DIBUTYL PHOSPHATE

CAS number: 107-66-4

Synonyms: Dibutyl acid o-phosphate, dibutyl hydrogen phosphate, di-n-butyl phosphate, phosphoric acid, dibutyl ester, DBP

Chemical formula: $C_8H_{19}PO_4$

Workplace exposure standard (amended)

TWA: **0.6 ppm (5 mg/m^3)**

STEL: **—**

Peak limitation: **—**

Notations: **—**

IDLH: **30 ppm**

Sampling and analysis: The recommended value is quantifiable through available sampling and analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 0.6 ppm (5 mg/m^3) is recommended to protect for effects in the bladder and eye and upper respiratory tract irritation in exposed workers.

A STEL is not recommended as limited information are available to support a health-based value. However, noting the expected irritant effects, the TWA is considered sufficiently protective.

Discussion and conclusions

Dibutyl phosphate (DBP) is used in the paint industry as a catalyst, in the manufacture of phenolic and urea resins, as a plasticiser, in hydraulic fluids and in the textile industry.

Limited toxicological data exists, but it is a relatively strong acid that can be expected to be irritating on contact with the skin, eyes, mucus membranes and the respiratory tract. Tributyl phosphate, a closely related chemical, is metabolised in part to dibutyl phosphate. A two year tributyl phosphate oral study identified a NOAEL of 9 mg/kg/day and 12 mg/kg/day for bladder epithelial hyperplasia and papilloma for male and female rats, respectively. Converted to an eight hour shift, the equivalent airborne concentrations using generic factors is 63 mg/m^3 and 84 mg/m^3, respectively (ACGIH, 2009).

A TWA of 0.6 ppm (5 mg/m^3) derived by ACGIH (2009) is recommended. This was derived by dividing the lowest human equivalent inhalation concentration of 63 mg/m^3 by an interspecies uncertainty factor of 10 and rounding down the result to 5 mg/m^3. Based on the weight of evidence the recommended TWA is considered sufficiently low to prevent the identified irritation effects.

It is recommended to remove the current STEL given the absence of information regarding short-term effects.

Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Not classified as a skin sensitiser or respiratory sensitiser according to the GHS.

There are insufficient data to recommend a skin notation.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 1 ppm (8.6 mg/m^3); STEL: 2 ppm (17 mg/m^3)***
ACGIH	***2009***	***TLV-TWA: 0.6 ppm (5 mg/m^3)***
The TLV-TWA is recommended to protect for bladder, eye and upper respiratory tract irritation. Summary of data: Human data: • No human data from peer-reviewed literature • Moderately strong acid and can be expected to be irritating on contact with the skin, eyes, mucus membranes and the respiratory tract and may cause contact dermatitis. Animal data: • Limited data on dibutyl phosphate (DBP); data available on tributyl phosphate, a closely related chemical that is metabolised in part to DBP • Classified as highly irritating • NOEL of 30 mg/kg; (rat, oral, 45 d); ≡8 h human exposure: 210 mg/m^3 • LOAEL of 100 mg/kg; (rat, oral 45 d); ≡8 h human exposure: 700 mg/m^3; epithelial hyperplasia of the bladder mucosa, mucosal degeneration and ulceration • 2 yr tributyl phosphate feeding study: ○ NOEL of 9 mg/kg/d (male rats) and 12 mg/kg/d (female rats) ○ toxic effect being bladder epithelial hyperplasia and papilloma ○ reported human inhalation equivalents: 63 mg/m^3 and 84 mg/m^3; assumed to be based on 70 kg worker breathing 10 m^3 per 8-h shift with 100% absorption • Delayed neuropathy in chickens following exposure 90 d dermal exposure to 100 mg/kg • Chronic exposure in diet induced bladder tumours in rats but not mice; non-genotoxic mechanism. Assuming 10 m^3 of air breathed over 8 h by 70 kg worker with 100% absorption, exposure to the TLV-TWA of 5 mg/m^3 results in 0.7 mg/kg. Not mutagenic. Insufficient data to recommend SEN notation or derive a TLV-STEL.		
DFG	***NA***	***NA***
No report.		
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		

Source	Year set	Standard
HCOTN	***2004***	***TWA: 5 mg/m³***

Summary of additional data:

- No relevant toxicological data
- Workers exposed to unspecified vapour complained of respiratory irritation and headache
- Severely irritating to the skin and corrosive to the eyes of rabbits.

Secondary source reports relied upon

Source		Year	Additional information
NICNAS	✓	2019	• Reported experimental pH of 1.4 and pKa of 1.0–1.7 at 25°C indicates that the chemical is a relatively strong acid • A major urinary metabolite of tributyl phosphate.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic? No

The chemical is not a non-threshold based genotoxic carcinogen.

Notations

Source	Notations
SWA	—
HCIS	NA
NICNAS	NA
EU Annex	NA
ECHA	NA
ACGIH	Skin
DFG	NA
SCOEL	NA
HCOTN	—
IARC	NA
US NIOSH	NA

NA = not applicable (a recommendation has not been made by this Agency); — = the Agency has assessed available data for this chemical but has not recommended any notations

Skin notation assessment

Calculation
Insufficient data to assign a skin notation.

IDLH

Is there a suitable IDLH value available?	Yes

Additional information

Molecular weight:	210.21
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 8.598 mg/m^3; 1 mg/m^3 = 0.116 ppm
This chemical is used as a pesticide:	☐
This chemical is a biological product:	☐
This chemical is a by-product of a process:	☐
A biological exposure index has been recommended by these agencies:	☐ ACGIH ☐ DFG ☐ SCOEL

Workplace exposure standard history

Year	Standard
Click here to enter year	

References

American Conference of Industrial Hygienists (ACGIH®) (2018) TLVs® and BEIs® with 7th Edition Documentation, CD-ROM, Single User Version. Copyright 2018. Reprinted with permission. See the *TLVs® and BEIs® Guidelines section* on the ACGIH website.

Health Council of the Netherlands (HCOTN) (2004) Dibutyl phosphate. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/117.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2019) Phosphoric acid, dibutyl ester: Human health tier II assessment – IMAP report.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations –dibutyl phosphate.