test laboratory staff indicated that they were aware of a general improvement in recent years in attitudes towards wearing RPE, especially (but not exclusively) among younger employees.

Although the risks from asbestos exposure are well established, many of the comments from staff involved in providing asbestos-related services to clients reflected poor attitudes to RPE use among asbestos workers they came into contact with, with RPE not being worn correctly or being temporarily removed within enclosures. In many instances, this was seen to reflect general attitudes and a relative absence of management influence. Well-managed sites were described as those where management staff would visit and reinforce the need to wear RPE. However, many sites function without such managerial influence, with more reliance on the members of the work team. There was an impression that, while hazard awareness might have been reasonable, personal risk perception was often deficient. In particular, an age-related differentiation was suggested, with a proportion of older, more experienced workers not considering the risks from asbestos to be sufficiently serious. The absence of obvious immediate (acute) effects of exposure, the long latency of any response, and the fact that some employees, who
anecdotally have been exposed to relatively high levels, do not go on to develop asbestosis (suggesting an apparent immunity) were all factors which contributed to this.

While peer support or pressure can, in some circumstances, be of positive effect, the impression was that, in general, peer influences were negative. Older workers were seen as dismissing the training and information received by (usually) younger workers entering the industry, thus undermining the messages received. As a further overlay, the issue of attitudinal influences was also seen to make a significant contribution. The prevailing ‘macho’ culture militated against the wearing of RPE, further undermining any individual who might wish to do so.

While the asbestos industry can perhaps be regarded as somewhat extreme, it is likely that such perceptions, attitudes, and beliefs prevail to some extent elsewhere and should be accounted for in any strategy. It emphasizes a need for strong policies and procedures and reinforcement of those by supervisors and other managers. There can be a tendency, in this and other industries, for management to feel that they have discharged their duties by the act of telling employees to wear RPE and that any subsequent failure to do so is solely the responsibility of the individuals concerned.

Occupational hygiene staff endorsed much of the information presented previously, which will not therefore be repeated here. However, a potentially important additional factor was that any programme for RPE should be presented in the context of any other measures, which have been introduced or at least considered. The concern was expressed that use of RPE might be seen as a cheap way of dealing with a problem, which is easy for ‘them’ (management) but places the burden on ‘us’ (workers). Clearly, in any risk management programme for an airborne hazard, RPE would be seen as the last resort (or possibly a temporary expedient while longer term measures are devised and introduced). However, there is an impression that, in some workplaces, the thinking behind this is not communicated to the workforce, which only sees the final solution. This can be seen as a specific example of the benefits of an inclusive organizational culture where employees are more actively involved in the risk reduction process and are therefore more likely to sign up to the eventual solution.

As a further practical issue, the relative pros and cons of the use of prescriptive zones for compliance within a workplace were discussed. While such zones have the merit of being easier to manage (and can avoid any ambiguity as to where and when RPE is required), they can have the disadvantage of requiring RPE to be worn where it might well be apparent to all that it is not necessary (possibly in more peripheral parts of the zone). There is historical evidence from IOM studies (e.g. Edlin et al., 1974) that some individuals at least are quite efficient in identifying when RPE is necessary and taking appropriate action. In some industries/workplaces, enabling individuals by giving them such control might offer an appropriate alternative to more prescriptive measures, although clearly this would require a higher level of knowledge and awareness among the workforce to be an effective control measure.

**WORKSHOP**

**Outline method**

As planned, a workshop was held to discuss the findings of the reviews and to:

- overview the information gathered from these reviews;
- identify any other issues which participants might be aware of;
- discuss the relative importance of the issues raised;
- identify ‘avenues for amelioration’—i.e. what can be done about improving RPE use by employees?

The workshop was attended by IOM and HSE staff drawn from a wide variety of backgrounds, including occupational hygiene, ergonomics/human factors, and asbestos services. To avoid unnecessary duplication, the views expressed during the workshop and more detail surrounding this outcome have been incorporated into the following more general discussion and conclusions. However, the general consensus which emerged during the workshop was that promoting the right attitude among managerial and supervising staff (including senior peers) was essential. Unless management and supervisory support, reinforcement and enforcement were in place, there was little or no real value in addressing issues such as wearability.

**OVERALL DISCUSSION**

The various overviews and explorations carried out as part of this project have identified a clear pattern in the factors influencing RPE usage, albeit one modified by the circumstances surrounding a particular industry or workplace. There would appear to be broad consensus, using information from a variety of sources, of what the issues are regarding effective RPE protection and programmes. These issues have
been encapsulated in the recommendations given below.

It is clear that, in addition to ensuring the selection of technically appropriate RPE, organizational/management issues are fundamental factors in any successful programme. To a certain extent, this is self-evident in that, unless the need for RPE has been recognized and accepted, then there is no value in addressing individual factors such as attitudes to the RPE or the wearability of any RPE provided.

This is perhaps most problematic where a respirable hazard is newly recognized, where this was not previously the case, or where the risks associated with that hazard are not apparent (at least in the short term). There are many older workers, for example, who can recall using substances such as mercury or benzene with a relatively relaxed regime in force and who perhaps find the comparatively recently identified hazards associated with these substances difficult to appreciate.

Coupled with this issue is that of the apparently ‘immune’ workers. There has been a long tradition of seeking to protect those in any workforce who are potentially most susceptible. However, establishing, for example, a 5% ‘at risk’ level means that, by definition, 95% of the workforce can safely be exposed to that level (and most exposed to higher levels) without apparent risk. Such inter-individual variability means that, almost inevitably, any hazard in any industry will spawn apparent survivors. Overcoming the consequent attitudes and beliefs that this engender is one of the challenges to be faced.

Any form of PPE (and RPE is no exception) imposes a barrier between the wearer and their environment and creates some degree of additional load. The extent of that barrier and loading depends to a large extent on the nature of the RPE selected, which, in turn, will depend to some extent on the risk in question. Tolerance of these barriers and loads will also depend considerably on the nature of the risk or, more specifically, the perceived risk. At one extreme, the loads and barriers imposed by self-contained breathing apparatus (SCBA) are far in excess of those associated with a simple limited use (disposable) half-mask and yet, these loads are frequently accepted by those people required to wear the SCBA because of the potential hazards and risks they face.

It is difficult to predict the outcome of the complex interactions between perceived risk and tolerance of discomfort and disability. However, what is clear is that problems can occur if these loads or barriers are perceived as unacceptable. Problems are most likely to arise where there is a mismatch between actual risk (which determines the type of RPE and therefore, in general terms, the associated loads) and perceived risk (which will be a strong determinant of attitude to and consequent acceptance of the RPE). Selecting excessively protective RPE could be a further factor in particular instances of RPE wearing; disturbing the balance between the level of RPE load perceived as acceptable and that actually imposed.

A case study published by the US Environmental Protection Agency provides an excellent illustration of the key role for management and supervision (EPA, 2001). The strategy described had three ‘key components’: awareness of hazard, use of PPE, and employee training. A workshop manager was dedicated to ensuring that the workers knew the risks and how to protect themselves. Having made sure that the workers knew the dangers, he then worked with them to select and purchase equipment that was ‘right for them, effective and comfortable’. The workers received periodic refresher courses and instruction on how to wear RPE correctly. However, despite all these elements being in place, the manager is quoted as saying: ‘I do have to keep reminding the guys, especially some of them . . .’.

**RECOMMENDATIONS**

From the reviews, it is clear that the first steps in any RPE programme start with management, although employees clearly have an essential role to play. It is hoped that adherence to the recommendations outlined below will help to ensure the effective provision and use of RPE and, in doing so, will help to protect the respiratory health of workers.

Implementing an RPE programme is of course only part of the bigger picture of risk management and control. For the purpose of this discussion, it is assumed that the stages that precede introducing such a programme, leading up to the decision that RPE is an appropriate element of any risk control programme, have already been addressed. In addition, these recommendations are intended to complement efforts to ensure that the correct type of RPE protection is selected.

The following programme is not derived from any one source. The elements of it are based on a combination of knowledge and information drawn from all the types of source examined during the study: peer-reviewed literature, IOM research and consultancy reports, and the expertise of those interviewed or making other contributions. Examples of each element, or the equivalent failure (e.g. not recognizing the need for RPE/PPE), have been raised within
the written literature and have been observed in specific instances by IOM staff.

Much of the good practice advocated in these recommendations reflects legal duties such as those in Britain incorporated in the Personal Protective Equipment at Work Regulations, within the European Union, based on the EC Directive from which the PPE Regulations are derived (89/656/EEC), and in the USA (OSHA Standard 1910.134).

As indicated above, it is clear that the first steps in any RPE programme sit with management.

- Managers at all levels need to recognize the need for RPE;

It is important that those with management or supervisory responsibilities are aware of the hazards involved in any processes, know of the possible consequences of exposure, and recognize and accept the role that correctly selected and worn RPE can play in controlling such risks.

- All employees should accept their role in an effective programme;

As with other workplace health and safety issues, there is a clear need for all employees, especially managers, to recognize that they have a role to play in health and safety and that their attitudes and behaviour can be a major positive (or negative) influence.

- Managers must ensure that appropriate RPE is selected which must be:
  - Technically appropriate

Clearly, any RPE must be technically appropriate for the hazard in question. As stated earlier, systems offering greater protection are often more intrusive and/or uncomfortable to wear and any tendency therefore to overprotect should usually be discouraged. There is evidence to suggest that involvement of the workforce in the selection of RPE is likely to encourage subsequent use.

  - Comfortable to wear

The importance of the comfort of any RPE should not be underestimated. Even where the need for RPE has been recognized and accepted, there can still be a reluctance to wear such equipment if it is seen to be uncomfortable or intrusive. Although worker involvement in selection will help to offset this, the possibility remains that some employees will find the level of discomfort from a particular form of RPE unacceptable. Interactions with workplace factors (e.g. space, temperature) can also be important.

- Compatible with other PPE

Issues relating to interactions between different types of PPE have long been recognized and, in the EU Member States, are embodied in EU Council Directives relating to the manufacture (89/686/EEC) and use (89/656/EEC) of PPE. In Britain, the provisions of the ‘Use’ Directive are contained within the Personal Protective Equipment at Work Regulations 1992. It is important to recognize that RPE might interfere with other forms of PPE (especially eye protection but also possibly any other head-borne PPE) and might therefore either not be worn correctly or not worn at all as a result. No RPE programme should be introduced in isolation of the consideration of other workplace risks or of the protective requirements they engender.

- Fits the individual

RPE must be selected which is appropriate for the individual workers, taking into account factors affecting fit such as face size and shape, facial hair, etc. A suitable fit-testing programme should help to ensure this.

- Managers must ensure that sufficient RPE is provided;

Appropriate RPE (and other PPE) must be readily available. Whether disposable or reusable systems are used, replacement supplies must be easily obtainable by the workforce or any efforts to ensure compliance will be undermined.

- Managers must ensure that information and training needs are met;

Intuitively, it is important that employees are made aware of the hazard and consequent risks associated with the substances being protected against. However, there is some evidence from contacts in industry that, in some industries at least, an almost authoritarian approach is more effective, with people responding better to just being told what to do. Parallels can be drawn with the introduction of seat belt legislation in the UK—where a legal imposition proved effective where information and exhortation had failed. Nevertheless, some at least in the workforce are likely to respond better to a more informed approach. Training should also cover the correct fitting and use of RPE and ensure that wearers appreciate the limitations of any protection provided.

Properly conducted, training in hazard awareness and risk perception should provide an opportunity to identify and address the entrenched attitudes, which engender a disproportionately low risk perception.
and consequent antagonism to wearing RPE. It must be recognized that there is often a considerable gulf between getting people to recognize/acknowledge a risk and getting them to change their behaviour as a result. There can be many contributory factors at play here, including the ‘macho’ culture prevalent in some workplaces.

- Managers must make suitable provision for cleaning, maintenance, and storage (as appropriate);

Some types of RPE, most notably those which are powered in some way, have higher cleaning and maintenance requirements than others and may well require centralized provision. Examples have been encountered where, for example, powered respirators have been provided without this ancillary provision (with predictable consequences). However, even less demanding types of RPE might nevertheless require some provisions to be made, for example, storage of disposable items when not being worn.

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