The use and abuse of gloves

Are your gloves really protecting you? For many the answer will almost certainly be probably not, particularly where protection is needed against hazardous chemicals, says Chris Packham.

In a recent paper published in *The Annals of Occupational Hygiene* a team of dermatologists investigated the uptake into the body through the skin of carbon disulphide, classified in the latest Classification, Labelling and Packaging (CLP) Regulations as capable of causing damage to internal organs from skin exposure as well as being a skin irritant. They appeared surprised to find that wearing nitrile or natural rubber latex gloves resulted in an increase in what they had not recognised is that this chemical will quickly migrate through the glove materials and then make contact with the skin. The barrier properties will have been impaired due to the hyperhydration that results from both sweat and, importantly, trans-epidermal water loss, a generalised continuous loss of water through the skin quite separate from sweat.

A complex picture

The selection and use of gloves for chemical protection is much more complicated than many realise. It is incorrect to assume that the data on glove performance published by manufacturers in accordance with the standard (EN374) will actually tell you what your gloves will achieve in practice.

Permeation – that is the transport at a molecular level – is undetectable by the wearer and can vary enormously depending upon the many factors shown in the table. In use testing with a glove and a nominal permeation breakthrough time of 36 minutes against xylene showed these were mixed in equal proportions, a breakthrough time of just nine minutes. Indeed, for some common chemicals there is no glove that offers little more than ‘splash protection’. In other words, should the chemical come into contact with the glove, it is important that it is immediately removed and, if necessary, replaced with a fresh glove. Since in some cases, such as with the carbon disulphide, the only glove that offers any real protection may cost upwards of £25 per pair, protection using gloves can become an expensive approach.

Wet work

As well as the potential for the glove to fail to protect, we need to recognise that all occlusive gloves will actually cause damage to the skin itself. We are not referring here to allergic reactions to the gloves but to the accumulation of excessive water in the skin. This can lead to what dermatologists have called ‘hydration dermatitis’. Indeed, wearing chemical protective gloves is equivalent to ‘wet work’, for example skin contact with water, a common cause of irritant contact dermatitis.

The belief that this can be controlled by the application of creams that can block sweat is misguided. Blocking sweat glands will not stop the production of sweat by the glands. This is then forced through the sweat duct into the skin and can cause adverse effects on the cells in the epidermis. Nor can the cream prevent the trans-epidermal water loss that is a major cause of skin hyperhydration due to occlusion. Furthermore, the active ingredient in these creams, usually aluminium chlorohydrate, is a recognised skin sensitisser and, in the micro-environment that will exist inside the glove, could possibly result in sensitisation and allergy. In fact, the Personal Protective Equipment (PPE) Regulations address this problem. Appendix II, paragraph 2.2: ‘Enclosing parts of the body to be protected’ states: ‘As far as possible, PPE ‘enclosing’ the parts of the body to be protected must be sufficiently ventilated to limit perspiration resulting from use; if this is not the case, it must if possible be equipped with devices which absorb perspiration.’

To date the only effective way of effectively minimising skin hyperhydration from the wearing of occlusive gloves is to wear separate cotton gloves beneath the chemical protective gloves.

A last resort

It should be obvious from this article that the selection and use of gloves to protect against chemical hazards is actually more complex than might at first appear. Bear in mind that any failure is fail-to-protection is considered a last resort to managing exposure have been applied and there is still a residual risk due to skin exposure.

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