

*Recommendation from Scientific Expert Group
on Occupational Exposure Limits
for Orthophosphoric acid*

8 hour TWA	:	1 mg/m ³ (0.2 ppm for vapour)
STEL (15 mins)	:	2 mg/m ³ (0.5 ppm for vapour)
Additional classification	:	-

Substance:

Orthophosphoric acid		H ₃ PO ₄	
Synonyms	:	Phosphoric acid	
EINECS N°	:	231-633-2	
EEC N°	:	015-011-00-6	Classification : C; R34
CAS N°	:	7664-38-2	
MWt	:	98.0	

Conversion factor (20°C, 101kPa) : 4.08 mg/m³ = 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, MPt of 42.3°C and BPt 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 0.004kPa. 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. $\text{H}_4\text{P}_2\text{O}_7$, $\text{H}_5\text{P}_3\text{O}_{10}$ and $(\text{HPO}_3)_n$], 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 5×10^6 tonnes per annum. Most occupational exposure tends to occur at thermal process production facilities.

Health Significance:

The SEG discussed the document (SEG/CDO/7) on phosphoric acid prepared by ERL, London. The phosphate anion is an essential component of the body, with 1-2g 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. Concentrated phosphoric acid is corrosive and lower concentrations are irritant to skin, eyes, and mucous membranes of the oral cavity, respiratory and gastrointestinal 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 unacclimatised 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

desiccates tissues, it is likely to cause more tissue damage than preformed phosphoric acid. Therefore, applying the results of studies on phosphorus pentoxide to an assessment of the hazards of phosphoric acid may over-estimate 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 TLV committee was taken as a basis for setting 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 (15mins) 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.

Bibliography:

Principle reference

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Key Studies

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