FORMALDEHYDE-RELEASING BIOCIDES AND METALWORKING FLUIDS

Water-based (or water-containing) metalworking fluids are used in all parts of the world and are subject to contamination by bacteria and fungi on a daily basis. The control and monitoring of microbial growth are essential components of a good fluid maintenance programme, and are specifically recommended in national best practice guidance such as that issued by UK Health and Safety Executive [1]. The addition of preservatives to water-based metalworking fluids contributes significantly in maintaining the quality of these fluids. Additionally, the use of preservatives protects these fluids against the growth of potentially harmful microbes that could cause health problems in workers. For efficacy and cost effectiveness, a large proportion of bactericides (which are preservatives that specifically control the growth of bacteria) on the market in Europe today act by releasing small amounts of formaldehyde under specific conditions.

Formaldehyde is a ubiquitous chemical that can be found in the environment, both from natural processes and man-made sources. Large quantities are naturally formed in the troposphere by the oxidation of hydrocarbons whereas minor sources include decomposition of plant residues and the transformation of chemicals emitted from foliage. Man-made releases are from vehicles without catalytic converters, and from products and processes using materials either made with formaldehyde such as urea-formaldehyde and melamine-formaldehyde resins, or treated with it. Formaldehyde also has a medical application as a sterilant and embalming fluid, and can be found in consumer products such as food, cosmetics and cleaning agents. Other environmental sources of exposure include cigarettes and tobacco products, furniture, building materials, adhesives, carpets, paints, disinfectants, gas cookers and open fireplaces.

In spite of the large number of possible opportunities for exposure to formaldehyde, the environmental burden remains extremely low. This is because the substance is rapidly broken down by sunlight or by bacteria present in soil or water and so does not persist or accumulate in the environment. Formaldehyde is also quickly and efficiently metabolised by normally-functioning cells, so it is not expected to accumulate in living organisms above extremely low, non-toxic levels.

However, it has been known for some time that chronic exposure of rats to formaldehyde vapour at high levels over their lifetime can lead to the formation of nasopharyngeal cancer. It is believed that the key contributory factor to this event is repetitive irritation of the nasal mucosal lining, leading to increased cell death and regeneration, ultimately resulting in cancer at the site of contact. Current expert opinion holds that the degree of respiratory irritation, and hence carcinogenic response, is directly related to the concentration of the vapour. It is known that sensory irritation of the eyes and respiratory tract in humans occurs at levels above 0.3 ï 0.5 ppm, however, with eye irritation being the more sensitive end point [2]. It is therefore reasonable to conclude that unless exposed workers can detect formaldehyde themselves either by smell or because it is already causing eye irritation, the risk of them developing this rare form of human cancer is extremely low.

Nevertheless, following publication of data from human epidemiological studies the International Agency for Research on Cancer (IARC) re-classified formaldehyde from Group 2A (probably carcinogenic to humans) to Group 1 (known human carcinogen) in 2004. In spite of this, some scientists consider that the human (epidemiological) evidence for the carcinogenicity of formaldehyde

amongst exposed workers is not conclusive, and is essentially based on the findings seen in one US plant where there was a slight excess of nasopharyngeal cancer compared to expected levels. A further epidemiological analysis incorporating more recent data is being conducted, and this is expected to provide more definitive information when it is available in the near future. Currently in the European Union formaldehyde is classified as a Category 3 carcinogena but as a result of the IARC decision it is likely that this classification will be reviewed. It is the UKLA position that such a review should wait until the additional epidemiological information is available.

Note a - Category 3 is appropriate for substances that are well investigated but where the evidence is insufficient to classify as Category 2 or substances that are insufficiently investigated but where existing data raises concern for humans

It must be emphasised that formaldehyde itself is not added to metalworking fluids; biocides that rely on the action of formaldehyde use the substance bound strongly to other molecules and it is only present at very low concentrations. A major industry study conducted some years ago in the US with triazine (a formaldehyde release biocide) [3] showed that very low levels were detectable in metalworking operations, and these were well below reporting levels and Occupational Exposure Limits (OELs).

The UKLA believes, along with many other informed bodies, that maintaining workplace exposure below the current national OEL for formaldehyde (range; 0.4 mg/m3 (Denmark) to 1.3 mg/m3 (VLE) and 0.7 mg/m3 (VME) (France) as time-weighted average in European countries) [4], [5] and avoiding any peak concentrations above these values provides effective protection of workers from both acute respiratory irritation and longer-term carcinogenic effects. Additionally, the available exposure data suggests that the use of formaldehyde-releasing biocides in metalworking fluids is not expected to generate levels of formaldehyde above current OELs, and in the absence of perceptible workplace sensory irritation there is no additional risk of long-term harm to operators [6], especially compared to workplaces using badly-maintained metalworking fluids.

Although the UKLA believes that the use of formaldehyde-releasing biocides in metalworking fluids gives no additional risk of long-term harm to operators, it is always important that the fluid manufacturersô instructions are accurately followed and the product is used as intended. Also it is the responsibility of the user to keep the misting of metalworking fluids as low as practicable and ensure that relevant national and international exposure limits are not exceeded.

References (numbers in **red**)

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