TECHNICAL UPDATE

Respiratory Protection - Basic Information

Providing respiratory protection for workers is part of the duty of care of the employer in the modern industrial situation. In Australia, there are various state and commonwealth laws that mandate the use of controls to provide a safe workplace. Employers are required to use appropriate means to prevent health hazards to the workers. This includes measures like use of low toxicity materials, provision of engineering controls like extract ventilation and enclosures and, as a final resort, the use of personal protective equipment.

Respiratory protection is necessary in many workplace situations because engineering controls are not available, are impractical or are too expensive to implement in the short or medium term. Each workplace will have its own problems and hazards and will require assessment by a suitably qualified person like an occupational hygienist to determine if there is a need for respiratory protection and, if so, what specific types of respirators are needed.

Guidance for the appropriate use of respiratory equipment is given in Australian Standard AS/NZS1715 “Selection, use and maintenance of respiratory protective devices”. This gives the framework to look at a respiratory problem, identify the hazards and then covers the various options available to deal with the problem.

There are a number of basic requirements needed to assess a respiratory hazard. The first is to identify the contaminant, and then to quantify the amounts of the airborne contaminant in the working environment. In some cases, this may require the use of an occupational hygienist, who will have the knowledge and equipment to measure the airborne concentrations of the materials in question, and to make informed recommendations as to the appropriate responses to the hazard.

Common contaminants found in many workplaces can include:

- “Nuisance” dusts – small particles that, at high concentrations, clog up the airways of the lungs and create discomfort and breathing difficulty e.g. rock dust, dirt.
- Toxic dusts – particles that are toxic to the body and can cause local or remote effects to the body after being inhaled into the lungs e.g. asbestos, silica.
- Irritant gases – gases that are water-soluble and cause irritation to the upper respiratory tract eg ammonia.
- Asphyxiants – gases that interfere with the supply of oxygen to the body. They can be simple, such as an inert gas like nitrogen that can dilute the oxygen in the air to a dangerously low level. Or they can be chemical asphyxiants like carbon monoxide or hydrogen cyanide, which are taken up into the bloodstream in preference to oxygen, causing the body’s organs to shut down due to lack of oxygen supply.
- Anaesthetics – many organic solvents e.g. petrol, ethanol, benzene, are readily absorbed from the lungs into the bloodstream. They are then carried around the body and can cause damage to organs like the brain and the liver. They can depress the operation of the central nervous system and at high levels cause paralysis and death.
- Sensitisers – these can cause allergic asthma-type reactions, after an individual is exposed and is sensitised e.g. isocyanates, some timbers.

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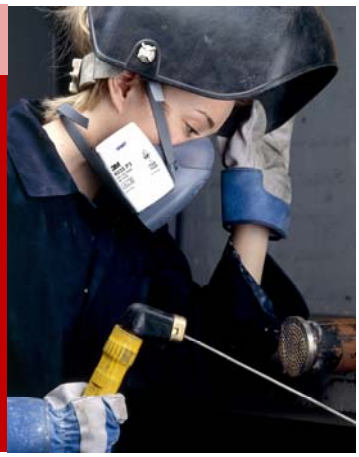

After identifying the type and magnitude of the respiratory hazard, suitable respiratory equipment for these conditions should be identified. Normally there will be a number of options, depending on the local conditions, wear time, cost and other factors which will help to decide the appropriate equipment. Sometimes, there will be State regulations that require a certain type of protection for a specific substance eg spraying isocyanates must be done wearing an airline system with clean air supplied from a compressor or air bottles.

All respirators used should comply with the requirements of AS/NZS1716 "Respiratory protective devices, which specifies the tests and performance criteria for all respirators to be used in the workplace. This sets the level of performance in terms of what each type of respirator product must be able to do and the performance characteristics needed.

Various types of filters are produced specifically for use against various contaminants and are tested and marked accordingly. For gas/vapour hazards there are many types:

Type	Target gas/vapour
A	Organic vapours with boiling points > 65^0C
B	Acid Gases
E	Sulphur Dioxide
G	Low vapour pressure materials (< 1.3 Pa) – this includes many agricultural chemicals
K	Ammonia
Hg	Mercury

There are also several other types for other specific chemicals. All of these rated filters are tested against a suitable test gas to determine their performance and minimum service life.

All gas/vapour filters are also rated for absorptive capacity. In increasing capacity these are Class Aus, Class 1, Class 2 and Class 3 filters. Therefore, for example, you can get an A1 filter or a B(Aus) or a combination A2B1. The higher the class, the higher the concentration they are able to deal with when fitted on the appropriate type of respirator.

For protection from particulates, there are three classes of filters under AS/NZS1716 – called P1, P2 and P3.

P1 – used for mechanically generated particles eg silica, dusts, powders.
P2 – used for mechanically and thermally generated dusts eg welding fume, metal fume.
P3 – used for all particulates requiring high protection factors.

The performance of particulate filters is determined by testing the penetration the filter by a sodium chloride aerosol of 0.02-0.2 micron equivalent diameter and ~0.3-0.6 micron mass median diameter - which is the most penetrating particle size for filters at breathing flow rates.

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The choice of filter and mask will depend on the airborne concentration of the contaminant e.g.: for silica dust – a P1 half face respirator will be suitable. This type of filter will capture the particles effectively - so a simple half face disposable type mask fitted and worn appropriately will be suitable.

However, for say, asbestos stripping work, where very high levels of fibres are normal, a full facemask or Powered Air Purifying Respirator (PAPR) fitted with P3 filters is needed. PAPR's provide a number of advantages compared to tight fitting facemasks. These include:

- No breathing resistance
- Moving airflow provides cooling effect
- Does not rely on a tight faceseal so can be used by those with beards etc.
- Can include multi layered protection e.g. head, eye and face.

AS/NZS1715 gives guidance on the type(s) of respirator appropriate for use by indicating the level of protection that each type gives – the protection factor is a measure of the effectiveness of that type of respirator/filter/air supply combination e.g. for mechanically created particles, a half mask (P1 or P2) gives a 10 times protection factor (ie it reduces the airborne concentration of the particles by a factor of 10), while a full facemask will give 50 times protection factor with P2 filters fitted. A PAPR like the Airstream AH12 fitted with a PAPR-P2 filter gives a protection factor of 50. These factors have been calculated by doing workplace studies and measuring the performance of the various types of equipment and then introducing a safety factor.

So by knowing the airborne concentrations in the workplace and applying the information included in AS/NZS1715, an employer can select a respiratory product that will reduce exposures to an acceptable level.

For the employer or worker who is not familiar with the various factors and product features necessary to choose the correct respiratory protection for their applications, 3M Australia has a TechAssist Hotline (1800 024 464) that is available to purchasers/users of 3M products. Advice and guidance is available to assist in providing the end user with the information needed to obtain appropriate respiratory protection for the task at hand.

How to contact us:

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