

technical week

CIA argues case against zero VCM exposure limits

AT A press briefing held last week in London on vinyl chloride (VCM) toxicity the UK Chemical Industries Association (CIA)'s vinyl chloride committee stressed that the PVC industry would stop dead if society demanded zero exposures to VCM in the production, fabrication and use of PVC to eliminate the risk of industrial injuries.

The vinyl chloride committee, which was set up about three months ago, has as its terms of reference, "to enquire into the nature and extent of the hazard to health of vinyl chloride, whether in the free state or as a constituent of polymerized material. Secondly, to establish in collaboration with expert bodies both in the UK

penetration of PVC in to a wide range of market applications, as a major industrial material where alternatives are not available in the quantities nor in most cases with the properties required, the CIA stated.

The four UK producers of PVC are so far spending over £4m. this year to reduce the maximum possible atmospheric concentration of VCM exposure to plant operatives to 25 ppm by volume, from the existing legal limit of VCM exposure of 220 ppm.

Currently, 12 cases of angiosarcoma of the liver (a rare liver cancer) have been discovered in the USA, one in the UK, and around five in continental Europe. These diagnoses (two cases are still surviving) have occurred over a ten-year period.

Of the 18 cases, seven have occurred on one plant in the USA (B. F. Goodrich), a further three in another US plant (Goodyear), with the incidence elsewhere being very low. Average exposure time of the known cases approaches 20 years. However, the levels of vinyl chloride monomer to which these workers were exposed, thought to be at least 1 000 ppm., is extremely high compared with present permitted levels.

Average exposure levels in the UK are now 5 ppm for plant

atmospheres in VCM production, 50 ppm in plant atmospheres for production of PVC from VCM, and generally 0.5 ppm in plant atmospheres for fabrication of PVC articles. Vinyl chloride absorbed in a human diet is about 0.001 ppm of the diet.

Thus the CIA considers that the problem, if one still exists, is confined to the industrial process of converting VCM into PVC. Levels in food are infinitesimally small, and atmospheric exposure levels in the fabrication industry, where they may at present exceed 5 ppm, can easily be reduced by improved ventilation, the CIA maintains.

Therefore the committee's work is being focused on the VCM polymerization process itself. It estimates that average atmospheric concentrations in the UK were 1 000 ppm in the 1945-1955 period, 400-500 ppm in 1955-1960, 300-400 ppm in 1960-1970, 150 ppm in mid-1973, and is now 50 ppm.

Major improvements in the past six months have come mainly from the elimination of procedures which permitted vinyl chloride to escape into the plant atmosphere (within the prescribed limit of 200 ppm).

Ultimate Levels

Further improvement will come from detailed plant modifications to eliminate or reduce adventitious leaks, according to the CIA committee, with the ultimate for most existing plants at 10 ppm. However, entirely new plants using the latest available technology might achieve 5 ppm, as the lowest possible level attainable, the CIA states.

In contrast, OSHA, the US Government body concerned with the VCM problem has just proposed a standard of less than 1 ppm for atmospheric VCM levels. The proposal is however open to public comment before being adopted as law and the US Society of the Plastics Industry has already responded by calling the new standard "excessively and unrealistically restrictive."

Up till now a temporary limit of 50 ppm has been established in the USA. Nevertheless a limit of less than 1 ppm is tantamount to a zero exposure, and therefore zero risk.

The CIA stresses that it is impossible to prove a zero risk. In the case of VCM there has always been some risk, as VCM presents a fire and explosion risk very similar to that of butane and other liquefied gases used for heating and lighting. There have been more deaths from fire and explosions of such materials than from industrial disease and in the case of VCM, on a world-wide basis, more people have died from these causes in the past ten years than from cancer, the CIA committee stated.

As far as fabrication of PVC is concerned, the CIA is recommending that fabricators achieve atmospheric concentrations of less than 5 ppm. However, the fact remains that the concentration of VCM in freshly-produced PVC ex-plant is in the range of 200-400 ppm by weight, although the level drops on storage.

Typical levels on delivery to a customer are around 250 ppm, but after processing this drops further to somewhere between 0.5 and 20 ppm by weight, depending on the fabrication involved.

Table 1: UK use of PVC in 1973

Application	Tonnage used	Main uses	Market penetration %
Pipes & fittings	100 000 (30 000 miles of pipework)	Water mains, rainwater pipe, soil pipe, electrical conduit	30 80 75
Electric cables	48 000	House wiring, motor vehicles, domestic appliances, power cables	25 100 100 70-80
Hard flooring	1 30 000 sq	Tile & continuous vinyl flooring	40-50 80
Packaging (a) Foil & film	24 000	Foil: margarine tube, biscuits, chocolates Film: fresh meat & vegetables	
(b) Bottles	13 000 (400m. bottles)	Fruit squash, cooking oil, sweet jars,	20-25 80 50
(c) Bottle closures	5 000	food and drink products	30
Records (phonographic)	21 000 (140m. records)	all records are PVC	100
Cars	20 000	Upholstery, roof interiors	95
Footwear	20 000 70m. pairs	Shoes (35%) and shoe uppers	100
Colliery conveyor belting	8 000 (about 1 000 miles)	Underground safety belting	100

and overseas as well as with government departments, the actions necessary to safeguard the health of workers and users and to make recommendations for their speedy implementation."

A major reason for the committee's determination to arrive at a satisfactory solution to the VCM carcinogenicity problem is the importance of PVC to the UK national economy.

Four companies, BP Chemicals, ICI, British Industrial Plastics and Vinatex (jointly owned by the National Coal Board and Conoco), produce 400 000 ton of PVC annually in the UK, involving 2 000 workers.

Table 1 shows the extent of the