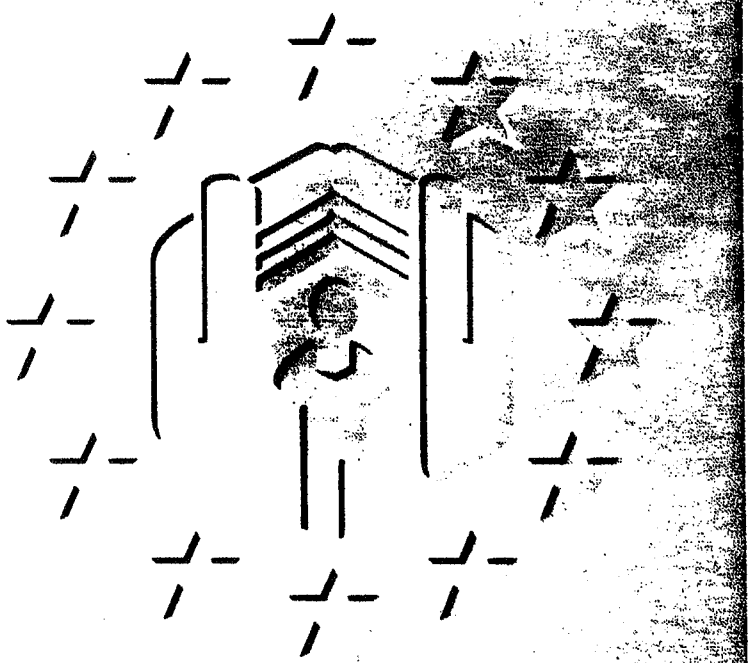
EUROPEAN COMMISSION

Occupational exposure limits

Recommendations of the Scientific Expert Group 1991-92



Health and safety

Report
EUR 15091 EN

Orthophosphoric acid

8-hour TWA: 1 mg/m^3 (0.2 ppm for vapour)
STEL: 2 mg/m^3 (0.5 ppm for vapour)
Additional classification: —

Substance

Orthophosphoric acid	H_3PO_4
Synonyms:	Phosphoric acid
Einecs No:	231-633-2
EEC No:	015-011-00-6; Classification: C; R34
CAS No:	7664-38-2
MWt:	98.0
Conversion factor (20xC, 101 kPa):	4.08 mg/m^3 = 1 ppm (valid for phosphoric acid vapour, not aerosols)

Occurrence/use

Phosphoric acid in its crystalline form is a pure white solid with a density of 1.864 g/ml, melting-point of 42.3°C and boiling-point of 261°C. It is odourless and completely soluble in water. Aqueous phosphoric acid is a clear, colourless, viscous liquid. The vapour pressure is highly temperature and concentration dependent. At 20°C, the vapour pressure of pure phosphoric acid is 0.004 kPa. At room temperature, atmospheric phosphoric acid is likely to occur predominantly in aerosol form, although vapour may be appreciable at high temperatures. There are several 'condensed' forms of phosphoric acid (e.g. $H_4P_2O_7$, $H_5P_3O_{10}$ and $(HPO_3)_n$), giving rise to a possibility of concentrations in excess of 100% H_3PO_4. Phosphoric acid concentration is therefore expressed in terms of its P_2O_5 content.

About 75% of manufactured phosphoric acid is used for fertilizers. Miscellaneous applications of the aqueous acid include metal treatment, refractories, catalysts, foods and beverages. The production rate in Western Europe is in the region of 5 x 10^6 tonnes per annum. Most occupational exposure tends to occur at thermal process production facilities.

Health significance

The SEG discussed the document on phosphoric acid prepared by Environmental Resources Ltd, London. The phosphate anion is an essential component of the body, with 1 to 2 g of total phosphorus ingested per person per day. Occupational exposure to phosphoric acid would not make a significant contribution to the normal body load of phosphate. Thus, the hazards associated with occupational exposure to phosphoric acid are likely to depend primarily upon its acidic nature, and toxicity is more intimately related to concentration than to dose. Con-

centrated phosphoric acid is corrosive and lower concentrations are irritant to the skin, eyes, mucous membranes of the oral cavity, and respiratory and gastro-intestinal tracts.

There is an absence of quality data on the effects of inhalation of phosphoric acid (rather than of phosphorus pentoxide) which would allow a more accurate assessment of the threshold level of irritation, or an evaluation of the effects of prolonged low-level exposure.

Phosphorus pentoxide, at levels of 3.6 to 11.3 mg/m^3, causes coughing in unacclimatized workers and 100 mg/m^3 has been found to be intolerable to all except hardened workers (Rushing, 1957). Phosphorus pentoxide is a powerful dehydrating agent combining with moisture to produce phosphoric acid in an exothermic reaction. As this generates heat and dessicates tissues, it is likely to cause more tissue damage than pre-formed phosphoric acid. Therefore, applying the results of studies on phosphorus pentoxide to an assessment of the hazards of phosphoric acid may overestimate the hazard but will supply an adequate margin of safety.

Recommendation

Further data allowing a more accurate determination of the threshold level of irritation for phosphoric acid are required. For practical reasons the Rushing observation on phosphorus pentoxide to the ACGIH Threshold Limit Values Committee was taken as a basis for setting the exposure limits for phosphoric acid. The recommended 8-hour TWA for phosphoric acid is 1 mg/m^3 (a value of 0.2 ppm may be used for vapour). A STEL (15 minutes) of 2 mg/m^3 (0.5 ppm for vapour) was also recommended. A 'skin' notation was not considered necessary as skin absorption would not contribute significantly to the normal body load of phosphate. These values are based upon extremely limited data and additional animal and human exposure studies on phosphoric acid are urgently required.

At the levels recommended no measurement difficulties are foreseen.

Key bibliography

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